TIGRAY

War in a Digital Black Hole

- Book 3 -

EDITED BY

Mirjam van Reisen, Araya Abrha Medhanyie, and Munyaradzi Mawere

Tigray

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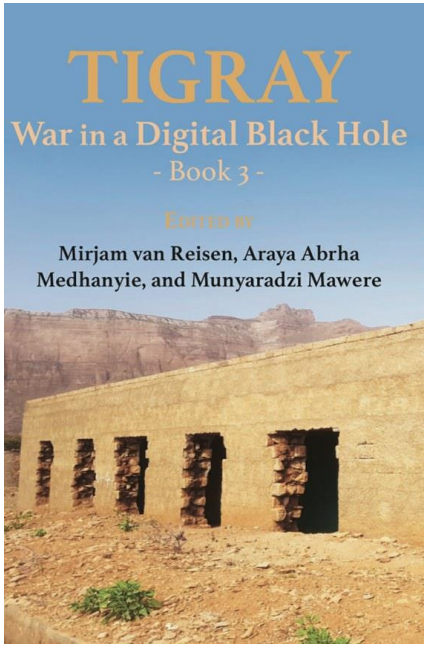

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Health facility destroyed and abandoned

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Disclaimer

This research examines the perceptions of a specific community, namely the Tigray community, within a broader context like the Horn of Africa. The research acknowledges that social situations are dynamic and continually evolving. Therefore, the findings serve only as a snapshot and the authors refrain from making essentialist conclusions or generalisations beyond the study's scope. The ethnographer's perspective is subjective and may be open to debate. The research does not provide any certainties, from a legal or any other point of view.

The editors have verified the information presented to the best of their ability within the circumstances and make no claims as to absolute truthfulness. Publication is weighed on the basis of interest to understand the potential impacts of events (or perceptions of these events) on the situation. The editors recommend the reader to examine the most current information available through trustworthy channels and thus supplement the information provided in this work.

This study captures personal experiences from the Tigray region during the siege and communication blockade, without claiming to represent the only valid viewpoint. References to social groups should not be interpreted as statements about all individuals within those groups. The research is conducted without the intention of offending any individual, group, or community. We welcome immediate communication regarding any concerns related to respect or cultural integrity.

Great care has been taken to accurately represent the authors' research findings. The content of the chapters is the sole responsibility of the authors and editors. The authors welcome any additional information, feedback or claims of factual errors, which can be directed to: mirjamvanreisen@gmail.com.

We dedicate this research to our beloved families – our sons and daughters, mothers and fathers, brothers and sisters, grandparents, and all our relatives. This work is also dedicated to every individual who tragically lost their life during this challenging time of war and pandemic. In the face of such profound loss, may we all find the strength to carry on.

We hold their memories in our hearts, and pray that their souls rest in eternal peace: **ኑብሶም ኣብ ዘለኣለማዊ ሰላም ይዕረፍ።።**

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Contents

Acknowledgements

This book is the third of three books on the war in Tigray, which are the result of a five-year collaboration with the Research Network Globalisation, Accessibility, Innovation and Care (GAIC), which started in 2020.

Courage was needed for this project. We are very much indebted to the coordination offered by Berhe and the 'Sit Rep Team' for the Europe External Programme with Africa (EEPA) Situation Reports on the Horn of Africa, during the Tigray war. This was a difficult and demanding task, due to the siege, the Internet and communication block-out, and the disinformation, it required rigour. We thank Gebremedhin for interpreting some of the material. We also thank the friends, many whom are experts of the Horn, for generously sharing information and checking in on each other to make sure everyone would be alright.

Gebru Kidanu was the star coordinator of the collaboration on the training we established as a team in Mekelle during the war. She has done a wonderful job in motivating people, being sensitive to their needs, giving a listening ear, and bringing energy and hope. We are grateful for everything that she brought to make sure we stayed together, and she has done a great service to the team, sharing with us the insights on trauma and healing, gained as part of her PhD work.

Daniel Tesfa provided a lot of support to the team. He established a data base, for information on the war, that was verified and available for the use of all authors. He translated from Tigrinya and Amharic to English. He helped check sources across all the chapters. He also helped the editorial team to finalise the manuscripts of the three books as part of his PhD work. His work is fast, reliable and precise. We are very thankful for his availability, and tireless work, day and night.

Finally, we would like to thank the survivors of the Tigray war who told us their stories, often through pain and grief. Our heartfelt gratitude goes to all who talked to us, gave us advice and information, participated in interviews and focus group meetings, allowed us to make observations, and provided us with critical information and

sources. It is easier to try and forget about this war. But in the name of humanity and in the name of justice, having encountered so much unnecessary death and suffering, we pray that the research presented here will contribute to upholding the principle of valuing life. The members of our research group have suffered great losses during this time. Despite this, we continued as a community to move forward, supporting each other where we could.

On behalf of the entire editorial team,

Mirjam Van Reisen, 1 October 2024

Note on Content and Editorial Decisions

Mirjam Van Reisen, Araya Abrha Medhanyie & Munyaradzi Mawere

πάντα ῥεῖ

Everything flows (Heraclitus)

The research presented in the three books, 'Tigray'. 'The Hysteresis of War' (Book 1), 'The Panarchy of War' (Book 2) and 'War in a Digital Black Hole' (Book 3) (2024) is the result of a five-year interdisciplinary research programme, carried out from 2020 to 2024.

The research approach entailed an emphasis on ethnography, on research carried out in real life situations and on the ground. The purpose was to build up a systematic knowledge base that can be studied, corroborated, corrected and improved.

It is very difficult to write on the topic of war. It is personal, it is sensitive, it is hurtful and painful, it is emotional, and there are many contrasting views on the situation. In addition, the siege and communication blockade and Internet shutdown during the war created a digital black hole in Tigray. Therefore, there is an urgent need to document perspectives from within Tigray that are accessible to outside audiences. This research is an attempt to contribute to this.

To develop an in-depth understanding of the situation, there is a need to build trust, to engage, and to develop an in-depth understanding on the situation in real life, there is a need to have access, be present, be in the situation, speak the language, and be part of the culture. All of these are necessary for understanding and all of these give a particular viewpoint on the situation.

Ethnography

This research used ethnography, as it allows us to be immersed in a situation, to participate in it for a moment, to reside in it for a short time, while also perceiving it as a 'stranger', an 'outsider', and to reflect on it. In-depth interviews are often used in ethnography to deduce understanding and meaning from a small description of a situation. This may also include small sample groups, autoethnography and long

interview methodology. Interviews allow the definition of a situation through the eyes of the participants.

This research should not be read as the one truth on the war in Tigray. It seeks to promote dialogue and ensure the participation of Tigrayans as an important stakeholder in the peace-building process, which hopefully continues to move forward. There are many contrasting viewpoints in a war, and we have only been able to capture insights from different angles. We have tried to bring the voice of the communities who have suffered so much in this war and have a stake in the future, which will be established on the shattered pieces of the war. We encourage everyone who is interested in the war to debate the content, and we motivate each reader to consider what it says and to feel free to disagree. We do not have a claim on a final truth.

We request the reader to make a distinction between the contribution of ethnography to the understanding of the war, which allows us greater freedom to document what was experienced in the war, what perceptions were there, what rationales were seen, and what causalities were entertained. This offers a particular scientific genre that allows us to explore new viewpoints and to document perspectives that have remained hidden and can be uncovered in this way.

We want to insist that for any legal determination, additional tools should be employed. In this book, Tefera provides a legal argument, but none of the other chapters in the three books should be read as legal arguments or as facts presented for that purpose.

While we would like to ask that the sentiments and feelings of the people sharing these harrowing accounts, which were collected first hand, be respected. We recognise there may be elements documented in a certain way, requiring further corroboration with other sources. We invite you to engage in a productive exchange to strengthen a common understanding where possible.

Translations

The translations used in this research concern:

- Spoken conversations (interviews, focus group participants, fieldwork visits)
- Written text
- Media material, TV, videos
- Other

The spoken conversations were transcribed and translated under the guidance of the main researcher. For editorial purposes, small changes were made to make the translations more comprehensible to the reader. In doing so, care was taken to capture the spirit of the original spoken word and cognisant of the fact that a translation, if done literally, word-for-word, cannot achieve this.

Other material was translated under the responsibility of the main researchers, but they were asked to use a panel of judges for translation in some cases. The editorial team had access to the outcome of the review by the panel of judges.

There may always be some discussion on interpretation and translation between languages. We encourage debate on the meaning of what is presented, we do not claim that the selected representation is necessarily the only one, or even the best one. It was the interpretation of what was understood and available to all of us, when we published the book.

Language editing

The researchers presented in the books are not born in areas in which English is a first language. We have published in English to share the results of our work. We have edited the chapters for understanding and easier reading, however, we have not polished the chapters to become something else. The editing takes into account the way of expressing in English by the authors.

In translating from Tigrinya or Amharic to English, many variants are possible. For instance, Aksum can be spelt as 'Aksum' or Axum'. We have tried to create coherence across all of the chapters and books. There is no linguistic reasoning supporting the decisions.

For references to names, in Ethiopia and Eritrea, generally the first name is used as the main name, so for instance President Isayas Afwerki is referred as President Isayas. There are also different spellings of the names available. The editors have chosen a coherent use of the name, but no linguistic rule was used to make the decision.

Sources and use of proverbs

The Tigrinya proverbs presented at the top of each chapter are not provided for their literal meaning. They are presented to offer a figurative association with the situation, allowing the reader some freedom to reflect on values, norms, fears and emotions from the place where these originate. Proverbs often have a long history and have moved and transformed across times and places and languages and should not be read as a direct commentary on the situation at hand. The translation from Tigrinya to English may also not be perfect.

There are two sources for the proverbs used in this research. The First is the article by Filip Busau (2020) *Comparative Analysis of Some Tigrinya Proverbs*, Proverbium 37. These are written in Tigrinya, the language spoken north and south of the Mereb in the highlands of Tigray and Eritrea. The article draws upon the work of the author on the topics of birth and death in Tigrinya proverbs. The translations are by the author with alterations where it was deemed necessary by Daniel Tesfa, B. G. Kahsay, and Gebru Kidanu.

The other source is the work of Tsigereda Teklu, Asmelash Weldemariam and Asmerom Gebreslassie, published by the Ethiopian Languages Academy under the then Ministry of Culture and Spots, published by Artistic Publishing in 1993 (GC).

Names and references

With regards to names used in this topic, the following procedure was followed. In Tigrinya, people usually have three names, the name of the grandfather, father and the given name. The references in this book use the reference name chosen by the author.

All the participants and sources have been anonymised and deidentified. This was necessary, to ensure the safety of all participants.

This research uses references to Tigrinya and Amharic sources, which are written in original script.

Use and re-use of data and verification of data

For any use or re-use of any of the data and arguments presented in this research, we want to insist that it is the task and responsibility of anyone who wishes to (re-)use the data to understand the perspective from which the data is presented here and to seek triangulation with other sources on sensitive issues that may be contested.

We have been careful to verify the sources and participants. For future understanding and research, we believe it is important to document this data. However, we are aware that it is possible that viewpoints or facts may be disputed and we invite anyone to respectfully come forward with any grievances to help improve, correct or change what is presented and the interpretation of it.

The media material was presented for verification to a panel of judges. The judges were selected for their ability to understand the material and the context of this material being produced. In this way, the originality of speeches and other expressions was traced and verified. Where in on-line productions alterations were made by the publishers of the content, this has been identified. The author and editors have a database of material that was verified and used for this publication.

The editors are responsible for the content presented in these three books. We would like to receive any comments.

Symbols, expressions and generalisation

The use of symbols and expressions in any part of this ethnography are not in any instance presented as a generalised statement to judge, accuse or demonise a person, a group of persons, or a people.

Ethical considerations

The research ethics applied to this research adhere to the principles of: (i) authenticity; (ii) veracity; (iii) diversity; (iv) inclusiveness; (v) (self-)reflection; (vi) responsibility; (vii) providing credit to all who contributed; (viii) avoid claiming the work of others or exploiting contributions of others; (ix) ensure that there is no plagiarism (x) open dialogue; (ix) allow critical reflection; (x) reliability; (xi) respect for others; and (xii) operate with cultural awareness.

The research was also guided by the principles of (i) informed consent and ongoing consent; (ii) do no harm; (iii) protect the privacy of participants by keeping personal information confidential; (iv) providing comprehensive information on the purpose of the research to participants; (v) voluntary participation of all participants; (vi) accurate reporting; (vi) transparency of disclosure of conflict of interests; (vii) treatment of all participants with respect and dignity; (viii) open communication; (ix) minimise suffering, avoid (re)traumatisation and offer referral and support; (x) personal and sensitive data-protection; (xi) adherence to the legal frameworks in the place where research is carried out; (xii) adherence to international norms and standards; (xiii) clear documentation of all procedures; and (xiv) reproducibility within the research scope and approach. The research should also be feasible and realistic in scope within the given timeframe and be realistic in its ambition.

Each part of this research was subjected to double blind peer review, the ethical committee of the Research Network GAIC, the ethical board of Tilburg University and Mekelle University, and, in specific instance, boards, as provided in each chapter.

Peer review

Many of the researchers are members of the Research Network Globalisation, Accessibility, Innovation and Care (GAIC). Many of them are in peer-groups and discussed their work in the peer-groups, and presented their work in the on-line meetings. In this way, they were able to receive valuable comments on the studies performed. These also served to provide mutual support and encouragement.

We thank everyone who took the trouble to provide proposals for inclusion in the books. We regret there were some proposals that did not make it to final publications. The research team consisted of senior and junior researchers, and this may be clear from the work presented. The point of departure was that learning to do research is by doing, and by publishing and receiving comments. We invite anyone to provide comments to improve any work presented here.

The criteria for publishing was: (i) relevance of the topic to the research project; (ii) clarity on the methodology (iii) transparency on data obtained and used and on the process of their analysis; (iv) ability to improve the drafts based on comments received within given timelines; (v) ability to present and discuss the content with peers; (vi) editorial fit with the overall content of the three books and (vii) prove of authenticity of the contributions of all of the author(s). Every chapter is accompanied by an explanation of the contributions of each author to the chapter.

The double-blind peer-review was an anonymous review process. The authors of the chapters did not know who their reviewers were. The reviewers did not know who the authors were. The reviewers were asked to provide their opinion on the article in a form that was sent to them.

The double-peer reviewers also made comments in the text of the chapter, as comments and suggestions to improve the chapters and clarify the language. Their work is gratefully acknowledged. It provided an important step to select the chapters for publication.

All drafts of all the chapters have been saved in a database and are versionalised. The final decision to publish was with the editors.

Referencing

The references are presented at the end of each chapter. The references to other chapters in the book are separately referenced, for easy findability, and to allow the chapters to be read in a stand-alone way.

Time references

Ethiopia uses the Ethiopian Calendar (EC), which is identified in the text with EC in the specific cases that this calendar is used. Most of the years follow the Gregorian Calendar (GC). If no abbreviation is provided the GC calendar is used.

Warning about traumatic content

Finally, the material presented in these three books may be hard to read. We have tried to balance honesty about what we heard on the situation, with what can be presented to a reader. Some of the elements we encountered were simply unimaginable. We have tried to be truthful, but also sensitive. The work was guided by Van Reisen et al., 2023), which sets out a methodology of an ethnographic research with exposure to trauma.

We encourage the reader to take care of your health and mental health and well-being and to seek support if that is needed. We thank you for picking up this book and for your interest.

Figures

The figures in the books were converted to black and white to fit with formatting requirements. In some cases, this may make them less easy to read. The original pictures, in colour, can be found at the following link: https://raee.eu/wp-content/uploads/2024/10/Figures_Tigray.-War-in-a-Digital-Black-Hole-Volume-3-1.pdf

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Busau, F. (2020). *Comparative Analysis of Some Tigrinya Proverbs*. Proverbium 37.

Tsigereda Teklu, Asmelash Weldemariam, & Asmerom Gebreslassie. (1993). **ምስላታት። የትግርኛ ምሳሌያዊ ንግግሮች።. ብናይ ኢትዮጵያ ቋንቋታት ኣካዳሚ ሚኒስቴር ጉዳይ ባህልን ስፖርትን።** (*Proverbs: Tigrinya proverb speeches*). **ሕታም** 1985 EC, **ኣዲስ ኣበባ።** (Addis Adaba: Ethiopian Languages Academy under the then Ministry of Culture and Sport)

Van Reisen, M., Smits, K., Wirtz, M., & Mikami, B. (2023). Skin in the Game: Methodology of an Ethnographic Research with Exposure to Trauma. In: Van Reisen, M., Mawere M., Smits, K., & Wirtz, M. (eds), *Enslaved Trapped and Trafficked in Digital Black Holes: Human Trafficking Trajectories to Libya*. Bamenda, Cameroon: Langaa RPCIG, pp. 70-120. Chapter URL: https://www.researchgate.net/publication/367240496_Skin_in_the_Game_Methodology_of_an_Ethnographic_Research_with_Exposure_to_Trauma

This chapter is available at: https://raee.eu/tigray-war-in-a-digital-black-hole/

Acronyms

ACSH	Ayder Comprehensive Specialized Hospital
ADF	Amhara Defence Forces
ARTI	Antibiotic use for Acute Respiratory Tract Infections
ASF	Amhara Special Regional Forces
AU	African Union
CED	Chief Executive Director
CEDAR	Centre for Expanded Data Annotation and Retrieval
CHIS	community health information system
DHIS2	District Health Information System2
DISH	Digital Innovation Skills Hub
eCHIS	Electronic Community Health Information System
EDF	Eritrean Defence Forces
EEPA	Europe External Programme with Africa
ENDF	Ethiopian National Defence Force
FAIR	Findability, Accessibility, Interoperability, and Reusability
FAIR-OLR	FAIR Ownership Localization and Regulatory Framework
FAO	Food and Agriculture Organization
FGD	focus group discussion
GAIC	Globalization, Accessibility, Innovation and Care
GBV	gender-based violence
HeRAMS	Health Resources and Services Availability Monitoring System
HIS	health information system
HMIS	health management information system
HVOD	hepatic veno-occlusive disease
ICC	International Criminal Court

ICCG	Inter-Agency Coordination Group
ICJ	International Court of Justice
ICM	interdisciplinary, cross-sectoral, and multi-level
ICRC	International Committee of the Red Cross
IDI	in-depth-interviews
IDP	internally displaced people/person
IRB	Institutional Review Board
INGO	international non-governmental organisation
IOM	International Organisation for Migration
MSF	Médecins Sans Frontières
NDVI	normalised difference vegetation index
NGO	non-governmental organisation
OBGYN	obstetrics and gynaecology
OCHA	Office for the Coordination of Humanitarian Affairs
OHCHR	Office of the High Commissioner for Human Rights
OLA	Oromo Liberation Army
OPD	outpatient department
PCH	paediatrics and child health
PMT	Members of the Performance Monitoring Team
PSEA	Prevention of Sexual Exploitation and Abuse
RRM	rapid response mechanism
SAM	severe acute malnutrition
SDG	Sustainable Development Goal
SEM	social ecological model
TDF	Tigray Defence Forces
TPB	theory of planned behaviour
TPLF	Tigray People's Liberation Front

TRHB	Tigray Regional Health Bureau
UN	United Nations
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNHAS	United Nations Humanitarian Air Service
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNSC	United Nations Security Council
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization

Timeline of Key Events

24 December 2017	Behind-the-scenes, diplomatic efforts to broker peace between Eritrea and Ethiopia in exchange for Ethiopian access to the Assab port and European Union (EU) roads from Eritrea to Ethiopia do not receive a positive reception in Mekelle, the capital of Tigray.
14 January 2018	President Isayas Afwerki of Eritrea announces the policy 'Woyane, Game Over', signalling a hardline stance against the Tigray People's Liberation Front (TPLF).
15 February 2018	Ethiopian Prime Minister Hailemariam Desalegn announces his resignation.
27 March 2018	Prime Minister Abiy Ahmed is elected as the chairman of the Ethiopian People's Revolutionary Democratic Front (EPRDF) coalition.
2 April 2018	PM Abiy is sworn in as Prime Minister by the Ethiopian Parliament.
15 June 2018	PM Abiy uses the term **የቀን ጅቦች** to describe TPLF or Tigrayans as 'daylight hyenas', a derogatory and dehumanizing label.
23 June 2018	A bombing at Meskel Square in Addis Ababa occurs during a rally for Prime Minister Abiy Ahmed, and chanting of "down, down Woyane", indicating the accusation that the perpetrators are Tigrayan. The courts in Ethiopia do not find Tigrayans guilty of the bombing.
9 July 2018	Ethiopia and Eritrea sign the Peace Agreement in Asmara, ending two decades of hostility and restoring diplomatic relations. This agreement is seen as a significant step toward regional stability.

9 July 2018	PM Abiy visits the Assab Port in Eritrea.
14–16 July 2018	President Isayas visits military camps and installations in Ethiopia.
18 July 2018	PM Abiy visits the Eritrean military training camp Sawa. National service in Eritrea is indefinite and widely regarded as a crime against humanity by the international community.
14 November 2018	The UN Security Council (UNSC) lifts sanctions against Eritrea (in place since 2009).
22 June 2019	Several high-ranking officials are assassinated in Ethiopia. General Seare Mekonen, the Chief of General Staff of the Ethiopian National Defence Force (ENDF), is killed in Addis Ababa, along with Major-General Gezae Abera. Both General Seare Mekonen and Major-General Gezae Abera are Tigrayans. In Bahir Dar, the regional capital of Amhara, the regional president Ambachew Mekonnen and his advisor Ezez Wassie are also assassinated.
11 October 2019	PM Abiy is awarded the Nobel Peace Prize.
1 December 2019	The Prosperity Party (PP) is officially formed on 1 December 2019. The party is created by merging three of the four parties that make up the EPRDF coalition, along with five other regional parties. The TPLF, one of the founding members of the EPRDF, refuses to join the PP, which contributes to the escalating tensions between the federal government and the TPLF.
28 February 2019	The EU signs a road-building agreement with Eritrea to connect Eritrea's ports (Assab and Massawa) with neighbouring countries.

15 June 2020	The European Parliament holds a hearing on the EU road-building program with Eritrea, which is carried out with national service labour, widely seen as forced labour. The European Commission indicates a shift to a "no more roads approach". The projects are stopped in the following year.
9 September 2020	Elections are organised by the TPLF in defiance of the federal government's decision to postpone all elections in Ethiopia due to the COVID-19 pandemic. The elections heighten tensions between the Tigray regional government and the Ethiopian federal government, contributing to the subsequent conflict.
25 September 2020	The first irregular flight is identified in connection to pre-war military preparations from Addis to Asmara (flight ET8312, tail ETALK and 20/10/2020 Tail ETAQQ).
3 November 2020	The Tigray War begins with Ethiopian federal forces, including Special Forces, being airlifted to Mekelle, the capital of Tigray, marking the start of an intense military conflict.
4 November 2020	Prime Minister Abiy Ahmed announces the Ethiopian government's 'Law and Order Operation' in Tigray, aiming to remove the TPLF leadership, which had challenged federal authority.
November 2020	The Ethiopian government imposes a communications blackout on Tigray, cutting off telephone, Internet, and other forms of communication. This severely limits the flow of information and access to the region, making it difficult for humanitarian organisations and the international community to monitor the situation.

6–10 November 2020	The Mai Kadra massacre in Western Tigray occurs. The Ghent University Database 'Every Casualty Counts' attributes the killings to Ahhara Special Forces or Fano Militia, ENDF, and Tigray Defence Forces (TDF).
11 November 2020	TPLF President of the Tigray region, Debretsion Gebremichael, accuses Eritrea of being involved in the war in Tigray and of using heavy weaponry in Humera against Tigray civilians. Eritrean Foreign Affairs Minister, Osman Saleh, dismisses the claim.
November 2020	The Adigrat and Edagu Hamus Massacres are allegedly perpetrated by Eritrean and Ethiopian military troops.
13 November 2020	A massacre with indiscriminate killings takes place in Zalambessa allegedly perpetrated by the Eritrean Defence Forces (EDF), following shelling of the town.
24 November 2020	The UN Security Council holds its first closed-door discussion on the conflict in Tigray, but no official statement is issued due to disagreements among members, particularly regarding how to address the situation.
11 November 2020	The 'Law and Order Operation' is redefined as a 'Law Enforcement and Existential Operation', emphasizing the existential threat the Ethiopian government perceives from the TPLF.
November 2020	The Humera Massacre occurs with the ENDF, Amhara militias, and EDF implicated in the violence.
November 2020	The first wave of mass arrests of Tigrayans begins.

28 November 2020	The TPLF forces withdraw from Mekelle, the capital of the Tigray region.
27–28 November 2020	An attack on Al-Nejashi Mosque, the oldest mosque in Africa, occurs.
28–29 November 2020	The Aksum massacre occurs. During this event, hundreds of civilians are reportedly killed by the EDF in the city of Aksum, Tigray, during the religious festival of Tsion Mariam, the feast of St. Mary of Zion. Aksum is a place of pilgrimage for the festival, as Ethiopian Orthodox Christians believe Aksum houses the Ark of the Covenant.
30 November 2020	The Dengelat Massacre occurs. The EDF attack civilians gathered for the religious festival of Tsion Mariam.
7 December 2020	The Ethiopian federal government appoints an interim administration for Tigray, led by Mulu Nega. This administration was intended to replace the TPLF leadership, which the federal government considered illegitimate.
January 2021	Closure of the Eritrean refugee camps in Tigray, Shemelba, and Hitsats after camps are attacked by the EDF and refugees are forcibly returned to Eritrea. In July 2021 the EDF enters Adi Harush and Mai Aini camps for Eritrean refugees.
10 February 2021	The Abi Addi massacre occurs, including mass killings by the ENDF and EDF.
10 March 2021	During a congressional hearing, US Secretary of State Antony Blinken states that acts of "ethnic cleansing" are taking place in Western Tigray. He specifically referred to reports of atrocities and the displacement of ethnic Tigrayans from the region by Amhara forces and allied troops of the ENDF. He calls for

	independent investigations to hold perpetrators accountable.
23 March 2021	Prime Minister Abiy Ahmed publicly acknowledges and thanks Eritrea for its military support during the conflict in a speech to the Ethiopian Parliament, confirming Eritrea's involvement in the war.
15 April 2021	The UNSC holds a session on the humanitarian crisis in Tigray.
20 April 2021	A chemical white phosphorus attack by the EDF against civilians is reported in the location of Adi Yieqoro, within Ahiferom Woreda in Tigray.
23 April 2021	Jeffrey Feltman is appointed as the US Special Envoy for the Horn of Africa. His appointment is part of the US government's increased diplomatic engagement in the region, particularly concerning the conflicts in Ethiopia, Sudan, and the broader Horn of Africa.
3 May 2021	The head of the Interim Administration by the Ethiopian federal government, Mulu Nega, is replaced with Abraha Desta.
June 2021	The blockade on humanitarian aid intensifies, with reports that Ethiopian federal forces and allied troops are preventing aid convoys from reaching Tigray. This exacerbates the already dire food and medical supply shortages in the region, contributing to a worsening humanitarian crisis.
15 June 2021	The European Union's special envoy to Ethiopia, Pekka Haavisto, who is also Finland's Foreign Minister, refers to the situation in Tigray as potentially amounting to "genocide"

	during a briefing to the EU Committee on Foreign Affairs.
22 June 2021	The UN Human Rights Council (UNHRC) adopts a resolution calling for an independent investigation into alleged human rights violations and abuses in the Tigray conflict. This resolution heightens international scrutiny of the conflict and increases calls for accountability for the atrocities committed by all parties involved.
June 2021	Operation Alula, launched by the TDF, begins. The operation is named after the famous Tigrayan general Alula Aba Nega and is part of a broader counter-offensive by the TDF against Ethiopian and allied forces. The operation aims to reclaim territory and defend key strategic areas in Tigray.
28 June 2021	The TDF recaptures Mekelle and regains control over parts of Tigray, but the siege and communication blockade by Ethiopia is maintained.
2 July 2021	The UNSC issues a first public statement on the Tigray war, expressing concern about the humanitarian situation.
25 July 2021	"We will not rest unless this enemy is stamped out. These people [Tigray people] are the enemy of the whole people of Ethiopia. They are the enemy of the Oromo, the enemy of Afar, and the enemy of Somali. We have to continue heroically struggling against the enemy,"[1] declares the former President of the Amhara region.

[1] Gebremichael, T. (2021, July 25). Amhara President: Tigrayans are Enemies of Ethiopia. *TGHAT*. https://www.tghat.com/2021/07/25/amhara-president-tigrayans-are-enemies-of-ethiopia/ (Accessed on 18 October 2024)

10 June 2021	The UN and other humanitarian organisations report that over 350,000 people are experiencing famine conditions, with millions more at risk due to the ongoing conflict, disruption of agriculture, and blockade of aid.
28 June 2021	The TDF recaptures control over the capital of Mekelle in Tigray.
July 2021	A second wave of mass arrests of Tigrayans in Addis Ababa begins in July 2021.
July 2021	The TDF initiates Operation Tigray Mothers reflecting a broad mobilisation effort to resist the advancing Ethiopian and Eritrean forces.
26 August 2021	Former Nigerian President, Olusegun Obasanjo, is appointed as the African Union (AU) High Representative for the Horn of Africa. His role is to mediate the ongoing conflict in Ethiopia and promote peace and stability in the region.
17 September 2021	President Joe Biden issues an Executive Order authorising broad sanctions against individuals and entities involved in the conflict, including Ethiopian and Eritrean officials, as well as those from Tigray. The order specifically targets those contributing to the conflict and obstructing humanitarian access. The sanctions include asset freezes and visa restrictions on individuals and entities seen as prolonging the conflict or obstructing peace efforts.
October 2021	TDF Operation Tigray Sunrise starts. The TDF advances outside the Tigray region.
October 2021	The UN suspends its humanitarian flights to Tigray after an airstrike on Mekelle, the regional capital, endangers their operations. This suspension further restricts the delivery of humanitarian aid to the region.

7 November 2021	Obasanjo makes his first visit to Mekelle, the capital of the Tigray region.
20 December 2021	Having advanced into the neighbouring regions of Amhara and Afar and coming within a few hundred kilometres of the capital, Addis Ababa, the TDF halt their offensive, leading to a temporary stalemate as both sides prepare for further operations or potential negotiations.
24 March 2022	The Ethiopian government declares a unilateral humanitarian ceasefire in Tigray.
August 2022	Coalition forces, including Ethiopian and Eritrean troops, resume a major offensive against the TDF, seeking to regain control over lost territories before peace talks.
August 2022	The resumption of hostilities leads to a tightening of the blockade. Tigray remains largely cut off from the rest of the country, with reports of increased starvation and lack of medical supplies.
27 September 2022	The Sheraro massacre occurs; the EDF reportedly kill dozens of civilians during an offensive in September 2022, as part of the renewed conflict before the Pretoria peace talks.
25 October 2022	The first round of formal peace talks starts in Pretoria, South Africa, facilitated by Obasanjo, and former President of Kenya, Uhuru Kenyatta, and former South African Deputy President Phumzile Mlambo-Ngcuka, representing the AU and the wider international community.
2 November 2022	The Pretoria Cessation of Hostilities Agreement is signed between the Ethiopian government and the TPLF, marking a formal

	agreement to end active hostilities and begin the process of peace-building.
3 November 2022	The Pretoria Cessation of Hostilities Agreement officially comes into force, leading to a significant reduction in active combat operations.
4–5 November 2022	The EDF perpetrates shelling of Adigrat, a town near the Eritrean border, in Tigray, leading to civilian casualties
January 2023	The EDF begin a partial withdrawal from Tigray, as part of the implementation of the peace agreement, although reports indicate that some forces remain in strategically important areas.
June 2023	Eritrea is reportedly still occupying Hoya Medeb, Semhal, May Hamato; parts of Ziban Guila and Erdi Jeganu in Egela Woreda; Endalgeda, Weratle, Alitena and Hagerelekoma in Irob Woreda; Geter Badme, Badme Town, Gemhalo, Adi-Tsetser and some parts of Adeneyti and Lemlem in Tahtay Adyabo, as well as the whole Western Zone of Tigray.

Introduction

Mirjam Van Reisen, Araya Abrha Medhanyie & Munyaradzi Mawere

The first book in this series, *Tigray: The Hysteresis of War* (Van Reisen & Mawere, 2024), examined the critical junctures resulting from the Tigray conflict, wherein widespread and systematic atrocities led to catastrophic devastation, with estimated fatalities ranging from 500,000 to 700,000. The authors emphasise the systematic nature of the violence, including massacres, sexual violence, and the deliberate undermining of survival mechanisms, all conducted within the context of a siege and communications blackout. The research, predominantly conducted by Tigrayan scholars, sought to elucidate the realities on the ground, which were largely obscured by restricted access to information. This restriction effectively concealed Eritrea's involvement in the conflict. The book concludes that the methods employed in the war may constitute genocide. Using the concept of 'hysteresis', it is argued that a return to pre-war conditions is improbable, necessitating a focus on rebuilding with a clear understanding of the new realities that have emerged.

The second book, *Tigray: The Panarchy of War* (Van Reisen & Mawere, 2024), meticulously documents the widespread destruction during the conflict, including the targeted devastation of cultural heritage and religious sites as a strategy to undermine Tigrayan identity. This objective was reinforced by the rhetoric employed in speeches by political leaders, which was subsequently adopted by military forces and manifested in the graffiti left on the walls of occupied buildings. These inscriptions contained hate speech directed at the Tigrayan population, conveying an explicit intention to eradicate them. The book critically examines the interplay between various levels of influence, analysing how the rhetoric of political leaders shaped the messages conveyed by perpetrators on the ground, and how these regional dynamics contributed to widespread insecurity among the Tigrayan population.

Central to this analysis is the concept of imagined social reality, which explores how narratives constructed by those in power create a

perceived reality that justifies and perpetuates violence. The book also delves into the gendered dimensions of the conflict, highlighting how women and girls were particularly targeted through sexual violence as a means of asserting control and dominance. The study further emphasises the role of agency, examining how individuals and communities navigated these oppressive forces, resisting and asserting their identities despite the overwhelming violence.

In documenting these aspects, the research underscores the relevance of these concepts in understanding the multifaceted nature of war. It interrogates whether the population is ensnared in a perilous cycle of violence, prompting a search for pathways to escape this destructive pattern. By integrating these theoretical frameworks, the book offers a comprehensive understanding of the conflict, illuminating the complex dynamics that sustain violence and exploring possibilities for breaking free from this cycle.

In the third book, *Tigray: War in a Digital Black Hole*, the authors explore the resilience demonstrated by farmers, health workers, and researchers amidst the profound challenges of the Tigray conflict. The creation of a 'digital black hole', resulting from the blockade of the Internet and communications, severed the population's ability to share their narratives and seek external support, undermining their morale. Despite these and other exacerbating circumstances, the book underscores the persistent efforts of professionals who continued to contribute meaningfully to their communities. This persistence is examined through the lens of resilience, revealing a dynamic interplay between the collapse of existing systems and the emergence of innovative responses – a process reflective of the concept of hysteresis, where previous conditions cannot be fully restored, and new interventions are needed to rebuild.

This book also engages with the concept of 'panarchy', highlighting how different levels of societal systems interacted during the conflict, leading to adaptive cycles that either reinforced or challenged existing structures. This dynamic fostered a transformative capacity, where the war became a catalyst for rethinking and rebuilding agriculture, health systems, and digital infrastructure. The authors argue that this transformation, driven by the resilience of those affected, offers

valuable insights into developing conflict-proof systems that are better equipped to withstand future crises.

In the opening chapter, titled "'If We Break, Our Society Breaks": Researchers' Agony and Resilience in Times of War', Medhanyie and Wuneh examine the challenges faced by researchers in Tigray during the 2020–2022 war, who were operating within a 'digital black hole'. Interviews with 34 researchers reveal their sense of agency amid dilemmas and unexpected devastation. The war's magnitude left them feeling powerless, exacerbated by a siege, communication blackout, loss of income, and personal experiences of atrocities. The concept of 'hysteresis' explains their unpreparedness for this crisis. Despite these challenges, the researchers drew on sources of resilience, such as support from family and friends. They remain committed to contributing to breaking the cycle of violence in the Horn of Africa, advocating for academia's crucial role in conflict resolution.

In Chapter 2, titled 'Resilience Conceptualised through Transformation: A Framework for Interdisciplinary Application', Stocker examines resilience as a 'travelling concept', focusing on its spatial and interdisciplinary dimensions. The concept is analysed as a theoretical tool to explain transformations documented in three books on the Tigray war. The literature review reveals that resilience studies are predominantly Western, shaping global perceptions and approaches. Resilience is categorised into persistence, recovery, and adaptation/transformation, with the latter involving systemic change. The study highlights the variation in understanding 'adaptation' across disciplines, with psychology emphasising cultural context. The research identifies a gap in resilience studies within non-Western contexts, particularly in war settings. Stocker advocates for examining resilience at multiple scales, emphasising its dynamic nature, and how it evolves through hysteresis and panarchy, leading to new interpretations and broader processes of systemic transformation.

In Chapter 3, Gebreslassie, Gebru Kidanu, Weldu, Amare, Stocker, and Van Reisen rigorously examine the phases and consequences of the siege and communication blackout in Tigray during the 2020–2022 Tigray war. The study is titled "Life in Darkness: The Communication Blockade during the Tigray Siege". Using

frameworks such as 'information black holes', social identity theory, and critical transition theory, the research delineates five distinct phases of the siege, each characterised by varying degrees of communication control and severity. The communication blackout exacerbated the siege's impact, significantly altering Tigray's social identity and fostering a divisive 'we versus them' mentality. The study underscores the transformative societal changes, including the reconfiguration of social dynamics and the emergence of self-reliance within Tigray. Additionally, it highlights the development of innovative communication solutions, advocating for a shift towards federated digital infrastructure to bolster digital resilience in future crises.

In Chapter 4, 'Impact of the Tigray War on Farming: Plight and Resilience', Nyssen, Ghebreyohannes, Negash, Meaza, Tesfamariam, Frankl, Haegeman, Van Schaeybroeck, Redda, Abay, Annys, and Demissie investigate the impact of the Tigray war on agricultural activities during the 2021 cropping season. The conflict, which began in late 2020 amid a desert locust infestation, severely disrupted farming, leading to a humanitarian crisis, as farmers were unable to harvest or sow crops. This study uses field observations, interviews, and remote sensing data to analyse crop yields, weed growth, and the resilience of indigenous agricultural systems. The findings indicate that warfare and the destruction of agricultural inputs by military forces critically impeded farming. Despite this, smallholder farmers exhibited resilience, managing to irrigate and cultivate more land than anticipated under such adverse conditions. Nevertheless, overall agricultural productivity declined sharply, with crop yields reduced to 40% of pre-war levels. The study underscores the necessity for comprehensive damage assessments, including the agricultural sector, to fully address war-induced disruptions and support post-conflict recovery efforts.

In Chapter 5, 'The Impact of the Tigray War on Refugees from Tigray and Eritrea in Sudan: "In the Middle of Life and Death"', Smits and Wirtz critically examine the perspectives of Eritrean and Tigrayan refugees regarding the prospect of returning to their home regions following the Tigray war. The study uncovers a profound reluctance

to return, primarily driven by ongoing instability, pervasive human rights abuses, and the threat of human trafficking. Interviews and field observations reveal that Eritrean refugees overwhelmingly reject the idea of returning due to persistent security concerns. The situation is exacerbated by the presence of human trafficking networks within refugee camps. Similarly, many Tigrayan refugees express a preference for onward migration, particularly to Europe. The concept of hysteresis, which posits that systemic disruptions inhibit a return to previous conditions, is employed to elucidate this reluctance. The research underscores the critical role of connectivity, highlighting how communication blackouts further marginalise refugees. Consequently, the study advocates for targeted international interventions to address human rights violations and improve conditions to facilitate potential returns.

Kahsay's study in Chapter 6, entitled 'Humanitarian Crisis and Response of Non-Governmental Organisations in the Tigray War' examines the humanitarian crisis response during the Tigray war. It highlights the severe conditions resulting from a siege, communication blackout, resource shortages, and disrupted supply chains. Starvation, lack of medical supplies, and basic necessities like food, water, shelter, and healthcare plagued the population. Despite efforts by NGOs and UN agencies, challenges such as restricted access, insufficient funding, and political tensions significantly hampered aid delivery. The international community's response was inadequate, exacerbated by governmental actions like the blocking of aid. The study identifies key shortcomings in civilian protection and fulfilment of emergency aid, emphasising the crucial role of local NGOs in these circumstances. The findings suggest that collaboration between large humanitarian organisations and local NGOs is essential for effective humanitarian response and long-term recovery in Tigray.

In Chapter 7, titled 'The Impact of the War in Tigray on Undernutrition among Children Under-Five', by Hadush Kahsay and Medhanyie, examines the widespread severe acute malnutrition among young children in Tigray, Ethiopia, using the conceptual framework Impact of Armed Conflict on Health by Guha-Sapir and

Van Panhuis (2002). The research highlights that conflict-induced disruptions to food security, health infrastructure destruction, and mass displacement have significantly increased undernutrition risks. The war's direct effects, such as agricultural damage, and indirect effects, including economic destabilisation and psychological trauma, exacerbate this crisis. Vulnerable groups include displaced families, government employees facing salary cuts, and mothers stressed by the war situation. The study emphasises the need for rebuilding health facilities, supporting displaced caregivers, implementing food security programmes, and ensuring access to nutritious supplements.

In Chapter 8, Abrha and Van Reisen examine the impact of war on female adolescents and youth in northern Ethiopia, in 'Sexual Vulnerability, Sexual Violence, and Reproductive Health of Adolescent Girls and Young Women in Internally Displaced Persons (IDPs) Camps'. Using the social ecological model of health and the theory of planned behaviour they explore intrapersonal, interpersonal, and institutional factors. Conducted during the Tigray war in 2020, this in-depth qualitative research validated these constructs as effective for analysing the prevention of access to and use of health services among female youth in wartime. The study reveals severe conditions for displaced youth and adolescents, including food shortages, forced sexual relationships, and poor sexual and reproductive health, leading to outcomes such as unwanted pregnancies, sexually transmitted diseases, and unsafe abortions. The research underscores the urgent need for integrated services addressing food insecurity, famine, and financial challenges to improve sexual and reproductive health for youth and adolescents.

In Chapter 9, 'A Reinforcement Feedback Loop: Medical Care Services in Ayder Hospital During War', Niguse, Teka, Stocker, and Van Reisen analyse the devastating impact of the Tigray war on healthcare services, particularly focusing on Ayder Comprehensive Specialized Hospital, the largest in the Tigray region. The 22-month siege, marked by extreme shortages and military interference, severely strained the hospital, which narrowly avoided collapse just before the Pretoria Cessation of Hostilities Agreement. The conflict led to significant human and infrastructure losses, resource depletion, and

restricted patient access, causing numerous preventable deaths and obstructing rebuilding efforts. Despite these hardships, healthcare providers showed remarkable resilience, continuing to deliver care. The study highlights the crucial role of support systems in healthcare provision and recommends that Ayder Hospital prioritise retaining health workers and adopting crisis-developed coping strategies to strengthen resilience.

In Chapter 10, 'Genocide through Health Care Violence: The Systematic Destruction of Health Facilities in War', Medhanyie, Wuneh, Tefera, Stocker, Kidanu, Abebe, and Van Reisen analyse the intentional and systematic destruction of Tigray's health system during the conflict. The study reveals that the attacks, primarily involving Eritrean forces, were widespread, targeting all levels and geographic areas of the health system. Using the integrated, cross-sectoral, and multilevel (ICM) framework of health systems resilience, the research highlights the collapse of the health system, regressing to conditions reminiscent of the early 1990s. The authors argue that these acts, constituting war crimes, crimes against humanity, and genocide, necessitate a critical rethinking of health system resilience frameworks in conflict settings.

In Chapter 11, 'Measuring System Change: Shifts in the Health Landscape under the Tigray Siege', Stocker and Medhanyie examine the profound changes in Tigray's health system during the 2020–2022 war, using Fisher information to assess the system's stability. The study analyses disease prevalence, mortality data, and critical war events, revealing that health system trends closely aligned with the conflict. Mekelle and North Western zone exhibited the most stability, while the East, South, and South Eastern zones were the least stable, indicated by many missing data points. The Central Zone experienced a gradual decline in Fisher information, reflecting the cumulative impact of the war. Although temporary increases in Fisher information suggested resilience, the study could not confirm a significant post-war recovery. The research underscores Fisher information's effectiveness in analysing health system stability in conflict but highlights the necessity of comprehensive data for understanding long-term impacts.

In Chapter 12, 'War-related Destruction of the Digital Health Data Infrastructure: Discovering Features for a Resilient Digital Health Information System', Taye, Medhanyie, and Van Reisen examine the impact of the 2020–2022 war on Tigray's digital health systems. Prior to the conflict, significant investments had been made to enhance both digital and paper-based health data systems, aiming to support knowledge-based decision-making. However, the war led to the destruction of health data recording and reporting systems, causing a critical transition. The concept of hysteresis suggests that recovery to the pre-war state is unlikely without substantial new conditions being met. The authors advocate for developing a new digital health architecture tailored to the current context, emphasising resilience and incorporating lessons from past failures. This approach should prioritise local data management, ownership, and regulatory compliance.

In Chapter 13, 'Data Visiting in Digital Black Holes: FAIR Based Digital Health Innovation during War', Amare, Medhanyie, and Van Reisen examine the impact of the Tigray crisis on data findability and accessibility, which led to the creation of a 'digital black hole' during the Tigray war due to an Internet blockade. To counteract this, a data architecture was piloted in Tigray's health facilities, focusing on the principles of Findability, Accessibility, Interoperability, and Reusability (FAIR). The pilot demonstrated that 'data visiting', where algorithms access data in residence, can overcome accessibility challenges, while maintaining personal data privacy and data security. This innovation supports the development of a resilient digital health system that remains functional during crises. The success of this approach suggests the potential to establish a new global standard for resilient digital health architectures, emphasising local data ownership and regulatory compliance.

To conclude the introduction, the research contained in this book critically examines the concept of agency in the context of war, with particular attention to how individuals and communities navigate and resist the challenges posed by a 'digital black hole'. The deliberate severing of communication channels during conflict not only isolates populations, but also attempts to diminish their agency by restricting

their ability to share their experiences and mobilise support. However, by employing the concepts of hysteresis and panarchy, this analysis will explore how the disintegration of pre-existing systems can catalyse adaptive cycles that foster resilience. It is argued that even in the most adverse circumstances, the potential for transformation and renewal persists. By envisioning and nurturing alternative structures that are resilient to future disruptions, this research aims to contribute to a broader understanding of how communities can emerge from the shadows of conflict, not merely to restore what was lost, but to build a brighter, more sustainable future.

Chapter 1

"If We Break, our Society Breaks": Researchers' Agony and Resilience in Times of War

Araya Abrha Medhanyie & Alem Desta Wuneh

ዝተፅሓፈ ይውሳእ፣ ኣብ ቃል ዘሎ ይርሳዕ።

What is written is remembered to;
what [only exists] in words is forgotten.

Abstract

In this research, the challenges faced by the researchers in Tigray during the 2020–2022 war were inventorised, as well as their sources of resilience, which included support from family and friends. Based on interviews with 34 researchers, the research explored the agency of researchers and the dilemmas they faced. The researchers did not predict the magnitude of the war and felt powerless given the magnitude of loss and devastation. Challenges included a siege, a communication and Internet lock-down, being without income, and the experience of atrocities and death within families and communities. Hysteresis explains the lack of preparedness of the researchers to face an entirely unexpected situation. Feelings of being betrayed by Ethiopia motivated many researchers to explore how more independence could be obtained for Tigray towards a greater sense of security. Most researchers expressed a strong belief that research can contribute to understanding the causes of the vicious wars in the Horn of Africa and to breaking the cycle of violence. The research advocates for recognition of the role of academia in promoting solutions to conflict.

Keywords: researchers, Tigray war, resilience, hysteresis, adaptation, agency

Introduction[2]

In October 2020, Mekelle University convened an extraordinary meeting with its academic staff: they were to prepare for war. The escalating tensions in Ethiopia, coupled with the fraught relationship between the government and the region of Tigray, signalled that conflict was both inevitable and imminent. In the weeks leading up to the outbreak of war, the university urged its staff to mentally prepare and develop strategies to bolster their resilience.[3] But how does one prepare for a war when the extent of its brutality and duration remains uncertain?

Researchers are presumed to be resilient when exposed to challenging situations and crises (Ansoms, 2020; Siveres & Alves, 2022). They are seen as having capacity to anticipate and predict uncertainties, manage crises, be the voice of their society, and speak truth to power. As intellectuals, they are expected to put themselves in the driving seat of investigations and innovations. Research leaders, who have prior experience working in unstable situations and crises, have a much better understanding, empathy, and courage to take risks and express solidarity to support and maintain research partnerships (Bentele, 2020).

Recent published literature on researchers' challenges, resilience, and dilemmas in times of war and crisis tend to focus on the challenges of researchers during the COVID-19 pandemic. The main challenges of academicians were perceived to be an inability to undertake face-to-face interviews, the difficulty in holding conferences, travel restrictions, and the lack of funding and partnerships (Kumar, 2019). However, the situation of academic researchers in a war situation is not comparable to the challenges posed.by the COVID-19 pandemic This study, therefore, explores the researchers' challenges and resilience during war.

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[2] This chapter reflects on the perceptions represented in the timeframe of the research among a population in Tigray. This should not be generalised and does not have inflammatory intent. The objective is not to contribute to conflict, the objective is to provide insights and understanding.

[3] Notes on communication by KB to MvR (November 2020).

The Horn of Africa is one of the world's most unstable and war-torn regions (Kurtzer *et al.*, 2022), with most of the states in the region having experienced civil war. The war in Ethiopia's Tigray was one of the deadliest and bloodiest wars that recently occurred in the region. Tigray was engaged in war from 3 November 2020 to 2 November 2022 (ICHREE, 2023; Africa Union, 2022). The federal government of Ethiopia and its allied forces – the Amhara regional police, militia, the Fano vigilante group, and the Eritrean Defence Forces (EDF) waged war in Tigray. The war occurred while Tigray was fighting the deadly COVID-19 pandemic.

During the war, Tigray was put under total siege and communication blackout (Kumar *et al.*, 2022); the government shut down all governmental and public services, all means of communication were completely shut down, the movement from and to Tigray was restricted, bank services were frozen, and all humanitarian and lifesaving assistance was blocked (Abay *et al.*, 2022; Amare *et al.*, 2024; Kahsay, 2024).

According to global reports, 600,000 people may have been killed, and more than two million displaced in the war (Pilling & Schipani, 2023). The joint investigation by Amnesty International and Human Rights Watch concluded that large-scale war crimes and crimes against humanity were committed by the Ethiopian National Defence Force (ENDF) and allied forces on civilians in Tigray (Human Rights Watch and Amnesty International, 2022). Additionally, The New Lines Institute for Strategy and Policy report concluded that members of the ENDF, Amhara Special Regional Forces (ASF), and the EDF committed genocide against Tigrayans (New Lines Institute for strategy and policy, 2024).

All four universities in Tigray; Adigrat, Aksum, Maichew, and Mekelle Universities, were closed during the war and turned into military camps. Adigrat and Aksum Universities were even shelled and badly damaged. Libraries, laboratory settings, and classrooms were damaged and looted (Nyssen *et al.*, 2021). Most academic and research staff were either displaced, had unknown status, or had their very survival threatened as salaries were not paid. The war adversely

affected the teaching-learning, research, and community services (Nyssen *et al.*, 2021).

The events of the war and siege created a lot of strain on researchers, both in a practical and logistical sense, as well as in a mental and emotional sense. This research explores the coping strategies that were used by researchers during these unusual times. The study will answer the following research question: *What was the agency of researchers located in Tigray, during the two years of the Tigray war, what challenges did they meet and what did they develop as coping strategies to increase their resilience?*

The research question was divided into three sub-questions:

RQ1. Challenges of researchers: What were the main challenges that the researchers encountered and found difficult to absorb during the war?

RQ2. Resilience of researchers: how did the researchers at the individual level adapt to the challenges related to the war? What individual capacities did the researchers have to adapt to the shocks and maintain their research activities?

RQ3. Agency of researchers: how did the researchers view their situation? How did they act upon their interpretation of their situation?

Theoretical framework

Research is conducted within an ecosystem. The research ecosystem includes the researcher, research participants, research institution, funding organisation, the community in the study area, and concerned stakeholders. The political, social, and economic conditions have an impact on research undertakings and projects in any setting.

Researchers' resilience was explored from both a system and an individual perspective. To explore the researchers' resilience, the theoretical frameworks of systems resilience, everyday resilience, and human agency were combined. The word 'resilience' originates from the Latin prefix 're-' (back) and the verb 'salire' (to jump, leap) (Biddle 2020 *et al.*). The conceptual framework developed by Blanchet *et al.* (2017) was based on systems thinking and complexity theories. In this

framework, the resilience of a system refers to the capacity to absorb, adapt, and transform when exposed to a shock and still maintain the same control over its structure and functions. This framework characterised the management of systems resilience in terms of four interlinked dimensions: 1) Knowledge: the capacity to collect, integrate, and analyse different forms of knowledge and information; 2) Uncertainties: the ability to anticipate and cope with uncertainties and surprises; 3) Interdependence: the capacity to manage interdependence, to engage effectively with and handle multiple- and cross-scale dynamics and feedback; and; 4) Legitimacy: the capacity to build or develop legitimate institutions that are socially accepted and contextually adapted.

These four dimensions are interpreted considering the concept of everyday resilience and human agency to explore the challenges. Hanley-Dafoe identified five core competencies of everyday resilience at the individual level (Hanley-Dafoe, 2020). These are belonging, perspective, acceptance, hope, and humour. Everyday resilience is the ability of an individual to continue delivering services during ongoing challenges and strain. It is the result of a combination of absorptive, adaptive, and transformative strategies that actors in systems adopt in responding to strain (Béné *et al.*, 2012).

The core competencies associated with everyday resilience at a personal level are related to and better explained with the theoretical framework of human agency. Agency is the ability to understand the world and act accordingly. Emirbayer and Mische (1998) theoretically conceptualised human agency as a temporally embedded process of social engagement, informed by the past (in its habitual aspect), but also oriented toward the future (as a capacity to imagine alternative possibilities) and toward the present (as a capacity to contextualise past habits and future projects within the contingencies of the moment). Bourdieu explained that shifts occurred over time between forward and backward switches in periods of social crisis, requiring adaptations; this phenomenon is termed hysteresis (Bourdieu, 1990).

Research method

The study took place at Mekelle University, the leading university in Tigray and one of the top three universities in the country for publishing research outputs, including project-related documents in reputable journals before the war. During the war, the university was severely attacked, damaged, and looted. All campuses of the university, including Ayder Comprehensive Specialized Hospital and College of Health Sciences, were turned into military camps and safe fortresses for the Allied forces (Nyssen *et al.*, 2021).

The study used a phenomenological study design (Creswell, 2013) to explore researchers' lived experiences with the challenges, resilience, and dilemmas during the two-year war. A total of 34 (29 male and 5 female) researchers participated in the study. Face-to-face interviews were conducted with eight researchers and by email with 32. Six of the researchers participated in both interviews while two researchers only participated in the face-to-face interview. The investigators (AAM and ADW) and two research assistants conducted the face-to-face interviews while the email interviews were carried out by the principal investigator (AAM).

The participants for the study was selected based on their engagement in research during the war and their affiliation with ongoing research projects. Participants included researchers at the university, PhD students, and research staff working on research projects. The study was restricted to academics and researchers from Mekelle University due to movement restrictions, communication blackouts, and the total siege imposed on Tigray. These limitations inhibited the recruitment of researchers from other universities, such as Adigrat, Aksum, and Raya.

Of the 34 participants, 17 had an academic rank of assistant professor or above, 11 were lecturers, and 6 were non-academic research staff. At the outset or during the time of war, 14 of them were PhD students. Of the participants, 29 were health researchers including 4 medical doctors, who were engaged in clinical activities in the hospital. In addition, 4 of the participants conducted research in data science and digital health, 5 were social science researchers, 1 was an anthropologist, 2 were political science and international relations,

and 2 had backgrounds in journalism and communication. All the researchers lived in Tigray during the war. The researchers' work experience as academics and researchers ranged from 4 to 32 years.

The data collection process was conducted in two rounds. First, during the war in March and April 2022, the research team carried out in-depth face-to-face interviews (IDI) using an interview guide. The focus of this interviews was the collective challenges, resilience, and dilemmas for researchers in undertaking research during the war. Following a debriefing discussion on the preliminary findings with a group of researchers, the research team conducted second-round interviews to document individuals' unique experiences during the war and their case stories. These interviews were conducted after the Cession of Hostility Agreement was signed in Pretoria, South Africa on 2 November 2022, and the Internet connection had resumed in Mekelle. From February to June 2023 participants were asked to respond to questions on individual resilience and dilemmas as researchers. Conducting focus group discussions, ethnographic and surveys was not possible due to movement restrictions and security problems.

The total sample was determined based on the concept of saturation (Guest *et al.*, 2006). Deductive and inductive analysis were employed in combination. Initially, the principal investigator (AAM) used Atlas.ti to code and categorise the transcripts into themes. Then, the co-author (ADW) read the transcripts, validated the major themes, and a consensus was reached. The principal investigator (AAM) recorded and chronicled his lived experience and major events in his diary during the war. He triangulated this information with the themes identified from the face-to-face and email interviews.

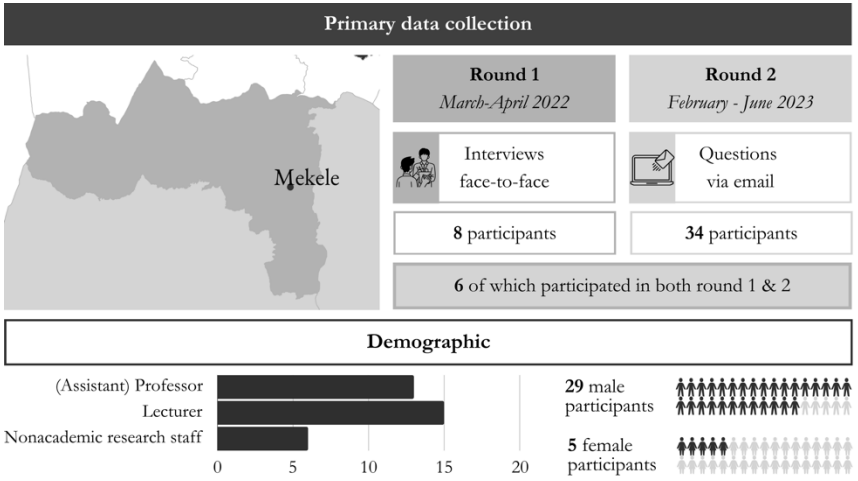

Figure 1.1. Overview of study methodology and participants

The Institutional Review Board (IRB) office of the College of Health Sciences of Mekelle University signed the ethical approval for this research. Participants of the study were informed about the purpose of the study, risks, and benefits of participation in the study. All participants consented to their participation. No participants' names and personal identifiers were recorded in the study.

Results

A total of 3 global themes, 14 themes, and 34 sub-themes emerged from the analysis (Table 1.1). Four themes were marked under 'resilience', four themes under 'challenges' and six themes under 'agency'.

Table 1.1. Main themes and subthemes emerged during the analysis in wartime, 2022/23

Global Theme	Theme	Sub-theme
Challenges	Endangering researchers' safety	Research institutions become military camp
		Violence against researchers
		Indiscriminate mass killings, shelling, air and drone strikes, and bombardments
	Total Internet connection blackout	Communication with partners stopped.
		Submission and publication of manuscripts become impossible.
	Blockage of banking services	No money for personal and family living expenses
		No compensation for researchers and no payment for covering the costs of research project activities
	The death of loved ones and its agony	Continuous agony and grief
		Difficult to focus on research work
		Personal and professional lives are affected.
Resilience	Knowledge	Information about war
		Misinformation and fake news
		Denial and disbelief
	Uncertainties	The roller coaster nature of the war
		Poor capacity for prediction and imagination
		Poor level or ill preparation
	Interdependence	Support from family, friends, colleagues and community
		Research partnership and solidarity
	Legitimacy	Weaponisation of education and health institutions and agencies

Global Theme	Theme	Sub-theme
		The hypocrisy of the international community and international human rights organisations
	The ethical dilemmas in conducting research	Rigor and scope
		Research versus life survival
		Research for free or with the family's financial support
	The researcher's role	Researcher or freedom fighter
		Serving the truth (impartial) or loyal to the cause of the people (partial)
	Existential questions	Defining moment and moment of truth
		What matters most in life?
		A blessing in disguise
Agency	The researchers' emotional trauma	Feeling of helplessness
		Guilty consciousness
		Double victimization
		Fear of political repercussions
	The sensation of disowning Ethiopia as an identity	Feeling of resentment
		Stateless
		Loss of trust
	The power of knowledge	The vicious cycle of war
		Quest for liberation
		Aspiration for the birth of a new nation-state Tigray

Source: Constructed by authors based on the themes of challenges, resilience, and agency

Researchers' challenges

The main challenges were identified as the researchers' safety, a total blackout of connectivity, the closure of banks and finance services, and the death of loved ones and their agony about their situation and the future.

Safety in danger

Researchers from Ayder Hospital found it difficult to believe that their hospital turned into a military camp and was used as a fortress. After the ENDF forces took Mekelle, around 500 soldiers camped within the college. As a result, researchers did not go to offices to conduct research and perform academic-related activities. Similarly, it was not safe for medical researchers to go to the hospital during the war. Medical doctors at Ayder Hospital were forced to walk in uniforms of the Tigray police forces within the hospital and to inform them on the identity of their patients to the ENDF.

One of the study participants was on the wanted list by the Ethiopian Government and spent eight months in the mountains until Tigray was free. Additionally, two researchers were subjected to physical harassment and were threatened with being shot as a form of intimidation. One researcher was caught by soldiers upon returning home from the office. He illustrated his encounter as follows:

> *I was beaten or perhaps killed for trespassing the curfew which I wasn't well informed about. I had a Zoom meeting with a technical assistant from Stanford and I was challenged by the mismatch in the time zone. It was also an election day for Ethiopians except Tigray. [...] I was also humiliated by the occupying forces another day. One military personnel even told me to leave academia and join the army sooner or later. But I never did.* (IDI 30, Email interview with a 39-year-old male, interview by Medhanyie, 12 March 2023)

A researcher was threatened with a gun because he was found with a tablet. The soldiers suspected and accused him of taking pictures and sending information to the Tigray Defence Forces (TDF). One of the interviewed researchers was a survivor of the Aksum massacre (Amnesty International, 2021; BBC, 2021) that took place on 28-29 November 2020. He was in Aksum at the time of the massacre and provided the following account of the tragedy.

> *I am one of the survivors of the Aksum Massacre. I have seen, from the second floor of a house through the window that the Eritrean soldiers massacred 8 people in our neighbourhood. Though helpless for myself, I still ask myself what I could have done to save life during the massacre. The soldiers tried to come into our compound but were unable to do so. I told my wife and the other four household heads living in the*

same compound to keep quiet, pretending as if nobody was inside. I was in charge of coaching children in the compound to keep silent as well. […] I lost three of my colleagues during the massacre. (IDI 23, Email interview with a 33-year-old male, interview by Medhanyie, 20 May 2023)

There was a constant threat of death at any time, with air and drone strikes happening nearby, within residential areas and workplaces. Despite the attacks, researchers continued to work and attend meetings. One of the researchers explained his moments of fear and vulnerability as follows:

[…] dealing with trauma, the risk of dying in the airstrike, and the burden of living with "survivors' guilt" make it hard to look forward. This is surprising without even being sure that you would survive as the danger has never been closer. Damage has happened in a block close to our residence. A couple of times, while we were in meetings, a drone or a jet, had been hovering over the sky. We hopelessly wait for it to throw the bomb, hoping that we and our relatives will not be the targets. (IDI 30, Email interview with a 39-year-old male, interview by Medhanyie, 12 March 2023)

These testimonies of the risks of dying and violence are provided by researchers who live and work in Mekelle. Relatively speaking, researchers from Mekelle were safer compared to researchers who lived and worked out of Mekelle. For instance, those working at Adigrat and Aksum Universities faced higher risks, with four academics and researchers from Aksum University killed in the Aksum Massacre (EEPA, 2021). A PhD holder who was a faculty member of Adigrat University was killed by Eritrean soldiers when he was traveling from Adigrat to Adwa by minibus.

Total blackout of Internet connectivity

Internet connectivity is the lifeline for many research projects (Kumar, 2019). Thus, almost all researchers expressed that undertaking and sustaining multisite collaborative and globally funded research projects was impossible during the Internet blockade. They also reported that they had difficulties in publishing their manuscripts, while PhD students stated that they were under pressure to publish their manuscripts and extend their studies by two to three years. One PhD student whose manuscript was accepted for

publication a few days before the war began was unable to follow the status of her manuscript due to the Internet shutdown. After several months without the Internet, she discovered that her manuscript had been withdrawn and that she had to submit it to another journal.

Blockage of banks and no finance

The researchers reported that their bank accounts and the university's accounts were both blocked and frozen. This meant that researchers were not receiving their salaries for months. The financial insecurity linked to this tempted many of them to leave academics and research in search of other jobs.

Women faced additional challenges. One female researcher explained:

> *I didn't have any money. I was on maternal leave. My child and I were very demanding by then. When I had my first child, I had a plan to fulfill everything I could for my child. But the time didn't let us to do so. I didn't even have money to buy clothes for my child. I got clothes for my child from my nieces and nephews. To survive, I had to search for a job but I didn't as I was in labour. We were begging for money from relatives, friends, and everyone close to us. Had I not been pregnant, I would have searched for a job and survived.* (IDI 13, Email interview with a 30-year-old female, interview by Medhanyie, 13 March 2023)

The lack of income was a challenge for all the participants. A male researcher said:

> *There were numerous instances. The second year of the battle was characterised by suffering and resentment on all sides. Academics had no salaries and no immediate means of generating income. I was highly tempted to leave academia once the full siege had become inevitable, and I had plans to look for employment with non-profit organisations. I come from a large family of ten, and I'm the eldest. I must provide for and sustain this family, including paying the majority of their regular monthly expenses like rent. Failure to do so has caused me to consider going back to the NGO [non-governmental organisation] job I left behind to uphold academic standards of excellence.* (IDI 15, Email interview with 32-year-old male, interview by Medhanyie, 14 March 2023)

At the time of publishing, four of the researchers who participated in this study have left academia and research and joined UN-based

humanitarian organisations. One female researcher who joined an international humanitarian and emergency organisation shared her financial struggle and decision as follows.

> *Yes, there were multiple times that I questioned my choice of career as an academician and researcher. For instance, receiving no salary was an enormous life burden. I was not able to afford my own and my family's essential expenses. I was under constant worry about what we could do if one of us faced a health problem that required medical attention and might cost us a lot of money. Apart from that, seeing how my colleagues and friends had benefited from a change of career where they were able to carry the financial constraints of their own and their loved ones, compelled me to feel that I ought to do the same. […] For that reason, I began to search for other opportunities that would address my financial issues and free me from the issues that come from the political situations.* (IDI 27, Email interview with a 29-year-old female, interview by Medhanyie, 12 March 2023)

The primary reason for researchers leaving their careers in research was due to financial struggles.

Death of loved ones and its agony

Many reported that they lost loved ones and family members during the war and siege. Almost all the participants expressed that they had lost at least one close family member[4]. The participants reported a collective total of 44 family member deaths, with 16 having been executed by the EDF, and seven executed by the ENDF. Additionally, four family members died in battle after joining the TDF and 12 died due to illness and lack of medical care. One of the female researchers expressed her agony at the loss of her loved ones:

> *I have lost my grandmother who I loved the most. She was sick. I came to hear about her death after several days. This was because there was no telephone communication. We didn't even have the moral to mourn for a relative who died of illness. This was considered a luxury. Many youths were being killed in the battles by air and drone strikes. I also lost my cousin. She was killed by the Eritrean forces. I was shocked when I saw a neighbourhood woman shot dead with her son. They shot and killed her. They didn't allow the family to bury her. She was buried during the night once*

[4] Family members in this study refers to mother, father, cousin, nephew, niece, grandfather, grandmother, grandson, granddaughter, brother, sister, uncle, and aunt.

they left the area. My father-in-law is a member of the TDF, but we don't still have any information about his status. In general, we have lost many relatives, friends, and colleagues during the two-year war. Let alone work, we even lost the meaning of life and became despondent during the two-year war. Days pass without accomplishing anything in life. We used to live a meaningless life. (IDI 13, email interview with a 30-year-old female, interview by Medhanyie, 11 March 2023)

The stories of death and being unable to say goodbye to loved ones were common to all researchers. Often people would hear about the death of a loved one months later. Death became accepted as a normal phenomenon, with no reason to mourn and attend the funeral of a family member, even if it took place in the same city.

All the study participants had at least one close family member, friend, or colleague who joined the TDF and fought on the war fronts. Not knowing their whereabouts and wondering whether they were alive or not was another painful agony. A researcher said:

I have a brother whose whereabouts are still not known. It is unknown whether he is alive or not. The entire family has been affected by this. This, in turn, affected both my personal and professional life as I am constantly thinking about him. My heart bleeds every time, I see young TDF soldiers on television or in the street thinking about him. It is bitter to not know whether your brother or any family member is alive or not. It is more difficult than the one you know for sure has passed away. (IDI 29, Email interview with a 35-year-old male, interview by Medhanyie, 07 March 2023)

Similarly, a female medical doctor and researcher said:

I lost my cousin in October 2022. He was a member of TDF; unfortunately, he was wounded during a battle and passed away on treatment in a hospital. His mother and sister don't know what happened to him yet. They are wandering around the region to find him. I found out about his death through my professional privilege but am not allowed to breathe a word about his death until it is announced formally by concerned stakeholders. It is horrible to hide such a thing from a family member; for that matter, I usually avoid meeting his mother and sister in family and other social gatherings. (IDI 18, Email interview with a 29-year-old female, interview by Medhanyie, 17 March 2023)

The death of relatives experienced by the researchers during the war greatly affected their morale, well-being, and mental health.

Researchers' resilience

The capacity of researchers to absorb and cope with the shocks that they faced during the war was investigated through four main themes: knowledge, uncertainties, interdependence, and legitimacy.

Knowledge

Most of the researchers were aware that war was inevitable and were actively following the political situation in the country. Understanding the political and conflict situation enabled researchers to make necessary trade-offs (Byrne *et al.*, 2017). However, most of them were shocked when the war broke out on the evening of 3 November 2020. They heard that the war started from the Prime Minister's media statement on national television and other state-owned mainstream media. He declared that the war formally began in the name of maintaining the constitutional order, which required a law enforcement operation in the early hours of 4 November 2020. Following his declaration, all means of communication including telephone and Internet were shut down. Air transport from and to Tigray was stopped. People's movement from place to place within Tigray was restricted and access to information was difficult across the borders of Tigray. The entire shutdown of telecommunication services worsened access to information and resulted in misinformation and fake news being common during the war. Many of the researchers were shocked when the ENDF seized Mekelle on Saturday, 28 November 2020.

Uncertainties

Many of the researchers described the Tigray war as a roller coaster. The capture of Mekelle was not the end, with the TDF and the Tigray People's liberation Front (TPLF) leadership retreating to the mountains and changing the military strategy from conventional to guerrilla fighting.

The researchers had assumed that the war would be between the warring parties and did not anticipate that the Eritrean government and its military forces would unite with the Ethiopian defence forces

to invade Tigray. During the occupation, it became clear that the war was not only between the armed forces. Most researchers agreed that the war targeted the people of Tigray. Yet, nobody expected that the war would become a war on the civilian people.

Due to the nature of the conflict, although researchers perceived themselves as impartial public servants, they were not able to remain neutral and observers. One of the PhD students said:

> *As I am a PhD student, once the war broke out in November 2020, I estimated the war would end within a few months. I had never assumed that the war would interrupt the teaching-learning process in higher education. As time went on, I felt annoyed that it mattered less whether I continued my education or not. I have seen many youths dying during the war including civilians. The situation made me feel that continuing my education was less purposeful. This feeling was exacerbated when the national troops controlled Mekelle City. For the first time in my life, I considered myself as less purposeful, to my institution and the community. This intensified further as airstrike and drone attacks were sustained.* (IDI 11, Email interview with a 34-year-old male, interview by Medhanyie, 03 March 2023)

The participants did not expect that the presumed government would execute all these unimaginably evil actions on them. They perceived that they were betrayed by the country that they had been serving for years. One of the participants illustrated the sense of betrayal with a crying voice in his throat as follows.

> *[…]How on earth [is it possible that] the country that we have been serving wholeheartedly would do this to us? I couldn't imagine this would come. We have been doing our best for this country and now the country doesn't allow us to use our own money […] They are so evil. If they could control the oxygen in the air, they would have prevented us from breathing and having oxygen.* (IDI 17, face-to-face interview with a 55-year-old male, interview by Medhanyie, 04 April 2022)

Although Tigray was a war-torn region and many of the study participants had lived through previous wars (against the Derg Regime and the 1998-2000 Ethio-Eritrea war), how this war on Tigray unfolded was beyond the researchers' imagination and expectations. The researchers admitted that they had been unprepared for the adversity and that their only means was to console one another. They

did not have the means to predict the atrocities and eventualities that happened in Tigray.

For some, working was a way of keeping themselves together. One of the participants said:

> *I come to the office not to work but to share my pains and worries with my colleagues to get relief and feel at ease. If I didn't come to the office and talk with my colleagues and friends, I don't know how I would cope with all the challenges that we had been passing through.* (IDI 17, face-to-face interview with 55-year-old male, interview by Medhanyie, 04 April 2022)

The researchers were going to the office to meet colleagues because they used it as means of coping the stress caused by uncertainty. They continued to work and collaborate, even though they were not receiving their salaries.

Interdependence

Researchers were able to cope with the challenges both individually and as a team with the help of their families, friends, and community. Global research partnership and solidarity emerged as a common element of interdependence.

Due to the blockage of banks and financial services, researchers had to do their research without being paid and with their own financial and material resources. For instance, in one research project, the researchers needed to solicit a favour for video cameras, time, and expertise for the production and editing, which took months and was a key part of their project. Most researchers claimed that their living expenses were being covered by the support of their friends and family members living abroad or in rural areas.

Most researchers claimed that it was difficult to cope with the siege and blockade during the first five months (June-October 2021). They were working as a team to find a solution or adapt to the siege and blockade. As a form of solidarity, the researchers established a pool fund. If members or projects of the research community obtained funds, 25% of the money would go to the pooled fund. This was done to support other colleagues working within the research centres or the College of Health Sciences in an emergency. With this approach,

researchers demonstrated how they were supporting each other to keep research members working and staying attached. One of the senior researchers who participated in this study stated that he established a humanitarian organisation with his colleagues. With this organisation, they were able to mobilise resources and give one meal a day to health workers working at Ayder Hospital who were unable to feed themselves. Additionally, they used to provide food twice a day to pregnant and lactating mothers with children under five who did not have anything to eat. Many academics voluntarily (without compensation) documented and assessed the health systems' damage during the war in Tigray.

Despite security agencies, including the police in Mekelle, not being functional during the war, society was able to maintain its security and peace. Neighbourhoods established safety measures to guard against theft and other dangers both during the day and at night. Researchers made an active contribution to the safety and security of their surroundings just like other members of society. They participated in patrolling and maintaining their surroundings at night. Researchers noted that their involvement in the community was a lesson in the society's traditions and institutions that were trustworthy and useful in times of war and siege.

The second element of interdependence that was common to most researchers was the importance of global research partnership and solidarity. For instance, there was an informal network formed by researchers and academics from different European countries (Norway, Germany, Belgium, the Netherlands, and the UK) who each had a partnership with Mekelle University. These researchers from Europe were trying to support and be a voice for Tigray in Europe and internationally. The coordination of research projects and those whose principal investigators were from outside Ethiopia or non-Ethiopian had a better sense of solidarity and commitment to maintaining the partnership and project. However, the participants acknowledged that they had difficulties communicating with and maintaining research projects coordinated by experts from Addis Ababa and/or Ethiopian citizens.

Participants found that they were unable to get feedback on their emails requesting updates on the projects and other issues. For example, the lead partners from a United Nations (UN) organisation based in Addis were unwilling to respond to emails of researchers from Mekelle as partners. Because of this, researchers felt that research integrity and partnerships were compromised.

On the other hand, global research leaders, who had prior experience in coping with insecure research situations, had much greater empathy with the researchers at Mekelle University. One of the research projects offered a VSAT connection to the research projects at the university in January of 2022. The connection was the result of engineering by the computer and information science experts at the University with material available in Tigray. Though the connection was very limited, it was a lifesaver to all the research projects at Mekelle University and it became a lifeline to all the researchers and research partnerships included in this study.

Legitimacy

Mekelle University is a public higher institution established by the Federal Government. As such, the Federal Government is mandated to protect academics and researchers working at the University, pay their salaries, and provide any other form of emergency support through the Ministry of Higher Education. However, during the war, researchers felt that Mekelle University was abandoned and became isolated. Institutions in other parts of Ethiopia cut communications with institutions in Tigray and some even raised funds to support the war. Because of this, researchers believed that the Federal Government had politicised all institutions in its war against the people of Tigray and that this contributed to the loss of trust in public institutions in the country. One researcher explained his frustration as follows:

> *I realized that, at least in the context of Ethiopia, academia is just not more than doing politics or business by other means. It has nothing or little to do with serving truth, justice, and thereby humanity via teaching, research, or community service engagements. Worst of all, in the war on Tigray, academics have served as a weapon of war in its own right (i.e., massively used as a tool of disinformation and misinformation, denial or fabrication of atrocities, false narrative setting, etc.).* (IDI

22, Email interview with a 35-year-old male, interview by Medhanyie, 17 May 2023)

More than half of the researchers in this study worked at the College of Health Sciences of Mekelle University. The college governs a teaching and referral hospital, which is one of the federal hospitals, and gets its budget from the Ministry of Health. However, during the war, the Ministry stopped sending the budget to Ayder Hospital.

Because of the lack of funding, Mekelle University collapsed, except for the faculty members and the administrative staff who continued working. One of the participants expressed his sympathy for the University:

> *I have grown up professionally at this University. I have worked at the University for about 25 years and have been contributing all I can to the growth of the University. Now, when I see my university is without students, I feel bad. It has been almost two years since we stopped going to classes to teach our students. It is upsetting but I can't dare to leave Mekelle University at this difficult time. I can't abandon my university even if I know I can get work opportunities in the UN humanitarian organisation and get a decent salary.* (IDI17, Face-to-face Interview with 55-year-old male, interview by Medhanyie, 04 April 2022)

Researchers were demoralised by the response of the international community during the 2 years of war. One senior researcher said:

> *I had a strong belief that the international community would stand on the side of victims from wherever they are. However, I have observed the international community, democratic governments, and UN agencies keeping silent while women are raped, civilians are displaced, civilians are killed, access to essential and basic services are denied, salaries of civil servants are denied, patients are denied access to health care services and medicines, children are denied access to schools, and people are put under siege or enclave and cut off from the rest of the world for more than two years. And I have come to realise that the planet Earth is not the right home for humanity.* (IDI 17, Email interview with 55-year-old male, interview by Medhanyie, 17 March 2023)

Another researcher shared similar desperation calling out the 'hypocrisy' of the international community:

> *During the war, on several occasions, we thought the UN or the US would come to our aid. We believed that there were international monitors of peace and security who would ensure that America remained committed to its foundational purposes of justice, equality, and liberty. We thought they would value all lives equally, regardless of race. After a few months of war, when they released statements expressing concerns about civilian atrocities, we thought that help was on its way. However, we have come to realise that America and the UN are merely organisations with vested political interests that serve their ends. They only care about their interests and are willing to let millions die if it serves their political goals or benefits them from the war. We have learned that no one will come to our aid no matter what happens […] Hundreds of pages of international agreements and conventions were neither observed nor enforced. Despite our harrowing experiences, I hope that others can learn from our suffering and understand that there is no global order to keep the world and its citizens safe. Our world is still led by money, muscle, and missiles. Do not hope otherwise.* (IDI 21, Email interview with a 36-year-old male, interview by Medhanyie, 08 May 2023)

Similarly, one young male researcher said that, because of the experience, his view of the world fundamentally changed:

> *My perspective on the world has shifted. When it comes to people, I used to think there is the rule of law and accountability. But this is incorrect. Humans are statistics that politicians may use to their advantage. I have witnessed instances where a Kalashnikov was more valuable than a human life. My sense of morality and ethics has been 180 degrees turned since I found myself in a situation where another human committed an act of cruelty that other animals, who are close cousins of humans, wouldn't ever consider in their right minds. Rape is a crime, and trying to insert something into a woman's reproductive system is insane. Mass murder, pillaging, and vandalism are also common in other parts of the world. But, because the crimes were intentional, our situation is special. The enemy's ultimate objective is to humiliate the Tigray people by deliberate and methodical action. I find it astonishing when the international organisations which were established for this did nothing. Governments that appear as standard bearers of the democratic process and the rule of law have prioritised their interests over those of humanity.* (IDI 15, Email interview with 32-year-old male, interview by Medhanyie, 14 March 2023)

The respondents expressed particular dismay about what they felt was a lack of adherence to the international rule of law and the impunity under which heinous crimes were committed with a lack of accountability.

Researchers' agency

The interviews demonstrated how researchers struggled with the shift in perception of the world and how this affected them on a personal and professional level. Six themes were identified as dilemmas that researchers faced under these circumstances. These themes are the ethical dilemmas in conducting research, the researchers' role, existential questions, the researchers' emotional trauma, the sensation of disowning Ethiopia as an identity, and the power of knowledge.

Ethical dilemmas in conducting research

The war caused severe restrictions and setbacks. Most of the researchers had to limit their research work to Mekelle or in places with relatively safe towns and villages that are found on major roads. Going to remote places and villages was riskier. For instance, one of the researchers who participated in this study (IDI 23, 33-year-old male) was held captive and imprisoned for two days in a small village some 50 km from Mekelle, the capital of Tigray. He had gone there to conduct interviews for his research, but local people suspected him of being a spy when they saw him interviewing with a digital recorder. Despite his explanation and showing his ID, they took him to a local police station. He remained imprisoned until his research colleagues briefed the relevant authorities in Mekelle about his research work.

While the ENDF and its allied forces were in Tigray, going out of Mekelle for field research work with a vehicle was unthinkable. Soldiers could take the vehicle by force, and possibly kill the driver and passengers. After the capture of Mekelle, the ENDF immediately captured thirteen of the university vehicles. Most of the researchers lacked experience in conducting research in war and conflict settings. The only option they had was to learn through the war. They found that things that work in times of peace did not work in crisis times. Finding acceptable research methods without significantly compromising the rigor of a given study was a mindboggling dilemma. Ethical procedures for researchers in situations that are

affected by war and/or violent circumstances should be produced to guide researchers who need to do their work under these circumstances.

Research as a systematic method of evidence-gathering, synthesis, and interpretation for problem-solving and making a timely evidence-based decision is more challenging in times of war and adversity than in normal times. Nevertheless, researchers noted the insensitivity of research partners and funding organisations to this Research, regardless of its importance, was considered a non-priority issue by most of the funding organisations. The researchers saw the hesitance of global funding organisations in taking risks, even on research projects which were developing and implementing life-saving interventions in unstable situations. Thus, researchers who participated in this study believed that there is a need to rethink the commitment to research in crisis and conflict situations.

Researchers' role

The participants described that they were not clear about the role they should play during the war, feeling confused and experiencing dilemmas with their role during the crisis. One researcher said:

> *The main reason is the mismatch between my perceived being and my actual being. Before the conflict, I considered that my expertise contributed to the power balance among the state, party, and democratic institutions. Following the conflict, I realised I was no one in the middle of nowhere. Someone, who had an understanding of the practical gaps and prospects of society through research and community engagements, looking for hideouts from bullets, is weird. As the bullet changed its form through time, I am now working for an NGO to feed my family.* (IDI 23, Email interview with a 33-year-old male, interview by Medhanyie, 20 May 2023)

According to the legislation from Mekelle University, every academic is employed to teach, research, and provide community services. However, this academic responsibility was broken during the war due to the collapse of Tigray's educational and health system. During the war, fighting against the invading forces was the top priority of the people of Tigray.

Most of the participants also perceived and understood that the struggle of the people was for freedom and dignity and had a just cause. This put researchers in a dilemma. On one hand, researchers and academics considered themselves neutral and expected to avoid political issues, instead focusing on their academic and research work. On the other hand, as members of the Tigrayan society, they felt an obligation to join the cause of their society and contribute meaningfully to the struggle for liberation in any way they could. Two of the PhD students who participated in this study decided to quit their research work and join the TDF. They served the defence forces until the agreement for the Cessation of Hostilities was signed on 02 November 2022 (African Union, 2022). One of these PhD students said:

> *When the situation changed, in Tigray; institutions were destroyed and looted, women were gang raped by soldiers; children starved and suffered, people were displaced and settled in caves, the sick died because of lack of medicine, and the elderly were left without a caregiver. Children were separated from their parents and scattered across the hills and roads without a caregiver. This situation made me decide to quit my PhD study and join TDF.* (IDI 5, Email interview with 38-years old male, interview by Medhanyie, 10 February 2023)

In addition to the two PhD students, two of the participants who were medical doctors and researchers (one female and one male) said that they had decided to leave their medical profession and join the TDF. The female medical doctor and researcher expressed herself:

> *This was the most frustrating and darkest time of all. As the war between the TDF and opposing allied forces re-initiated at full-scale in August 2022, it escalated intensively through the two months until October 2022 at which time there were rumors of recolonizing the region as a whole by the opposing forces right before Pretoria's peace deal was signed. Personally, the idea of being recolonized was extremely grave and unimaginable to bear. It was at this time that I decided I belonged somewhere else, where I could share my contribution even if a small one. I was looking for a spot on the battlefield, not in my academic career. Now, I thank God for making the peace deal come true.* (IDI 18, Email interview with a 29-year-old female, interview by Medhanyie, 27 March 2023)

In a debriefing discussion with the researchers, some questions remained unanswered and puzzling: where is the boundary between research and politics? Where is the boundary between science and politics? Despite these repeated and unanswered questions, there seemed to be a consensus that the researchers wanted to be loyal to the cause of their people and do whatever they could to help. One of the senior researchers said, "If we (academicians and researchers) break, our society breaks and vice versa. We break as Tigrayans". For these reasons, almost all the researchers supported the struggle against the invasion in one way or another. For instance, three of the researchers were involved in the diplomatic and advocacy efforts of the people at the international level to influence the international community to act and put an end to the war against the Tigray people.

Research and academic work are thought to be a right for scholars who do not want to engage themselves in politics and power struggles, especially in the politics of undemocratic and unstable societies. Researchers assumed that their role as academics, researchers, and intellectuals was independent of any political organisation. They believed that the responsibility of academic researchers was to produce knowledge and speak the truth. However, in the context of the Tigray war, they felt that the contrary was true. In a brutal war like the one that took place in Tigray, the brunt of the war affected every segment of the population.

Existential questions

The two-year war was a defining moment for most academic researchers. It was an existential situation that led to many questioning the meaning and purpose of their life. One of the researchers articulated how their life's purpose and worldview changed from a PhD student to a politician because of the war.

> *Yes, of course; and to some extent it changed my view and tactics in this concern. These include (1) After November 04, 2020; I was not comfortable teaching at the university. Because few students were coming to the university campus with ENDF soldiers and those soldiers were intimidating academic staff; (2) I was a PhD student too and I could not collect any data for my dissertation for security reasons, and associated issues, such as the costs related to executing the research (3) I could not track my manuscript submitted for blind reviews in various online journals because*

I have no communication about the progress, since there was no Internet access; (4) talking about scientific research was sometimes also a luxury business for most people; (5) other two research projects were halted at the mid of data collection because of the war; (6) moving from one area to other and talking with people and carrying tools that are important for data collection was very difficult; (7) I was also interested in the political movements and joined the IRA [Interim Regional Administration]. (IDI 31, Email interview with 42-year-old male, interview by Medhanyie, 26 May 2023)

Although it varied, almost all participants agreed that the war changed the purpose of their lives and what was deemed important in their lives. They agreed that the crisis was a moment of reflection on what was important in life at the individual and community level. This reflection pushed some of the researchers to question the value of research and an academic career in times of war. They put themselves in a dilemma regarding the type of professional career to pursue, to contribute to stopping the war and limiting the damage. Some of the participants expressed feelings of unease in that they would have preferred to be soldiers or politicians rather than researchers and academics. One young female researcher said:

Certainly, so, there were many times that I regretted and doubted whether or not I should be an academic. The reason for such thoughts and feelings lies in different facts that have happened. To begin with, I am from Addis Ababa. And I was cut off from contacting my family and friends. On top of that for 2 years I wasn't getting paid or involved in a job that could generate money that could help me or my family. But most importantly for me being academic meant, I had some power to make a difference and help the community to improve however this event has shown me the bitter truth, you only have power with money and status and whatever meaning and purpose you give to your life can shatter with those who have political power and money and there is so little you can do to help yourself or the community. The knowledge and the rights you have been taught or preached in your life only apply in stable conditions […] so it made me question whether I have chosen the right path and whether was it even worth being far away from family to be able to work as an academic and what is the purpose of knowledge or spending your whole life telling yourself you are doing some significant work in higher educational institutions when you can't provide solutions to a community in worst times. This feeling still lingers

in my thoughts. (IDI 16, Email interview with a 27-year-old female, interview by Medhanyie, 14 March 2023)

There is nothing good about war. However, a blessing in disguise that many of the researchers witnessed was the reflections on the meaning of life and what should take priority in life. Many agreed that family should come first and admitted that they had spent adequate time with their families and children when compared to before the war. They had been relieved from unnecessary business and sometimes meaningless workshops and meetings, and there was no more social media. Another insight that most researchers shared was that they changed the adversity to opportunity. Many of the researchers said they used the time for reading books to acquire new knowledge. They also created a weekly learning forum to discuss different topics related to research, politics, and the crisis, and to review books and share their thoughts. Many agreed that they read more books and improved their reading habits.

Researchers' emotional trauma

All participants experienced bad encounters and emotional trauma. They passed through the upheaval of the war and were victims of the total siege and war. On the other hand, as researchers and academics, they were expected to be front liners in documenting and being a voice for their people, telling the rest of the world the truth of the war. However, the researchers in this study found themselves helpless and not able to help others. One of the researchers shared how he had felt powerless in helping his sister:

I have an elder sister who lives in a rural area where she was raped by the Ethiopian military forces on 5th April 2021. When the military forces invaded the entire woreda [district], the health workers abandoned the area, and the health facilities were looted. As a result, my sister was unable to obtain medication for HIV/AIDS and other sexually transmitted infections. She was not even able to access pregnancy-controlling tablets. She was not able to travel to Mekelle to get medical care. The Eritrean forces had control of all the roadways leading to Mekelle. She remained untreated. I was not even able to travel to the village and provide her medications. I heard that she was raped quite late. There was no telephone communication. (IDI 4, Email interview with a 35-year-old male, interview by Medhanyie, 9 February 2023)

What was traumatising for most researchers was not only the violence and atrocities that were committed on oneself, loved ones, and the people of Tigray but also the feeling of guilt and the impotence to prevent families and their people from such dehumanizing acts of violence.

All participating researchers comprehended that they had a professional and moral obligation to document, analyse, and write about the atrocities and damage that happened during the war. The health researchers felt that they had a dual responsibility. The war targeted the health system of Tigray, and the siege resulted in the blocking of medical supplies and lifesaving medicines from entering Tigray. Death from malnutrition and starvation increased from day to day. Sexual violence was used as a weapon of war. All these were related to the health of the people and health researchers were expected to document the problems and devise and deliver a solution by being a voice for their people and informing the international community. However, many of the researchers found that it was traumatising to hear and document the situation. One of the participants reported that she could not continue writing the stories of the sexual violence that she had collected through interviews. She found it difficult and traumatising to listen to them again and again, to transcribe and put them into a manuscript. Many of the researchers reduced or stopped watching local TV as a means of protecting themselves from the painful stories of atrocities and associated trauma.

Researchers in health had relatively better access to and understanding of the atrocities and crimes that were happening to their people. However, their knowledge did not seem relevant to help stop the atrocities from being committed.

The politicisation of research is another emotional upheaval that exacerbated the researcher's emotional trauma and feelings of helplessness. Every aspect of thinking was politicised. The deaths of hundreds of thousands were politicised. Many of the researchers who participated in this study believe that the crimes that happened to the people of Tigray amount to genocide. With all their readings and understanding of the concept of genocide based on the UN

convention, they believe that the war on Tigray was genocide. However, they could not write and express their ideas by labelling the Tigray war as a genocidal war in fear of political repercussions and judgments by others, in particular by partners who did not want to enter into conflict with the Ethiopian Government. In most cases, research partners and colleagues from other countries were hesitant to make statements about the war.

In addition to the war and the siege, the politicisation of research also posed a methodical challenge to undertake research in a time of war and crisis. Many research agendas needed investigation but it was unthinkable to travel to rural areas and conduct surveys. Surveys and assessments of damage, crimes, and atrocities that happened during the war and their findings were perceived as politically sensitive assessments. Researchers found themselves in controversial territory when they presented and published the findings of their assessment or views about the war and associated consequences. Considering this, the researchers in this study admitted that they were not well prepared on how to conduct research in times of war and conflict.

They were particularly not prepared when all means of communication, transport, and bank services were shut down, and everything being rendered uncertain and controversial. A research project that was being implemented at the time of war was halted for five months by local political leaders because they suspected it had political aspirations and did not align with their interests. The researchers who coordinated this project had to abide by the instructions of the local political leaders.

The trauma experienced by researchers resulted in a loss of trust in the reasoning and the intentions of the decisions that were affecting their ability to cope professionally with the circumstances. This led to feelings of frustration and desperation, which undermined the sense of self-efficacy to be useful and to be a good researcher who could contribute to ameliorating the situation. It led to a sense of powerlessness.

The families, friends, and colleagues' monetary and in-kind support were crucial to remain resilient and stay focused on research work.

However, some of the researchers expressed that they had a troubling guilty conscience of using family support to stay focused on their research work. In one of the debriefing sessions among the researchers, the lead author of this study admitted and expressed his gratitude to his childhood friends but also his guilty feelings which he illustrated as follows:

> *It was a paradox to see my childhood friends who were living abroad sending money every three months through all the means they found. They encouraged me to continue my office and research work. I came to feel that my salary was paid by my childhood friends [...]. I was really in an emotional dilemma about whether to receive money from friends to keep working and save the research projects from failing in times of darkness.* (First author, self-narration)

Another researcher expressed this feeling of guilt as:

> *There were times when the financial challenge was unbearable as due to the siege transport and other costs were high and we couldn't withdraw our savings as well. Spending the little cash, I felt like a paradox as I felt I was paying to work while I should have been paid.* (IDI 30, Email interview with a 39-year-old male, interview by Medhanyie, 12 March 2023)

A study by Ansoms (2020) explored the psychological challenges that researchers faced in terms of the prevalence of trauma and mental health problems in times of war. She found that the researchers endeavoured to normalize the stress and psychological challenges associated with the war for different reasons. First, the war and associated crimes were massive and affected the entire population. So, researchers assumed that the challenges they experienced were less intense than the atrocities and challenges reported in the general and the rural population, and the vulnerable women and children. Second, the sense of purpose and cause was the single most important string that pushed researchers to keep going and prevented a complete break with their research work and serving their community. The researchers perceived that the challenges they experienced over the two-year war were a sacrifice paid for liberty and dignity.

Most researchers considered that the enemies gave only one option to the people of Tigray, which was to choose between freedom and

slavery. However, this attitude can conceal the actual trauma that researchers might have faced and the consequences it might have had on their future mental health and intellectual capacity.

Disowning the Ethiopian identity

Many of the researchers developed a feeling and sentiment that they were no longer associated with the Ethiopian identity. With the war and all the atrocities that happened, they could not think that they belonged to Ethiopia any longer. Consequently, they began to express aspirations for greater autonomy and the potential establishment of a distinct Tigray nation-state. One of the researchers said:

> *So far, I have lost five of my relatives; two members of TDF and three in the Aksum massacre. I have also lost my youngest son due to sickness and the problem I had was difficulty in getting medicines. During my two-month stay at Ayder Hospital in Mekelle, I observed many victims die due to lack of medicines and I was so traumatised when I was visiting the war victims. Many of the victims from TDF members were saying that they were struggling for the independence of Tigray via a referendum and their sacrifices were for such a grand goal so that Tigray would be relieved from the historical vicious cycle of violence. Also, they were saying we couldn't live with the genocidal state of Ethiopia.* (IDI 24, Email interview with a 41-year-old male, interview by Medhanyie, 14 June 2023)

During the war, they developed a feeling of being without a country. This feeling was not only felt by the researchers but by most people, and particularly the youth. This posed researchers with a blurred vision of the future and how they would like to pursue their research and academic careers in the context of turmoil in Ethiopia. One of the researchers stated that if the future of Tigray was to continue with Ethiopia, he would not have any reason to stay in Tigray and the better option for him would be to look for a life somewhere out of Tigray and Ethiopia.

> *What I am challenged to figure out the most is where the position of academics and research is in Ethiopia. [...] I felt stateless. While being in life-threatening conditions during the war, I hoped to live longer so that I could explore more about what happened and why. I will be back to my lecturer and researcher career as universities formally start their roles. Peace can't prevail at the cost of justice. All my research will be geared towards how peace and justice should be served together, if not I will*

try exile as I can't wait for another cycle of genocide. (IDI 23, Email interview with 33-year-old male, interview by Medhanyie, 20 May 2023)

Another researcher said:

Nationally, I hate to share the same passport and citizenship with those who perform unbelievably inhuman atrocities, mass rape, looting, and destroying public and individual properties of civilians, churches, and health facilities by inviting foreign troops. And the most painful thing is the world was looking and doing nothing except putting statements that say "we are concerned". In these two years, I concluded that the UN is a toothless lion, powerless to implement the goals of the organisation, it can't save starving people, can't save patients who need lifesaving drugs, and even immunization for children. (IDI 14, Email interview with a 38-year-old male, interview by Medhanyie, 14 March 2023)

Similarly, a senior researcher said:

It also made me lose trust and confidence in some Ethiopian institutions. Afterward, I am not interested in saving money in the Commercial Bank of Ethiopia and other private Banks in Ethiopia. I do not want to be a client of Ethiopian Telecom Services. I do not like to fly the Ethiopian Airlines. I do not trust the security apparatus of the country as they failed to protect me from foreign forces and domestic armed vigilante groups. The lesson for others is to stay focused and get involved in activities other academics and research that matter most to the victims of the war. (IDI 17, Email interview with a 55-year-old male, interview by Medhanyie, 17 March 2023)

The sense of being violated by the Ethiopian state caused a sense of statelessness and aspiration for an independent state, Tigray, or the desire to move elsewhere. The war in Tigray was a life-defining moment for most researchers. They believed that the relationship between the people of Tigray and the rest of Ethiopia would not be the same as it was before the war. The federal government of Ethiopia and the TPLF signed a Cessation of Hostilities Agreement on 2 November 2022, in Pretoria (African Union, 2022). The politicians who signed the agreement and the international community were hopeful that the war would be over and Ethiopia would return to the status quo before the start of the war on 3 November 2020. However, the scars that the war left in the hearts and minds of the researchers did not heal. Most of the researchers considered that what happened

to the people of Tigray had not passed. As a result, many researchers expressed doubts about the long-term prospects of Tigray remaining within Ethiopia.

Power of knowledge

In the debriefing discussion with the researchers, it was evident that breaking the vicious cycle of violence and war in Tigray became the question. One social science researcher said:

> *From November 2020 to June 28, 2021, I was with the TDF on the battlefields of Tigray and totally off my academic life, struggling for survival from the genocidal atrocities. I had fortunately survived life-taking attacks and sieges. On the battlefield, I witnessed the heroism, resilience, and exceptional and determined mobilisation of the Tigray people. I had lost my relatives and friends from members of the TDF and innocent civilian massacres in Aksum. My wife and my kids also faced the trauma and were hiding themselves in different places in Mekelle. They lived without salary and were supported by relatives and my friends abroad. After, I came back to Mekelle in June 2021, after the "historic operation Alula", I rejoined my family but was cut off from my academic life due to an Internet and communication blackout. The only academic engagement I had during the two-year war was writing a book chapter. Therefore, in the two-year war, I had no appetite and access to academic life but simply struggling for survival from the genocidal atrocities.* (IDI 24, Email interview with a 41-year-old male, interview by Medhanyie, 14 June 2023)

The researcher also added:

> *I did not consider myself an academician or researcher but one whose life existence was at high risk as the government has accused me a "wanted terrorist" until February 2023 and my bank account is still blocked by the federal government. My family's life was dependent on others' support. Due to security reasons, I couldn't visit my family in Aksum. After the war, my outlook towards Ethiopia, Amhara, Eritrea, and the international community has shifted. And I believe the only solution to Tigray's problem is establishing an independent state of Tigray. Tigray has been a victim of Ethiopia and Eritreans although Tegaru [Tigrayans] were considering Ethiopians and Eritreans as brothers. Also, the international community failed to stop the genocide in Tigray in favor of the Ethiopian and Eritrean states. So, Tigray should continue its struggle for statehood and be a member of the family of states. If Tigray fails to secure statehood, it will also face another cycle of genocide shortly.*

> *Therefore, my research and academic focus will be on how Tigray's vision for statehood will be secure.* (IDI 24, Email interview with 41-year-old male, interview by Medhanyie, 14 June 2023)

The general sense was that there was an academic task to solve the problem of vicious cycles of war in Tigray and to contribute to a solid area of work on how these cycles could be prevented.

Discussion

The researchers who participated in the study shared some of the serious challenges that they had to face and overcome in their work, as well as in their personal lives, during the Tigray war. Significant challenges related to the inability to conduct research as they had been used to, due to lack of financial or material resources, relationship breaks with partnering institutions and universities, lack of connectivity, unsafe working situations, and the inability to conduct fieldwork. Next to this, researchers experienced struggles related to the emotional burdens of the war, shifting world views, and a conflicting sense of identity as Ethiopian and Tigrayan researchers.

Using the concept of hysteresis as described by Bourdieu provides a useful framework within which to place these challenges. Bourdieu described hysteresis as:

> *The presence of the past in this kind of false anticipation of the future performed by the habitus is, paradoxically, most clearly seen when the sense of the probable future is belied and when dispositions ill-adjusted to the objective chances because of a hysteresis effect are negatively sanctioned because the environment they encounter is too different from the one to which they are objectively adjusted.* (Bourdieu, 1990, p. 62)

This hysteresis effect creates discordance for researchers having to continue their research in times of war and crisis despite being ill-adjusted to working in these conditions. This drives adaptation, for instance through researchers changing the scope of their research and the pool fund to deal with the lack of financial resources. Bourdieu discusses how hysteresis can lead to adaptation:

> *The persistence of the effects of primary conditioning, in the form of the habitus, accounts equally well for cases in which dispositions function out of phase and*

> *practices are objectively ill-adapted to the present conditions because they are objectively adjusted to conditions that no longer obtain. The tendency of groups to persist in their ways, due inter alia to the fact that they are composed of individuals with durable dispositions that can outlive the economic and social conditions in which they were produced, can be the source of maladaptation as well as adaptation, revolt as well as resignation.* (Bourdieu, 1990, p. 62)

The findings of this study indicate that the circumstances to which the researchers were subjected led to both revolt and resignation. At a personal level, there was an internal revolt for some against being a researcher, and for most against being Ethiopian. Yet researchers also resigned to the situation they were in, and the challenges that they were facing, and continued their work within this new framework. The support of family and friends was critical to supporting resilience, confirming the findings of Suttie (Suttie, 2017).

Several researchers expressed frustration with being treated so poorly by Ethiopia, the country that they felt they had served dutifully. This led to hysteresis in two ways. First, the conditions around them changed as Tigrayans were antagonised, their institutions stopped receiving funding, and partnerships were discontinued. In this instance, the researchers were confronted with being put in a situation by others resulting in a mismatch with what was before. This led to a belief that Tigray should be independent. After the war ended, and the researchers' perspectives and sense of identity had changed because of the war, a second mismatch occurred. This mismatch between the reality of having to return to the status quo, denying the emotional shock, devastation, and loss they had lived through during the war.

Conclusion

In this chapter, the researchers lived experiences, challenges, the dilemmas the faced, and resilience during the Tigray war are explored. The resilience of researchers primarily depended on research partners resolving the communication blackout. Research projects financed and coordinated by global partnerships, that were built on trust and mutual understanding, were found to be crucial for researchers to develop resilience. The researchers noted that adapting, continuing,

and maintaining research activities in wartime was impossible without the support of family and friends.

Despite preparations in anticipation of the war, researchers were ill-prepared for the enormity of the shocks that the war brought to their lives and research work. The researchers who participated in this study had not predicted the war. They felt powerless in the face of the overwhelming loss and senseless devastation. The shocks experienced during the war pushed society to the extent of breaking point and this experience fundamentally changed the world view of the researchers. These emotions created self-doubt and humility about what academia can bring in a time of war.

Nevertheless, the researchers found that the systematic problem-solving approach of academia has important contributions to make to documenting and stopping the cycle of violence in the region. Many researchers selflessly continued with their research, despite the many challenges they encountered. The researchers who participated in this study said that they believe that there is a need to step up the commitment to research in crisis and conflict situations, as it can contribute to understanding the causes and breaking the cycle of conflict.

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Authors' contributions

The first author conceived, designed and implemented the research. He did the interviews with the assistant of the second researcher and two research assistants. Both authors did the data analysis. The first author wrote the first draft of the manuscript. Both authors have contributed to the revision of the first draft and subsequent versions of the manuscript. Both have read and approved the final version.

Ethical considerations

The Institutional Review Board (IRB) office of the College of Health Sciences of Mekelle University signed the ethical approval for this research, Reference number MU-IRB 1973/2022.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 2

Resilience Conceptualised through Transformation: A Framework for Interdisciplinary Application

Joëlle Stocker

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That which you cannot bear will not be given to you.

Abstract

The research examines resilience as a 'travelling concept', focusing on two key aspects: spatial and interdisciplinary perspectives. It was found that resilience studies are largely Western-based, influencing how resilience is perceived. The measurement of resilience can be either economically reductionist (objective) or qualitative and participatory (subjective), with cultural differences affecting what contributes to resilience. Resilience is categorised into persistence, recovery, and adaptation/transformation, the latter involving either 'bouncing forward' or a complete systemic transformation. Resilience travels across disciplines, with 'adaptation' being a widely used construct, although its understanding varies by field. Psychology emphasises cultural context more than other disciplines. The findings suggest studying resilience on different scales, from narrow disciplinary views to broader cross-disciplinary perspectives, revealing its connections to other processes like cultural entropy and critical junctures. Resilience – with its twin concepts of hysteresis and panarchy – is a dynamic and evolving concept, changing as it moves across disciplines and cultures, leading to new interpretations and reflecting broader processes of adaptation, learning, and systemic transformation.

Keywords: resilience, literature review, hysteresis, resilience models, interdisciplinary research, cultural entropy, critical junctures

Resilience as a travelling concept

In 1969, the artist Sol Lewitt wrote *Sentences on Conceptual Art*. Therein he states that "the words of one artist to another may induce an idea chain, if they share the same concept", adding that "the artist may misperceive (understand it differently from the artist) a work of art but still be set off in his own chain of thought by that misconstrual". (LeWitt, 1969, cited in Alberro & Stimson, 1999, p. 107). In a similar way, the French philosopher Michel Foucault (1972) describes how concepts transform as they travel from user, field, and theoretical context, much like an artistic idea travels from artist to artist, thereby changing by virtue of the misconceptions brought forth by one's context:

> *There are the displacements and transformations of concepts: the analyses of G. Canguilhem may serve as models; they show that the history of a concept is not wholly and entirely that of its progressive refinement, its continuously increasing rationality, its abstraction gradient, but that of its various fields of constitution and validity, that of its successive rules of use, that of the many theoretical contexts in which it developed and matured.* (Foucault, 1972, p. 5)

In 2002, Mieke Bal coined the term 'travelling concepts', which describes how concepts, specifically in the humanities, can move through time, space, and discipline, thus evolving and changing (Bal, 2002). She explains how important it is to understand the mobility of concepts, to grasp the affiliations and legacies that are left behind by their development and uses. In the analysis of travelling concepts, she further identifies two distinct types of concepts: interdisciplinary and transdisciplinary. The first is when a concept has different meanings across disciplines, whereas with the latter the definitions stay the same throughout the disciplines.

In this chapter, we will be looking at resilience as a travelling concept. Resilience started emerging as a scientific concept in the 20th century, although whether this was in the early 20th century as an engineering term, or in the 1960s as an ecological term, depends on the perspective (Leys & Fossion, 2023). However, regardless of its origin, this concept has grown and expanded throughout a large number of disciplines to become an overarching concept with its definitions and

constructs becoming blurred. Especially in the past decade a lot has been published on how resilience should, and should not, be defined (Walker, 2020; Folke, 2016; Clark, 2021). For instance, there has been some debate on whether resilience is an inherent property of a system or person, or rather a process (Leys & Fossion, 2023). Another common point of focus is whether resilience is the ability to bounce-back from a disturbance to how it was before, or if it is about the ability to adapt and transform as a reaction to a disturbance (Walker, 2020).

Another issue in the field of resilience is the applicability of the concept in different contexts and cultures (Gaillard & Jigyasu, 2016). In general, it is not clear how accurate and reliable resilience measures are when frameworks are applied in the 'real world' (Saja *et al.*, 2019). This becomes even more problematic when looking at it from a global perspective, as resilience and its frameworks were developed in the West, creating a disparity when applying it to non-Western contexts. This is enhanced by the fact that, so far, most studies of resilience have been conducted in the Global North but particularly absent on the African continent (Xu & Marinova, 2013; Xue *et al.*, 2018; Yang *et al.*, 2021). Those that were conducted in Africa were carried out by non-African researchers (Xu & Marinova, 2013). Yet, it would be expected that the study of resilience is important in the African continent which is facing climate disasters, governance challenges, and social conflicts. However, it is not yet clear as to what extent the concept can be used and applied in a context that is so different from where it was developed. Similarly, in the context of the war in Tigray, it is not evident as to whether current frameworks for resilience are usable.

Some aspects of resilience as a travelling concept have been extensively documented. For instance, several studies have looked at how the concept of resilience has evolved through time and across disciplines (Alexander, 2013; Fraccascia *et al.*, 2018; Taşan-Kok *et al.*, 2013; Xue *et al.*, 2018). There are also several studies identifying the spatial distribution of resilience science (Xu & Marinova, 2013; Xue *et al.*, 2018; Yang *et al.*, 2021). However, one aspect of a travelling concept, and especially resilience, that has not yet been clearly

identified is how it travels across cultures. An important element of this is language; for a concept to be usable on a local scale it must first be translatable. Even then connotations might still differ. This has a significant impact on how resilience is defined and measured, especially if it is assessed by someone who is not familiar with the language and culture. How can resilience then be measured, if it is not even fully understood?

While the study of resilience has been extensive and there is certainly no lack of material, there is a need to review the concept and understand how its travel across time, space and disciplines, have influenced the way it is measured and contextualised. Furthermore, it is important to add the dimension of culture into the study of travelling concepts, to better understand how resilience has travelled through space and time. This study will answer the following question: *How can the understanding of "resilience" as a travelling concept enable new insights into the use of this term?*

This chapter aims to accomplish the following:

- Provide an overview of the various concepts under the umbrella of 'resilience', including how they relate between fields and definitions of resilience.
- Establish how resilience travels across cultures and what that means for the usability of the concept in different contexts.
- Explore how resilience is measured according to the various conceptualisations of resilience, including resilience models.
- Create linkages between concrete resilience models and social science theories.

Methodology

This study was conducted as a review on the literature on resilience. The literature used in this review was acquired through Google Scholar. Several search words were used.[5] As the literature on

[5] The search words used for the review were the following: "resilience", "cultural entropy", "critical transitions", "catastrophic shifts", "qualitative vs quantitative analysis", "measuring resilience", "critical junctures", "resilience studies geographic distribution", "resilience across cultures", "resilience Tigray", "social transformation".

resilience is so vast, it was not possible to do a systematic review of all relevant articles. In addition, snowballing was used to fill any gaps in the literature found thus far. The articles which were the basis for snowballing were those of Leys and Fossion (2021), Saja *et al.* (2019), and Capoccia (2016). Aside from reviewing the literature, some input for this article came from the research network GAIC (Globalization, Accessibility, Innovation and Care), which is affiliated with Tilburg University. This network consists of an international and diverse group of researchers, in which an extensive reflection on the conceptualisations of resilience in different cultures took place. The discussion consisted of input from the researchers on how resilience was expressed in their native language and used in research in their countries. The GAIC research network was further used to pick several relevant sociological theories and frameworks related to conceptualisations of resilience.

Finally, a systematic review was conducted of review articles on resilience published since 2019, using the search word 'resilience', which had to be in the title of the articles. This resulted in 3,040 articles. To further narrow the search and select the most relevant publications on resilience, articles that had more than 100 citations (according to Google Scholar) were selected. This resulted in 97 articles. A further selection was made based on relevance, specifically on whether the article was indeed a review article and on whether it identified constructs of resilience. Two more of the remaining articles were removed due to access restrictions. The final number of studies included in the review was 45. The systematic review of the resulting articles looked mainly at two factors: the geographic distribution of the publications and the constructs that are found across disciplines.

Definitions and development of resilience as a travelling concept

Different conceptualisations of resilience

Resilience is defined in various ways depending on the discipline and interpretation of researchers therein. Based on the literature three main categories were identified in which definitions of resilience can be grouped. The first is robustness, buffering capacity and the ability

to absorb changes. In other words, it is the perseverance of the same state for a system, where a system can remain unchanged after a disturbance. Berkes *et al.* (2020) describe it as:

> *…a measure of robustness and buffering capacity of the system to changing conditions.* (Berkes et al., 2020, p.12)

The second is the ability of a system to recover and bounce back from a disturbance reverting to the state of the system was prior to the disturbance. An example thereof is:

> *…'the ability of a substance or object to spring back into shape' or 'the capacity to recover quickly from difficulties; toughness'.* (Robertson & Cooper, 2013, p.1)

The final category is that of adaptation and transformation, whereby the system adapts and transforms after a disturbance to be able to cope with it better. This is described by Walker (2020) as follows:

> *Resilience is in fact the ability to adapt and change, to reorganize, while coping with disturbance. It is all about changing in order not to be changed. A resilient system responds to a disturbance by changing the relative amounts of its different parts and how they interact, thereby changing the way it functions.* (Walker, 2020, n.p.)

These categories were also identified by Folke (2006), shown in Table 2.1, where the first category was framed as the narrower interpretation and the final one encompassed the broader social-ecological context.

While these categories are useful to understand why the concept of resilience is used in such different ways, it is a simplification of how resilience is defined in the literature. It would be more useful to interpret them as the extremes of a continuum (or a three-dimensional graph), with all the possibilities in between. Many definitions are a combination of categories, sometimes focusing on one, while others find themselves in the middle of all categories. An example of the latter is the following definition by Bruneau (2003):

> *The ability of social units (e.g., organizations, communities) to mitigate hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of future earthquakes.* (Bruneau, 2003, p. 735)

Table 2.1. Overview of resilience concepts

Resilience concept	Characteristics	Focus on	Context
Engineering resilience	Return time, efficiency	Recovery, constancy	Vicinity of a stable equilibrium
Ecological/ecosystem resilience social resilience	Buffer capacity, withstand shock, maintain function	Persistence, robustness	Multiple equilibria, stability landscapes
Social-ecological resilience	Interplay disturbance and reorganisation, sustaining and developing	Adaptive capacity transformability, learning, innovation	Integrated system feedback, cross-scale dynamic interactions

Source: Based on Folke (2006)

This definition consists of the following important elements: mitigation, containing effects of disasters, and recovery. Both mitigation and containing the effects of disasters fit best within the first category, whereas recovery fits in the second. Moreover, recovery is not framed as bouncing back to the way it was before, but rather adapting so that the system is better equipped to face future disturbances. Another example is Keck and Sakdapolrak's (2013) three dimensions of social resilience: (1) coping capacity – how well individuals can deal with adversity, (2) adaptive capacity – being able to learn from past experiences and adapt for the future, and (3) transformative capacity – the ability to create change on an individual and institutional level. In all of these examples, recovery is directly linked to adaptation, where it is not about bouncing back to the way it was before but "bouncing forward" to a more resilient state (Hynes *et al.*, 2020). Keck and Sakdapolrak (2013) then add an important

aspect: transformation. This is an important part of resilience, although it is the least commonly discussed. Whereas adaptation, recovery and persistence or robustness are all common throughout disciplines, transformation is scarcer (Biddle *et al.*, 2020). Consequently, transformation is not understood as a vital part of resilience. Yet, as we will see in this chapter, it is an unavoidable part of the resilience narrative of systems, institutions and individuals.

Resilience across space and disciplines

As mentioned earlier, there is an abundance of literature describing how the concept of resilience has evolved over time, moved through disciplines, and travelled through space. Resilience is often perceived to have been introduced in the academic literature from the environmental sciences, with one of the early definitions by Odum (1969) and Holling (1973), in which adaptation is followed by transformation when the former is no longer possible due to climatic stress. From there, the concept quickly spread to psychology, introduced by Emmy Werner in 1971, and psychiatry, as well as anthropology (Leys & Fossion, 2023). Although it became widespread in the 1970s, the concept was used scientifically for the first time in the 17th century (Alexander, 2013). Later, at the end of the 19th century, it was introduced to the field of engineering (mechanics) in relation to finding the breaking point of iron bars (Leys & Fossion, 2023). From there it spread to the social sciences in the 1940s and 1950s (Alexander, 2013). The conceptualisation of resilience in anthropology was similar to that of ecology, being centred around 'systems', subsequently moving to psychology, in which the mind is the system (Alexander, 2013).

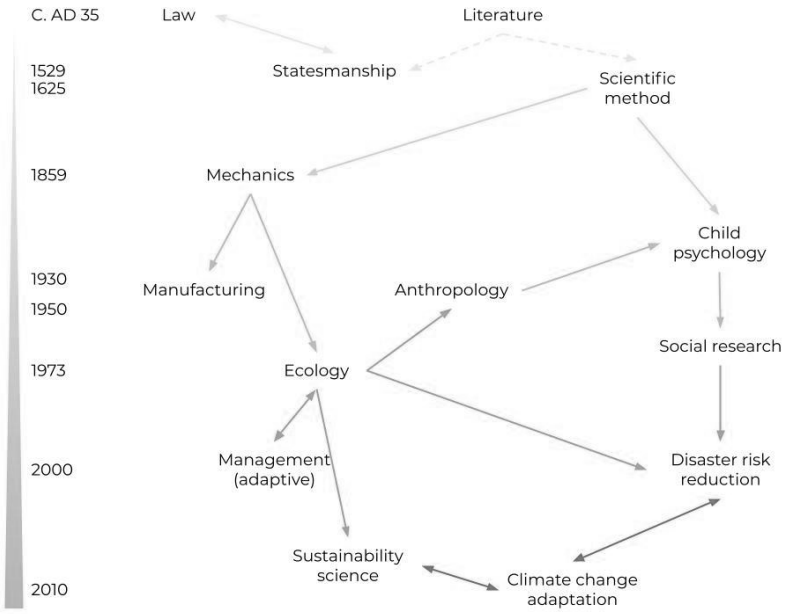


Figure 2.1. The introduction of resilience in various disciplines over time

Source: Adapted from Alexander (2013)

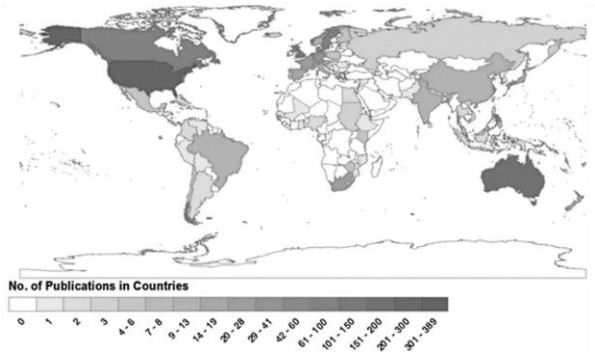
Xue *et al.* (2018) studied how resilience has changed spatially over time in the top 10 countries that published articles on resilience. This study found an interesting change between 1985 and 2014, when resilience literature transitioned from a more global distribution to mainly taking place in North America and Western Europe. Between 1985 and 1994 the list featured India, Israel, Japan, and South Africa, in comparison with the final decade (2005–2014), when the only non-Western countries featured were South-Africa and China. The absence of publications in different parts of the world is clearly visible in the map created by Xu and Marinova (2013), in which notably the African continent scarcely produced publications, compared to the rest of the world, and notably North America, (Western) Europe and Australia (Figure 2.2). This demonstrates an issue that is not often discussed, about how representative the measures for resilience are across spatial and cultural scales.

The geographic distribution of the review publications on resilience was also mapped, with Figure 2.3 showing the result. The countries

were selected based on author affiliations. If a publication had authors affiliated to institutions in different countries, the publication was counted for all those countries. The results are similar to those of Xu and Marinova (2013), Xue *et al.* (2018) and Yang *et al.* (2021), with the overwhelming majority of studies coming from the United States, Australia and Western Europe.

The issue of cultural context in the assessment of resilience is clear when looking at it from a psychological perspective. Leys and Fossion (2023) describe how during a collaboration with Cambodian researchers, they were told that in their culture symptoms of fatigue and sadness were considered normal and not related to depression. The danger of prescribing Western standards of wellbeing and resilience have been explored in a number of studies, though this is mostly limited to the field of psychology (DeVries, 1985; Ungar & Liedenberg, 2011; Gaillard & Jigyasu, 2016). For instance, Ungar (2008) discusses how it is difficult to know how much a particular aspect of resilience influences individuals, as they are not comparable across cultures. This can be defined as construct inequivalence, when people from different cultures are not able to comparably understand constructs, such as those related to resilience and resilience itself (Ungar, 2008).

A



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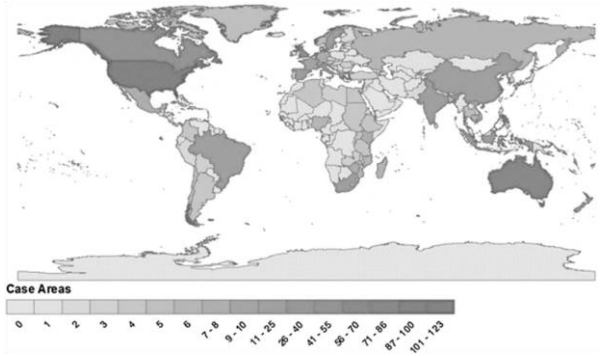

Figure 2.2. A: Number of publications on resilience by country; B: Number of case studies mentioned in resilience publications by country

Source: Xu & Marinova (2013)

When discussing resilience with the GAIC research network[6], it became clear that there is not one word that can fully encompass the entire concept, and a sentence would usually be needed to properly explain what is conveyed in different languages. For instance, in Dutch and Slovak the different aspects of resilience would be expressed through the words: 'veerkracht' (Dutch) and 'ohybnost' (Slovak) referring to bouncing-back, bendability, and flexibility;

[6] GAIC explores digital innovation, health, humanities, social sciences, and culture studies through inquiries into phenomena across diverse locations. It serves as a platform for intellectual exchange, mutual development, and offers essential research training in methodology and theory development for its PhD students.

'elasticiteit' (Dutch) and 'elastickos' (Slovak) meaning elasticity; and 'weerstand' (Dutch) and 'odolnost' (Slovak) translating to resistance and robustness. When asking several Luganda speakers in Uganda to translate resilience into their language, three different words were given: 'obuvumu' (to be able to withstand), 'okulumerako' (to persist) and 'okuguma' (to strengthen yourself). An interesting example was the translation to Amharic, 'chay', which was defined as the resistance to challenges or the resistance to change. Thus, directly going against the aspect of transformation within resilience. Similarly, in Tigrinya the word resilient translates to the terms 'ፅኑዕ' and 'ፀዋር', referring to coping or adaptive capacity, in which the sense of transformation and anticipation are missing. To refer to the aspect of transformation in resilience, the word 'ሰጋር' ('segar') is used.

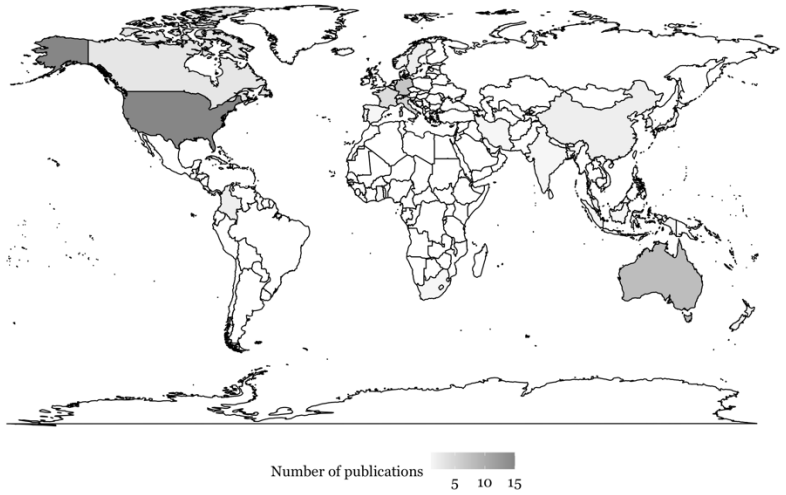

Figure 2.3. Geographic distribution of publications on resilience in the systematic literature review

Abundance of constructs linked to resilience

It is expected that the variety of ways in which resilience can be defined and understood leads to the abundant use of constructs, some of which are found across disciplines, adaptation being one of them, while others are specific to one. To showcase how extensive this is, we identified constructs from 45 review articles, in the fields of health science (1), medicine (1), sustainability (11), psychology (9), business/management sciences (8), environmental sciences (2),

engineering (6), Disaster mitigation sciences (4), economics (2), and data science (1). The 53 constructs most commonly mentioned in the literature (more than 3 times) are given in Table 2.2.

Table 2.2. Overview of constructs identified in the systematic literature review

Construct	Field	Source
Adaptation	Sustainability	Ribeiro & Gonçalves, 2019; Mahzarnia *et al.*, 2020; Ansah *et al.*, 2019; Roostaie *et al.*, 2019; Jufri *et al.*, 2019; Koliou *et al.*, 2020
	Psychology	Masten *et al.*, 2021; Cooper *et al.*, 2020; Stainton *et al.*, 2019; Ungar & Theron, 2020; Sisto *et al.*, 2019
	Health science	Haldane *et al.*, 2021
	Business/ management	Conz & Magnani, 2020; Hillmann & Guenther, 2021; Hosseini *et al.*, 2019; Negri *et al.*, 2021; Ntounis *et al.*, 2022; Golan *et al.*, 2020; Ali & Gölgeci, 2019
	Environmental sciences	McWethy *et al.*, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019; McClymont *et al.*, 2020; Saja *et al.*, 2019; Tiernan *et al.*, 2019
	Engineering	Liu & Song, 2020; Singh *et al.*, 2019
	Data science	Linkov & Kott, 2019
Agility	Business/ management	Conz & Magnani, 2020; Hosseini *et al.*, 2019; Shekarian & Mellat Parast, 2021; Ali & Gölgeci, 2019

Construct	Field	Source
	Disaster mitigation science	Cariolet *et al.*, 2019
	Engineering	Spieske & Birkel, 2021; Singh *et al.*, 2019
	Sustainability	Ali *et al.*, 2021
Anticipation	Business/ management	Hillmann & Guenther, 2021; Negri *et al.*, 2021
	Disaster mitigation science	McClymont *et al.*, 2020
	Engineering	Liu & Song, 2020
	Sustainability	Roostaie *et al.*, 2019; Jufri *et al.*, 2019
Avoidance	Business/ management	Hillmann & Guenther, 2021; Negri *et al.*, 2021
	Disaster mitigation science	Tiernan *et al.*, 2019
Bounce back	Business/ management	Negri *et al.*, 2021
	Disaster mitigation science	McClymont *et al.*, 2020; Tiernan *et al.*, 2019
	Sustainability	Béné, 2020; Roostaie *et al.*, 2019
	Psychology	Ungar & Theron, 2020; Sisto *et al.*, 2019
	Engineering	Liu & Song, 2020
Buffering	Sustainability	Ribeiro & Gonçalves, 2019

Construct	Field	Source
	Disaster mitigation science	Cariolet *et al.*, 2019; McClymont *et al.*, 2020
	Data science	Linkov & Kott, 2019
Capacity	Sustainability	Mahzarnia *et al.*, 2020
	Disaster mitigation science	Saja *et al.*, 2019
	Engineering	Sun *et al.*, 2020
Change	Sustainability	Ribeiro & Gonçalves, 2019; Elmqvist *et al.*, 2019
	Psychology	Cooper *et al.*, 2020
	Business/ management	Negri *et al.*, 2021
	Disaster mitigation science	McClymont *et al.*, 2020
Collaboration	Business/ management	Hosseini *et al.*, 2019; Ali & Gölgeci, 2019
	Engineering	Spieske & Birkel, 2021; Singh *et al.*, 2019
	Sustainability	Ali *et al.*, 2021
Connected-ness	Sustainability	Ribeiro & Gonçalves, 2019
	Business/ management	Negri *et al.*, 2021
	Sustainability	Elmqvist *et al.*, 2019
	Disaster mitigation science	Saja *et al.*, 2019

Construct	Field	Source
	Environmental sciences	Nyström *et al.*, 2019
	Psychology	Laird *et al.*, 2019; Cooper *et al.*, 2020; Brooks *et al.*, 2020
	Engineering	Sun *et al.*, 2020
Control	Psychology	Cooper *et al.*, 2020
	Business/ management	Negri *et al.*, 2021
	Disaster mitigation science	McClymont *et al.*, 2020
Coping	Medicine	Seiler & Jenewein, 2019
	Psychology	Masten *et al.*, 2021; Laird *et al.*, 2019; Brooks *et al.*, 2020
	Engineering	Liu & Song, 2020
Diversity	Sustainability	Ribeiro & Gonçalves, 2019; Elmqvist *et al.*, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019
	Environmental sciences	Nyström *et al.*, 2019
	Engineering	Sun *et al.*, 2020
Dynamic	Business/ management	Ntounis *et al.*, 2022
	Psychology	Stainton *et al.*, 2019; Sisto *et al.*, 2019
	Engineering	Sun *et al.*, 2020

Construct	Field	Source
Efficiency	Sustainability	Ribeiro & Gonçalves, 2019; Elmqvist *et al.*, 2019; Ansah *et al.*, 2019; Jufri *et al.*, 2019
Equilibrium	Sustainability	Ribeiro & Gonçalves, 2019; Roostaie *et al.*, 2019
	Business/ management	Ntounis *et al.*, 2022
Exposure	Psychology	Ungar & Theron, 2020
	Disaster mitigation science	Tiernan *et al.*, 2019
	Sustainability	Jufri *et al.*, 2019
Faith	Psychology	Masten *et al.*, 2021; Cooper *et al.*, 2020; Prime *et al.*, 2020; Laird *et al.*, 2019
Flexibility	Medicine	Seiler & Jenewein, 2019
	Business/ management	Conz & Magnani, 2020; Hosseini *et al.*, 2019; Ali & Gölgeci, 2019
	Sustainability	Mahzarnia *et al.*, 2020; Ali *et al.*, 2021; Roostaie *et al.*, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019
	Engineering	Singh *et al.*, 2019
	Economics	Ivanov & Dolgui, 2019
Functionality	Health science	Haldane *et al.*, 2021
	Business/ management	Hillmann & Guenther, 2021

Construct	Field	Source
	Disaster mitigation science	McClymont *et al.*, 2020
	Sustainability	Jufri *et al.*, 2019; Koliou *et al.*, 2020
	Data science	Linkov & Kott, 2019
	Engineering	Sun *et al.*, 2020
Information sharing	Business/ management	Hosseini *et al.*, 2019; Ali & Gölgeci, 2019
	Engineering	Singh *et al.*, 2019
	Disaster mitigation science	Saja *et al.*, 2019
Learning	Business/ management	Hillmann & Guenther, 2021
	Disaster mitigation science	McClymont *et al.*, 2020
	Sustainability	Roostaie *et al.*, 2019; Jufri *et al.*, 2019
Maintaining	Sustainability	Ribeiro & Gonçalves, 2019; Roostaie *et al.*, 2019
	Business/ management	Hillmann & Guenther, 2021; Negri *et al.*, 2021
	Disaster mitigation science	McClymont *et al.*, 2020
	Engineering	Liu & Song, 2020
Management	Psychology	Masten *et al.*, 2021
	Sustainability	Elmqvist *et al.*, 2019

Construct	Field	Source
	Disaster mitigation science	McClymont *et al.*, 2020
	Data science	Linkov & Kott, 2019
Mitigation	Sustainability	Ribeiro & Gonçalves, 2019; Jufri *et al.*, 2019
	Business/ management	Negri *et al.*, 2021; Ali & Gölgeci, 2019
	Engineering	Zhou *et al.*, 2019; Sun *et al.*, 2020
	Disaster mitigation science	Saja *et al.*, 2019; Tiernan *et al.*, 2019
	Economics	Aldrighetti *et al.*, 2021; Ivanov & Dolgui, 2019
Optimism	Medicine	Seiler & Jenewein, 2019
	Psychology	Masten *et al.*, 2021; Cooper *et al.*, 2020
	Sustainability	Elmqvist *et al.*, 2019
Organisation	Psychology	Masten *et al.*, 2021; Prime *et al.*, 2020
	Sustainability	Elmqvist *et al.*, 2019; Roostaie *et al.*, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019
Persistence	Business/ management	Conz & Magnani, 2020; Ntounis *et al.*, 2022
	Disaster mitigation science	McClymont *et al.*, 2020
	Sustainability	Roostaie *et al.*, 2019

Construct	Field	Source
Plan	Psychology	Masten *et al.*, 2021
	Business/ management	Golan *et al.*, 2020
	Data science	Linkov & Kott, 2019
Preparedness	Sustainability	Hussain *et al.*, 2019; Roostaie *et al.*, 2019; Jufri *et al.*, 2019
	Engineering	Bešinović, 2020; Zhou *et al.*, 2019; Liu & Song, 2020
	Disaster mitigation science	McClymont *et al.*, 2020; Saja *et al.*, 2019; Tiernan *et al.*, 2019
	Business/ management	Ali & Gölgeci, 2019
Prevention	Sustainability	Ribeiro & Gonçalves, 2019; Roostaie *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020
Recovery	Sustainability	Ribeiro & Gonçalves, 2019; Hussain *et al.*, 2019; Mahzarnia *et al.*, 2020; Roostaie *et al.*, 2019; Grafton *et al.*, 2019
	Business/ management	Hillmann & Guenther, 2021; Negri *et al.*, 2021; Golan *et al.*, 2020
	Engineering	Bešinović, 2020; Spieske & Birkel, 2021; Zhou *et al.*, 2019; Liu & Song, 2020; Sun *et al.*, 2020
	Disaster science	McClymont *et al.*, 2020; Tiernan *et al.*, 2019
	Economics	Aldrighetti *et al.*, 2021

Construct	Field	Source
	Data science	Linkov & Kott, 2019
	Psychology	Sisto *et al.*, 2019
Reduce impact	Business/ management	Negri *et al.*, 2021
	Engineering	Liu & Song, 2020
	Sustainability	Jufri *et al.*, 2019
Redundancy	Sustainability	Ribeiro & Gonçalves, 2019; Mahzarnia *et al.*, 2020; Elmqvist *et al.*, 2019; Ali *et al.*, 2021
	Business/ management	Conz & Magnani, 2020; Shekarian & Mellat Parast, 2021; Ali & Gölgeci, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019
	Engineering	Liu & Song, 2020; Singh *et al.*, 2019; Sun *et al.*, 2020
	Economics	Ivanov & Dolgui, 2019
Resistance	Sustainability	Ribeiro & Gonçalves, 2019; Roostaie *et al.*, 2019; Jufri *et al.*, 2019; Grafton *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020; Tiernan *et al.*, 2019
	Engineering	Liu & Song, 2020
	Business/ management	Ali & Gölgeci, 2019
	Sustainability	Ribeiro & Gonçalves, 2019; Mahzarnia *et al.*, 2020; Elmqvist *et al.*,

Construct	Field	Source
Resourceful-ness		2019; Roostaie *et al.*, 2019; Ansah *et al.*, 2019
	Health science	Haldane *et al.*, 2021
	Business/ management	Conz & Magnani, 2020; Hillmann & Guenther, 2021; Ali & Gölgeci, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019; Saja *et al.*, 2019
	Psychology	Ungar & Theron, 2020
	Engineering	Liu & Song, 2020
	Data science	Linkov & Kott, 2019
Response	Health science	Haldane *et al.*, 2021
	Business/ management	Conz & Magnani, 2020; Negri *et al.*, 2021
	Engineering	Bešinović, 2020; Spieske & Birkel, 2021; Zhou *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020
	Sustainability	Béné, 2020; Roostaie *et al.*, 2019
Restoration	Business/ management	Hosseini *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020
	Engineering	Liu & Song, 2020; Sun *et al.*, 2020
	Economics	Aldrighetti *et al.*, 2021
Risk	Engineering	Zhou *et al.*, 2019

Construct	Field	Source
	Psychology	Ungar & Theron, 2020
	Disaster mitigation science	Saja *et al.*, 2019
	Economics	Aldrighetti *et al.*, 2021
Robustness	Sustainability	Ribeiro & Gonçalves, 2019; Mahzarnia *et al.*, 2020; Grafton *et al.*, 2019
	Business/ management	Conz & Magnani, 2020; Negri *et al.*, 2021; Ali & Gölgeci, 2019
	Engineering	Bešinović, 2020; Zhou *et al.*, 2019; Liu & Song, 2020; Singh *et al.*, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019; McClymont *et al.*, 2020
	Economics	Aldrighetti *et al.*, 2021
Scale	Sustainability	Elmqvist *et al.*, 2019; Roostaie *et al.*, 2019
	Data science	Linkov & Kott, 2019
Stability	Disaster mitigation science	Cariolet *et al.*, 2019; McClymont *et al.*, 2020
	Sustainability	Roostaie *et al.*, 2019
Stress	Medicine	Seiler & Jenewein, 2019
	Psychology	Cooper *et al.*, 2020; Ungar & Theron, 2020
Survivability	Business/ management	Conz & Magnani, 2020
	Engineering	Bešinović, 2020

Construct	Field	Source
	Disaster mitigation science	McClymont *et al.*, 2020
Tolerance	Psychology	Cooper *et al.*, 2020
	Sustainability	Mahzarnia *et al.*, 2020; Jufri *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020
Transformation	Sustainability	Ribeiro & Gonçalves, 2019; Elmqvist *et al.*, 2019; Ansah *et al.*, 2019; Roostaie *et al.*, 2019
	Environmental sciences	McWethy *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020; Saja *et al.*, 2019
Transition	Sustainability	Elmqvist *et al.*, 2019; Roostaie *et al.*, 2019
	Business/ management	Ntounis *et al.*, 2022
Understanding	Health science	Haldane *et al.*, 2021
	Engineering	Spieske & Birkel, 2021
	Disaster mitigation science	Saja *et al.*, 2019
Variability	Sustainability	Ribeiro & Gonçalves, 2019
	Business/ management	Negri *et al.*, 2021

Construct	Field	Source
	Environmental sciences	Nyström *et al.*, 2019
	Economics	Ivanov & Dolgui, 2019
Velocity	Engineering	Spieske & Birkel, 2021; Singh *et al.*, 2019
	Business/ management	Ali & Gölgeci, 2019
Visibility	Business/ management	Hosseini *et al.*, 2019; Ali & Gölgeci, 2019
	Engineering	Spieske & Birkel, 2021; Singh *et al.*, 2019
Vulnerability	Health science	Haldane *et al.*, 2021
	Engineering	Bešinović, 2020; Zhou *et al.*, 2019
	Disaster mitigation science	Cariolet *et al.*, 2019; Tiernan *et al.*, 2019
	Sustainability	Jufri *et al.*, 2019
With-standing	Business/ management	Conz & Magnani, 2020; Negri *et al.*, 2021
	Sustainability	Hussain *et al.*, 2019; Ansah *et al.*, 2019; Roostaie *et al.*, 2019; Jufri *et al.*, 2019
	Disaster mitigation science	McClymont *et al.*, 2020
	Engineering	Liu & Song, 2020

What is striking is that many constructs have overlapping meanings. These include avoidance, preparedness, reduced impact, and mitigation; bounce back, recovery and restoration; anticipation and preparedness; and learning and adaptation. Similarly, in the review on

urban resilience by Ribeiro & Gonçalves (2019), many constructs were found with similar characteristics and processes such as buffering and robustness; overlap in governance and redundancy; and social capital and resources. It is also interesting to look at constructs that are specific to particular fields. For instance, faith, optimism, stress, and coping were almost exclusively used in psychology, whereas efficiency was only found in articles on sustainability. Many terms seem to be widespread in other disciplines, but not in psychology, such as risk, functionality, anticipation, restoration, preparedness, agility, response, withstanding, vulnerability, mitigation, robustness, diversity, redundancy, flexibility, resistance, and maintaining. This could indicate that resilience studies in psychology are more separated in terms of how the term is understood and defined compared to other fields, in which there is a bigger overlap.

Measuring resilience

The wide use of the constructs of resilience means that many frameworks and assessment methods have evolved by which it is measured. It is to be expected that the methods used in psychology are not the same as those used in environmental sciences. However, even within disciplines there are wide variances in the assessment methods used and, most significantly, in what exactly is being measured according to how resilience is defined.

Overview of methodologies used

As many as there are definitions of resilience, so there are ways by which it is measured. If we look back at the three ways in which we can categorise definitions of resilience – namely, the ability of a system to persist, the ability of a system to recover (quickly), and the ability of a system to adapt and transform – we already find very different ways of measuring resilience. For instance, with persistence a commonly used metric is redundancy, which identifies the connections between elements, focusing on those that could take over functions of others in the system (Hosseini *et al.*, 2019). Alternatively, a risk-assessment could be made, in which the probability that a disturbance would impact on the system is

measured (Stochino *et al.*, 2019). The obvious way of measuring resilience in the context of bouncing back is by looking at recovery time (Pimm *et al.*, 2019). On the other hand, when looking at resilience through the lens of adaptation and transformation, Arani *et al.* (2021) suggest measuring it by using the 'life expectancy' or 'mean exit time' of a system, which looks at the average time that a system spends in a particular state before transforming into a new one.

In general, however, it has often been found that approaches to measuring resilience do not assess it adequately (Ungar, 2003; Biddle *et al.*, 2020; Saja *et al.*, 2019). A mixed-method approach is better able to correctly and all-roundedness measure resilience and explore relevant constructs of resilience within a particular circumstance or context (Ungar, 2003). This allows the methods to complement each other. According to Biddle *et al.* (2020) who reviewed methods of assessing resilience in healthcare systems, qualitative and mixed methods are able to capture more dimensions of resilience than can quantitative analyses. Another way of overcoming this issue is by using specific resilience models. These are also extensive, but they at least provide a context within which measurements can take place (Ungar, 2003).

Biddle *et al.* (2020) provides two ways in which resilience can be quantified: the probability of failure and the consequences thereof. For instance, a standard measure in ecology is to look at the maximum perturbation a system can endure, although this paints an unrealistic picture of systems, which are subjected to almost constant shocks and fluctuations (Arani *et al.*, 2021). Furthermore, Biddle's (2020) distinction is only realistic if resilience is perceived as a process, rather than an inherent characteristic of a system. In case of the latter, the resilience of a system could be measured regardless of the presence of a disturbance, by identifying the specific characteristics that enhance the system's resilience.

Several studies that have classified how resilience is measured. For instance, Cutter (2016) went through assessments in disaster resilience and distributed the findings into three categories. These are indices, scorecards, and tools, with the first two being more abundant. Indices are quantitative analyses consisting of indicators of a specific

characteristic of resilience, which are condensed together into one numeric value. Scorecards on the other hand measure the presence and absence of actions and items related to resilience. These tend to be based on qualitative assessments. Finally, the category of tools is a combination of models and tools, such as toolkits, sample procedures and survey instruments.

Gaillard and Jigyasu (2016) also categorised measures of resilience to disasters into three groups: economic reductionism, anthropological particularism, and participatory pluralism, based on the methodologies used in poverty research by Chambers (2007). The first consists of quantitative assessments such as scorecards, ranks, and indexes. One of the most important weaknesses of such methods is the fact that they are contextually blind and based on generalised assumptions and definitions of the concept. Anthropological particularism, on the other hand, tends to be qualitative methodologies consisting of extensive descriptions in which the context is taken into consideration. Finally, participatory pluralism comprises participatory methods in which resilience is assessed by the people who are at risk themselves. Gaillard and Jigyasu (2016) point out an important limitation of qualitative research (anthropological particularism): such research is not so usable for policy and practice, and not easily reproducible, diminishing its usability in policy making. Qualitative research is, therefore, often limited to staying in academia and is not transferable to more practical dimensions.

Jones (2019) suggested that when looking at how we measure resilience, there are two things we must consider. The first is how resilience is defined, and the second is how resilience is evaluated. Both can then be analysed using a subjectivity-objectivity continuum. If we then look at the categories mentioned by Gaillard and Jigyasu (2016), economic reductionism would be placed in the quadrant where resilience is both defined and evaluated in an objective way. In other words, the researchers have a set idea of what resilience is and what elements characterise it. This has clear drawbacks when taking construct inequivalence into account. At the other end of the continuum, where resilience is defined and evaluated in a subjective way, lies the category of participatory pluralism in which both the

interpretation of the concept and the identified characteristics are not fixed by the researchers, but are decided by participants themselves. This also gives a voice to communities that tend to be silenced in knowledge production and, thus, creates a better understanding of the local perception of the concept of resilience (Ungar, 2003).

Looking specifically at studies on resilience that were conducted in Tigray, participatory and qualitative methodologies are already used, especially when looking at community resilience (Maxwell *et al.*, 2010; Forch, 2012; Ahmed, 2011, Ghebreyohannes *et al.*, 2022). On the other hand, when looking at livelihood resilience, more of an economic reductionist approach tends to be taken (Vaitla *et al.*, 2012; Tsehaye *et al.*, 2009). For instance, Vaitla *et al.* (2012) measures livelihood resilience using indicators with set quantitative frameworks developed in the literature, but that have not been adjusted for the Tigrayan context. They define resilience as:

> *the ability of an individual, a household, a community, or an institution to withstand a shock or setback of some type and recover, or 'bounce back,' after a setback. As such, it implies the ability to cope with adversity by adapting, learning, and innovating.* (Vaitla, et al., 2012, p. 3)

Thus, here, resilience is both defined and evaluated in an objective way. In contrast, Forch (2012) established a methodological framework within the community with the goal of creating an understanding of resilience within the Tigrayan context, which was subsequently tested and developed further. Yet, resilience is still defined in an objective way as the ability of a system to absorb change. Consequently, we can argue that while the assessment of resilience is defined objectively, the assessment thereof is subjective. Although the issue of language was mentioned in the latter, specifically mentioning that the translations were conducted to reflect what was being said, rather than editing it to fit in broader categories, the issue of language and translation was not reflected upon in terms of how the concepts were translated to, and understood by, the participants.

Resilience models

As an assessment tool, models are important to show relationships between different dimensions that define resilience. They visualise

processes, while providing a mathematical dimension to the concept, thus facilitating measurement. The importance of models lies in the fact that rather than defining a concept, they depict a process that has been observed and can be used separately from the concept. As such, the model can be applied in various scenarios, if the process itself is present and relevant.

One model of resilience used in a number of studies is one in which critical functionality is assessed as a measure of time (Ganin *et al.*, 2016), as depicted in Figure 2.4. This model encompasses the notion of resilience in which the three categories: persistence, recovery, and adaptation, are the stages of resilience to a disturbance. This is especially useful in fields such as disaster risk reduction, where the concept is centred on the reaction to a disturbance. Consequently, this model is a linear conceptualisation, in which the emphasis is on recovery, in the form of bouncing forward.

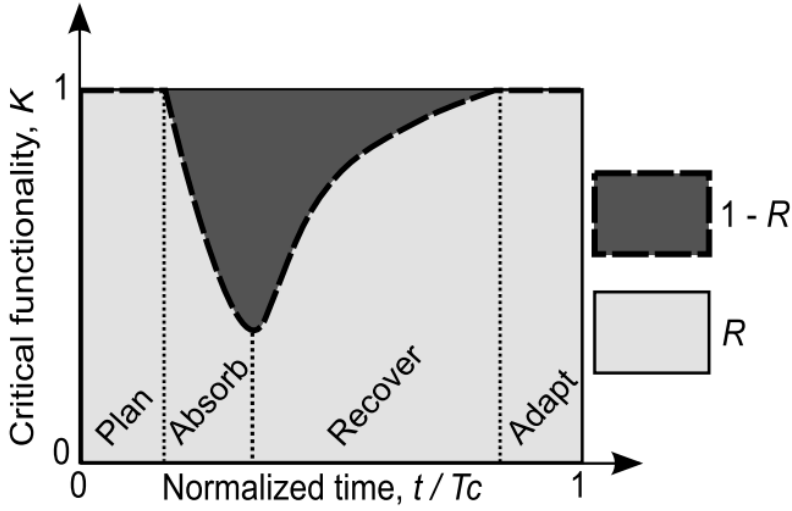

Figure 2.4. Critical functionality as a function of time

Source: Ganin *et al.* (2016)

A more circular model is that of the adaptive cycle, introduced by the Resilience Alliance (2010) in a workbook they created for assessing socio-ecological resilience. The cycle depicts the different stages that a socio-ecological system goes through, namely, rapid growth (r),

conservation of resources (K), release of resources (Ω), and reorganisation (α) (Figure 2.5). These stages are somewhat similar to the ones in Ganin's model (Ganin, 2016), where the disturbance is the release of resources and reorganisation is simultaneously recovery and adaptation. However, this model has some important aspects in the resilience narrative that have not been discussed so far, namely, the existence of different system scales that are connected hierarchically, where what happens on one scale affects events on other scales (Gunderson and Holling, 2004). The way in which several adaptive cycles on multiple scales are connected is called panarchy[7] (Resilience Alliance, 2010). Being aware of this cycle and scales is essential when introducing efficient management interventions, as the same intervention may have very different results according to where in the cycle it is introduced.

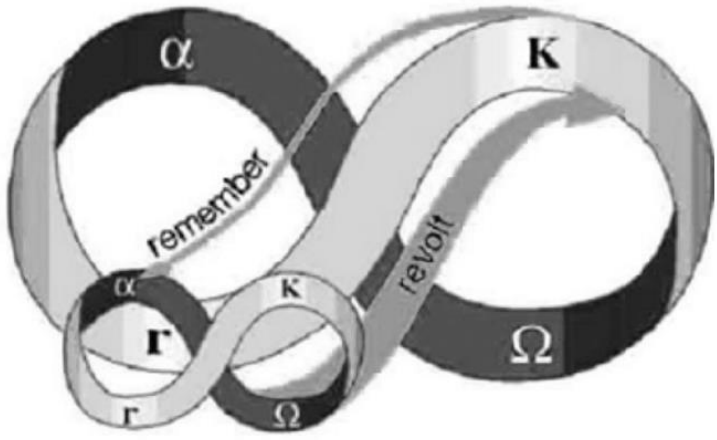

Figure 2.5. The adaptive cycle
Source: Resilience Alliance (2010)

[7] Defined by the Resilience Alliance ("Panarchy", n.d.) as: "No system can be understood or managed by focusing on it at a single scale. All systems (and SESs especially) exist and function at multiple scales of space, time and social organisation, and the interactions across scales are fundamentally important in determining the dynamics of the system at any particular focal scale. This interacting set of hierarchically structured scales has been termed a "panarchy" (Gunderson & Holling 2003)"

The last model is widely used in environmental sciences. It looks at critical transitions or catastrophic shifts within ecosystems, focusing on the transformation of systems. A significant term for this is that of alternative regimes or system states, which a system can move to as a consequence of disturbances and low resilience. Figure 2.6, which is adapted from Scheffer *et al.* (2012), depicts this transition, with F2 being the tipping point or threshold. The S-curve of the graph indicates that this transition is difficult to reverse. Although it is possible to reach the tipping point, which will bring the system back to its previous state, it is not sufficient to bring the conditions of the system back to the way they were at the threshold. Rather, they must go back much further to reach the backward shift. This process, which is essentially the distance between F1 and F2, is called hysteresis[8].

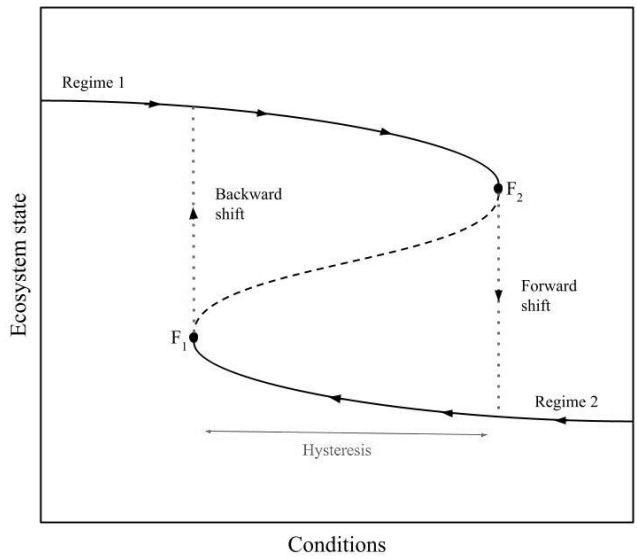

Figure 2.6. Visualisation of a critical transition
Source: adapted from Scheffer *et al.* (2012)

[8] Scheffer & Carpenter (2003) defined hysteresis as: "To induce a switch back to the original valley, it is not sufficient to restore the environmental conditions present before the collapse. Instead, one needs to go back beyond another bifurcation point (F1), where the system shifts back. The difference between forward and backward switches is known as hysteresis".

This model is also often linked to the ball-in-the-cup analogy, where the system is visualised by a ball that lies at the bottom of a basin. When a disturbance occurs, the ball (or system) is moved away from the bottom of the basin, with the magnitude of the disturbance defining how much the ball is pushed. The steepness of the slopes of the basin are, therefore, imperative in how fast the ball will come back and stabilise at the bottom. It also means that the less steep the slope, the more easily a disturbance can move it from one basin to another, to an alternative system state. Figure 2.7 by Scheffer (2020) visualises how it is linked to the model of critical transitions, with the slope becoming less steep as the system moves towards the tipping point.

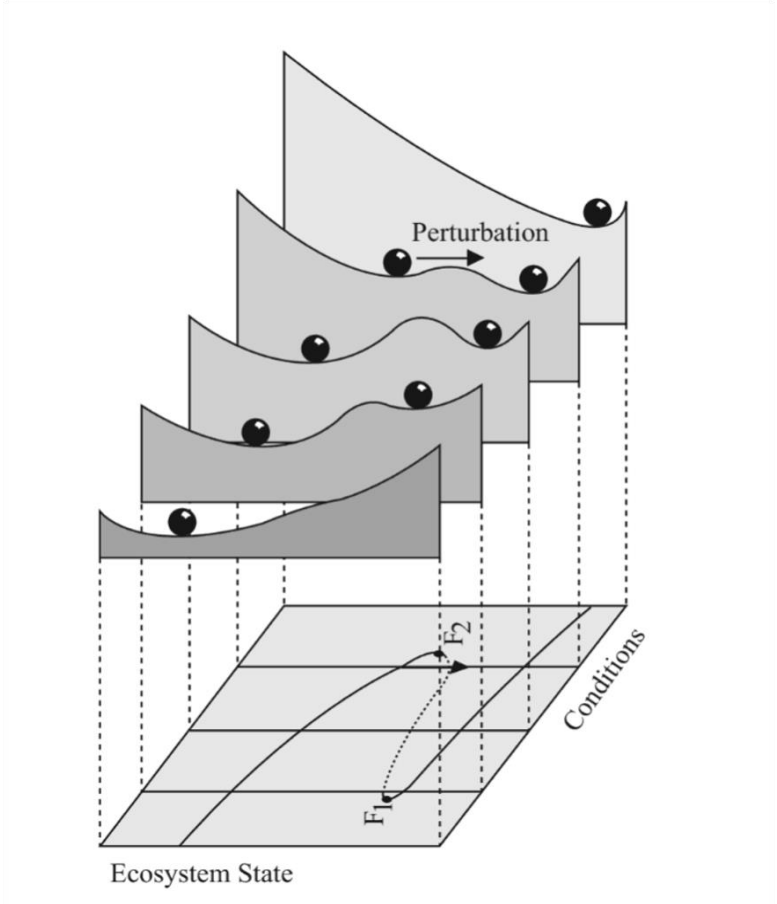

Figure 2.7. Critical transitions visualised together with the analogy of the ball-in-the-cup

Source: Scheffer (2020)

Another important element in the models of critical transitions is the feedback loop, which can be classified as positive or negative feedback loops (Palmer, 2022). Negative feedback loops are stabilising reactions, meaning that an action will lead to a reaction which cancels out the effect of the reaction, i.e., homeostasis. A common example of this is a hot cup of coffee: it starts off very hot from which it cools down quickly. However, the more it cools down and thus the colder it gets, the more slowly it cools, until it reaches an equilibrium temperature. A positive feedback loop has the opposite effect, an action leads to a reaction that enhances the action leading to exponential growth. A clear example of this is the melting of the ice caps caused by warming. As the ice melts, the vegetation below the ice becomes visible, which absorbs more heat than the ice, leading to more warming. These feedback loops are important in critical transitions, with a negative feedback loop maintaining the status quo, in contrast to a positive feedback loop, which will result in a transition to a new regime.

Linking resilience models to sociological concepts and theories

Our understanding of resilience is related to the observations we make of the world, individuals and systems. It is based on processes from the past and present that have been identified and analysed. This is what science is about – creating knowledge that can help predict how things and entities behave, enabling better interventions, management and care of the world around us. Thus, processes that are attributed to one concept, are often not limited to that concept, instead being described in different ways in different contexts. This next and final part of the chapter looks at how we can identify the processes described in resilience science across various theories in the social sciences, specifically looking at cultural entropy, theories of Foucault, Kingdon's multiple streams approach, and critical junctures.

Cultural entropy

An important concept in the study of organisations is cultural entropy. This has already been discussed in connection with resilience

(Normandin & Therrien, 2016; Comfort *et al.*, 2009; Comfort *et al.*, 2011; Golicic *et al.*, 2017). Cultural entropy is described as how much disorder a system contains, moving it away from an equilibrium state (the attractor of the system) to a state of imbalance (Martínez-Berumen *et al.*, 2014). Thus, the higher the entropy, the further the system moves from the state of equilibrium. This can be easily visualised with the ball-in-the-cup, where the bottom of the basin is the equilibrium state, literally attracting the system towards it, and the level of entropy is reflected in how steep the slopes are. A steeper slope is related to low levels of entropy, whereas a less steep slope means that there is a high level of entropy. Normandin and Therrien (2016), for instance, discuss this through negentropy and entropy, representing order and stability and disorder and change, respectively. They compare them to negative and positive feedback loops, being forces of stabilisation and destabilisation.

Foucault

Michel Foucault spent a lot of time discussing knowledge and power. He introduced a new way of looking at power: rather than it being a top-down approach, he saw it as an inherent force acting from the bottom-up. In his works, Foucault often talks about transformation. As mentioned in the introduction, he discusses how concepts change through the various fields of validity, successions in their deployment and the theoretical contexts in which they evolve He also talks about transformation in individuals and institutions. For instance, he talks of theoretical transformation, which "establishes a science by detaching it from the ideology of its past and by revealing this past as ideological" (Foucault, 1972, p. 5). This is the transformation of knowledge: what we perceive as true or scientific can shift when a particular theory is introduced which changes our understanding of the world, leading to a new regime of knowledge and science. He describes this further as follows:

> *There are the epistemological acts and thresholds described by Bachelard: they suspend the continuous accumulation of knowledge, interrupt its slow development, and force it to enter a new time, [...] they direct historical analysis [...] towards the search for a new type of rationality and its various effects.* (Foucault, 1972, p. 4)

He also discusses transformation in the context of systemic change, similar to that of critical transitions:

> *The process which, through ceaseless struggles and confrontations, transforms, strengthens, or reverses them, as the support which these force relations find in one another, thus forming a chain or a system, or on the contrary, the disjunctions and contradictions which isolate them from one another.* (Foucault, 2004, pp. 92–a 93, translation by Jessop, 2017)

Here, Foucault discusses power, how it exerts its force on people and institutions, through force relations. He states that if these work together, and find their support with each other, they lead to transformation. Whereas if they work against each other, they are isolated from one another and cancel each other out. This can again be easily compared to feedback loops: negative loops cancel out the effects of individual actions and positive loops enhance these actions leading to transformation. Thus, it can also be linked to entropy, stability, instability, and, as such, resilience. Another important concept that he mentions is that of scales, where one must make distinctions at what scale an event takes place and how it affects the other scales, thus, describing panarchy:

> *There is the distinction, which we also owe to Canguilhem, between the microscopic and macroscopic scales of the history of the sciences, in which events and their consequences are not arranged in the same way: thus a discovery, the development of a method, the achievements, and the failures, of a particular scientist, do not have the same incidence, and cannot be described in the same way at both levels; on each of the two levels, a different history is being written.* (Foucault, 1972, p. 5)

Foucault argues that change on one scale directly and sometimes immediately impacts on (all) knowledge on another scale and transforms knowledge. It follows that resilience in the context of (any) knowledge creation is a dynamic, not static, concept that emerges from the mind in a social and cultural understanding of it. Resilience cannot be understood outside the realm of knowledge creation, as a process that is situational and time bound.

Kingdon's multiple streams approach

In his multiple-streams approach, Kingdon explains how policies and organisations change as a consequence of policy windows. He

describes three streams (Figure 2.8): the problem stream (identification of a policy problem), policies stream (finding a solution to the problem) and politics stream (motivation and opportunity to create a policy out of the solution) (Kingdon, 1984). Focusing events are described as circumstances that have the potential to open a policy window, with the situation before and after such an event being different.

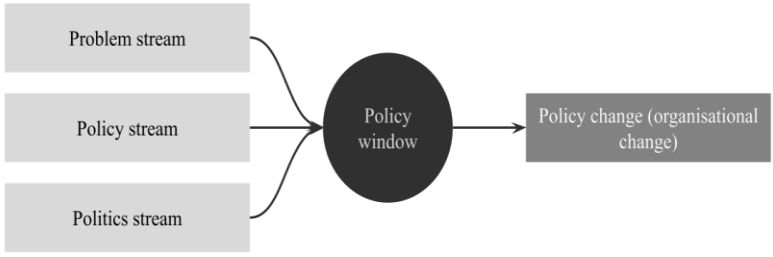

Figure 2.8. Kingdon's multiple-streams approach
Source: Adapted from Asmoredjo (2020)

There are several ways in which Kingdon's multiple-streams approach resembles the model of critical transitions. First, it is easy to compare the policy window with the threshold, leading to policy change and, thus, an alternative state. The streams are different scales at which disturbances can take place, influencing one another. For instance, Boin *et al.* (2020) describe how positive feedback loops occur within the multiple-streams approach, where an action or non-action in one stream can lead to a reaction in a second and third stream, which then affects the other two streams in return, ultimately leading to regime and policy changes.

The concept of hysteresis can also be found in the multiple-streams approach. Zahariadis and Exadaktylos (2016) investigated education reform in Greece at the beginning of the previous decade. In this study, they explained how in April of 2015 the reversal of some important reforms was proposed, with ultimately a return to the previous state. Yet, the reversal of these policies was not straightforward: "cosmetic changes are made but the core structure

remains the same until the environment changes to once again fit more closely to existing policy" (pp. 78–79).

Critical junctures

Critical junctures stem from the study of institutions, identifying processes of change within them. They are defined as a short period of time when political reorientation leads to the founding of new institutions, resulting in a set trajectory of change for nation states (Collier & Collier, 2002). Critical junctures can be both brief and long, for instance, choosing to go down one path or another, or an extended period of reorientation. It can be easily linked to Kindgon's policy windows, in which conditions lead to changes in policy, direction, or governance. An important aspect of critical junctures is that of legacies – it must be clear that the critical junctures connect to a clear hypothesis in relation to its consequences. If these do not match, meaning that the critical junctures do not generate that legacy, we cannot talk of a critical juncture (Collier & Collier, 2002).

An interesting aspect of critical junctures is that they do not necessarily always lead to change, but rather can lead to the re-equilibration of the institution (Capoccia & Kelemen, 2007). Thus, instead of being about the change itself, it is about the process and the legacy of a decision made regarding the future of the institution. Capoccia and Kelemen (2007) make a distinction between 'weak' and 'strong' institutions, with the former being more prone to "breakdown and replacement" during institutional change than the latter. Collier and Collier (2002) also discuss the importance of acknowledging what does not change with critical junctures, in which the new regime needs to be compared with the old regime and what did not transform.

Conclusion

The aim of this chapter was to shed light on how we use and conceptualise resilience to enhance understanding of how we choose to use it. There are two important aspects of resilience that need to be discussed when looking at it through the lens of a travelling concept. The first focuses on the aspect of space, an obvious part of which is the geographic distribution of resilience studies, being

overwhelmingly Western, thus influencing the perspective through which resilience is viewed. Another significant element to acknowledge is how resilience is measured. Adopting the framework of Chambers (2007) or Jones (2019), it is important to consider whether the concept of resilience is being assessed in an overwhelmingly economic reductionist (i.e., objective) or qualitative and participatory (i.e., subjective) manner.

As has been found several times within the field that what we expect to be resilient and what we expect to help with resilience does not translate equally between cultures and situations. This perhaps explains the three categories in which resilience can be defined: persistence, recovery, and adaptation/transformation. The latter is especially interesting, with a distinction to be made between adaptation in the sense of bouncing forward and a complete transformation of the system with the emergence of an alternative regime. Although transformation is less present in the literature on resilience, it emerges clearly when looking at social science theories, thus distinctly acknowledging this resilience transformation process by different scholars with diverging perceptions.

The second important aspect in looking at resilience as a travelling concept is to analyse how it travels across disciplines. A measure of this is how resilience is defined and the constructs that are used in relation to it. For instance, the construct of adaptation is the most widely used one, indicating that this part of resilience is most widespread. As is clear from the distribution of constructs across fields, there is less overlap in how resilience is understood in psychology, in contrast to all other disciplines which were included in the analysis. This may also be the reason why the importance of cultural context in resilience is much better discussed in the field of psychology, in comparison to other disciplines.

Studying the concept of resilience can be done at various scales. A narrow scale may focus on disciplines or even streams within disciplines. A slightly broader perspective would be looking at resilience across disciplines. At the broadest scale, resilience may be removed from the box of 'resilience', by incorporating theories that are related to but not defined as resilience. This chapter focused

mainly on the latter two, since the concept of resilience within disciplines has been extensively discussed. Across disciplines there is also a vast abundance of literature, however, there are fewer studies identifying how the concept of resilience is linked to processes described outside the field of resilience studies. The importance of this is that the essence of resilience is not on the concept itself, but the process that the concept describes. The conceptualisation of resilience merely helps to create a concrete framework around this process. Although as we have seen, when it comes to resilience, this framework is often not so concrete. It is useful, therefore, to compare resilience to other well-defined processes, allowing a more tangible use and understanding of resilience itself. For instance, the theories of cultural entropy and critical junctures may help in using resilience in the context of institutions, looking at feedback loops, alternative regimes and whether change is necessary within that framework.

The creation of knowledge is messy, especially when considering the multiple perspectives in which knowledge is assembled and through which it travels. While talking about art, Lewitt perhaps unknowingly describes a process that has been the essence of knowledge production: the borrowing of ideas, leading to their constant development, at the heart of which lies misperception and misconstrual. When discussing resilience as a travelling concept, one process takes centre-stage: transformation. As has been shown in this chapter, the term itself has evolved and transformed into not one, but several, perceptions of itself. It is a dynamic concept that keeps taking on new forms and identities, as it is used and passed on from discipline to discipline and scholar to scholar. In the same way, it transforms with the different languages used, as we apply it in contexts far from its birthplace, often failing to understand the infinite nuances in translation and understanding. Finally, it describes transformation, through the adaptation and learning that individuals, systems, and institutions undergo, as well as through the catastrophic transition that takes place when systems fall from one state to another, in the same way that Foucault describes the decisive regime changes that take place with the creation of knowledge.

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Author's contributions

Joëlle Stocker is a PhD student at Wageningen University and works as a researcher at Europe External Programme with Africa. She also is a fellow of the Research network Globalisation, Accessibility, Innovation and Care (GAIC). She is solely responsible for this chapter, and conceptualised the research, the methodology and wrote all versions of the chapter.

Ethical clearance

There was no ethical clearance required for this research.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 3

Life in Darkness:

The Communication Blockade during the Tigray Siege

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Either share mutual affection and laughter, or part in enmity.

Abstract

This study investigates the phases and characteristics of the siege and communication blackout in Tigray during the 2020–2022 war. Employing concepts such as 'information black holes', social identity theory, and the theory of critical transition, the study delves into how the communication blackout and siege impacted on people's mental states and societal structures. The research outlines five distinct phases of the siege, and throughout these phases, the degree of control over communication and the severity of the siege varied significantly. The analysis highlights how the blackout exacerbated the siege's impact, altering Tigray's social identity and fostering a 'we versus them' mentality. It underscores the transformative societal changes, reconfiguration of social dynamics, and the emergence of self-reliance within Tigray. The study reveals the implications of the digital divide resulting in innovative solutions developed to maintain communication and data sharing under restricted conditions. These findings suggest a potential shift towards federated digital infrastructure, minimising dependency on central digital systems and enhancing digital resilience in future crises.

Keywords: information black holes, resilience, digital resilience adaptation, social identity theory, Tigray war

Introduction

Following the start of the Tigray war on 3 November 2020 (ICHREE, 2023), the federal government cut Tigray's connection to the Internet, landline, and mobile phone networks and disconnected the region from the rest of the world (Gesesew *et al.*, 2021). Banks and other basic service providers that depended on ICT infrastructure for their operations shut down after the communication outage. Tigray was closed off on all sides; from Ethiopia on the East and South; from Eritrea in the North; and the Ethiopian federal government quickly secured closed access to the Sudanese border; it besieged Tigray from all directions (Al Jazeera, 2022).

As Tigray was besieged and inaccessible to anyone from outside, and communications from inside Tigray to the outside world were blocked, there was little to no information coming out of Tigray. The acts of the invasion, killings and atrocities committed, sexual violence and rape, vandalism of cultural heritage and economic property, looting, and – later in the war, on starvation remained hidden to the outside world (Tesfa *et al.*, 2024a; Tesfa *et al.*, 2024b; Kidanu & Van Reisen, 2024; Kahsay *et al.*, 2024; Gebremariam & Abrha, 2024; Kahsay, 2024). The communication blockade and siege in Tigray made it difficult for the international community to understand the situation. On 23 February 2021 EU Special Envoy, Haavisto held a press conference after visiting Ethiopia and stated, "that Ethiopia's leadership had failed to provide a 'clear picture' of the situation in Tigray – including the widely documented involvement of forces from neighbouring Eritrea" (Euractiv, 2021).

With the lack of access to information the international community had little understanding about the military actors operating in Tigray apart from information coming from the Ethiopian government, and from some sources from which the information was hard to corroborate. In his Press conference Haavisto declared: "The question of Eritrean troops is extremely sensitive, so we don't get the clear answer about the whereabouts or magnitude of the Eritrean troops" (Euractiv, 2021). The governments of Ethiopia and Eritrea both denied that Eritrean forces were involved in the conflict, despite reports of widespread atrocities committed, and a massacre in Aksum

(Tesfa, Van Reisen & Smits, 2024). The denial of participation of the Eritrean military in Tigray was "contradicting eyewitness reports from civilians, aid workers and some military and government officials in Tigray" (Euractiv, 2021). To obtain clear information and set up support lines for the civilian population of Tigray, Haavisto called on the Ethiopian government to end the siege and "to provide full humanitarian access to Tigray, including areas beyond its control" (Euractiv, 2021).

Ethiopia has a long history of denying Internet service to citizens. Before the Tigray war, there were sporadic Internet shutdowns whenever there was civil unrest, election, or national exams. These Internet shutdowns were similar in intention and action to other countries' experiences (Pandow, 2021). In the Tigray siege, everything that worked that was not part of any national interconnected communication channel was prone to be cut by the federal government. The people of Tigray were isolated by a dysfunctional communication infrastructure and to live a disconnected life in an information black hole, in which all communication is controlled by the dominant group.

The effect of the communication blackout and siege on the people of Tigray, including its manifestations and societal impact, has not been researched. This study attempts to investigate the lived experiences of the Tigrayan people amid an absolute siege and communication blackout, which lasted two years.

The research question for this study is: *What are the lived experiences of the people of Tigray during the communication blackout that was enforced on the population as part of a siege during the 2020–2022 Tigray war?*

The sub-questions are:

- What are the feelings, thoughts, and perceptions of the Tigrayan people regarding the communication blackout in the context of the siege?
- How has the communication blackout during the siege affected the lives of the people of Tigray?

Theoretical framework

The concept of the information black hole sees the digital infrastructure as a social structure that is characterised by power dynamics. In the digital era, the amount of access to digital infrastructure is an aspect of power that can be exercised. If information access is suppressed or disabled, this creates social dependencies. Van Reisen *et al.* (2019) find that digital information black holes:

> *.. create a situation in which those living in them are dependent upon gatekeepers for information and cannot send information, or only with great difficulty. This establishes a social reality in which power relations control the information that goes in and out.* (Van Reisen et al., 2019, p. 23)

Van Reisen *et al.* (2023) find that access to the Internet is often repressed as a first measure in a strategy to gain control over individuals or a group of people. Consequently, the individual or group not only lacks access to the receiving information on the Internet, but the individual or group can also no longer send information. This means that such individuals or groups are locked and cannot share the information with others, and this hampers the possibility of sharing information on their condition, creating emotional bonds between people in similar conditions, limits the possibility for empathy, and undermines the possibility for solidarity with their situation (Van Reisen *et al.*, 2019). Following Rorty (Rorty, 1998), This could be an explanatory factor in the lack of sympathy received and affecting how those subjected to information black holes can be derived from their human right. Their right to exist is violated as they are unseen and unable to speak (Van Reisen *et al.*, 2023).

What are the metrics of an externally imposed information black hole in people's lives, especially during a siege and war? How do people react to this change and begin to adjust their lives both individually and collectively. Previous similar research that captured the lived experience of besieged people of Sarajevo identifies three fundamental constructs of mental state. These constructs are disbelief, adjustment, and dissent (Maček, 2009).

Disbelief: There is confusion and bewilderment that people experience following the impotence to escape the unprecedented sever conditions of war. The acts of atrocities, humiliation, darkness, and disgrace have driven many to question reality.

Adjustment: Adjusting to a rapid and frequent change of actions that produce new norms with economic and political shifts helps people comprehend reality and reflect on the moment of new truth by pursuing alternative knowledge.

Dissent: Facing reality and putting trust and truth to the test, whether to be a part of it or not, is always an issue of integrity. There is sometimes disagreement and a shift in viewpoints based on information and knowledge gathered on the ground.

These constructs were triangulated with the social identity theory. In Social identity theory, People have both personal and social identities. Personal identity is a description of a person's personality in terms of abilities and achievements. Social group membership, on the other hand, can express social identity. As a result, people self-identify and emphasise group membership based on factors such as race, gender, ethnicity, country of origin, and religion. People who are influenced by ingroup bias desire to believe that their group is positive and prefer their group over another. This ingroup bias can result in prejudice, discrimination, and conflict, amongst other things (Hornsey, 2008; Tajfel *et al.*, 1971).

The constructs of the social identity theory are social categorisation, social identification, and social comparison.

Social categorisation: Social categorisation involves organising individuals into social groups, to help them comprehend the social world. This process allows us to define people, including ourselves, based on the groups to which we belong. Collective threats are prioritised over individual threats. Emphasising the similarities within our group while highlighting differences between other groups is a common outcome of this categorisation.

Social identification: This is the knowledge that the person belongs to the formed group and sees the phenomenon as an action perpetrated to the formed group.

Social comparison: People compare their situation to that of other social groups that are in the out-group category.

These cognitive processes lead to creation of different groups based on the situation created, which will help understand how the siege and information blackout impacted the identity of the group (Vinney, 2019).

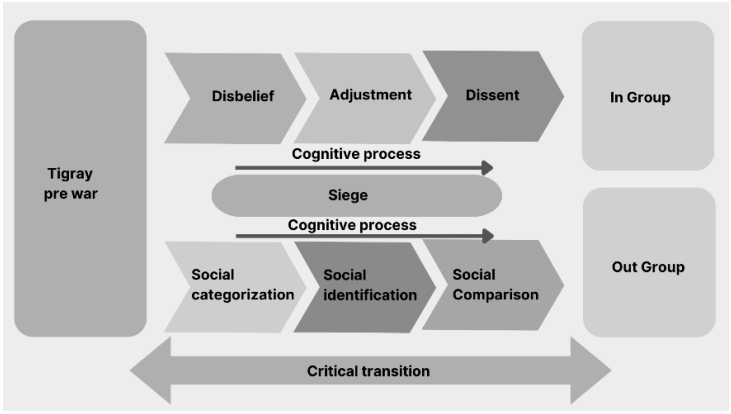

Figure 3.1. Critical transition in social identity because of siege

Another theory to help understand the findings of this chapter is the theory of critical transition. This concept serves as a framework for comprehending the dynamics of transformation in ecological and social contexts. The concept of critical transitions as defined by Marten Scheffer is a pivotal moment in a system's behaviour when it undergoes abrupt and significant alterations due to relatively small changes in its conditions or structure. These transitions often result in a shift from one stable state to another, sometimes accompanied by far-reaching and transformative consequences for the system's dynamics (Fisher, 2011).

The purpose of this research is to provide a clear and in-depth understanding of life under siege, as well as to assess the impacts and negative effects that a lack of communication has had on society.

Methodology

This study consists of two parts. In the first part the communication blockade and siege are described by analysing the entries on it in the

Europe External Programme with Africa (EEPA) Situation Report on the Horn of Africa, which systematically reported on the war in Tigray. In the second part, the findings of the interviews with participants (Internally Displaced People (IDPs)) in Tigray are presented.

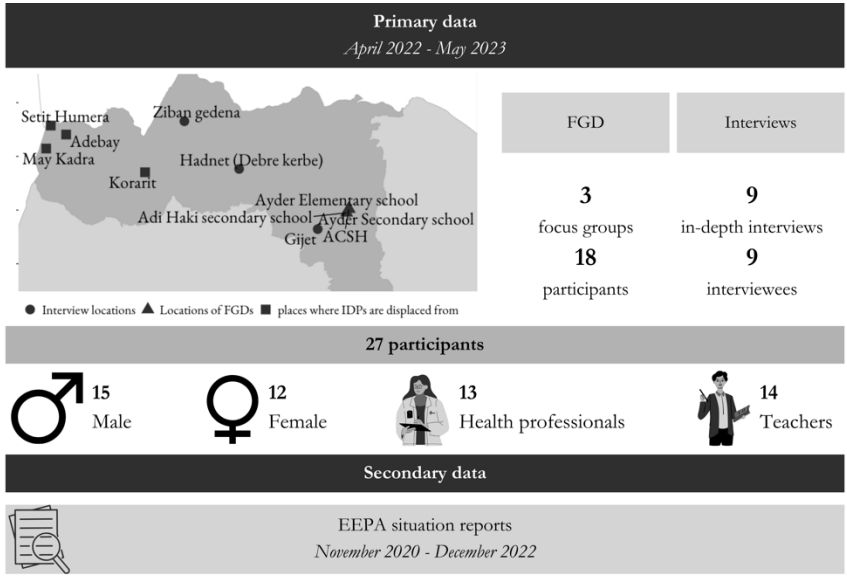

Figure 3.2. Overview of data collected and used in the study

EEPA Situation Reports on the Horn of Africa

In the first part we study how the information black out and siege was reported. In this part of the study, we analysed and identified siege and communication blackout daily updates from the EEPA Situation Reports on the Horn of Africa. These reports focused on the situation in Tigray during the entire period of the war. The reports are two-pagers published almost daily with key points updated on the situation in the Horn of Africa, with specific attention to the situation on the war in Tigray. The reports started on the 17th of November 2020 and were published until after the Cessation of Hostilities Agreement. The reports were sent to diplomatic missions, uploaded on social media, and sent to a listserv. The reports are still available on the EEPA website and serve as a record. The purpose was to ensure that information about the situation on the ground was available in the public domain, and available for further investigation.

For this study the EEPA Situation Reports covering the period November 2020 to December 2022 were considered. The reports were analysed with purposeful coding-labelling to identify the testimonies from Tigray which reported on the information blackout and siege. The data of the EEPA Situation Report is public and the spreadsheet in which the coding-labelling strategy was carried out, is stored by the researchers.

Interviews and focus group discussions

The second part of the research consists of interviews and focus group discussions. The research was carried out in Tigray, Ethiopia from January 2022 to May 2023. The data was collected between April 2022 and May 2023. Efforts were made to purposefully recruit participants who represent and cover the lived experiences of people from all over the region and from all walks of life, with a particular focus on teachers and health workers who have been internally displaced and are living in various towns throughout the region since the beginning of the full-fledged war. Internally displaced teachers and healthcare workers are members of a society that bears a double burden. They were at the forefront of serving and guiding a tremendous load of duties and responsibilities throughout the war. Furthermore, due to their profession, they are in a unique position to see and engage with a wide range of people and situations; for this and other reasons, they are knowledgeable about the life of the Tigrayan people under the siege and communication blackout.

To describe and understand the life of the Tigray people during the communication blackout and siege, an interpretative qualitative study design was used. This design guides in obtaining an understanding of how participants give meaning to their experience and supports analysis of their feelings and thoughts authentically and richly. The researcher focuses on the agency of the participants in the study. Agency refers to the ability of human beings to understand their situation and to act per that understanding (Emirbayer & Mische, 1998).

To document the participants' lived experiences, eight in-depth interviews, and two focus group discussions were conducted.

Twenty-seven teachers and healthcare workers from different parts of the region were selected for participation. These participants were from the Hadinet health centre in the Zana district, and Ziban Gedena health centres in the Tahitay Adyabo district in the North Western Zone, as well as a health centre in the Seharti district of the South-Eastern Zone and two primary and secondary schools from Mekelle called Ayder Elementary and High School and Hastey Yohannes Elementary and Preparatory School. The first focus group consisted of teachers who had been internally displaced from Western Tigray, divided into two groups depending on gender. The second focus group included healthcare practitioners who had worked throughout the war in various districts of Tigray and are now working on the Saving Little Lives project at Mekelle University.

Out of 27 participants, 12 were female and had an education level above an advanced diploma. The participants had more than three years of work experience. Participants were from all zonal administrations of Tigray including people displaced from the Western Zone and living in IDP centres.

Table 3.1. Socio-demographic characteristics of participants

Socio-demographic data		
Category		***Participants***
Sex	Female	12
	Male	15
Age	20–25	11
	>25 years	16
Occupation		

	Health professionals	13
	Teachers	14
Work experience	<= 5 years	16
	> 5 years	11

Questions for guiding the interviews were initially prepared in English and later translated to Tigrinya. A semi-structured questionnaire with probing questions was prepared; the questionnaire was initially prepared in English then translated into the local language Tigrinya then translated back to English by a translator to ensure language consistency.

A pretest was conducted among co-workers who met the inclusion requirements prior to actual data collection, and required adjustments were made to improve the methods employed based on important lessons learned from the pretest. The principal investigator was engaged in all processes including preparation of the interview guide, data collection, data translation, and transcription.

The research team used checklists and facilitated the process by trained investigators who were fluent in Tigrinya. The interviews and discussions were conducted face-to-face at the participant's preferred location. The in-depth interviews lasted approximately 40 minutes, and the focus groups lasted an hour. The interviewer allowed sufficient and proper time with study participants and all interviews were audio-recorded and notes were taken during an interview for cross-checking and to capture observations of physical and emotional gestures as needed. The investigator summarised the content of the interviews before participants left and copies of the transcribed interviews were returned to participants or verbally explained to enable them to comment or make any corrections.

After the interviews were conducted, the notes as well as recorded audio were transcribed verbatim. All transcriptions have details of time, location and specific comments attached. The transcribed initial data was translated from Tigrinya into English. The translated transcript was read independently by the investigators, and each investigator came up with their code, categorise and possible themes using Atlas.ti Version 9.

In the final stage, the investigators reviewed the analysis collectively and adjustments were made based on the discussion among the researchers. This resulted in the identification of seven major themes that emerged from the interviews.

Ethical consideration

The study was conducted after receiving permission from the ethical review committee of Mekelle University College of Health Sciences. The purpose and importance of the study was clarified to the participants. At the start and end of the interview participants were invited to sign the informed consent to permit the information be used in the study. All participants were assured that a code would be used to indicate confidentiality.

Background

A siege is defined by Merriam-Webster as "a military blockade of a city or fortified place to compel it to surrender" (Merriam-Webster, 2023). Similarly, the Oxford Dictionary defines a siege as "a military operation in which an army attempts to capture a town by surrounding it and cutting off the supply of food, etc." (Merriam-Webster, 2023; Oxford Advanced American Dictionary, 2023). Is it imaginable that the encirclement extends across an entire region, displacing one million individuals out of a population of more than seven million?

The two-year siege in Tigray caused a total communication blackout and free movements in the region was no longer permitted (UN News 2020; Omna Tigray, 2021). The challenges started before the outbreak of open war. Ethnic Tigrayan people were facing deportations to Tigray from various regions of Ethiopia, mainly from Amhara and

Oromia (Gebreslassie & Van Reisen, 2024). Transport from the central part of Ethiopia to Tigray via Amhara was closed long before the war, and another route connecting to Afar was also closed at times. The intentional cutting of a transportation route to impose a challenge to the Tigray region existed long before the war began (Jeffrey, 2019).

The election of the regional government held on the 9 September 2020 (BBC, 2021) caused serious friction between the regional government and the federal government, which led the federal parliament to vote to sever ties with Tigray's newly elected government on 7 October 2020 (Al Jazeera, 2020).

In the subsequent period, the siege began as the withholding of funding and a range service by the federal government to the Tigray region.

> *The Federal government diverted the region's budget, instructing the Ministry of Finance to disburse funds to lower-level administrative districts bypassing the executive bodies. The federal government also withheld funding for the safety net programme, a cash subsidy programme for the poor funded by western donors. During a locust invasion, federal officials halted operation of chemical spraying aircraft and blocked the import of a chemical spraying drone donated by the Tigrayan diaspora and neglecting Tigray when distributing Covid-19 protective equipment and masks, even to healthcare workers and vulnerable sections of the society. Even the federal sports commission circulated a memo instructing national leagues to sever ties with the Tigray region. The Ethiopian Postal service ordered its employees not to accept couriers destined to Tigray. The Federal public notary on its part rejected legalizing documents originated from Tigray on the ground that the government in Tigray was illegal.* (Tigray Government Talking Points, 6 June 2021)

After the Ethiopian federal government launched a military operation, referred to as a 'law enforcement operation', in November 2020, communication within the Tigray region became difficult (Melicherová *et al.*, 2024). A communication blockade and siege were put in place, impacting the entire population. Transportation to and from Tigray was strictly prohibited. People were denied access to their money deposited in the bank as private and government-owned banks stopped functioning in Tigray. Salaries and assets of civil

servants, health workers, teachers, and university personnel were frozen.

Although there was some limited access to landline and mobile phone services in the initial period after the federal government entered Mekelle, to demonstrate that the military operation was completed and that services were resumed, the lines were not fully repaired due to the ongoing military operations. After the federal government was ousted from most parts of Tigray in June 2021, communication was no longer available at all, and Tigray was completely shut down (Davies, 2021). In addition, government forces destroyed the UNICEF Mekelle branch office VSAT satellite infrastructure while leaving Mekelle following their defeat by Tigray forces (AFP, 2021; BBC, 2013).

The sharp growth in market good value and shortage of commodities reached an alarming level. This intensified the terrible repercussions of war and siege, such as starvation and malnutrition (De Waal, 2021). As a result, a critical number of children died of starvation (Akinwotu, 2021). The trickle-down impact of the communication shutdown and siege made it impossible for citizens to meet their everyday needs while also coping with market inflation (Gebremichael, 2022).

Communication was also hampered by permits being denied to journalists. Journalists who continued to report on the war, were harassed, intimidated, and denied visas. Ethiopia now ranks with Eritrea on the unfavourable highest place for detaining journalists in sub-Saharan Africa; a report from the Committee to Protect journalists says at least 63 journalists and media personnel have been arrested in Ethiopia since the Tigray conflict broke out in November 2020 (Harter, 2022).

Aside from instant communication control, there was also communication device control. International reporters were not permitted to enter the conflict zones. Any humanitarian worker permitted to visit Tigray was not allowed to carry any communication equipment (Dahir & Walsh, 2021; Zelalem, 2022).

The impact of the comprehensive siege was felt by everyone, including non-governmental organisations (NGOs) and humanitarian

aid organisations. As stated in various NGO statements, the lack of access to transportation, communication, and financial services was said to have harm on the community by impeding the work of those agencies in distributing food and non-food items, as well as medical supplies, resulting in increased morbidity and mortality (OCHA, 2021).

The siege in Tigray included the encirclement of Tigray and a communication blackout, including control over ICT infrastructure. This created inequitable information access to digital media or objects that harm pluralism and suppress dissent (Gebreananye *et al.*, 2022; Scott, 2021).

Before the Tigray war, there were around 12 Internet shutdowns to control elections, public uprisings and national avoidance of cheating in exams (Access Now, 2020). In those instances, the impact of the information blackout was limited to only detaching telecom and broadband connectivity. Hence, the black-out was limited to temporary disruption on ICT communication channels, leaving other private and government services intact and running smoothly without service disruption.

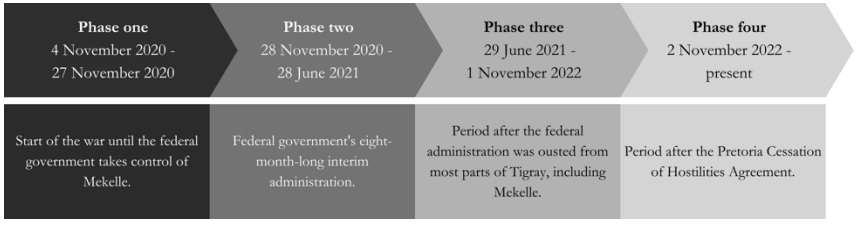

Figure 3.3. Phases of the Tigray siege

EEPA Situation Reports on Tigray

The Belgian based non-governmental organisation, EEPA, published almost daily on the war in Tigray. EEPA states that it is a Belgium-based Centre of Expertise with "in-depth knowledge, publications, and networks". It specialises "in issues of peacebuilding, refugee protection, and resilience in the Horn of Africa" (EEPA, 2020).

In this section, the attempt to circumvent the communication blackout is described and in the following section, the reports on the communication blackout and siege are analysed.

Circumvention of the communication blackout

The communication blackout during a time when wide-spread atrocities were committed motivated EEPA to produce the daily EEPA Situation Report on the Horn of Africa, so that the scale of the problem would be appreciated:

> *The scale and brutality of crimes of Conflict-Related Sexual Violence against Women committed in Tigray have drawn widespread condemnation from around the world. While Tigray has been entirely closed off from communications for three months, and large parts remain closed off, large numbers of sexual violence have been reported.* (EEPA, 2021, SR 156)

From later documentation, it can be analysed that EEPA decided to produce the Situation Reports providing a window for communication during the blackout and the siege:

> *Truth is an indispensable element of any pathway to justice and peace. The search for truth in Tigray was hampered by a complete communication shutdown in the first three months of the conflict. This created a situation of impunity against atrocious crimes.* (EEPA, 2020)

There were different means through which EEPA was able to collect information, making use of a fine-mazed network of arteries that allowed it to receive information and assess reliability. EEPA prioritised information of what it considered reliable witness reports. Reflecting on the quality of the information it published, the organisation stated:

> *EEPA considers what civilian people in Tigray have testified when they were able to do so and have rigorously verified the testimonies. What we presented early in the Situation Reports has been systematically denied by the perpetrators, but as time went by, each of those stories appeared to be true.* (EEPA, 2020)

The EEPA Situation Report was the first to report the Aksum massacre, and the first to report the attack on the oldest mosque in Africa, located in Tigray. The EEPA Situation Report prioritised the reporting of what it considered credible eyewitness testimonies since

the victims had no other means of being heard outside Tigray due to the communication blockade and siege. EEPA Situation Report also identified the presence of Eritrean troops – in its first report on 17 November 2020, which was vehemently denied by the Ethiopian and Eritrean regimes, but later confirmed (EEPA, 2020, SR 1). The events or situations – such as the atrocity in Aksum, the invasion by Eritrean troops and the attack on the Al Nejashi Mosque, at first denied, have been investigated by independent international organisations who confirmed these events took place (EEPA, 2021, SR 55).

In the actual moment of the reporting, the communication blackout and siege hampered the possibility of EEPA, and of any publisher on the situation, to verify it. To qualify for the selection, it made to publish, the organisation clarified that:

> *While EEPA is confident of the sources and the checks implemented to verify the information, independent investigations remain necessary to establish the veracity of all the information and testimonies.* (EEPA, 2021, SR 55)

In a series of webinars held in 2021, EEPA clarified its objective and way of working, and how it ensured persons that provided information were not put in danger (EEPA, 2021, SR 45).

The EEPA Situation Reports covered the situation in Tigray in an almost near-daily rhythm during the communication blackout and siege and can therefore be considered an important source of information. The delay in reporting on important events, such as the Aksum massacre, underscores the point that the communication blockade and siege were effective in ensuring that the atrocities were kept under wraps. It took the EEPA Situation Reports a few weeks to begin to report on the Aksum massacre, and the lack of communication lines had a chilling effect on the communication of the atrocities being committed.

Tigray in darkness

The major events related to the siege and communication blackout are analysed based on the coverage of it in the EEPA Situation Reports.

On 17 November 2020, just two weeks after the war started, EEPA began reporting on the Tigray war. In its first report it stated that the Tekeze hydroelectric power facility had been damaged and that there was a communication blackout with only limited satellite communication possibilities (EEPA, 2021, SR 176).

People were unaware of the depth of the war's escalation after it erupted unexpectedly. An American witness who was in Aksum during the massacre described the situation to EEPA as follows:

> *A source reports a meeting with a doctor from Aksum who stated that on the day of the Aksum massacre he listed 300 bodies. The reflection is that even more than 750 people might have been killed. The community had understood that the Eritrean soldiers were intending to remove the Ark of the Covenant and the community came to protect it, including women and young people. The source states: "This was a massacre.* (Report collected from Aksum on 31 January 2021, cited in EEPA, 2021, SR 82)

> *The communication blockade and siege were experienced already before the war, but only reported three months later for the first time in the EEPA Situation Report: In Aksum water and electricity went out on 2nd November, before the start of hostilities on 3rd and 4th November. As a result, people in Aksum did not see any news. A few days later people arrived from Humera. They said that they came because of the war, that their houses were destroyed, and people had been killed.* (Report collected from Aksum on 31 January 2021, cited in EEPA, 2021, SR 82)

The whole of Tigray was cut off from the rest of the world. Immediately after the declaration of the law enforcement operation by the Federal Ethiopian government on 4 November 2020, connectivity was limited, and it was difficult to reach anyone in Tigray by phone, e-mail, or other communication means. Following the federal government's capture of Mekelle and the majority part of Tigray on 28 November 2022, the communication blockade was near-complete. There was only limited VSAT connectivity via international organisations and telecom service resumptions in Mekelle and its surroundings by Ethio-telecom. In June 2021, after an offensive by the Tigray Defence Forces (TDF) and the defeat of the federal Ethiopian military in much of Tigray, including Mekelle, Tigray was

completely cut off from any communication and infrastructure set up by the central government. While leaving Tigray, troops of the Ethiopian National Defence Force (ENDF) stormed the UNICEF branch office in Mekelle. The military demolished and damaged the telecommunications infrastructure that served practically as the backbone for all Tigray's non-governmental organisations (EEPA, 2021, SR 176).

EEPA received reports of a total blackout from sources in Tigray:

> *Tigray is still entirely locked off from the world in terms of communication; there is no phone connection and no internet connection, apart from some services by international organizations.* (EEPA, 2021, SR 191)

The loss of connectivity meant that there was no contact possible with the outside world and that it was not possible to communicate what was happening in the region:

> *'In the Tigray Region, millions lacked reliable electricity, telecommunications networks, and banking services, while commercial supply chains were severely disrupted.* (EEPA, 2022, SR 208)

Due to the overwhelming demand and the difficulty communicating with the outside world via the Red Cross and UNHCR hotlines, people were seen heading to the borders of Afar and Amhara in search of telecom signals (EEPA, 2022, SR 299). People travelled from across Tigray to border towns to connect and seek money from family and friends in other parts of Ethiopia and beyond.

In several parts of Tigray's Western, North Western and Central zones the Eritrean military was setting up and expanding the Eritrean network and dial code. Residents in these areas were paying the Eritrean military to call relatives outside Tigray. Those with relatives abroad are then detained for ransom (EEPA, 2021, SR 45).

Following the agreement on a humanitarian truce, which was reached by the end of March 2022, the Ethiopian government agreed to allow aid into besieged Tigray (EEPA, 2022, SR 265). However, the Ethiopian government exacerbated the situation by allowing only a few foods and medicines in and keeping fuel and cash in short supply. European Union Foreign Affairs Chief Borrell commented:

> *A cease-fire doesn't mean cutting a region off power or destroying critical infrastructure. Instead, it is about doing everything possible to help those vulnerable and in need.* (EEPA, 2021, SR 180)

Following the Pretoria Cessation of Hostilities Agreement on 2 November 2022 (Africa Union, 2022), services such as electricity, telecommunications, banking, and air travel began to be reinstated gradually in the parts controlled by the interim regional state government of Tigray.

Lived experience in an information black hole

Seven themes emerged from the interviews and discussions with the participants, which could be organised in a negative feedback loop of feelings associated with disbelief and a positive feedback loop associated with adjustment to the situation.

Disbelief

The study participants expressed they were horrified and perplexed by the war. Participants, particularly those near the border, said they were in a state of denial and unsure of what to do. Nobody considered leaving their homes, and they were hoping that Tigray forces would manage the crisis caused by the invasion.

When Tigray forces withdrew from the frontlines of the Western Zone, particularly Dansha, Welkaiyt, and Kafta Humera, people were made to seek safety and flee to Sudan and other areas within Tigray.

Because of the communication blackout, participants said they were uninformed of how the war progressed. The news that Tigray soldiers had withdrawn from important bases at the beginning of the war in 2020 was not taken seriously.

The primary source of information concerning the retreat of the Tigray army in 2020 was only conveyed through personal communication chains. There was no official channel to report this situation and therefore it was difficult to orientate what the status was in the region. As a result of the confusion, there was considerable denial and disbelief concerning the rapid change in events.

Because of the lack of information, and the uncertainty surrounding the information, it was difficult to know the veracity of any type of information. It was difficult to ascertain the veracity of big incidents that were reported, such as the mass killings and massacres that happened in different towns of Tigray.

Because of the Communication black out, negative feelings of darkness, helplessness, dependency, and loss of trust in the system were reported. These feelings characterise the disbelief of the situation reported in this study.

Darkness

As part of the invasion, telecommunications, banking, electricity, and all lines of transportation were closed and shut down. Tigray was in the dark. As a result, the lives of the people of Tigray were deeply affected. Almost all the participants in this study left their homes and they were internally displaced. They travelled on foot with no money for transportation and other necessities:

> *The whole situation was peculiar for me! … well, I used to have an experience with phone and Internet services. But suddenly these were all gone.* (Interviewee 301, interview by T. G. Gebreslassie, face-to-face, June 2022)

A male, 38 years of age, who was married, a father of two and who teaches in a high school in Mekelle, explained that the news of the death of his father reached him only after three months:

> *I was not able to visit my family members who have been in Nebelet [Central Zone] for almost two years due to security, transport and financial reasons caused by the siege. The death of my beloved father, after a long illness, came from Nebelet in a piece of paper. Mind you! Living 200 km apart and not hearing about the death of your beloved father for three months. I haven't got the chance to even participate in his funeral and share the pain with my siblings and the whole family. It is hard to bear it!* (Interviewees 101, focus group interview by Liya Mamo, face-to-face, July 2022)

The darkness ripped the cultural moral and social fabric of Tigray apart. It was not uncommon to wait weeks or even months before learning of the death of a close family member.

Things got significantly worse after the Allied forces took over most of Tigray. Displaced individuals traveling from remote districts of Tigray to places such as Shire, Aksum, Adigrat, and Mekelle were unaware that the allied forces had invaded these cities and controlled them. A then-pregnant teacher from Korarit remembers the situation as follows:

> *Because my hometown is in the middle of nowhere, we had no idea what was going on, when the entire communication system went down. We were unable to contact anyone and request information. Because the enemy arrived in our town so early, many of us fled the day they arrived. We were told when we passed the Tekeze River that the enemy had returned the next day, but this was merely a rumor. The truth was that the opponents had complete control of the town, and many people were trapped and had not been able to leave. I've witnessed horrific awful incidents. Soldiers have taken numerous women from the arms of their brothers and spouses. So, because of the communication blackout and our inability to obtain information, we lost lives, and the enemies had entered Shire before we arrived. We arrived in Shire after a 15-day journey.* (Interviewees 106, focus group interview by Liya Mamo, face-to-face, July 2022)

A male midwife who had worked at Badme Health Centre in the North Western Zone; had returned to his hometown in the Central Zone called Mahbere Dego and was in a hidden maternal and delivery facility in his village when the Eritrean and Ethiopian troops took control. He described the gun violence and mass shootings as follows:

> *The murder, gang rape, looting, and vandalism all took place in broad daylight. Nobody could put a stop to it. Unfortunately, the testimony of the Tigrayan diaspora was dismissed as anecdotal, and all our claims fell on deaf ears. It was unbelievable this could happen in the twenty-first century.* (Interviewee 201, interview by T. G. Gebreslassie, face-to-face, June 2022)

In Mahbere Dego an extrajudicial assassination was alleged to be committed by the ENDF and dozens of civilian Tigrayans were killed in a single day. This is one example of what happened in a widespread and systematic way throughout Tigray. The atrocities were committed in daylight and openly, as the military had no fear of these being communicated. The Mahbere Dego event is well-known, because a whistle blower was able to deliver a video made of the event and it

reached the Tigray Media House. The Tigray Media House is a Tigray-affiliated TV station based in the US and it subsequently covered the assassination on its station. Subsequently this event received widespread attention in the international media.

Not all people fled at the same time. Some felt that the war only involved local and national governments and that it would be over as soon as the operation was completed. Their perception of the situation appeared incorrect, and they got caught up in atrocities. They were the victims of mass massacres, rape, and kidnapping. They were taken away in prisons, rounded up, and then dropped into the Tekeze River. The testimony of a survivor of a heinous act remembers the event as follows:

> *The Tigrayans who resided in May Kadra were all arrested in different places. My child and I were held captive in a camp called 'Haile Jebar'. The Fano group [an Amhara paramilitary group that was part of the allied forces invading Tigray] was persuaded by my younger sister, who was not identified as being Tigrayan, that we were innocent and should be excused from guilt. Yet again, we were then detained in 'En-da Abadi' and those who claimed their families had been murdered or somehow lost, flocked to seek for the murderers among us. We would be told to line up and take off our clothes in front of our kids and other males and they would laugh and occasionally point fingers at us since we appeared to be a suspect in the murder of an Amharan relative. [...] They seized our gold and cash. We were all suffering and in great pain since our children and everyone else had cholera. After some time, the Ethiopian army took us to Tekeze and instructed us to walk. We did nothing but walk and run for days...* (Interviewees 202, focus group discussion by Liya Mamo, face-to-face, July 2022)

With tears in his eyes during the interview, the midwife recalled situations like the assassination in Mahbere Dego, which he witnessed but was unable to report, due to the blockade and communication blackout. He expressed his disbelief of what he saw:

> *I've witnessed killings firsthand. The soldiers were cruel and even joyful... [sobbing]. How can humans be so callous as to kill someone and then order him not to be buried? I recall the murder of thirty innocent individuals from our village. This event was never broadcast or relayed to any organisation.* (Interviewee 201, interview by T. G. Gebreslassie, face-to-face, June 2022)

The inability to bury the dead became a very important issue. While on the one hand the invading forces stopped relatives or community members from burying the dead, causing great aggravation and pain, the lack of communication lines also caused many to learn late of the death of family members.

Shock: Experiencing helplessness and dependency

Financial services highly depend on centrally managed communication infrastructure. Banks use a communication system to connect their branches. When the war broke out, the federal government cut off the services and froze all financial transactions. Users from Tigray could not access their money, and civil servants did not receive their salary for more than one year.

One of the respondents who had used the banking service his entire working life, explained the genesis and status of the financial siege.

> *The saving culture has been improving. ATM and mobile banking were the best options for transactions. Since the government was also discouraging the use of cash by limiting the maximum amount [50,000 birr] that an individual could withdraw each month, every transaction was online. Following the outbreak of the war, banks are left only with chairs and tables and don't even have a penny. Let alone a monthly salary; there is no way to withdraw what you deposited trusting the bank.* (Interviewee 101, interview by T. G. Gebreslassie, face-to-face, June 2022)

Due to the collapse of the banking system, people were taking alternative measures to get cash by transferring money from outside to others in Ethiopia, who would give half of the amount in cash. Similarly, if you had someone outside of Tigray who could deposit money in a financial agent's account, this could be (in part) transferred in a parallel cash transfer arrangement in Tigray. 'Hawala' is a money transfer service where someone outside Tigray pays money, and 50%, or often more, is cut and delivered in a parallel transfer to relatives in Tigray.

A participant who had such kind of experience explains:

> *'I was empty cash-wise and unable to access my money. The best solution I found was to manually transfer to someone who could give me cash for half of what I*

transferred. People who have friends and families abroad are also getting services via brokers. Families' overseas deposit in the dealer account, and the dealer gives half of it to designated ones.' (Interviewee 102, interview by Liya Mamo, face-to-face, June 2022)

All respondents stated that they relied on aid from NGOs or family and friends. Civil servants were compelled to work without pay. Participants explained their shock when faced with powerlessness and dependency. A female clinical nurse, who was once the family breadwinner, described how she suddenly was forced to beg for money from her poor farmer family for sanitary goods.

We are dependent on our families. There were one or two rounds of food aid from the international organisation. But the support is just a drop in the ocean. It is not only food that I, for example, demand as a person or a woman. I had to ask my family for a small amount of money to buy sanitary products, especially menstrual hygiene materials. (Interviewee 301, interview by T. G. Gebreslassie, face-to-face, June 2022)

A health expert from Sheraro's Ziban Gedena Health Center likewise revealed his powerlessness in advising the community to follow conventional disease prevention measures that he could not follow:

We don't have basic cleaning materials as an institution or individual. I get ashamed when I try to educate my patients or the community on basic disease prevention issues while I am not able to do so. It's been a year; I wash my cloths only using water. (Interviewee 401, interview by T. G. Gebreslassie, face-to-face, June 2022)

The participants who were teachers passed through a hard time, as they witnessed the suffering of every family through their students. One of the participants explained how he was helpless when seeing hungry kids in school:

Students and teachers are from and within the community, and I know the teachers are expected to look tough and are a role models, but they are starving, and in a deep problem. You see the kids hungry, and it makes you feel numb not being able to do anything about it. It makes you ask yourself: will it ever pass? (Interviewees 203, focus group interview by Liya Mamo, face-to-face, July 2022)

Another teacher portrayed the level of the problem, talking about his health status and physical strength:

> *Look, I am a young man, as you can see, but these days I can't go through two class sessions without rest, and it is like if you sat down because you are tired you feel like you can't get up. We have witnessed teachers falling into exhaustion and hunger. This is because teachers are part of the community and are coming here without a bite of bread.* (Interviewees 204, focus group interview by Liya Mamo, face-to-face, July 2022)

It was apparent from their faces and physical appearance that all the respondents had a story to tell about how they were shocked to find themselves in a situation of dependency and helplessness.

Loss of trust in the system

The infrastructure that facilitates communication and financial services is, in one way or another, government owned. The federal government centrally manages this infrastructure. When the war broke out, the government terminated these services immediately. A male health professional described the central government's intention and how it affected his livelihood:

> *Money, I deposited to use it in my hard times trusting the system and the government has now vanished. How can I call it a government when it is denying my money by cutting off the entire network? It is foolish to believe a government that even killed and raped us, will facilitate our money later in time. I am not sure our money is even available anymore. Nobody could give us a guarantee. What makes things worse is that we could not even get the money that our relatives sent us from overseas.* (Interviewee 101, interview by T. G. Gebreslassie, face-to-face, June 2022)

All respondents cited the effect of the communication blockage in other systems apart from the financial system.

The federal government also deliberately cut off virtual private networks (VPN). HealthNet is a typical example. The health system was using the HealthNet for pipelined communication to send health

data to and from health facilities. A female health professional discussed that:

> *Before the war, the health information system of our facility was excellent. We used to have a computer to register our patients at the medical record unit and another computer to capture the aggregated health data of our patients. Besides, we had computers in different units and departments of our health centre. Currently, we don't even own a TV. All are looted and destroyed by the Eritrean forces. To your surprise, there was a HealthNet network we used to communicate with the district health office and regional health bureau. At this time, all the materials are either destroyed or looted.* (Interviewee 301, interview by T. G. Gebreslassie, face-to-face, June 2022)

Not only the government system but also the social function was also affected. A male teacher stated:

> *Our social function has been impaired. We are not able to communicate and gather on schedules. Many meetings were cancelled due to a lack of participants because they hadn't gotten the information. And we are now afraid of gathering and seeing friends hospitalised and just had a baby with the worry of what will we be taking and will we be going empty-handed.* (Interviewee 501, interview by T. G. Gebreslassie, face-to-face, June 2022)

The communication blockade and siege undermined the financial and public sector resulting in great disruption. It damaged the trust in the government and the social system.

Abandonment

After fleeing their homes and being separated from loved ones, IDPs were forced to seek refuge in temporary shelters or schools in Tigray's main towns. Initially, the host communities in these towns aided with food and other necessities. However, as time went on, the host community were no longer able to provide support and required aid as well, and no one felt able to provide special care to the IDPs. As a result, IDPs suffered.

A mother who was expecting her first child at the start of the war and at the time of interviewing had a two-year-old child, recalled every detail of the ordeal caused by the war. She testified to the unimaginable atrocities committed by the allied forces. She followed

her testimony of the difficult situation she found herself in due to the lack of assistance. Local authorities and aid agencies were unable to provide help.

She testified that support was generally better in the eight months between the start of the war and the time that the TDF took over Mekelle, and the Tigray regional government returned:

> *After running away and traveling hundreds of kilometres on foot from Adebay to Shire, nothing awaited us. There was no organised hospitality or assistance. We felt abandoned. I've come to see how unfair the world is. Even those who we elected to govern us did not handle us well.* (Interviewees 204, focus group discussion by Liya Mamo, face-to-face, July 2022)

This sense of being forgotten persisted in the aftermath of the Pretoria Cessation of Hostilities Agreement. For Tigray to relaunch its educational system, IDPs were forced to leave their shelters in the schools without sufficient preparedness.

Loss of hope

Following the declaration of victory by the Ethiopian federal government and the takeover of Mekelle, many people fled from Tigray to Addis Ababa and other countries. The situation became worse when the regional authority retook Tigray, and a total siege and blackout was on full scale.

Initially, there was hope that the Ethiopian federal administration and the Tigray regional administration would resolve their differences. As the situation deteriorated and the siege and blackout persisted, people began to flee Tigray.

A young man from Mekelle justified the reason why youths opted to leave the region via risky routes.

> *'Ethiopia's political climate is fragile, and things frequently change dramatically. It seems dangerous to continue to live here, start a family, and grow. Why would I risk my life? To challenge and see myself in other parts of the world, would be a good idea.* (Interviewee 601, interview by T. G. Gebreslassie, face-to-face, June 2022)

Tigrayans started to dream of living in a place elsewhere as they experienced a loss of hope as the situation of the communication blockade and siege persisted.

Adjustment

Passing through adversity and realising the new reality, people of Tigray began to adjust their lives accordingly. There were innovative ideas brought to the table to lessen and ease the difficulties.

Persistence

Participants expressed their belief that, despite the hardships and obstacles, the situation would eventually pass and that a brighter day was awaiting. Civil servants were willing to help society at any cost, regardless of how unpleasant the problems were. According to one female teacher, the situation was as follows:

> *Despite the unfortunate difficulties, I am optimistic. I must carry my bag of hope for better days to come and that this is a struggle we must face to let the sunshine. I believe better day would come. I get the motivation from my students. Teaching and interacting or helping them in any way allows me to leave a fingerprint on the next generation.* (Interviewees 205, focus group discussion by Liya Mamo, face-to-face, July 2022)

A health practitioner added:

> *The only choice we have is to look brave for our patients and share their pains and struggles. Even with the lack of medical equipment, shortage of drugs in our facility, and the breaking of the health system, we are trying to give them comfort and support by making sure what they need is within their reach. We keep gluing every failure in the system with the sweat and energy of the health providers. But most of all, the positivity and glimpse of hope witnessed in the eyes of our clients are what keeps us lingering and going non-stop.* (Interviewee 301, interview by T. G. Gebreslassie, face-to-face, June 2022)

To be a teacher or health professional helped to overcome the negative feelings and to look for ways to contribute and help others:

> *…Our community is overwhelmed by various difficulties, and our role is needed more than ever. We have a sense of purpose in serving our community. We should step up to be role models and be courageous enough to commit to delivering. Even if it takes to write down 40–50 questions on the blackboard for mid-exam, teaching six*

sessions on an empty stomach, or having recurrent intruding thoughts of our family's whereabouts or worries. (Interviewees 106, focus group discussion by Liya Mamo, face-to-face, July 2022)

The ability to be useful for others, helped the teachers and health workers in finding a sense of purpose and in developing a more positive mindset.

Dissent and creativity adaptation: Circumvention of the communication blockade.

The primary sources of social media were NGO workers. They not only updated their Facebook and Twitter feeds, but they also took screenshots to share with others who did not have an opportunity to connect with the rest of the world.

Daily screenshots were sold for 10 Ethiopian birr, and what was said and done in the social media stream throughout the day was spread via screenshots throughout the major cities. Through the screenshots shared by Bluetooth, people still had the most up-to-date information on the globe, including through the EEPA Situation Reports.

One participant eloquently explained how he was able to get information at that time by saying:

People were attempting to get acquainted by assisting one another. Despite the Internet and communication blockade, people were still utilising screenshots to share information, and movies and audio were being sold. It was fantastic that you could copy up to 2GB of data for only 10 Ethiopian birr. I believe that as a culture, such problem-solving abilities were among many of the characteristics we should improve and maintain. (Interviewees 307, focus group discussion by Liya Mamo, face-to-face, July 2022)

Furthermore, those with an Internet connection might keep other people's phone numbers and compose messages offline in instant messaging apps like Messenger, Telegram, or WhatsApp, and then send a voice or text message operating as a middleman between the two ends.

There was also a local mail delivery service, where delivery personnel would pick up letters from one town and bring them to another for a fee of 50 Ethiopian birr.

The study also revealed that people were able to communicate and share information through the electronic transfer of social media screenshots from Facebook and Twitter as well as the EEPA Situation Report via Bluetooth and the Xender mobile application. There was also a great need for learning, using offline mechanisms, while not depending on Internet connectivity. For example, a project called Digital Innovation Skills Hub (DISH) (https://dish-portal.kiu.ac.ug/) has tested an alternative eLearning system whereby Students come to specific places sync tailored courses and follow the course material at their own pace on any screen available.

Similarly, in digital health, the shortage of paper-based tally sheets for reporting, the shortage of registers and reporting formats under the siege, and the lack of access to the central government systems during the siege, resulted in the creation of new solutions. For instance, the central government's medical reporting system collapsed during the war. The new solutions were engineered based on the possibility of local existence of the data and local control over the use of the health data. This led to the first operational test of a distributed, federated health data reporting system (Amare *et al.*, 2023). The reliance on centrally controlled communication infrastructure was questioned since it lacked the resilience to cope with the strain of conflict, as was experienced in Tigray war.

After the Pretoria Cessation of Hostilities Agreement

At the time of drafting the article, schools are still home to people who have been displaced from various parts of Tigray (The New Humanitarian, 2023). One million displaced people are currently living in schools and IDP centres in different Tigray towns, including its capital, Mekelle. The IDPs still lack access to food and other essential items and services.

One of the cornerstones of the Pretoria Cessation of Hostilities Agreement was the establishment of an interim regional government in Tigray, which was expected to be followed by the withdrawal of outside forces. At the time of writing, Amhara and Eritrean forces continue to occupy Tigray's Western Zone, as well as some areas in the North Western, Central, and Eastern zones. This has exacerbated

the issue, as the farming season approaches, and the displaced people remain in refugee camps (Berhe, 2023a). Communication with and access to these areas is generally still very difficult.

Besides the helplessness and dependency, participants lost trust in the systems that were used against them. While Tigray was shut off, there was a 5G network expansion in the other regions of Ethiopia (Endeshaw, 2022) Even after the Pretoria Cessation of Hostilities Agreement, there was no attempts to expand the 3G congested network in Tigray.

Similarly, land transportation of commodities from the central part of Ethiopia to Tigray has been hampered by the establishment of checkpoints in practically every city, as transporters are requested to pay extra money for passing permits.

Furthermore, Ethiopian Airlines, the only air transport firm that has been criticized for participating in the Tigray war by delivering artillery and troops, has been mistreating Tigrayan passengers. People traveling from Tigray to Addis Ababa were denied tickets based on their age and ethnic identity and those who were able to get tickets were asked for extensive details about their stay and went through luggage searches which were not common in other flights by the airport security (Berhe, 2023b; Tekeste, 2022).

With regards to telecommunications, the deployed telecom connection was a congested line, leading to people queuing outside the telecom office to get service. Later, communication services have started to improve significantly. In November 2023 EthioTelecom started 4G service in the capital Mekelle and Safaricom services entered the Tigray region (FBC, 2023; Fidel Post, 2023).

Discussion

The world has witnessed long blackouts in Pakistan, India, and Myanmar. However, in those cases the communication restrictions were selective and services such as banking were functional (Kamran, 2017; Hlaing, 2020; Maqbool, 2020; Access Now, 2022). The blackout in Tigray was comprehensive (Access Now, 2022). Tigray was isolated from the rest of the world and kept in darkness. People were not only

cut from communication services such as mobile phone networks, landline networks, or the Internet but also from any national service that depended on the ICT infrastructure.

Like the accusation by the government of Syria that opposition groups were responsible for cutting off the Internet (Ackerman, 2014), the Ethiopian government blamed the Tigray forces for the shutdown of the communication infrastructure. The communication blackout and the absolute blockade forced inhabitants of Tigray to live in the dark for two years, feeling deprived and helpless.

The blockade created a communication blackout whereby those who could get limited access benefitted from it. Individuals with Internet access were doing business by delivering information and facilitating money transfers. These brokers were in favour of the information gatekeepers who demanded half of what was being transferred. This activity corroborated with the activities of the network gatekeepers for human trafficking in Eritrea (Van Reisen *et al.*, 2019; Van Reisen *et al.*, 2020; Van Reisen *et al.*, 2023).

In contemporary history, numerous sieges have been portrayed. The siege of Tigray is comparable to these sieges, yet distinct from them. As it was a result of war, there are certain similarities. However, the siege had its distinctiveness when we consider its scope, goals, and participants. The siege in Tigray was not only an enemy's attempt to enclose its rival and seize control of it; it was also a comprehensively planned line of action that encompassed communication blockade, suspension of essential services, and humanitarian efforts.

The siege of Sarajevo, the capital Bosnia Herzegovina during the Bosnian war, lasted longer than the siege of Tigray. Nevertheless, compared to the Tigray region, which is estimated to have a population of over seven million, Sarajevo was a much smaller city with a modest population. The siege in Sarajevo took place before the Internet, and all media outlets in Sarajevo were covering the event and establishing a communication infrastructure, placing Sarajevo in the spotlight (Morrison, 2021). However, during the Tigray siege in this digital age, individuals were methodically shut off from all forms of communication, including the Internet, and placed in an

information black hole. The lack of attention and focus made Tigrayans feel helpless. Besieged Ukrainians were able to obtain Internet access from Starlink after the Russians infiltrated their Telecom network (Wadhwa & Salkever, 2022).

Teachers and healthcare workers have been working in situations with limited resources, without benefits or salary, simply because they believe their presence matters in stimulating hope in the people of Tigray. The mentality of those who lived in besieged Leningrad, or modern-day Saint Petersburg, during World War II is like the reaction of the people of Tigray. There, emaciated instructors even passed away in their classrooms while imparting knowledge and hope to their students (Semenov, 2019).

Conclusion

There were five distinct phases to the Tigray siege and communication blackout. The initial phase encompassed the period before the war. The second is the period from the start of the war until the federal government took control of Mekelle on 28 November 2020 and declared victory. The interim administration appointed by the federal government, lasting eight months until June 2021, took place within the third phase. The fourth phase spanned from June 2021 to November 2022, encompassing the time after the federal administration was expelled from much of Tigray, including Mekelle, until the Pretoria Cessation of Hostilities Agreement. The fifth phase was the period after the Pretoria Cessation of Hostilities Agreement. The siege lasted two years, from November 2020 until the signing of the Pretoria Agreement in November 2022. During these five phases, the control of communication and the extent of the siege differed.

This chapter assesses the distinctive features of the siege and communication blackout in Tigray, while focusing closely on the personal lived experiences of teachers and healthcare workers. This research employed the concepts of 'information black holes', social identity theory and the theory of critical transition to interpret and explain the lived experiences of people in the communication blackout and siege in Tigray during the 2020–2022 war. The goal of

the study was to explore the lived experiences, and it is not a comprehensive study. The participants were selected from teachers and healthcare providers because they were on active duty. The participants, except for a small number, were all internally displaced people housed in IDP centres.

The analysis shows that the control over information was profound. For instance, the Aksum massacre took place over three phases in the period from 19 November 2023 when Eritrean military entered Aksum and looted the city and the massacre which took place on 28–29 November (Tesfa *et al.*, 2024), which was reported for the first time on 31 January in the EEPA Situation Report, the first outlet to report it. All that time, the presence of Eritrean troops in Tigray was denied by the Ethiopian and Eritrean governments. The black hole created in Tigray provided a strong advantage to the invading forces to control information about the situation.

As the population was undergoing extremely difficult circumstances of war, without an outlet through which to communicate and ask for help, their lived experiences exacted a severe mental toll. Looking at disbelief, adjustment, and dissent as response mechanisms, recorded in earlier studies on the impact of siege, the following sub-themes emerged in this study from the interviews:

Disbelief, associated with feelings of:

- darkness
- helplessness and dependency
- loss of trust in the system
- abandonment
- loss of hope

Adjustment:

- persistence

Dissent and creative adaptation:

- circumvention of the communication blockade

This study shows the relevance of the constructs of the mental state of people living under siege, as previously studied by other scholars in Sarajevo. During the state of disbelief, this study found confusion

and bewilderment; during the adjustment period, people were adapting to rapidly and frequently changing actions that produced new norms with economic and political shifts. During the state of dissent, people were facing reality and putting trust and truth to the test, with persistence and creativity. In Tigray, plentiful examples of creative innovation and seeking solutions within the new circumstance are registered.

The constructs of mental state during the siege were triangulated with the components of the social identity theory of social categorisation, social identification, and social comparison to create a framework that explores how the communication blockade and siege during the Tigray war impacted Tigrayans as a group entity.

Living in a communication blockade aggravated people's experience of the siege. As a result, the social identity of Tigrayans was altered. The people of Tigray were pushed to the verge of irreversibility by these pivotal moments, which made them interpret the war and its aftermath in a 'we and them' categorisation and gave rise to the perception of an in-group (Tigrayans) and out-group (the invading forces) phenomena. The siege resulted in a social categorisation by Tigrayan people as an identity apart from others and different from others, including from other Ethiopian people.

The experiences of the people of Tigray during the war encapsulate such rapid and transformative societal changes, leading to a reconfiguration of social dynamics, power structures, and collective beliefs within the region. Because of the communication blockade and the siege, an awareness has deepened in Tigray, that it must be able to always rely on its resources.

The study found that the communication blockade raised concerns over the digital divide and its consequences for the future. The disbelief of what happened was compounded by the sense of total lack of control over communications. It was, therefore, difficult if not impossible, to ask for help and to communicate the ordeal with relatives, or anyone else. The research found that participants realised the weakness of centrally implemented and controlled information systems and demanded a federated infrastructure. Creative

engineering emerged in Mekelle, through which such systems are tested. This has the potential of revolutionising the use of federated infrastructure, to lessen dependency on central government communication infrastructure.

How people can creatively come up with digital solutions in the event of a digital black hole is also illustrated in the Tigray communication blockade and siege. The digital system – even if offline – remained a source of communication, but adapted to a situation that was dependent on intranet features, and making use of people (who were able to 'gatekeep'), who could provide information from the outside world on the situation inside Tigray[9]. This also led to innovation. New creative forms of using digital devices for health and education data sharing were engineered and tested. These can form a new generation of federated digital engineering that is not externally controlled.

[9] The situation reports collected information that, because of the communication blackout, people in Tigray did not have and therefore was used by people in Tigray to understand and disseminate information on the situation in Tigray. This information was disseminated by Bluetooth and word-of-mouth because there was no internet. It was also sold in bundles in street markets.

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Authors' contributions

T. G. Gebreslassie and Gebru Kidanu are both first authors of this article. This work has been carried out as part of the PhD studies of both of them. The first author oversaw the design and implementation of the study. The second first author designed the framework and connected it to the analysis and results. The third and fourth authors coordinated data collection and analysis. The fifth author has reviewed all versions of the articles and advised the researchers on their approach and on the theoretical framework.

Ethical clearance

This research was carried out under ethical clearance obtained from Mekelle University, reference number MU_IRB 1978/2022. Tilburg University has also provided ethical clearance. This research was also carried out under ethical clearance obtained from Tilburg University Identification code: REDC # 2O2On13 on "Social Dynamics of Digital Innovation in remote non-Western Communities".

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 4

Impact of the Tigray War on Farming: Plight and Resilience

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A locust swarm that ravaged your crops camps in your backyard.

Abstract

This study investigates the impact of the Tigray war on agricultural activities in the region during the 2021 cropping season. The conflict, beginning in late 2020 amidst a desert locust infestation, resulting in a humanitarian crisis due to the inability of farmers to harvest or sow crops. This research analyses crop yields, weed growth, and the resilience of indigenous agricultural systems using field observations, interviews, and remote sensing data. The findings reveal that warfare and the destruction of agricultural inputs by military forces severely hindered farming activities in Tigray. Despite these challenges, smallholder farmers demonstrated remarkable resilience, managing to irrigate and cultivate more land than expected under dire conditions. However, the overall agricultural productivity in Tigray significantly declined, with many fields remaining fallow and crop yields dropping to 40% of pre-war levels. This study highlights the critical need for comprehensive damage assessments that include the agricultural sector to address the full extent of war-induced disruptions and support post-conflict recovery efforts.

Keywords: Agriculture, farming, resilience, conflict, locust, crop yield, weed growth, Tigray war.

Introduction[10]

The Horn of Africa has a long history of conflict. Since late 2020, a war has been fought in Tigray, Ethiopia's northernmost region. During this war, intense fighting occurred in the region, resulting in huge loss of life, looting and damage to property, infrastructure, and agriculture (Dedefo Bedaso, 2021; Annys *et al.*, 2021b). When the conflict began in late 2020, farmers were harvesting their crops in the middle of a desert locust infestation. The war did not allow farmers to harvest their crops or to sow crops for the following season. As a result, a humanitarian crisis occurred.

To measure the impact of wars, direct losses are quantified over a particular period (Lindgren, 2004). Post-conflict damage assessments typically concentrate on losses to businesses, services, infrastructure, and facilities in cities, even though the primary source of income in developing countries is the agricultural sector. Even when damage assessments of the agricultural sector are carried out, they mostly focus on crop losses and ignore how wars affect land management (WorldBank, 2006). For instance, farmers may fail to prepare their land for the forthcoming season because of war disturbance.

In Tigray, crop yields have failed three years in a row (2021–2023). In 2022, the failure was attributed to the blockade of the region, a lack of agricultural inputs, and a total disorganisation of society (Tesfaalem Ghebreyohannes *et al.*, 2022c; Nyssen *et al.*, 2023). In 2023, erratic rains and drought combined with a society that was still largely disorganised again contributed to low harvests (Claes, 2024).

The research question examined in this chapter was: *How did the Tigray war affect farming activities in Tigray in the 2021 cropping season?* To investigate this, we assessed not only the crop stands for 2021 (Nyssen *et al.*, 2022; Tesfaalem Ghebreyohannes *et al.*, 2022b), but also weed growth (Biadgilgn Demissie *et al.*, 2022). We also looked at the indigenous agricultural system's resilience (Nyssen *et al.*, 2022). Thanks to remote sensing technology, Western Tigray was included

[10] All original, coloured figures for this chapter are available here: https://raee.eu/wp-content/uploads/2024/10/Figures_Tigray.-War-in-a-Digital-Black-Hole-Volume-3-1.pdf

in the study despite the dire circumstances and ethnic cleansing that had occurred there (Human Rights Watch & Amnesty International, 2022).

Agriculture in Tigray: Background

On Tigray's small-scale family farms, which use a permanent farming system based on cereals, oxen are used to plough fields (Westphal, 1975). As cropping depends on highly seasonal rainfall, the growing period is short (Figure 4.1).

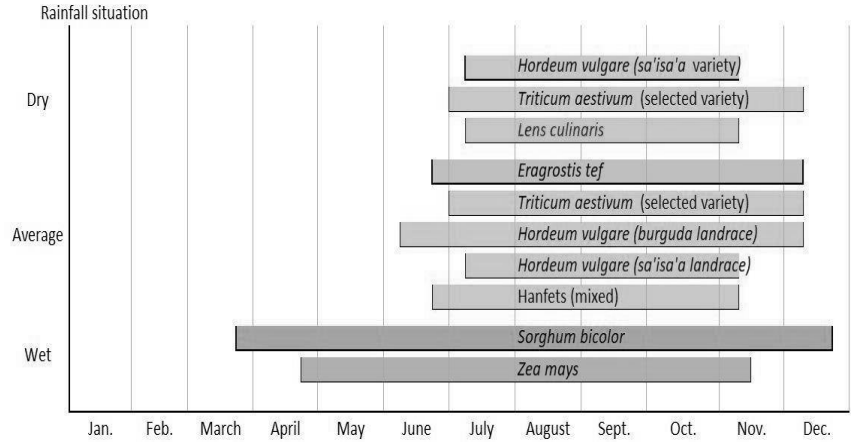

Figure 4.1. Crop calendars (from sowing to harvest) in Dogu'a Tembien, Tigray at 2,200 metres above sea level; tillage takes place in the months before sowing

Source: After Frankl *et al.* (2013) and Jacob (2010)

Crop agriculture has been practised in Tigray for at least three thousand years (D'Andrea, 2008; Blond *et al.*, 2018), during which time the agricultural system has gradually improved, and Tigray farmers have amassed considerable knowledge about seed selection and land suitability for the cultivation of crops at different times (Fetien Abay *et al.*, 2008). The indigenous knowledge (Bruchac, 2018) also includes a broad vocabulary of different soil types (Nyssen *et al.*, 2019), and the capacity to interpret the rainy season so as to select the crops to grow for the specific agriculture season (Frankl *et al.*, 2013).

A significant degree of equality in the extent of landholdings has resulted from the strengthening of the egalitarian land tenure system

during the 1980s (Hendrie, 1999). In the study region, a typical household uses two or three plots of farmland totalling less than a hectare. The ownership and management of grasslands, rangelands, and woodlands are communal (Nyssen *et al.*, 2008).

Methods

This study used field observations, interviews, and remote sensing to collect data. The status of rain-fed tillage and irrigation from April to June 2021 were assessed in 30 sample areas (Figure 4.2) using True Colour Composite images of Sentinel 2.0 satellite imagery (Nyssen *et al.*, 2022), with a spatial resolution of 10 m x 10 m (Sovdat *et al.*, 2019).

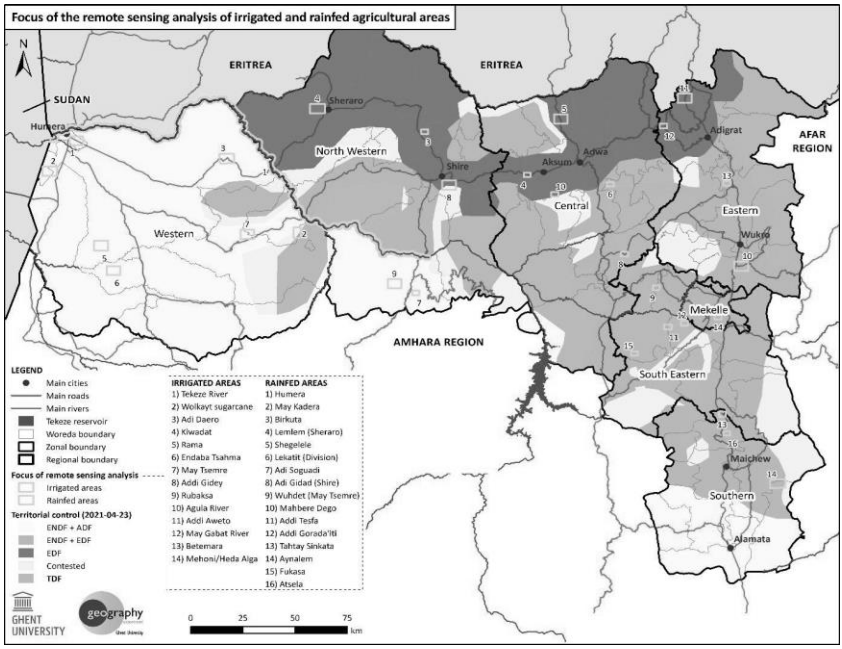

Figure 4.2. Sample areas and territorial control by ENDF, EDF, TDF, Amhara Special Forces and Fano Amhara militias (grouped as ADF) (status at end of April 2021)

Source: Annys *et al.* (2021b)

The normalised difference vegetation index (NDVI) of croplands was analysed in Google Earth Engine using Sentinel satellite images (Lang *et al.*, 2019) taken in the spring seasons of 2020 and 2021, after the typical ploughing season began, but before crops emerged, to detect

changes in weediness in farmlands (Biadgilgn Demissie *et al.*, 2022). The NDVI was calculated in Google Earth Engine to examine this greenness index with the goal of identifying whether or not lands were ploughed, using the presence of weeds as a proxy (Figure 4.3). Because chlorophyll and other pigments absorb light, healthy vegetation has a low reflectance in the visible region of the electromagnetic spectrum and a high reflectance in the near-infrared due to the internal reflectance of the spongy mesophyll tissue of green leaves (Lunetta & Elvidge, 1998). Bands 3 (Red) and 8 (near-infrared) of the Sentinel images are the appropriate bands for NDVI analysis. The NDVI values at output vary from -1.0 to +1.0. Sand, dirt, or ploughed farmlands are represented by NDVI values of 0–0.2; sparse vegetation, such as shrubs, grasses, or senescent crops are represented by NDVI values of 0.2–0.5; while crops at their peak growth stage are represented by NDVI values of higher than 0.5 (Ghorbani *et al.* 2012). Using picture differencing in ERDAS Imagine, it was possible to identify the differences in greenness between 2021 and the pre-war situation (Ghorbani *et al.*, 2012). To further understand the rainfall circumstances, we analysed the CHIRPS 2.0 spatially distributed dataset (Funk *et al.*, 2015) from January 1981 to April 2021 (Nyssen *et al.*, 2022).

In addition to these tools, semi-structured interviews were conducted by telephone with 17 key witnesses (Schmidt, 2004; Holt, 2010; Cachia & Millward, 2011) who are experienced in the agricultural sector in Tigray; they each have a strong network in the region, which allowed the spatially explicit results to be contextualised (Nyssen *et al.*, 2022). Quantitative data were also collected from 161 farm parcels within a radius of 70 km from Mekelle (Tesfaalem Ghebreyohannes *et al.*, 2022a). Participatory monitoring was used to collect data for each cropland. This involved noting the crop type, performing a group assessment of the crop's status according to local standards (good, medium, bad, failed; taking into account growth characteristics like plant height, greenness and density, ear length, and homogeneity in crop stand), observing whether or not neighbouring farmers were cropping in blocks, and conducting a semi-structured interview with the farmer or a group of farmers (Nyumba *et al.*, 2018; Young &

Hinton, 1996). Interviews were translated into English and analysed in a qualitative way.

Results

Interviews and participatory monitoring confirmed that Ethiopian and Eritrean military looted and killed oxen and destroyed farm inputs and tools. Farmers reported feeling exposed when coming out in the open with their oxen. Farmers assessed the hazards associated with farm operations and set up lookouts when ploughing (Nyssen *et al.*, 2022).

In general, a large share of the croplands in Tigray were tilled under difficult conditions, and crops that require little upkeep and little fertiliser have lately been sown (Nyssen *et al.*, 2021; Tesfaalem Ghebreyohannes *et al.*, 2022b). Smallholder irrigation schemes were operational, but a change occurred from commercial crops to small cereals/staple crops for different reasons that reinforce each other, namely: it is less labour-intensive, hence, there is less exposure to risks, staple crops contribute to food security, and there is less risk of looting of standing cereals than, for instance, maize, tomatoes or onions (Table 4.1).

Table 4.1. Story behind abandonment (or expansion) of irrigated lands during the Tigray war in 2021

No	Location	Field information from local witnesses
1	Tekeze River banks	"There is massive displacement in these areas, almost no farmers are remaining. Fruit plants are destroyed mostly by Eritrean and Amhara soldiers. We doubt if there are any irrigation activities at the moment." "Soldiers tried to take over some of the banana plantations but failed to irrigate them properly."
2	Wolkayt sugarcane	"Sugar factory destroyed. Residents and employees displaced, except those who are from Amhara."

3	Adi Daero	"Farmers in the North Western Zone are largely displaced and relocated to the nearby urban areas in search of safe places. The remaining few farmers, plant cereals instead of vegetables and fruits; they also have no access to seed, fertiliser, phyto-sanitary products or technical support."
4	Kiwadat	"Irrigation activities are limited as farmers are at risk. They largely shifted from fruits and vegetables to cereals. No access to farm inputs or technical support." "Farmers started to irrigate their plots while the Tigray forces were controlling the area. They are mostly growing faba beans (as that crop requires less water). About 120 ha out of 198 ha was covered by the crop. Later the farmers feared the Eritrean troops and did not manage their crops. Production is low; no access to fuel and lubricants."
5	Rama	"(Part of) the produce at this site has been looted by Eritrean soldiers." "No cash crops grown, but only maize. The expert for monitoring the dam and canal structures does not live there anymore, and thus sometimes it may not even function. No seed and fertiliser supply; farmers however use their own ways to obtain it (if available)."
6	Endaba Tsahma	"Frequent warfare hinders farmers' activities. Shift from fruits and vegetables to cereals. Farmers sometimes work at night; no technical support or inputs supplied."
7	May Ts'ebri	"Fewer challenges as compared to other areas in Western and North Western zones. The new Amhara administration is pushing farmers to continue irrigation activities."

		"Farmers were able to grow sorghum, tomato and other crops."
8	Addi Gidey	"Frequent warfare hinders farmers' activities. Farmers sometimes work at night; no technical support or inputs supplied." "Relatively good production of mango and orange. Some farmers sow crops between the tree lines."
9	Rubaksa	"Frequent warfare hinders farmers' activities. Shift from fruits and vegetables to cereals. Farmers sometimes work at night; no technical support or inputs supplied." "Irrigation through diversion from the perennial river. Due to frequent warfare and insecurity problems, farmers are not able to irrigate their farms."
10	Agula'i River	"[Part of] the produce at this site has been looted by Eritrean troops." "The main diversion in Agula'i is operated by Wukro St. Mary College, which monitors the irrigation structures and farm activities. Irrigation continued in Agula'i and a few other areas around Wukro. These irrigated farmlands used to grow high-income vegetables such as cabbage, onion, and tomato; sometimes intercropped with maize. Now all irrigated farms are covered by tef, wheat, and sometimes maize, which does not require intensive management and frequent revisit. Most of the men have joined the Tigray Defence Forces, and the remaining men, the elderly, and the women mostly stay at home. The land west of the road in Agula'i was leased to a small investor. Unlike other years, now it is only covered by tef. Farmers are trading fertiliser with each other in the market. There are no formal ways of distributing/getting fertiliser or seed."

		"The farmers fear that if the soldiers find youth farming or managing the land, they kill them. Two young men were killed near Wukro while irrigating their crops (around 30 April 2021)".
11	Addi Aweto	"No farm inputs supplied. Fruit trees reportedly destroyed by Eritrean soldiers."
12	May Gabat River	"Unlike other areas, farmers in the Inderta district have better access to farm inputs from Mekelle, that are transported on donkeys. Although there is a shift towards tef, wheat and maize, farmers are also able to produce vegetables. The growing market demand from Mekelle is a stimulant. There is strong fear of war and looting when crops are transported to Mekelle."
13	Betemara	"The irrigation that takes place here is by diverting water from the main river and not from a reservoir; there was also no fighting in the area. That has somehow allowed the farmers to continue their farm activities."
14	Mehoni/ Heda Alga	Seen from Mekelle, the overall picture of agro-industrial farms, to which regional authorities have no access, is: "Motor pumps and equipment completely looted and destroyed. It is similar for all plantations in Raya Azebo, Chercher and Alamata *woredas* [districts]. All these plantation farms are not active at the moment." Local people mention that the large perimeter is a "commercial farm that belongs to a Spanish company. Unlike other farms, nothing was looted and destroyed." "On the Spanish farm, like on other land held by foreign investors nothing was looted. The farms held by Tigrayan investors were largely looted. The manager of the Spanish farm evacuated all staff and left the area. No farming is undertaken."

	West of the plantation, there are "smallholder irrigation farms that benefit from borewells that were dug by the Tigray government. One borewell serves 30–40 ha of land. Currently, they are growing sorghum. It is less probable that they cultivate commercial crops, such as vegetables because commercial crops are grown by small investors who rent land from the farmers. Now, these investors are not there because of security problems."
	"The local farmers have managed the farms using irrigation (from the borewell) and likely some rainfall events – sorghum, tomato and onions are grown. More water seems available than last year, so they can irrigate more."

Source: Nyssen *et al.* (2022); numbers refer to sites on Figure 4.2

For example, in the May Gabat command area (Figure 4.3), the irrigated area was expanded by 39% in 2021, compared to 2019–2020 (Temmerman, 2020). The proximity of Mekelle as a market for products and a source of supplies, as well as the impossibility of off-farm labour in nearby Mekelle and relative safety due to distance from the main road, stimulated farmers to maximally implement irrigation activities. A person familiar with the area stated:

> *Near the May Gabat irrigation scheme, there has only once been warfare. People are irrigating, but not like before. They are producing tef, onion, garlic and tomato, but they are afraid of transporting their products to Mekelle because robbers and soldiers can steal them.* (Interviewee 001, interview by Negash, 13 May 2021)

Tef is Tigray's most widely sown cereal (Wilson, 2023).

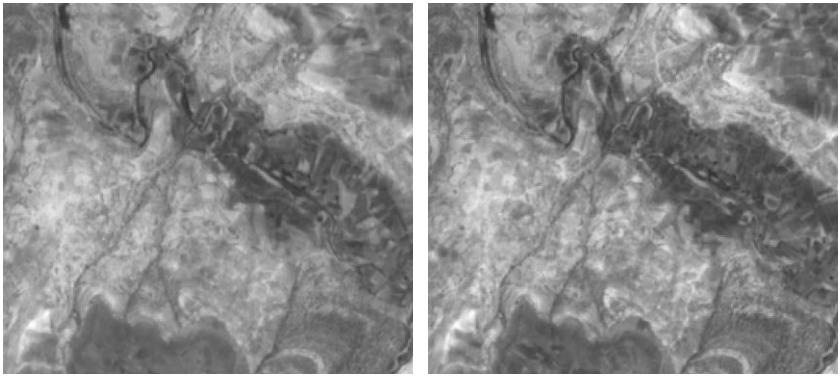

Figure 4.3. May Gabat irrigated land (no. 12 on Figure 4.2) as a True Colour Composite, with vegetated places in green[11]
Left: 2019–2020, 74 ha irrigated; Right: 2021, 102 ha irrigated, increase of 39%, illustrated by the densification of irrigated land
Source: Temmerman (2020)
Note: Main source of irrigation water is seepage from upstream homonymous reservoir

In Western Tigray, many of the 2020 rainfed crops were not harvested (Nyssen *et al.*, 2022). For instance, based on earlier studies along the Tekeze River (Annys *et al.*, 2021a; Annys *et al.*, 2020), all the irrigated areas along the river were mapped, and values of the NDVI standardised vegetation index contrasted (Peters *et al.*, 2002) for the 2019–2020 average and 2021. This allowed the extraction of lands where riparian perennial irrigation (for bananas essentially) was stopped and crops dried off. In 2021, 678 ha of irrigated farms were abandoned along the Tekeze River, which is 57% of the pre-war irrigated land (Figure 4.4).

[11] Coloured picture available here: https://raee.eu/wp-content/uploads/2024/10/Figures_Tigray.-War-in-a-Digital-Black-Hole-Volume-3-1.pdf

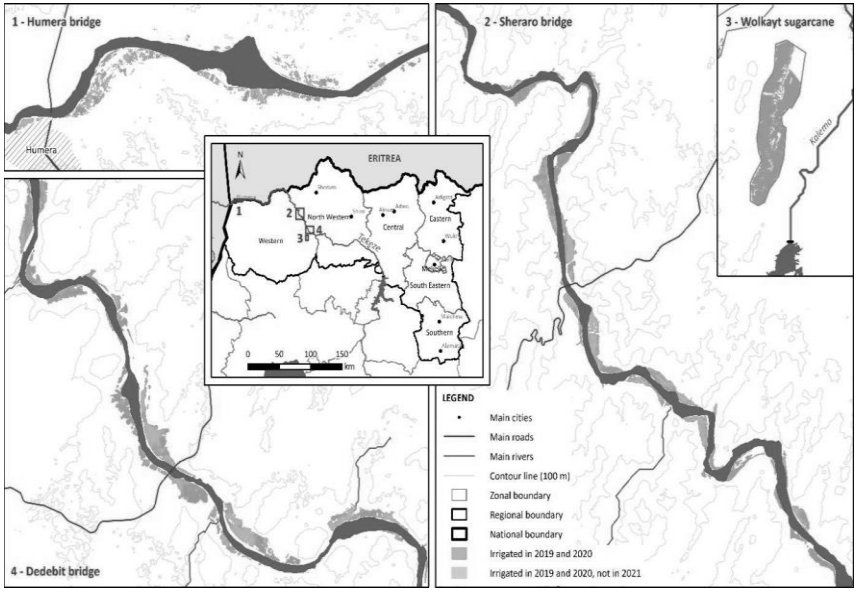

Figure 4.4. Changes in irrigated area along the Tekeze River (from 2019 to 2021)

Source: Nyssen *et al.* (2022)

We noticed that the NDVI map of farmlands hardly showed any greenness in the spring season of 2020, corresponding to the near absence of weeds, but strong weed growth was seen in the same season of 2021. Before the crops began to emerge, 72% of farmlands had seen an increase in green vegetation, interpreted as weeds (Biadgilgn Demissie *et al.*, 2022), which is most probably because of the conflict and the absence of ploughing (Figure 4.5). Lack of ploughing contributed to most of the increase in vegetation cover on croplands during the 2021 spring season. Rainfall was responsible for more greenness on only 18% of the croplands in Tigray.

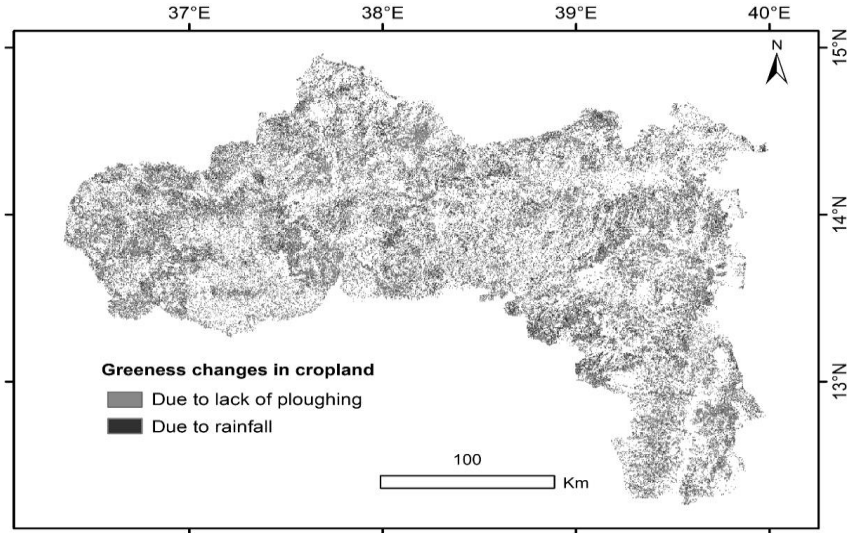

Figure 4.5. Vegetation cover increase on croplands in the 2021 spring season is locally caused by better rainfall, but in most cases by lack of ploughing

Source: Biadgilgn Demissie *et al.*, 2022

Note: Other land uses left blank on this map.

Due to warfare, a shortage of farming tools, oxen, fertiliser, seeds, or manpower, farmers cultivated their farms late or left them uncultivated (Nyssen *et al.*, 2022). For instance, heavy combat during the sorghum planting time led to just a few fields being sown with sorghum compared to in peace years (Tesfaalem Ghebreyohannes *et al.*, 2022b). By late June 2021, when Ethiopian and Eritrean troops had left, the communities revived and the seeds left over from consumption were sown (Tesfaalem Ghebreyohannes *et al.*, 2022b). Where grown, wheat and barley generally had good stands (Figure 4.6) (Nyssen *et al.*, 2022).

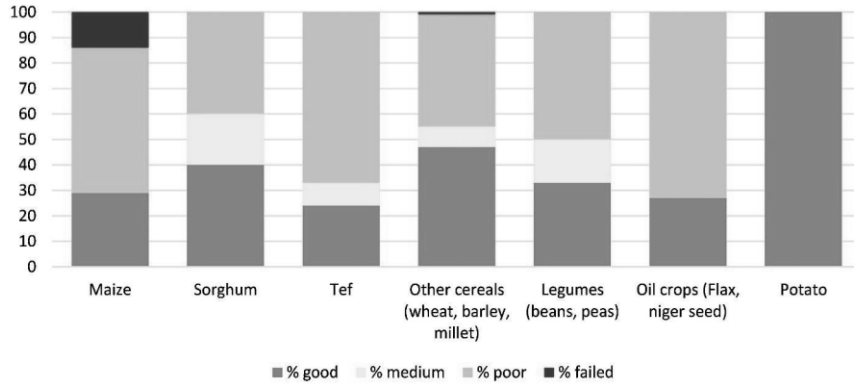

Figure 4.6. Assessment of the crop status per crop type by the end of August 2021

Source: Tesfaalem Ghebreyohannes *et al.* (2022b)

However, often farmers had eaten the seeds of these principal grain crops while hiding for combat, but tef grains were too small to be boiled or roasted and, hence, seeds were available and tef were sown on a greater share of the land (Tesfaalem Ghebreyohannes *et al.*, 2022b).

Discussion

The war started while farmers were harvesting their crops in the fall of 2020 (3 November), and it continued throughout the spring (March through May) and summer (June through August) of 2021, when farmers had to cultivate crops in the wet summer to be harvested in the following autumn. The failure of farmers to till and prepare their land for the main rainy season was due to a variety of circumstances. Farmers were compelled to abandon their villages and flee to towns and other secure locations due to the prolonged and intense nature of the conflict. When they were unable to reach towns, they hid in gorges and caves until the fighting locally calmed down (Mulugeta Abai, 2021).

In addition, a lack of agricultural equipment, such as oxen, seeds, farming tools, fertiliser, and other resources, made them even less able to prepare the land (Nyssen *et al.*, 2021; Tesfaalem Ghebreyohannes *et al.*, 2022b; World Peace Foundation, 2021;

Kahsay, 2024). According to the data collected from the farmers and other stakeholders for the present study, it was found that farmers often did not plough their lands at the beginning of the wet summer, leaving the farmlands fallow. Later, once the Tigray troops had taken over large territories, the farmers frequently cited the lack of agricultural supplies and tools as one of their biggest problems (World Peace Foundation, 2021).

Senior agricultural specialists in Mekelle also noticed a sharp decline in Tigray's agricultural productivity in 2021. The crops harvested during the wet season fell from 2.1 million metric tons in 2019 before the war to 880,000 metric tonnes in 2021 (Mistir Sew, 2022). Findings by Tesfaalem Ghebreyohannes *et al.* (2022b) state that only 25–50% of Tigray's croplands had normal crop stands in 2021 are in line with agricultural experts' estimates of a crop yield, which was 40% of those in pre-war years (Mistir Sew, 2022).

The failure to plough farmlands on time also resulted in weed growth in the spring of 2021 (Biadgilgn Demissie *et al.,* 2022; Nyssen *et al.*, 2021). According to the precipitation data, there was less rain in 2021 than in 2020, showing that precipitation did not play a role in the increase in greenness on farmlands (Biadgilgn Demissie *et al.*, 2022).

According to the evidence (Nyssen *et al.*, 2021), many crops, particularly those with extended growing seasons (sorghum, maize, finger millet, and certain crops sown lately), were not harvested because they had not reached maturity at the end of the rainy season. Here, tef provided a partial solution, as the crop develops readily on moisture left behind after the rains have ended; hence, tef could still be sown up until the middle of the wet season (Mizan Tesfay *et al.* 2017). Indeed, tef became a leading crop in semi-arid northern Ethiopia due to its versatility in use under challenging conditions (see also D'Andrea, 2008). Tef is not as high-yielding as wheat, barley, or sorghum, but its capacity to endure and maintain at least a minimal level of output under harsh conditions makes it an effective component of risk-management systems. It may have been domesticated because of farmers' (both ancient and modern) preference for risk mitigation above production maximization in specific circumstances (A. Catherine D'Andrea, Department of

Archaeology, Simon Fraser University, pers. comm., 13 January 2022).

Figure 4.7. A Tigrayan farmer ploughs his field in May 2021 to survive at all costs; most surrounding lands were still unploughed
Source: RFI, 2021, © Sébastien Nemeth / RFI published with permission

All in all, in 2021, the ability of farmers to self-organise under extremely difficult conditions was remarkable. Despite the harassing and killing of farmers, as well as the looting of their assets, satellite imagery and interviews show that farmers in Tigray did their best to survive, and more land was ploughed than what had been expected based on witness interviews. In our sample areas, smallholder farmers managed an average of 2,057 irrigated ha in 2019 and 2020, which was increased by 6% to 2,184 ha irrigated in 2021. Similarly, farmers ingeniously circumvented all kinds of obstacles and harassment to plough their rainfed lands.

However, at the same time, the woody vegetation regrowth was also hampered in Tigray during the war. Since the 1990s, the region has successfully restored its landscapes, assisting in ensuring food security. The Conflict and Environment Observatory discovered indications of conflict-related deforestation and a slowdown in vegetation regrowth using satellite data. Gains in soil and water

conservation might be undone by this, which would put extra strain on agricultural output (Schulte-to-Bühne 2022; Schulte-to-Bühne *et al.*, 2022).

Overall, the findings of the study show that the Tigrayan smallholder farming system is resilient and is able to rely on the traditional *lefenti* farming support system (Nyssen *et al.*, 2022), where a farmer invites friends to assist them in working in the fields, sharing food and drink, and then returns the favour at a later time (Naudts, 2002). As in wars in Nigeria, Uganda and South Sudan (Kuol, 2014; Adelaja & George, 2019a; El Bushra & Piza-Lopez, 1994), in the Tigray war, shifting crop types was an important coping mechanism for agrarian societies. Like in most war situations, farmers in Tigray also prioritised cropping in areas out of sight of troops. Less mentioned or used coping mechanisms worldwide include the use of communal aid and the cunning of soldiers. These mechanisms were typical in Tigray during the war, enhancing resilience (Table 4.2).

Table 4.2. Commonly used coping mechanisms as part of war resilience in agrarian societies

Country or region	Period	Shifts in crop types	Communal aid systems	Outwitting the soldiers	Prioritise cropping in less exposed areas	Out-migration	Off-farm income	Reference
Angola	1975–2002	/	/	/	++	+	N	(Carranza & Treakle, 2014; Bowen & Steinberg, 2003)
Syria	2011–ongoing	N	/	/	+	+	++	(Bolton, 2020; FAO, 2017)
Mozambique	1975–1992	+	+	/	/	+	+	(Giesbert & Schindler, 2012; Bozzoli &

Country or region	Period	Shifts in crop types	Communal aid systems	Outwitting the soldiers	Prioritise cropping in less exposed areas	Out-migration	Off-farm income	Reference
								Brück, 2009)
Nigeria	2009–ongoing	+++	/	/	++	+	/	(Adelaja & George, 2019b, 2019a)
Uganda	1986–1994	++	/	/	/	+	++	(El Bushra & Piza-Lopez, 1994)
Caucasus	1994 – 2009	/	/	/	+	/	/	(Yin *et al.*, 2019)
Nuba Mts, Sudan	1985–1999	/	/	/	+++	/	/	(African Rights, 1995)
South Sudan	1983–2005	+++	N	++	+	++	+	(Kuol, 2014; Macrae

Country or region	Period	Shifts in crop types	Communal aid systems	Outwitting the soldiers	Prioritise cropping in less exposed areas	Out-migration	Off-farm income	Reference
								& Zwi, 1994)
Tigray	1975–1991	N	++	+++	/	+	+	(De Waal, 1990; Hendrie, 1994)
Tigray	2020–2021	**++**	**+**	**+++**	**++**	**/**	**N**	(Nyssen *et al.*, 2022)

Notes: N mechanism not used; **/** not mentioned; **+** mentioned; **++** successful and **+++** very successful coping mechanism

Source: Nyssen *et al.* (2022)

In contrast to other war areas, the Tigray farming communities could not fall back on outmigration and off-farm income (Table 4.2) because opportunities were extremely limited. Lack of off-farm employment opportunities due to war conditions (World Peace Foundation, 2021) even made some farmers (those who could cope with all difficulties mentioned) plough their land early. This may explain the advancement of crop cultivation observed at several sites, more even than in the rain-rich spring of 2020.

Conclusion

This study looked at the agronomic roots of famine-like conditions in Tigray in 2021, which resulted from cereal crop yields that were insufficient to feed the local people because the planting season was mostly missed. Due to the conflict, farmers were unable to prepare their farmlands in time for the 2021 growing season, hence, weeds were able to flourish. There was a near-absence of weeds in the NDVI map for the spring season of 2020, but in the same season of 2021, 72% of the farmlands had seen an increase in green vegetation, interpreted as weeds.

However, this study also found that a large share of the croplands had been tilled, despite the difficult conditions, and crops that require little upkeep or fertiliser were sown, although late. Crop yields after the 2021 main rainy season were in the order of 40% of the average pre-war years. The main constraint on cropping in 2022 was a near-total absence of fertiliser. Smallholder irrigation schemes were operational. Yet, there was a change from commercial crops to cereals. Another interesting finding is the ability of indigenous farming systems to partially rebound in periods without flows of goods or cash.

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Ethical considerations

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Chapter 5

The Impact of the Tigray War on Refugees from Tigray and Eritrea in Sudan:

"In the Middle of Life and Death"

Kai Smits & Morgane Wirtz

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On top of poverty, the death of a calf is added.

Abstract

This study explores the perspectives of Eritrean and Tigrayan refugees regarding their willingness to return to their home regions after the Tigray war. The narratives of the refugees indicate a strong reluctance to return, influenced by ongoing instability, human rights abuses, and human trafficking. Interviews and field observations reveal that none of the Eritrean refugees who participated in this research considered returning due to concerns about financial extortion and safety due to human trafficking, while many Tigrayan refugees preferred to move to Europe rather than return to Tigray. The interviewees indicated that human trafficking intermediaries were already coming to the refugee camps, and many of the youth were thinking of moving on. The research suggests that the concept of hysteresis, where significant systemic disruptions prevent a return to prior conditions, explains this reluctance. The study highlights the importance of connectivity, as communication blackouts further marginalise refugees and increase their vulnerability. The findings underscore the need for targeted international measures to address human rights abuses and improve conditions to facilitate potential returns. Further research is recommended to explore the long-term impacts of critical transitions on refugee return decisions.

Keywords: refugees, human trafficking, instability, hysteresis, human rights abuses

Introduction

Longing to go home is a sentiment that defines the conversation with almost any refugee from Eritrea or Tigray. Perhaps more precisely, the sentiment is about a longing for a time when the conditions will be such that it is possible to return home. Yet, from previous research, we know that very few, if any refugees return home to Eritrea (Malk, 2021), and it is not clear whether Tigrayan refugees would return home (Gardner & Wilmot, 2023). Eritrean refugees trapped in Libya and other countries often express fear of being forcibly returned, even if they never stop dreaming of a day that they could return safely (Müller, 2015; Birger, 2020; Smits & Van Reisen, 2023). There is only scant literature on the factors that contribute to the anticipation by refugees of returning to their country of origin after the adverse conditions that led to the flight are no longer in place. This study compares refugees from Tigray with those from Eritrea in terms of the likelihood of them returning to their homes after the situation resulting from the war in Tigray normalises. The research question is: *Would Eritreans and Tigrayans fleeing after the war in Tigray be willing to return?*

Research context

The war in Tigray has led to the internal displacement of people, as well as Tigrayans fleeing to neighbouring Sudan and other countries. The United Nations Refugee Agency (UNHCR) recorded almost 60,000 refugees from Tigray living in Eastern Sudan at the time of the fieldwork in June 2021 (UNHCR, 2022; Refugee Consultation Forum, 2021). In addition, many of the 100,000 Eritrean refugees who had been residing in refugee camps in Tigray also fled to Sudan. These refugees joined other Eritrean refugees that continued to flee directly from Eritrea to Sudan. Altogether, UNHCR has currently registered around 137,000 Eritrean refugees at the time of writing (UNHCR Operational Data Portal – Sudan, n.d.), although unrecorded changes may have occurred due to the outbreak of war in Sudan.

The war had a devastating impact on civilians, creating new refugee flows and impacting existing ones. Tigrayans fleeing the war have

been subjected to human rights abuses that may amount to crimes against humanity and war crimes from the Ethiopian army, the Eritrean army, and others such as the Fano militia (UN Human Rights Council, 2022; Kahsay, 2024a; Tesfa *et al.*, 2024a; Tesfa *et al.*, 2024b; Kidanu & Van Reisen, 2024; Kahsay, 2024b; Tefera, 2024). Eritrean refugees who were already residing in Tigray's four refugee camps were targeted; the camps faced destruction, and many refugees from Eritrea were returned to Eritrea, the country from which they had fled (Human Rights Watch, 2021). Eritreans still in Eritrea faced other effects of the war, such as increased roundups for the army and forced recruitment and deployment in the war in Tigray (Bekit & Chothia, 2022).

The new refugee flows from Tigray have caused challenges for non-governmental organisation (NGOs) and authorities in Eastern Sudan because the flows of these new refugees have come on top of the existing refugee flows of Eritrean refugees fleeing from Eritrea and from other secondary movements from Ethiopia. New locations such as Um Rakuba and Tunaydbah were opened by the UNHCR, going from empty land to improvised camps, to accommodate the sudden flows (UNHCR, 2022).

The Tigrayan refugees are for the most part housed in refugee camps in Eastern Sudan, in the states of Al Qadarif and Blue Nile in Sudan. In response to the rapidly increasing number of refugees, the government of Sudan, in cooperation with humanitarian partners, opened new locations such as locations for arrivals (such as Hamdayete, Village 8, and Wad Al Mahi) and refugee camps for longer stays (main locations Um Racuba, Tunaydbah, Babikri, Dem Saad and Mancheleng) (UNHCR, 2022). Most refugees from both Eritrea and Tigray who were interviewed for this book crossed the border by foot. The refugee camps were specifically erected for the refugees from Tigray. Each of these camps can hold around 20,000 refugees. Officials in Um Racuba said that nothing was there when the camps were erected, although it had been the location of a camp previously during the famine in Ethiopia in 1983–1984. Eritrean refugees mostly go to the established Shegarab refugee camp.

The Tigray war has created new and unstudied situations for both Tigrayan and Eritrean refugees fleeing to Eastern Sudan, which this research will investigate. The data for this chapter was collected before the April 2024 outbreak of the war in Sudan. The outbreak led to new additional flows of refugees and new movements of refugees and internally displaced persons (IDPs), including those from Eritrea and Tigray; however, this is not part of this study.

Theoretical framework

Dynamic change and resilience

The theoretical model employed and tested for this analysis is derived from work on dynamic change and resilience considered in a certain ecosystem (Scheffer *et al.*, 2012, Ganin *et al.*, 2016).

The war in Tigray dramatically disrupted the lives of Tigrayans and Eritreans. Many were forced to flee. What is not known is whether this disruption leads to a permanent change or whether the refugees can move back to their original situation after the conflict is over. The consequence of a severe disruption to the lives of people can be investigated by using the concept of resilience. It is often used in the context of different types of systems, to look at their ability to endure or bounce back. Stocker (2024) describes the concept of resilience across disciplines, with qualities such as the ability of a system to remain unchanged after a disturbance, and the system's ability to bounce back after a disturbance or to transition into another state, which is called an alternative system state or alternative regime (Scheffer *et al.*, 2012). Once a critical shift in the system causes a transition, the system functions fundamentally differently, which is called an alternative system state (Scheffer *et al.*, 2012).

The 'regime' refers to the ecosystem state in the situation. Regime 1 refers to the state before the critical transition and regime 2 refers to the state in the situation following the critical transition. Hysteresis is the distance between the conditions that caused the alternative regime and the conditions that would need to be in place to return to the original situation. To return to the regime before the critical transformation took place through a backward shift, a higher degree of conditions causing the transition need to be met. While this theory

is applied to biological ecosystems, Stocker discusses as to whether this framework can also be applied to biological-social situations or even just the social situation (Stocker, 2024).

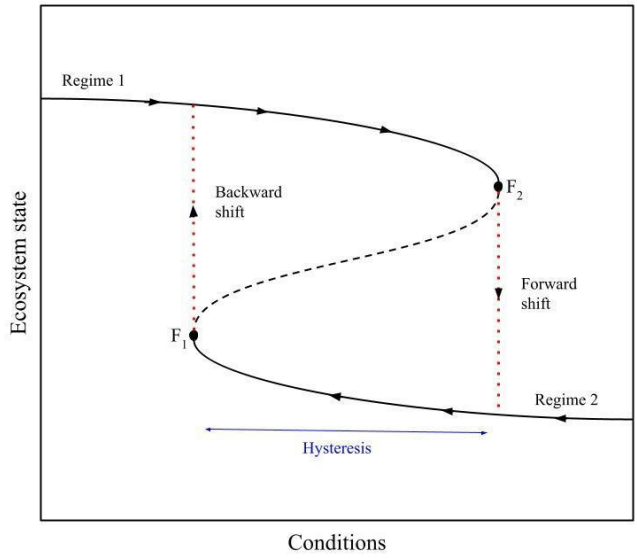

Figure 5.1. A shift between two different regimes causing hysteresis
Source: Adapted from Scheffer *et al.* (2012) by J. Stocker

Applying the concept of hysteresis can be useful in seeing whether a disturbance will be temporary or whether the system will be permanently changed. In the first case, the expectation is that there are indications of recovery, in the sense of the framework set out by Ganin *et al.*, (2016). Ganin *et al.* define system functionality in relation to time, distinguishing the stages of *planning* (for the disturbance), *absorbing* (the disturbance), *recovery,* and finally *adaptation,* where the system adapts to the changes caused by the disturbance. In contrast, if there is a critical transition (Scheffer, 2020), the system will settle in a state that is markedly different from the one it was in before.

This theoretical framework gives an alternative to the 'push and pull theory' on migration. The push and pull theory on migration would invite us to look at the computation of positive and negative conditions in the location or country of origin and the location or

country of residence (Lee, 1966). The decision to move forward or return, according to push and pull, depends on the positive 'pull factors' in places of destination and negative 'push factors' in places of origin. However, earlier research has shown that refugees from Eritrea do not want to return, or consider themselves unable to do so, even if they are facing the most severe circumstances including torture and potential death (Wirtz & Van Reisen, 2023).

Figure 5.2. Push and pull theory of migration
Source: Adapted from Lee (1996) by J. Stocker

The inadequacy of the push and pull framework to predict the anticipated journeys and the reasons for this invites us to reflect on the dynamic of fleeing and returning in a new way (Kidane, 2021). In this research, we explore this dynamic on the anticipation of returning in a comparison between Eritrean and Tigray refugees who fled under similarly severe pressure due to the war in Tigray, to a similar place, in a similar time frame (Refugee Consultation Forum, 2021).

This research looks at the four potential stages of the situation in a transition: the baseline (departure situation), the disturbance, the new situation, and potentially the alternative situation that may emerge, which is defined by a new system from which no return to the baseline will be possible, or only with extreme effort.

The system before the war is defined in this research as the baseline situation, which is regime 1. The situation that caused the fleeing is referred to as regime 2, or the alternative system. The assumption is that once the conditions for the alternative system are removed, the

situation will return to regime 1 and the refugees would anticipate going back as conditions have improved. This would be the hypothesis under push and pull theory which assumes that the anticipated destination is a computation of the advantages and disadvantages of the situation attracting refugees to the intended destination.

The disturbance in the situation of the outbreak of war in Tigray involves Eritrea and causes the flight of refugees from both groups interviewed in Sudan.

Hypothesis 0, based on the 'push and pull theory' is that more attractive conditions plus the desire to return home would provide the situation in which the refugees would consider returning home.

The alternative Hypothesis 1 is that the flight of refugees takes place in a critical transition and that much stronger conditions need to be in place for refugees to consider the situation such that they may anticipate returning. Hypothesis 1a is that the hysteresis may differ between different groups of refugees.

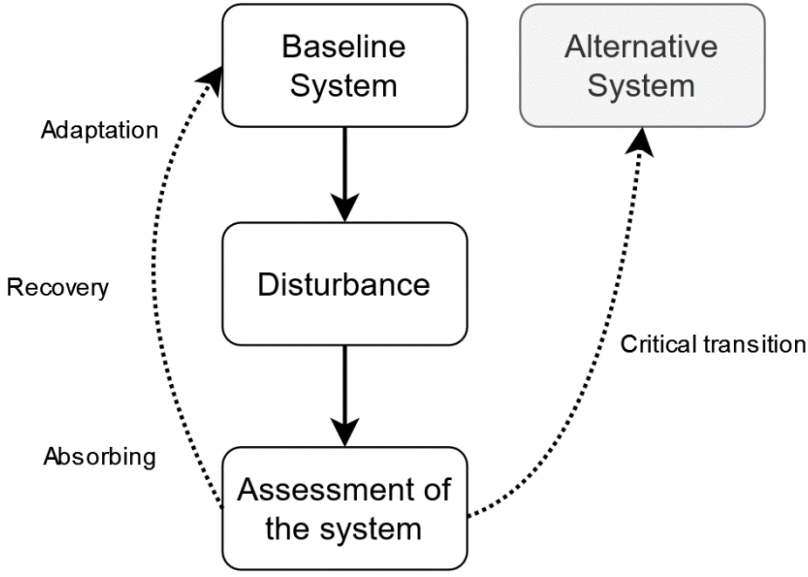

Figure 5.3 Framework to assess whether the disturbance of the Tigray war constitutes a critical transition or not

Source: Based on Scheffer *et al.* (2012) and Ganin *et al.* (2016)

To investigate the hypotheses the following sub-questions are considered:

Sub-RQ1. How do the two groups of refugees (from Eritrea and Tigray) who fled because of the war in Tigray, under different situations in their country of origin, assess (i) the baseline situation in their country, (ii) the disturbance that led them to flee, (iii) the system they fled from, and (iv) the alternative regime, following the disturbance?

Sub-RQ2. What is their perspective on the conditions that should be in place for them to anticipate returning to their country of origin (hysteresis)?

The theoretical framework will be used to look at the situation of refugees from Eritrea and refugees from Tigray, to describe their situation, the impact of the Tigray war, and their current situation. Below, the theoretical concepts are defined and operationalised for this research.

Definitions

The theoretical framework is created from research mostly from the field of ecology; the terms used are therefore defined and operationalised below for this research which concerns the lives and livelihoods of Tigrayan and Eritrean refugees.

A *baseline* is defined as the starting point for a comparison, in this case comparing one baseline situation (the situation in Tigray and Eritrea just before the war in Tigray) with other situations (the situation just after the start of the war, and the situation in the places of transition, the refugee camps).

An *ecosystem* in environmental studies is defined as a biological community of interacting organisms and their physical environment, but it can also be used in general to describe a complicated network. In this research, we describe a people-centred ecosystem, or *system* in short, which is defined as the community of people interacting with other people and their physical environment; forming a patterned network of relationships, livelihoods, aspirations, interactions, and

realities of people constituting a coherent whole that forms the basis of people's daily lives, as well as social and political structures.

The *disturbance* is defined as one or multiple events or changes that alter the *system* itself or the functioning of the *system*. In this research, the war in Tigray constitutes the disturbance.

Assessment of the system is the analysis of the *system* to look at the current state after the disturbance took place; to see if there are any indications of absorbing, recovery, and adaptation, or whether a critical transition is visible. In this research, the assessment took place in June 2021, around eight months after the start of the war in Tigray.

Absorbing, recovery, and adaptation are the stages through which a *system* can adapt to the impact of a *disturbance* and remain functioning without or with only minor changes. In this research, we defined this as indications of aspirations to return, and whether there is a stable and safe situation to enable waiting for improved situations to allow a return.

Critical transition is when one *system* changes to an *alternative system* following a disturbance. A critical transition in his research would mean that refugees can no longer return (whether voluntarily or involuntarily) to the situation they were in before the war started.

The *alternative system* is a different *system* that forms after a *critical transition* following a *disturbance* if the *system* has not been able to return to its former state or has not been able to adapt and incorporate changes caused by the *disturbance*. The alternative system in this research is defined as one where refugees move away or are moved away from situations in which they are able and willing to (easily) return.

Methodology

The research approach to this chapter is an explorative, ethnographic approach in east Sudan, which took place close to the borders of Tigray and Eritrea. The researchers have taken an interpretative approach that centres on understanding the perspectives of the interviewees. The research design is a comparative case study design, comparing the situations of Eritrean refugees and Tigrayan refugees.

The unit of analysis is at the level of the refugee, meaning that the analysis of the baseline, disturbance, and assessment of the system is done from the perspectives of the interviewed refugees.

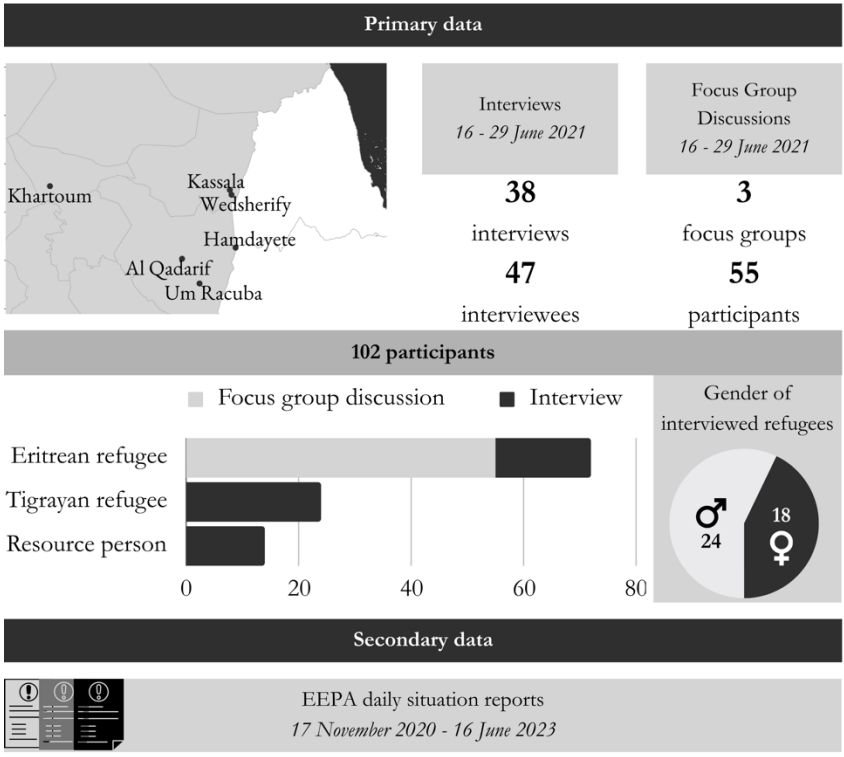

Figure 5.4. Overview of data collected and used in this study

Note: Several interviewees were counted both as refugees and resource persons

Data collection

The data was collected in the form of semi-structured interviews and semi-structured focus groups. The selection of the participants was purposeful, choosing participants who were refugees originating from either Tigray or Eritrea and who had fled recently. To contrast findings, a smaller subset of participants was selected of refugees from Eritrea or Tigray who had been in Sudan for a longer period to compare experiences. The participant sampling within those groups was largely opportunistic and carried out through snowballing; some interviewees were contacted through the help of a research assistant with contacts in the refugee communities. Some interviews and focus

groups were arranged with the help of NGOs. Another part of the interviewees was invited opportunistically to meeting places in the refugee camps if they were showing interest in talking to us. Often, those refugees could link us to others who were willing to tell us their stories. Within the timeline available, we were often not able to follow up with participants or to build relations of trust which would allow us to speak to people beyond those who were immediately willing to participate. However, by contacting people through trusted individuals within the camps, we were able to create trust and interview people from the refugee communities who may otherwise have refused to do so.

All interviews were done by the researchers together, Morgane Wirtz and Kai Smits. On some occasions, the researchers split to conduct the interviews separately. All interviews were held between 16 and 29 June 2021.

In total, 38 interviews with 47 interviewees and three focus groups with about 55 people total were analysed to write this chapter. All of them were conducted in a face-to-face manner, during fieldwork in Sudan, except one, which was conducted through a WhatsApp call in the Netherlands.

Most of the interviewees from individual interviews (24) had Ethiopian nationality and fled the Tigray regional state - in this chapter, they are referred to as 'Tigrayan refugees'- and others were Eritrean refugees (17). The focus groups were all conducted with Eritrean refugees. Refugee women (18) and men (24) have been interviewed. The Tigrayan refugees came from close to the border, mostly from Humera. The Eritrean refugees were also mostly from areas that were close to the border, including mostly from Omhajer and Teseney.

To complement the interviews with the refugees, participants related to different stakeholder groups operating in the situation were also interviewed. The resource persons included: 9 people working for NGOs or United Nations (UN) Agencies, 3 officials from the Sudanese Government's Commissioner for Refugees, 1 Rashaïda person from Sudan, and 1 local journalist. Those interviews served to

provide context on the situation in East Sudan and the challenges faced in relation to the organisation of the refugee camps. Some people working for NGOs or UN agencies were also refugees, so they were included in the totals for both, but not double-counted in the total number of interviewees.

Interviews were conducted in English, Arabic, and Tigrinya. In the latter two cases, the researchers worked together with translators.[12] Sometimes the translators were participants who translated for their friends. In other cases, research assistants collaborating with the researchers translated during the interviews.

The in-depth qualitative interviews collected for this research had an average duration of 1 hour 30 minutes. Before the interview, informed consent was given, either in writing or on record. The participants were informed that they had the right to ask any questions, to choose not to answer, and to end the interview at any time. They were also informed on how their interviews and data would be stored. In most cases, the interview had a semi-structured and linear format. The participants were asked to describe their situation before the war (baseline), then what they had been through at the outbreak of the war (disturbance), to describe and comment on their current situation (new situation) and finally to discuss their perspective for the future (alternative regime).

However, conscious of the situation that most interviewees had recently encountered traumatic situations and following the do-no-harm principle, it happened on occasion that the linear format of the interviews was not followed and that the researchers let the participant choose their way of telling their story. All interviews ended with the question: "Is there something you want to add?" to leave space for new topics to emerge that might not have been identified by the authors.

[12] Translators translated from Arabic to English, and Tigrinya to English. In a few cases collaboration was needed, composed of one translator from Tigrinya to Arabic and a second translator from Arabic to English. This last case was avoided, but put in place when interviewees really expressed their desire to testify and no direct translator from Tigrinya to English was available.

The interviews were held in informal settings, mostly in private places like rented apartments or the houses/tents of the interviewees.[13]

In parallel to the data collection in the form of interviews, a new data set was created composed of Situation Reports published by the Europe External Programme with Africa (EEPA). The EEPA Situation Reports started on the 17 November 2020 to fill the lack of information on the situation in Tigray after the war broke out. During the period of the war, the EEPA Situation Reports on the Horn of Africa were published on an almost daily, regular basis with some interruptions. These reports were published on the EEPA website and social media and shared with a list serve. The Situation Reports had a strong focus on the war in Tigray. The reports were published as two-pagers. For analytical purposes the content was transferred in a spreadsheet, allowing for coding-labelling of the content. This data was re-used for this research with EEPA's permission. The dataset contained every line published in the Situation Reports from 17 November 2020 to 16 June 2023.

Data analysis

After the field research, the interviews were transcribed by the researchers. As the researchers interviewed both Eritrean and Tigrayan refugees, the data were analysed separately for both groups, considering that the baseline systems and the subsequent disturbance and assessment would potentially differ. A line-by-line open coding was done in which the topics that came up in the interviews were labelled. When a new topic came up, previous interviews were also re-checked for this topic. The researchers then analysed the main topics and grouped them into categories to fit the theoretical framework of resilience. They included information about the

[13] The security of the interviewees is a top priority for the authors of this chapter. However, it could not be avoided that for some interviews in the Um Racuba refugee camp an official from the Commissioner for Refugees (COR) in Sudan was present. In this case, the researchers, working in close collaboration with the translator, took time to explain to the interviewees who the COR official was. His presence may have affected the answers from interviewees, as he was not trusted by the interviewees. How his presence might have affected the answers was discussed at length with the translator (Interviews were held in Tigrinya, a language that the COR official did not speak).

baseline situation (including topics such as what was life like before the war, what the situation and the interviewee's personal life were like), the disturbance (what happened after the start of the war, killings of civilians, sexual violence, and fleeing to Sudan) and the assessment of the system currently (what is the situation like in the refugee camps, how many people are going to Libya, what is the security situation) and the alternative regime (what are the perspectives for the future, does the interviewee have plans, if yes, what are they).

The data from the EEPA Situation Reports dataset was coded and labelled by research assistants according to different categories: Sexual violence, deliberate famine, destruction of the health system, key massacres, destruction of cultural heritage, refugee camps, and forced return, and perpetration of crimes by Eritrean soldiers. The objective of using this dataset was to contextualise and triangulate the data from the interviews. It was analysed comparatively with the interviews, to verify information and timelines of events.

Table 5.1. Overview of data collected

	Data type	**Source**	**Gathering tool**	**Analysis**
Primary data	Semi-structured interviews with Eritrean and Tigrayan refugees	Interviews with Eritrean refugees conducted by Morgane Wirtz and Kai Smits	Topic list: baseline, disturbance, new situation, alternative regime	Coding/ labelling
	Semi-structured interviews with resource persons	Interviews with resource refugees conducted by Morgane Wirtz and Kai Smits	Topic list: opinion and general information on the baseline, disturbance, new situation,	Supplementary information and comparative analysis with the interviews

	Data type	Source	Gathering tool	Analysis
			and alternative regime	
Reused material	Situation reports published by EEPA	EEPA	Mixed method (opportunistic, snowballing review and systematic)	Coding/ labelling; comparative analysis with the interviews

Source: Developed by the authors for this chapter

The quotes selected during the writing process are the most representative of the situation of refugees at the border between Sudan, Eritrea, and Ethiopia as found in the coding analysis.

Conscious of the precarious situation of the participants and considering concerns regarding their safety, the researchers gave high priority to ensuring that the privacy of the participants was protected and full adherence to privacy protection regulations. Data and metadata have been stored on password-protected secure drives. Participants were de-identified using identity codes. Multiple codes were allocated if necessary to ensure that the de-identification was carried out correctly.

Locations

The interviews were held in Khartoum (3), Kassala (11), Wedsherify (8), Hamdayete (13), Um Racuba (10), and Al Qadarif (2) in Sudan. Two focus groups were conducted in Hamdayete and one in Khartoum. We chose the locations to find a diverse range of refugees with which to speak, including refugees arriving in reception centres, those staying in refugee camps, and those outside refugee camps. For

time reasons, it was not possible to visit the Shegarab refugee camp, where Eritrean refugees are hosted.

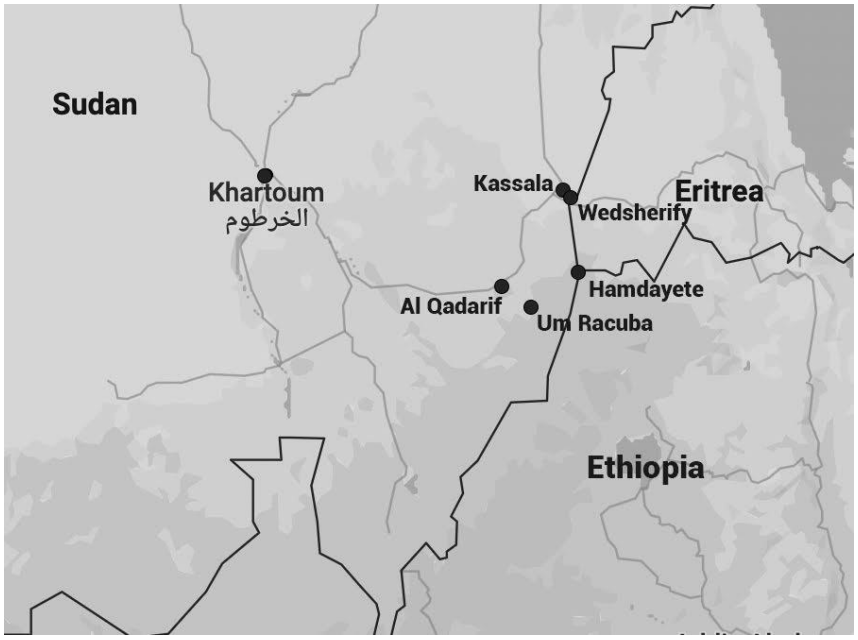

Figure 5.5. Locations of interviews

Source: Developed by the authors for this chapter using FreeVectorMaps.com

From Khartoum, we travelled first to Kassala, where we mainly interviewed Eritrean refugees who were living outside refugee camps. We then travelled to the nearby reception centre of Wedsherify, where we mainly interviewed recently arrived Eritrean refugees. We travelled along the border with Eritrea to Hamdayete, a reception centre close to the borders with Eritrea and Ethiopia.

The rainy season had started, which made it difficult to travel to Hamdayete. In the border reception centre of Hamdayete, north Eritrean and Tigrayan refugees arrive, but they are kept separate from each other, and Eritreans are transported to other reception points and camps. They are generally moved to Wedsherifay reception centre, and to the Shegarab refugee camp. When we were there most refugees were Tigrayan. While Hamdayete is not supposed to house

people permanently at the time when the interviews were taken a sizable community of refugees was staying there long-term.

Figure 5.6. Um Racuba refugee camp in June 2021
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From Hamdayete, we travelled to Um Racuba, which houses Tigrayan refugees. The camp was hastily constructed, with many buildings being little more than tents that are not always fit for Sudan's weather, which includes both heavy rains and strong winds. Tents were slowly being replaced with tukuls, UNHCR officials said, but it was only possible to build those in the dry season. The refugee camps are mostly surrounded by a vast open area and are easily accessible.

The camps also hold staff of NGOs who live there and perform various functions. However, at the time of the field visit in June 2021, the staff in Um Racuba were leaving the camp in the evening and lived in quarters outside of the camps.

The researchers then travelled to Al Qadarif, where more Tigrayan refugees were interviewed. From Al Qadarif, we travelled back to Khartoum where a final focus group with Eritrean refugees was held.

Results and findings

This section describes the background of the different groups of interviewees. The results will be presented for the two case study groups, with the results for the Tigrayan refugees discussed first, and the Eritrean refugees in the subsequent section. This order was chosen to look at the new refugee situation of the Tigrayan refugees first, as all the interviewees were directly impacted by the Tigray war, and then assess the situation for the more established stream of refugees, the Eritreans, and compare how the war impacted, including those indirectly impacted. For both groups, we analysed the aspects described in the theoretical framework, namely the 'baseline', 'disturbance', and 'assessment of the system' with the aim to look at whether there are signs of recovery towards the baseline system, or a critical transition towards an alternative system.

The baseline was operationalised in this research as the situation before the war in Tigray broke out. Refugees described their lives, the (human rights) situation in their countries, and their livelihoods. In the part about the disturbance, we look at the war itself: What happened after the war broke out; how the lives and situations of the refugees had changed; what they experienced and saw. Finally, we describe the assessment of the system at the time of the interviews: What the situation is like for the refugees in the reception centres, camps, and urban settings; are there indications that there is a process of recovery that may lead to a return to the baseline system; what are the perceived challenges, preventing the refugees from returning to their old lives. After the description of the results for both groups, the results will be compared.

Background to the interviewees

The refugees that were interviewed for the research came from various backgrounds. Most of the Tigrayan refugees who were interviewed had recently arrived, whereas in the Eritrean community, more people were interviewed who had been there for a longer time

and could tell us how the situation had changed. Six groups of refugees can be distinguished among those interviewed:

1. New refugees from Tigray that fled after the start of the war (Tigrayan refugees) (23)
2. Existing refugees or migrants from Tigray who were in Sudan before the start of the war (Tigrayan refugee) (1)
3. New refugees from Eritrea that fled after the start of the war (Eritrean refugees) (9, plus two focus groups)
4. Refugees from Eritrea that were in Tigray at the start of the war, and had fled following the war's outbreak (Eritrean refugee) (1)
5. Refugees from Eritrea who were in Sudan before the start of the war (Eritrean refugees) (7, plus one focus group)
6. Refugees from other places disturbed by the war (for example the Amhara region in Ethiopia) (Ethiopian refugee) (1)

There was only one Tigrayan refugee we interviewed who was already in Sudan before the start of the war; but given the differences between the Eritrean refugee numbers (who had consistently fled over the decades before) and the Tigrayan refugees (who fled in large numbers only after the start of the Tigray war), this was not unexpected. The refugees from all groups provided key insights into the results and findings below.

Tigrayan refugees

In this part, the results will be presented of the situation in Tigray before the war (baseline), what happened after the war in Tigray started (disturbance) and the current situation faced by Tigrayan refugees after having fled Tigray, including any indications that the refugees may be able to recover to the situation before the war, or the creation of a situation in which the refugees cannot return to that situation (assessment of the system).

In times of peace

This section describes the situation before the events that created the 'disturbance' that prompted them to flee. This is called the 'baseline'.

Most Tigrayan refugees interviewed had held jobs or were in school before the start of the war, such as a job as an architect, a doctor, a waiter in a restaurant, a hairdresser, and a cement worker.

> *Before this conflict began, our life situation was in a good place, a good time. Our children were going to school, we were eating good food. It was a good situation. Our homes, our beds were clean. We wore good clothes. Even our government had a good policy. It was good justice for us.* (Interviewee 5023-2, interview by Smits and Wirtz, face-to-face, June 2021)

Although for most interviewees, life was good, some people struggled amidst a lack of opportunities. One interviewee (5014) left to try and find work in Saudi Arabia but was intercepted by human traffickers and tortured for ransom in Yemen.

> *After the 12th grade in high school, I failed. After I failed, I gave up and I tried to go to Saudi Arabia through Yemen. I stayed there for long days. And after that, when I came back from Yemen, the war started.* (Interviewee 5014, interview by Smits and Wirtz, face-to-face, June 2021)

The overall baseline situation for the interviewees from Tigray was that they lived in a situation of relative calm and reasonable prosperity. When the war broke out, their situation rapidly and unexpectedly changed.

Facing killing and rape

What can be identified as a 'disturbance' in the model, was a dreadful situation that the participants faced. They faced killings and rape, because of which they decided to flee.

Most of the interviewees came from Humera, an area close to Eritrea. Many interviewees described the outbreak of the war as sudden and unexpected. It started with the use of heavy weapons, followed by an influx of soldiers from the Ethiopian army, Amhara regional forces, and Fano militia.

> *November 7th. In the middle of the day, in light time, we didn't see the military, we didn't see… But we saw heavy weapons dropped in our city, by the Eritreans. They left it in the middle of the streets, in front of the buildings, like every, every, everywhere.* (Interviewee 5028, interview by Wirtz, face-to-face, June 2021)

Once the Ethiopian army and the Amhara forces and militia entered, they started killing people. They targeted civilians, even children.

> *When I escaped, running to the church, I saw a lot of dead bodies and I also saw when they killed them. They killed them using knives in their hearts and throats. Even the [Amhara] militia and the military, when they see a child, they say: "This child is young now, but in the future, he will kill us, so kill him now". […] [A friend of mine was killed]. They are 18 years old. I saw that.* (Interviewee 5027-2, interview by Wirtz, face-to-face, June 2021)

Tigrayans and Amhara people who had been neighbours were suddenly enemies. The soldiers started targeting civilians who were suspected of cooperating with the Tigray People's Liberation Front, Tigray's main party – but civilians who had nothing to do with the party were targeted too.

> *The Amhara people showed them the Tigrayans home. Who was with the TPLF, who was working with the Tigrayans, who were participating in the meeting.* (Interviewee 5025, interview by Wirtz, face-to-face, June 2021)

> *And in this conflict [four months ago], they burnt our house. I lost my house. And this child, his father is from the Tigray region. I am from Amhara but my husband is from Tigray. [...] They targeted us because I am Amhara and my husband is from Tigray. There are many enemies against us.* (Interviewee 5006, interview by Smits and Wirtz, face-to-face, June 2021)

Many interviewees indicated that they fled when the soldiers started targeting civilians, but some people stayed in their houses. The houses were frequently looted. In Humera the perpetrators were alleged as being mainly the Amhara forces and Amhara militia. In addition, women experienced rape when the military entered their houses.

> *I was sleeping inside the house. My family were outside, drinking coffee. They knocked on the door and they said: "We want to search for weapons". My father said: "There is my daughter sleeping, so, shall we wake her up?". They said: "No, no, don't worry. It is okay". And then, they do what they did and told me not to scream, not to say anything. So I had to stay quiet.* (Interviewee 5014, interview by Smits and Wirtz, face-to-face, June 2021)

Another participant also described a horrific situation in which she was raped and held captive for three days, perpetrated by the military,

allegedly supported by neighbours, clearly creating great anxiety about the safety of the home:

> *Then after a while, we heard soldiers are staying at our house, so we wanted to go back to our house. Then they took our children out and they raped us. […] There were five soldiers. One of them beat me, and I fell down to the floor. Then the five of them raped me continuously for 3 days with no food or water. It was like … cruel and difficult, and it was harsh. There were neighbours, Amhara or Wolkait, with the help of them, they raped me.* (Interviewee 5015, interview by Smits and Wirtz, face-to-face, June 2021)

Rape also occurred on the streets, and on the road, women were taken to secluded places where they were raped. Some were subjected to sexual slavery for the soldiers. Women describe being raped in front of others.

> *Then they start raping, step by step, turn by turn … there were four of them, we were two women. […] One woman, two soldiers raped her. The other soldiers were watching, guarding. And after they finished the two, the two will go and rape the other, and the others will watch. [This happens in front of the men who were being beaten].* (Interviewee 5016, interview by Smits and Wirtz, face-to-face, June 2021)

The women who experienced rape experienced other violence and extreme cruelty during the perpetration of the rape.

> *They beat me, and they slapped me in my face. They smashed me. They said: did you change your mind about changing your nationality? If not, we're not going to leave you alive. In three days, they don't give me food or water. […] No toilet, no food, they beat me in my neck and my whole body. No talking, no food, no water, no latrine. Just they rape me and beat me.* (Interviewee 5015, interview by Smits and Wirtz, face-to-face, June 2021)

The women also indicated that language of ethnic cleansing was used during the rape, to either force the victims to change their nationality or to erase them – and any potential babies they may have. Both the Amhara militia and the Eritrean soldiers were allegedly implicated in sexual violence (Interviewees 5013-2, 5014, 5015, 5016, 5023-1, 5028) in some cases with elements of ethnic cleansing (Interviewees 5015,

5016, 5023-1, 5028). For example, one person told the story of a woman:

> *After they [raped] her, they burn steel and they will burn it in her abdomen [from the outside], because it will give birth to a Tigrayan man. When she asked: "Why are you doing that to me, because I didn't do anything to you?" They said: "Yes, we know that. But you will give birth to a Tigrayan man who can fight with us, who can stand with you also".* (Interviewee 5023-1, interview by Wirtz, face-to-face, June 2021)

There was no opportunity to bury the dead. Multiple people indicated that they saw dead bodies lying on the street, but they were not able to perform burials.

> *There is no permission to do the funeral. You will do it at night. Otherwise, they will kill you. Even, if they see you, they will kill you.* (Interviewee 5006, interview by Smits and Wirtz, face-to-face, June 2021)

While people fled, the roads to escape were very dangerous. A Tigrayan doctor in a reception centre in Sudan treated victims of rape. He described how the violence, including sexual violence, continued on the roads and that most rapes were gang rapes.

> *Most of the women that have come here [who have been raped], most of have been gang raped. A group of soldiers, a group of militias. And some of them are raped at different checkpoints. Raped here, and then at another checkpoint, another rape incident.* (Interviewee 5013-1, interview by Smits and Wirtz, face-to-face, June 2021)

The doctor also said the soldiers were trying to assert ownership over the women by giving them a note stating she had already been raped, but that this did not prevent further rapes in most cases.

> *Once a soldier has raped her, they give them a note. So this note would free them, from any other rape or attack. If they get a note from a soldier, then no one would touch them, they say – but only after being raped. Two women said they were raped at two checkpoints, even with the paper. [...] They said that the paper was saying, "She is mine, so don't touch her". That's what the women said. So this is how they treat the women.* (Interviewee 5013-1, interview by Smits and Wirtz, face-to-face, June 2021)

The stories of violence and rape we heard are too many to write down. They were defined by a high level of cruelty and targeted innocent civilians. Some interviewees expressed surprise that the violence had turned against them, instead of the Tigrayan soldiers. This extreme level of ethnically targeted violence is what defined the stories from the Tigrayan refugees about the disturbances. All Tigray interviewees, except for one who had been in Sudan before the war, fled due to the outbreak of violence.

In makeshift camps, becoming part of human trafficking networks

The refugees found themselves in a new system. We investigated how the Tigrayan refugees are currently adapting to the situation, and whether there are any indications that absorption, recovery, and adaptation are taking place, or whether a critical transition has occurred.

The key issues that came up were the difficult situation in the makeshift camps, which were quickly erected, and the looming threat of the established human trafficking networks finding their ways into the new camps.

Unsafe camps and lack of resources

Each of the families and individuals living in the camps have stories to tell of the war. The refugees interviewed in Hamdayete, a small town close to the border with Ethiopia functioning as a reception centre, were expected to leave to go to refugee camps, but over 5000 people still lingered there:

> *You know what the main reason is? Because as I told you before, my family is still in Humera, near here. So I don't need to go out of here, because I still need to hear information. I need … if any chance, I want to go and visit them, or to come back. So I need to be nearby, not far. That's why most people are staying here.* (Interviewee 5013-2, interview by Smits and Wirtz, face-to-face, June 2021)

The other camp, Um Racuba camp, located about an hour's drive from the town of Al Qadarif, is somewhat isolated at the end of a road under construction, was established on 20 November 2020. In June 2021, it housed 22,000 refugees from Tigray. For kilometres, tents and straw houses were visible. "Twenty aid organisations work

here. There is a food distribution every day for the refugees. Regarding education, we have three primary schools in the camps", explained a protection officer for the Sudanese Government's Commissioner for Refugees. However, some young refugees were not able to go, because the schools are far away from their tents.

> *The main challenge now is the season of rain. We are working on the streets and to protect the tents. […] They are flying away. And there are no clothes [available for the refugees] for the rainy season.* (Interviewee 8003, interview by Smits and Wirtz, face-to-face, Um Racuba, June 2021*)*

A lot of work was done in six months in the camps, but the situation remained difficult. Refugees complained about the lack of medicine and hunger. An elderly man explained:

> *In this camp, before, two months ago, it was good, it was nice because they gave us the food monthly, they gave us food distribution, aid, everything was good. […] Now we are in a bad situation because of the wind and the rain. Even the World Food Program (WFP) stopped the distribution of food. In those two weeks we are in danger times, we are in a bad situation. When the wind comes, our shelter will fall down and when we want to repair it, we must sell our food, our material. This is a big problem at the moment. Also, at the hospital, there is no medicine here. Because of this shortage of medicine, a lot of people are dying here in the camps.* (Interviewee 5023, interview by Wirtz, face-to-face, Um Racuba, June 2021)

Between May and June 2021, there was no food distribution in Um Racuba, several refugees said. The WFP wanted to replace the food donations with cash donations. The refugees refused, challenging the amount of 3,000 Sudanese pounds (6 euros) that the UN had offered them per person per month. In the meantime, the situation was blocked.

The refugees, having fled their homes in a hurry, left family members and material possessions in Tigray. In Sudan, they found themselves in a precarious economic situation. The ones that have a job are an exception. "Some refugees are working as volunteers, some as farmers, some have a business in the camp", the Commissioner for Refugees protection officer explained (Interviewee 8003, interview by Smits and Wirtz, face-to-face, Um Racuba, June 2021).

Most people do not have a job, and if they do have one, it is not enough to survive. However, they cannot go out of the camp without permission, and those who go out without permission are not able to obtain a work permit.

> *This job is not enough to survive. But it is better than having no job. Something is better than nothing. That is why I am working here. When I see people who don't have a job, I feel ashamed. I feel like that is not…. Because they don't have a job and they don't have…. It is difficult to survive for them. But for me it is good. Because I see less than me.* (Interviewee 5025, interview by Wirtz, face-to-face, Um Racuba, June 2021)

Another interviewee lamented that he could not continue his studies and that there was little to do:

> *I am a civil engineering student. But here I can't continue my studies. There is no university in the camps, and even if I go to Khartoum, the courses are in Arabic. I won't be able to understand. While waiting for a solution, I spend my time watching movies and series.* (Interviewee 5025, unofficial conversation with Wirtz, face-to-face, Um Racuba, June 2021)

The lack of things to do is weighing on the refugees. Sitting unoccupied with an empty stomach is a painful experience for everyone, especially after the traumatic experiences and losses that the Tigrayan refugees suffered. Leaving the camp to go to a city is not allowed without special permission.

> *5030: My health was not good in Um Racuba. [...]. I saw a doctor, doctor [redacted]. When he saw me, he said that he didn't have what was needed to cure me and that I had to go to Al Qadarif. So he gave me permission to go to Al Gadarif. [...] Sometimes when they ask me, the police maybe, I answer that still I have the permission and that I get the medicals from the hospital.*
>
> *Smits: Is the permission only valid as long as you are being treated in the hospital?*
>
> *5030: Yes. It is just for a very short time, like one month. You have to renew it all the time with the immigration police.* (Interviewee 5030, interview by Smits, face-to-face, June 2021)

This interview with a refugee working in a small cafe in Al Qadarif City illustrates that permits are given out only for valid reasons and that as soon as those reasons no longer apply, the refugee is expected

to travel back to the camp. It continuously needs to be renewed. According to refugees in Al Qadarif, the police have become more active in checking the validity of working permits in the city. Even Tigrayan refugees who had been there for a long time did not receive any permanent status, so they had also been facing additional scrutiny.

There is currently no prospect for the Tigrayan refugees to be able to work or to create a sustainable future for themselves in the camp. The housing and facilities are recently built and are not fit to face the extreme weather conditions. In addition, the camp is isolated and to travel outside, you need special permission.

Targets for the human trafficking networks

The aspirations of the Tigrayan refugees fell into one of two categories: go back to Tigray – either when peace returned, or to fight – or move onwards.

> *I already joined the army. I trained, I already trained. […] Yes, under three men, two men… I trained. I don't want to talk about that.* (Interviewee 5016, Interview by Smits, face-to-face, June 2021)

Some participants expressed clearly that they would consider returning to fight if they had weapons:

> *Everyone wants that. This is everyone's need. If they got …. Everyone, even that woman, even if you ask the children also. If we got the weapons, if we got this chance to go and fight with them, we will go. Even me, including me. If we got a chance to go inside and to fight with my friends, with my family, with my people, I am ready. If possible, stop the war. Otherwise, they are trying to destroy the whole Tigray, the whole Tigray. If Tigray is destroyed, we don't have any value here. They will take our properties, our lands, our leaders, our families, our people, everything they will destroy. So what are we doing here?* (Interviewee 5024, interview by Wirtz, face-to-face, Um Racuba, June 2021)

Some interviewees, like the ones above, speak about their desires and aspirations to fight in the war in Tigray. However, going back to Tigray was even more dangerous than leaving. Just to cross the

border, Tigrayans risked their lives. In Hamdayete, a volunteer explained:

> *Some try to cross the river [that separates Sudan to Tigray], and the river took them … to go back, to go visit their family. Because of the shortage of food and everything. […] You have so many people killed when they try to cross like that. So many young people, are taken by the river.* (Interviewee 5016, interview by Smits and Wirtz, face-to-face, Hamdayete, June 2021)

Others expressed the aspiration to take the road to Libya and Europe. In June 2021, this was already becoming apparent. Hamdayete's volunteer, herself a Tigrayan refugee, explained:

> *Yes, one of my brother's friends, he went, and he's still in Libya, I think. He says he is OK. I have some friends who are leaving to Libya. Of course, they are not OK in Libya. […] Yeah, most of them. Most of the young people are escaping.* (Interviewee 5016, interview by Smits and Wirtz, face-to-face, Hamdayete, June 2021)

One Tigrayan refugee volunteer had the opportunity to translate and speak to many young Tigrayans who were planning to leave.

> *I worked there in Hamdayete, in Um Racuba and also in Al Tunaydbah. I went to the camps so I had the chance to talk with many young people. So at that, I understand that most people are planning to leave Sudan, or to use Sudan as a transition to somewhere.* (Interviewee 5022, interview by Wirtz, face-to-face, Hamdayete, June 2021)

In many cases, it is out of desperation that refugees set out on this road. One of them explains:

> *I spend my whole time smoking and somehow drinking alcohol. The situation is so bored and hopeless. […] I start talking with my uncle […] about going to Libya or Egypt… In my view moving over there, there are two chances: die or alive … but here I am just in the middle of alive and die.* (Interviewee 5024, interview by Wirtz, WhatsApp messages, April 2022)

There are several factors that put Tigrayan refugees living in Sudan on the road to Libya. Among the reasons are (i) the economic situation in the camps, (ii) the feeling of insecurity that refugees still feel and (iii) the desire to help their family. The decision to leave can be a group decision, taken among friends: "From here, they go out

by group. Like he will talk to his friend, his friend will say that he agrees with him, they will go", a woman in Um Racuba explains (Interviewee 5027, interview by Wirtz, face-to-face, Um Racuba, June 2021).

In other cases, refugees are pushed onto the routes by intermediaries who work for smugglers and traffickers. Their role is to make some kind of "advertisement" for the journey to Libya. Two women describe:

> *From here. They come in, of course, because it's open, anyone can come in and out. I don't have much information but I think they came and they say: "It's easy to get through this in Sudan, and it's cheaper, so you can go easily", they told the young people, and they believed them.* (Interviewee 5016, interview by Smits and Wirtz, face-to-face, Hamdayete, June 2021)

We were walking with a Tigrayan refugee in Um Racuba refugee camp when his phone rang. After he finished his conversation, he turned to us, being very upset:

> *It was my best friend. And he has gone to Libya. He is gone. He was gone yesterday. It is my best friend. We have gone to primary school together, high school together, secondary school together. And he is gone yesterday. He is gone yesterday.* (Interviewee 5024, interview by Wirtz, face-to-face, Um Racuba, June 2021)

This young refugee, who lost his family in the rush to escape from Tigray, is now alone. Another relative we interviewed in Um Racuba was facing calls for ransom for their cousin, who recently left for Libya. Like the others, he did not say goodbye:

> *He didn't say goodbye. Even, he left his phone. When he left his phone in the house, after one week, we understood that he is gone. After two weeks, he called and said: "I am in Libya". If he is safe or not at that time, we don't know. But he said to us that he is in Libya.* (Interviewee 5028, interview by Wirtz, face-to-face, Um Racuba, June 2021)

A few days after this call, human traffickers started calling her. They demanded the sum of 300,000 Ethiopian birr (EUR 5,775.45[14]) and

[14] Currency calculated using Oanda.com at the time the payment demand is estimated to have taken place.

threatened to kill the young Tigrayan if the money was not sent. The relative and his family regularly received calls from the traffickers or voice messages with the cries of their cousin. The family was under pressure to pay:

> *We don't have that much money at this moment. Because we left our properties, our home, we don't have a job, everything. Even we are trying to gather money here from our people here, like helping us. And they help us, the people are helping us but the Sudanese money is much less. So we couldn't help him till now. Maybe he can die. God knows about him. But we are so stressed about him. And he sends vocals of his voice. I can't handle this. This is more than my capacity. I cannot control this, I cannot suffer these challenges at this moment.* (Interviewee 5028, interview by Wirtz, face-to-face, Um Racuba, June 2021)

Young Tigrayans are not just planning to go to Libya, but they already started to travel to Libya. Family members already started to receive calls for ransom in June 2021.

Although the refugee camp of Um Racuba is new, traffickers have already started to target it and the new refugee population. Although the Sudanese authorities that were interviewed, denied that there were any smugglers or traffickers inside the camp, the refugees in the camp said there are people inside to advertise the journeys and to arrange transport to Khartoum, from where the routes to Libya continue. About such people, who are agents of the trafficking networks, one interviewee said:

> *It is not simple and easy to know them because they work with the network and those networks are high up connected with the local community. They do this secretly. […] Some of them are Tigrayans and some of them are Sudanese. They work together as a network. [...] Most of them are young from 28 to 38 – 39.* (Interviewee 5022, interview by Smits and Wirtz, face-to-face, Hamdayete, June 2021)

Such intermediaries are described as Sudanese, and Tigrayan, and another interviewee also identifies that some are Eritrean. Furthermore, rumours about kidnapping have started to circulate:

> *We hear also sometimes Rashaïda. They come here. And also sometimes, the old people tell us: "Keep your children, maybe they are going to kidnap your child". We*

hear that there are kidnappings. (Interviewee 5028, interview by Wirtz, face-to-face, Um Racuba, June 2021)

The high drive of many young Tigrayans to leave for Europe is particularly clear from the interviews. Not all young Tigrayans interviewed, want to leave. Some are waiting to go back when the situation allows, and others are planning to go back to fight. However, what is clear is that the new camps have immediately become targets of human trafficking networks.

Eritrean refugees

In this part, the results will be presented of the situation in Eritrea before the war in Tigray (baseline), what happened after the war in Tigray started (disturbance), and the current situation faced by Eritrean refugees after having fled Eritrea or Tigray, including any indications that the refugees may be able to recover from the situation before the war or the creation of a situation in which the refugees cannot return to that situation (assessment of the system).

Repression and indefinite national service

The baseline situation for Eritrean refugees is quite different than the situation of Tigrayan refugees. This section below presents the findings of how the Eritrean refugees perceived their situation before the 'disturbance' that prompted them to flee.

All the Eritrean interviewees spoke about their experiences in the indefinite national service when discussing their lives in Eritrea before the war. Military training and national service are obligatory for all Eritreans, men and women. The national service has a civil service and a military component and the military component is particularly feared: "I sold coffee. From the coffee, I went directly to the army". (Interviewee 5002, interview by Smits and Wirtz, face-to-face, June 2021). All the interviewees expressed that they were unwilling to be in the indefinite national service. The longest period that one interviewee in this study served in the national service before fleeing was 23 years.

Many of the participants had attempted to escape and avoid the indefinite national service.

> *I joined the national service before. And when they gave me holidays, I stayed with my family. I spent two years in the national service. When you spend two years, they give you a holiday for one month. And then, I didn't go back.* (Interviewee 5011, interview by Smits and Wirtz, face-to-face, June 2021)

It is seen as normal to be on the run from the indefinite national service. One interviewee named it as almost an afterthought:

> *Nothing happens [in Omhajer]. Everything is normal. But we are under threat of national service.* (Interviewee 5017, interview by Smits and Wirtz, face-to-face, June 2021)

Three interviewees mentioned that they or their direct family tried to avoid military service by working in gold mines (Interviewees 5001, 5003-1, 5003-3). Militia are involved in some cases in the roundups of people for the military service. One interviewee mentioned a brigade called 65, working for the Eritrean government:

> *At first, some groups arrested me. It is militia. It is called 65. It is something official for the government. They are the government. It is kind of army. They catch people and they send them to training and then they put you on the border with Ethiopia or Sudan.* (Interviewee 5001, interview by Smits and Wirtz, face-to-face, June 2021)

Five participants spoke particularly about national military service training (5001, 5002, 5004, 5005, 5017). There is excessive punishment in national military service training:

> *Very high punishment. I saw one tried to escape and they did very high punishment, beating him, his head and everywhere. [And for small mistakes?] For example, for the small mistakes; if the soldier says "don't go to this place" or "don't take water", and you know people all the time, they want water, the soldiers will punish you by beatings, with iron.* (Interviewee 5001, interview by Smits and Wirtz, face-to-face, June 2021)

Sexual violence occurs in both the national military service and in the military training, one interviewee stated who had experienced it directly.

> *There is harassment. There is sexual violence. Yes, there is many. […] They do all the kinds of harassment. They do anything. Even the sex. […] They choose some girls. I don't know how they choose. They take whom they want. […] They have their house near us. For example, they send me to the group and tell, for example "Come, [Redacted] come, the leader wants you".* (Interviewee 5002, interview by Smits and Wirtz, face-to-face, June 2021)

Participants from Eritrea referred to imprisonment as a common situation. Prison names that were mentioned in the interviews were Wad Habit (north Teseney), 'John Cena' (north of Eritrea), unnamed prisons in Aligidir and Barentu, Oum Arba (Teseney), Ashrai (around Keren), Nakfa, Taroumba (in the south), Alla (near Dekemhare), Daguna (in Barentu), and Ashferet (near Keren).[15] Many interviewees had been to multiple prisons in different locations at different times. All interviewees had been sent to prison either for deserting or fleeing from the indefinite national service or attempting to escape Eritrea, except for one interviewee who was accused of participating in a coup attempt in 2013 (Interviewee 5009). The interviewees told similar stories about prison, including mentioning overcrowding, extreme heat or cold, lack of food, lack of hygiene, presence of pests, diseases, complete darkness, and severe punishment for things as small as asking for water.

> *It is very, very hard experience, to be honest with you. For example, in one room like this [about 30 square meters], it is normal to put even 400 people. It is very crowded. You haven't got any space to sleep well. They will not allow you to go to the toilet or do anything. And even you will not see the sun. [...] It is very difficult also for me or for all the people to deal with each other. Especially about the older prisoners. They have something like trauma, they are not okay like the others. […] Some people killed people. I found someone who spent 15 years over there. There are many people who died there. Even me, I was suffering from TB [Tuberculosis], because there is no good food. I remembered three people who died on my time, I saw them.*

[15] The researchers wrote down the names of the prisons as they understood them from the interview. The phonetic writing may differ.

(Interviewee 5004, interview by Smits and Wirtz, face-to-face, June 2021)

Corresponding to the baseline situation in Eritrea, interviewees discussed the lack of food and other essential resources. As a result of the indefinite national service, people identified part of the problems they were facing was that they were not allowed to freely work, and they were not allowed to travel:

> *[I left] because of the bad situation in Eritrea, no good food, no … I was suffering too much in Eritrea. […] Before it was better than now. Because before I found work, here, here. There is some money.*[16] *But now there is no job. I came before from the Highland. At that time I found work. But now even we have difficulties to find things like food.* (Interviewee 5007, interview by Smits and Wirtz, face-to-face, June 2021)

COVID-19 restrictions in Eritrea from 2020 onwards had made the situation worse, according to two interviewees, while one interviewee said that the situation was bad before and after, and that it hardly made a difference:

> *Corona brought more pressure on me and my family because at that time many things stopped; access to sugar, some food… Because no travelling was possible. Many things stop.* (Interviewee 5001, interview by Smits and Wirtz, face-to-face, June 2021)

All the Eritrean interviewees named one or more of the reasons above as the reason for fleeing to Sudan. One person fled to Ethiopia first before coming to Sudan. The baseline situation for Eritreans is defined by severe restrictions, no regular jobs, limited access to food and resources, and fear of repression. This repression was described in the context of the national service, particularly military service, and imprisonment.

Rounded up and deployed

The concept of 'disturbance' relates to the moment in time when a situation changes. In this section, the abstract idea of a 'disturbance'

[16] Generally, all people in Eritrea work in the national service; however, this interviewee was elderly and, therefore, may have been released from active national service and was trying to make ends meet by doing small, irregular jobs.

in a 'system' of an Eritrean refugee, is the moment that provoked the Eritrean refugee to flee. The following findings speak to the 'disturbance' that provoked the refugee to such an extent that they decided to flee.

Eritreans who were in the army at the time of the outbreak of the war reported that they were called up for training when the war started. They were not told that they would be deployed for the war.

> *Four months ago, in February 2021, they wanted to send us to the area of Omhajer. They want to send us to training. They told us, you would be sent to that area just for two weeks, just for training, but we do not trust that because we know it is not the area of the training. The area of the training is like the west or another area. I know that they will send me to Tigray area for fighting, and I know it is a very dangerous area. Some people have died, some are arrested… I'm thinking, if I die at that place, the government will not continue to see how my family will live and they will not give them anything. They will not care for my family. So I decided to leave Eritrea and I told my family about that.* (Interviewee 5005, interview by Smits and Wirtz, face-to-face, June 2021)

Army recruits were not the only ones finding themselves forced into a war. In one testimony, a prisoner was taken directly from prison to the battlefield, arriving there before the war had started. He stated that around 160 of the 640 prisoners, those that had spent longer than 8 years in prison, were sent to Tigray. He was the only interviewee that served in Tigray as a soldier in the war and who was not able to escape before being deployed.

> *They released us on 30 October from prison and at 2 November I was in Sheraro. It took like two days from the prison to Sheraro. […] No one gives you information. Just you will find yourself on the car, going to place. You don't know where you will go. At that moment, I was just thinking about how we can fight again against the regime. Maybe I discussed with many of my colleagues in the prison: If we are out of the prison, we will fight against the regime. But the Eritrean army didn't give us any chance to do anything. We found ourselves at the border. And also they divided us. They divided the prisoners in different armies. [...] We didn't understand anything until we reached the area of Badme, the conflict area between Ethiopia and Eritrea. At that area, we just know what will happen.* (Interviewee 5009, interview by Smits and Wirtz, face-to-face, June 2021)

The former prisoner fought in Sheraro, where he said the biggest battle was over in just one week. "We have all the army equipment, all the army cars, and even the heavy equipment for bombing - 120 and 130…" (Interviewee 5009, interview by Smits and Wirtz, face-to-face, June 2021). According to the interviewee, the relationship with the Ethiopian army was good and the Eritrean military was wearing Ethiopian army uniforms. At that time, the involvement of Eritrean troops was still a secret.

> *We wore the same uniform as the Ethiopians. […] We deal with them in a normal way. We eat with them. I think that all the things come from Ethiopia, like the food for example, the houses. All the things are from Ethiopia. It is normal. If the Eritrean army catches any group from Tigray or civilian people, they send them all to the Ethiopians.* (Interviewee 5009, interview by Smits and Wirtz, face-to-face, June 2021)

People refusing to fight were put into prison. This included leaders who refused to fight, but those were later locked up in a town were unable to leave, according to the interviewee.

> *There were people who refused to fight. Now all of them, they are in prison. Most of them are in Mai Serwa. They are in very bad condition, like in any prison. […] Even some leaders rejected to fight, so the president Isayas sent them to prison first, then he released them. But they live in a closed area, it is like a prison. They banned them from leaving the town. They live in one town but they are banned from leaving the town.* (Interviewee 5009, interview by Smits and Wirtz, face-to-face, June 2021)

People who were injured were sent either sent to Addis Ababa if they were far from Eritrea, but those close to the border were sent to an area the interviewee referred to as Glass, a military hospital, and they were not allowed any visitors.

> *They send them to Glass, an area called Glass in helicopter. Glass area is closed. No one goes inside Glass. Even when you have your brother or your son, you will not see him. For example, one woman knows that her son is injured in this hospital, then when she goes to the hospital to visit him, the army asks her: "Who told you? Who gave you this information?" Finally, she talks to them about the one, they brought the one and sent him to prison. She is with him. Now the two are in prison.*

(Interviewee 5009, interview by Smits and Wirtz, face-to-face, June 2021)

This was part of the information blackout around the conflict. Soldiers were not allowed a phone, so they could not inform their families about what was going on in the war.

You know the Eritrean government closed all the telephone and contact from the area of Tigray. And no one from the army has a telephone. So no contact with anyone. The government took all telephones of people from the army. Just our leaders. (Interviewee 5009, interview by Smits and Wirtz, face-to-face, June 2021)

The soldier was able to escape because he sustained an injury unrelated to battle and was able to escape to Sudan. Other refugees confirmed the lack of information to the people of Eritrea about the war. "No one knows information [about the people who are in Tigray]. […] No one returned. […] Nothing from the TV." (Interviewee 5017, interview by Smits and Wirtz, face-to-face, June 2021)

Youth reported that they faced an increase of national service roundups, called *giffas*, after the start of the war. Both women and men reported this.

I know people [who have been rounded up]. They come from house to house. If you haven't got school, you are not students, they will come and you will go with them directly. (Focus group 5017, focus group interview by Smits, face-to-face, June 2021)

Some Eritreans who had family members in refugee camps in Ethiopia lost contact with them.

Now she [my sister who was kidnapped in Sinai] is in Ethiopia. She is in Shimelba. Our last contact with her was in this camp, but now after the war in Tigray, we don't know where she is exactly. (Interviewee 5003-1, interview by Smits and Wirtz, face-to-face, June 2021)

One refugee who was in Hitsats after the start of the war was deported back by Eritrean authorities to Eritrea, where he spent four months in prison, before he managed to escape during a toilet break.

He said that particularly people who had deserted from the army were given long prison sentences.

> *When the war started, all the area is unsafe, so we decided to leave the camp. I wanted to leave to Sudan. I started the journey until the border. But in one area, the Eritrean army caught me and sent me again to Eritrea, to Barentu with a group. [They sent us over the border] By car. We are in a convoy of about 15 cars. It is army cars. Very big cars. A lot of people fit inside those cars. They divided us into two groups. The group who came from the camp, they allowed us, after two weeks of prison, to be released and to go to our family. But the other group, composed of soldiers who escaped from the army, they sent them to prison.* (Interviewee 5010, interview by Smits and Wirtz, face-to-face, June 2021)

The disturbance of the Tigray war, as described above, had some direct impacts on the situation of people in Eritrea. National service roundups increased and those in the army were (under threat of) deployment, including non-army persons like prisoners. Information was kept under wraps. In addition, people lost contact with Eritrean refugees in Ethiopia, and some refugees were deported back to Eritrea. Some interviewees indicated they had fled due to these reasons.

Persecution in Sudan amidst economic hardship

In this part, the results will be presented of how the Eritrean refugees are currently adapting to the situation, this is referred as the 'assessment of the system', and whether there are any indications that absorption, recovery, and adaptation are taking place, or whether a critical transition has occurred. The two key issues that came up were the insecurity inside and outside the camps, and the increasing threat of human trafficking. The two situations that were identified in the analysis are: the strict situation in both the camps and outside the camps for the refugees restricting their abilities to work and access services and the threat of human trafficking preying on Eritrean refugees in Sudan.

Deportation and extortion inside and outside the camps

Eritreans arriving in the reception centres were separated from the arriving Tigrayans. In Hamdayete, there were two groups of Eritreans in a separate housing structure, and other newly arrived refugees were

in the reception centre of Wedsherify. Both of those locations were places of transit, but refugees remained there for weeks waiting to be transferred. Refugees complained about a lack of basic resources and medical care.

> *We have no food and no water. Even to cook, we don't have that. [...] We are not allowed to leave this area. [...] They keep telling us, "tomorrow, tomorrow". Every day, they say tomorrow. Now we have one month in this situation. [...] If you find a doctor, you will not find the medications.* (Focus group 5018, focus group interview by Smits, face-to-face, Hamdayete, June 2021)

A main concern for the refugees was that they wanted to travel to Shegarab, the place where Eritrean refugees are housed; or conversely, not wanting to travel there, because they would not be able to work. Another key concern in the transit places is the fear for deportation to Eritrea by Sudanese authorities. The men in the focus group in Hamdayete were very concerned about deportation to Eritrea, after they had witnessed 6 persons being deported by Sudanese security:

> *They did that [deportation] for about 6 persons, they deported them already. Four days ago, they deported six people. […] Still, we are afraid of that, and those people were ten when they told them that they wanted to deport them, four of them went quickly, escaping, and they caught the other six and deported them. [...] In a car, it is a car of the [Sudanese] security.* (Focus group 5018, focus group interview by Smits, face-to-face, Hamdayete, June 2021)

Tribal conflict in Sudan is also affecting some refugees in and around the camps. A group of refugees described how Eritreans were caught up in such conflicts, because they look like members of a particular Sudanese tribe (presumably the Beni Amer).

> *Now it is not safe, but at the time, it was safe. In Shegarab, I am not sleeping well, everything is not well in the issue of security. […] It has been going on now for around 2 years. It started because of the tribe conflict here in Kassala. The insecurity started at that time. [...] We look like the other Sudanese tribe. When there are two sides, some Sudanese they think we are with one side.* (Interviewee 5003-1, interview by Smits and Wirtz, face-to-face, Kassala, June 2021)

In addition, refugees still feel threatened by the long arm of the Eritrean government which infiltrates the refugee groups.

Interviewees were fearful of their names and faces becoming known. "I think that if the Eritrean government knows what I have told you, they will kidnap me from Wedsherify" (Interviewee 5005, interview by Smits and Wirtz, face-to-face, Kassala, June 2021). One woman said she could recognise those operatives by the looks in their eyes:

> *I worked with the government as a soldier and I know, I have the ability to distinguish. Looking in your eyes, I know if you are working with the government.* (Interviewee 5002, interview by Smits and Wirtz, face-to-face, Kassala, June 2021)

Whether or not the look in someone's eyes is enough to judge whether they are Eritrean government agents, the fear of encountering these operatives on the streets every day is intimidating.

Just like Tigrayan refugees, Eritrean refugees faced the choice of staying in a refugee camp or going out to try to find work. In a refugee camp, refugees could get a refugee card, but with it, you were not allowed to leave the camp unless you had special permission (rarely given). They stopped registering Eritreans in Khartoum, so to get the card, even Eritreans who have been in the country for longer need to travel back to the camps to be able to receive a permission card. The refugee card is desirable, because with it, you may be able to get a work permit – it is not legal, so you need to pay a bribe. But the alternative is to get a foreigner card, which states on it that you are not allowed to work:

> *This is a foreigner card. It is already expired. See here? Not permitted to work. This is from Khartoum, a Sudanese government card. Even if you have this, they may break it, and you can go to prison. If you get fined money and you cannot afford, the community, neighbours, relatives can take up a sharing to get you out from prison. You have this card as Eritrean, but you're not permitted [to work]. [Someone hands a UNHCR card to the interviewer]. You have this one, UN card, and sometimes you are asked for a work permit, which is so expensive. If you have a UNHCR card, they also ask for a work paper.* (Focus group 5031, a focus group interview by Smits, face-to-face, Khartoum, June 2021)

Eritrean refugees, even those born in Sudan, cannot become Sudanese unless they are lucky with their tribal relations. The director of a Sudanese NGO explains how this is possible:

> *When it comes to Eritrea, you have the Beni Amer and so many other groups, who are border tribes, so you can find a Sudanese Beni Amer or an Eritrean Beni Amer. They do live in the lowlands near the Sudanese borders. And that area is a very rich, fertile land. And the government of Eritrea has always had the strategy of sending highlanders to lowlanders [driving lowlanders like Beni Amer off their land]. So, so many people, 100s of thousands of people, left this place claiming that they are Sudanese, benefitting from the corrupt system. So, they got their identity cards. […]. I can't understand, families [of Eritreans] living in Sudan since the 60s and not having any identity cards. You can find someone who entered Sudan two years ago who has a passport. The government has provided this to the Beni Amer because they can support the previous government.* (Interviewee 7006, interview by Smits, face-to-face, Khartoum, June 2021)

So, the interviewee implied that by having tribal relations and supporting the previous government, the government of Omar al Bashir, and some Beni Amer Eritreans were able to get privileges. However, the Eritreans are also discriminated against in many ways. A focus group in Khartoum explained that landlords would arbitrarily increase the rent to chase Habesha (Eritrean and Ethiopian) renters. The group said the situation got worse from January 2021 onwards, especially since the economic situation deteriorated. Eritreans and Ethiopians were also facing arrests from police officers, who could break your foreigner card in half or bring you to prison unless you paid them money.

> *Yes, sometimes they can bring you to prison. If there is a holiday, there is an increase in victims. Especially on holiday, when they need money. They scare you to make money. They don't ask you if you work or not. They just force you. […] I paid, and I got out. [...] Now, [they ask for] 150,000, 200–300 [thousand Sudanese] pounds – it depends, on the police officer.* (Focus group 5031, focus group interview by Smits, face-to-face, Khartoum, June 2021)

In addition to facing arrests by the police who may ask between 150,000 and 300,000 Sudanese pounds (between 350 and 700 USD[17]),

[17] Exchange rate calculated via Oanda.com dated 1 June 2021

the interviewees explained that Eritreans and Ethiopians were also targeted by robbers. They could also be extorted outside the villages; for example, the trip from Khartoum to Shegarab in order to get a refugee card, which is less often broken by police, and which allow to obtain a work permit through bribes, is dangerous.

> *My sister was here with me, and she got to Shegarab to get a UN ID. Eritrean smugglers were bringing her to Khartoum, but on the way, Sudanese smugglers kidnapped them. It happened yesterday.* (Focus group 5031, focus group interview by Smits, face-to-face, Khartoum, June 2021)

Facing the strain of the economic pressure, discrimination, inability to freely work and study, and the inability to obtain any permanent residence status, the Eritreans are under severe pressure in building up livelihoods in Sudan. Recently, the pressure increased for especially young Eritreans to move towards Europe.

The situation in the refugee camps, and outside, deteriorated severely after the war broke out in Sudan on 15 April, which happened after these interviews were conducted. Many of the refugees in the camps and within cities, such as Khartoum, had to flee (again) and without any safe places to go to (Interviewee 7007, communications over WhatsApp, 2023).

Threat of human trafficking increasing

The second issue that was identified in systematically changing the situation of the Eritrean refugees is the threat of the human trafficking networks. This threat is identified both within the camps and outside the camps. Eritreans who have stayed in Khartoum for a long time say it is getting worse: people taken, willingly or by force, to Libya.

> *Yes, yes, it happens a lot. Also from Khartoum. A lot of people, since January. The smugglers kidnap you, in collaboration with the police. […] People just disappear. They just go out of the house, and never come back. Then, you get a call from Libya.* (Focus group 5031, focus group interview by Smits, face-to-face, Khartoum, June 2021)

The youth were particularly targeted for being convinced to go to Libya. A mother whose daughter attempted to go to Libya explained how intermediaries in the camp tried to lure the youth out:

> *Smugglers are working but in another way. They are doing something for our children like washing their brains. They are speaking about Libya: "It is a very nice country, you will lose your age [youth] here in Wedsherify". We are suffering from this now, and many of our children want to leave now.* (Interviewee 5003.2, interview by Smits and Wirtz, face-to-face, Kassala, June 2021)

The woman's daughter, a young Eritrean, followed one of these intermediaries. Her testimony is a key to understanding the way networks towards Libya are organised from Sudan:

> *There is one Eritrean boy, who came with us. He wants to go to Libya. He planned everything and we feel that he is with us. He is on the bus and controls us. Now he is in Libya. […] The smuggler deals with this boy as free. If he brings 9 or 10 others, he can go for free. […] We get the normal bus from Kassala to Khartoum, but there is someone with us to protect us from the police. There are many questions on the road, especially for Eritreans. There are about two or three [check] points to Khartoum, but we have someone. The smuggler had given us all fake Sudanese IDs. I had another name.* (Interviewee 5003.3, interview by Smits and Wirtz, face-to-face, Kassala, June 2021)

The refugees we interviewed did not know the price of the journey to Libya. The girl explained that she had simply agreed with her smuggler that she would pay in Libya, by working. However, her mother knew what would happen: "For that reason, I am sick. They sent me to the hospital. Because I know my situation, I haven't got the money to give the ransom to people in Libya" (Interviewee 5003-1, interview with Smits and Wirtz, face-to-face, Kassala, June 2021).

The intermediaries knew the places where the refugees go. They often speak their language, they are from their culture and this is how they manage to convince them to take the road. Another woman explained:

> *Two days ago, I was in the office of UNHCR. I heard one speaking with the group: "Now the road to Libya is very good, the sea is very good these days". What happens if we can go? We live here in a very bad situation. They speak about the economic*

situation … (Interviewee 5003.3, interview by Smits and Wirtz, face-to-face, Kassala, June 2021)

The refugees interviewed say that they know the road is dangerous, but, as another girl who attempted to go to Libya explained, the information is not enough to dissuade young people from leaving. She explained:

> *I heard that the Libyan people deal with people in a very tough way. Some they detain them and some, they beat them. And I also heard that the sea is very difficult, that people die there. I heard that the Libyans haven't got respect for people, especially for girls and especially for the foreigners. [But] no one was thinking about those things. The main thing is: how can we leave? […] Our life is very hard and I see my mother living in a very bad situation so I try to help her.* (Interviewee 5003.3, interview by Smits and Wirtz, face-to-face, Kassala, June 2021)

Others appeared to underestimate the risks or thought that things will be better upon reaching Libya. One woman in a focus group interview said, "They know the way to Libya is so bad […] but they don't know how bad." (Focus group 5031, focus group interview by Smits, face-to-face, Khartoum, June 2021). Another one just knew about the desert:

> *It depends on what we hear from the people. It is the desert, so it is difficult. But if we reach Libya or Europe, things will be good. I am thinking about that.* (Interviewee 5011, interview by Smits and Wirtz, face-to-face, Wedsherifay, June 2021)

With increasingly poor situations for Eritrean refugees and increasing pressure to go to Europe, the risk of human traffickers had increased. The indications that kidnappings have also increased, together with the economic decline in Sudan, and this is concerning. This situation was investigated before the war in Sudan broke out. Indications from resource persons (Interviewee 7007, communications over WhatsApp, 2023) are that this threat has further aggravated.

Comparing the situations of Eritreans and Tigrayans

In this investigation we considered the situation of Tigray and Eritrean refugees who fled to Sudan during the time of the Tigray war and before the war in Sudan broke out. The reasons why they fled are

egregious circumstances and their situation, after they fled, is challenging.

In the analysis conducted, the situation of the Tigray and the Eritrean refugees was compared. The comparison served to isolate the factors that may give insight into the reasons and rationales as to whether the Tigray and Eritrean refugees would possibly return home and under which circumstances this would be the case. We used a conceptual framework that looks at their perceived situation as a perceived social system, which is disturbed, and we assessed the new circumstances of their situation. The original situation is referred to as the baseline situation.

The comparison shows that the Eritrean and Tigrayan situations differ in terms of all stages: the baseline situation, the disturbance, and the assessment of the new social system in which they are.

In Tigray, the baseline situation was perceived as relatively stable, with most interviewees content with their lives, but was completely disrupted by the war. The interviewees had all fled from experiences of brutal killings of civilians, under suspicion of fulfilling a role with the Tigray, but also just for being Tigrayan. It was accompanied by stories of brutal sexual violence, with elements of ethnic cleansing.

The situation that Eritreans face as a baseline is perceived as one of systematic repression, lack of rights and freedom, and a forced indefinite national service, particularly the military service, including forced round-up of youth to join the indefinite national service. The disturbance of the Tigray war has made their situation worse. The deteriorating situation concerned the increased round-up campaigns for the army, refugee refoulement from Tigray to Eritrea, and the deployment of unwilling and unknowing Eritreans, including prisoners, into battle. Those against this would be imprisoned.

Fleeing because of these factors, both groups of refugees ended up in the same area in Sudan, even if they were separated. They faced equally dire conditions in the reception centres and camps, as well as in urban settings. These conditions were also reported to be deteriorating by Eritrean refugees who had been there for a while. In addition, both groups faced the threat of human trafficking. For

Eritrean refugees, they reported that the intermediaries that came to persuade the youth to leave for Libya had got more intense, and that more people were leaving, being told lies about what they were facing. Eritrean refugees were more directly approached and enticed into human trafficking routes. Tigrayan refugees were divided between wanting to go back and taking the road to Libya. In the camps, intermediaries were already reported to be at work to persuade them to go, falling into the hands of human trafficking networks.

Furthermore, the aspects of access to information and denial to information were clear in the context of the war were clear from the refugees were spoke to. Tigrayan refugees stated that they lost touch with their families as they had to flee, and due to the connectivity blackout in Tigray, were not able to get in touch with them. However, hoping for a return in network, some stayed close to the border in Hamdayete hoping to connect with them. Eritrean refugees spoke about the information blackout around the war in Tigray. They received no information about the war. Soldiers were not allowed to bring their phones. There was no information about anyone deployed in the war either.

From the perspective of the Eritrean refugees, both those in Sudan for a longer time and those that recently fled, the circumstances would not allow them to return unless drastic changes would take place – both before and after the outbreak of the Tigray war. This appears to be a collective position among most Eritrean refugees. Thus, the refugees from Eritrea describe that they have come to rely on an increasingly unsafe system of extortion and human trafficking. The Tigrayan refugees that were interviewed, despite describing situations before the war that are relatively stable, also describe the pressure to rely on these same systems. Therefore, all Eritrean refugees describe that they have become part of an alternative system that does not leave room to return to Eritrea, and many Tigrayan refugees also expressed that they choose to try and find a way to Europe rather than to try and return to Tigray – becoming part of the same alternative system.

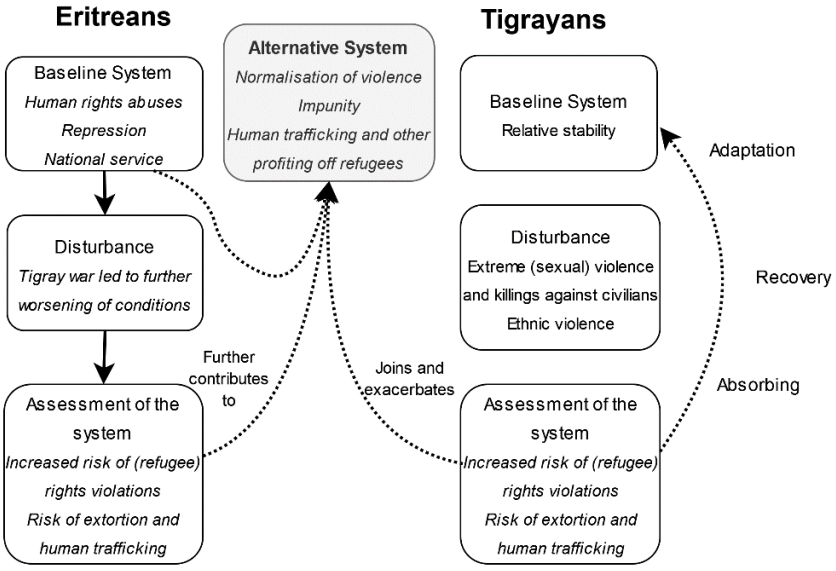

Figure 5.7. The disturbance of the Tigray war has led Tigrayan refugees to become victims of the alternative system already set in motion by the repression of Eritrean refugees

Source: Developed by the authors for this chapter

The transition is explained in the figure above, where it shows that Eritrean refugees describe they have already shifted into an alternative system where return is not possible, where human trafficking networks are the only slim option of escape, and the war has only worsened conditions; and that the war has caused many Tigrayan refugees to flee and now starting to describe a similar situation of normalisation of violence, impunity, human trafficking and other forms of profiting off refugees.

Discussion

Willingness to return

The narratives of the refugees show that Eritreans do not feel that they can return. A large portion of the Tigrayan refugees were also thinking of moving to Europe rather than returning – describing that human trafficking intermediaries were already coming to the camp, and that many of the youth were thinking of moving on. Although this chapter has described the perspective of only a small number of

the thousands of refugees, we feel that the narratives are representative of a larger collective, allowing us to answer the question of whether Eritreans and Tigrayans would be willing to return after the end of the Tigray war.

None of the Eritrean refugees we spoke to were considering return, despite the worsening conditions of extortion, the lack of safety and danger of human trafficking. For refugees from Tigray, many were already indicating that they would not return to Tigray, as the situation in Tigray was still relatively new (eight months after the outbreak of war). This could potentially be explained because the war in Tigray constituted such an extreme shift in circumstances that a critical transition indeed took place. This research suggests that the theoretical concept of hysteresis helps to explain the anticipation of refugees on returning to their country of origin. As explained by Scheffer *et al.* (2012), a critical transition can cause hysteresis, meaning that a simple return to the previous conditions is not enough for recovery.

In this case, the situation in Tigray would have to be significantly improved from the baseline situation for Tigrayan refugees to choose return. The situation of the Eritrean refugees causes a chain of transitions that drives them into human trafficking organisations which are active in the refugee camps. The human trafficking organisations are linked to the Eritrean regime – and its long arm abroad, which the refugees try to escape from. News articles suggest that Eritrean refugees traveling through Ethiopia to Kenya are facing a feared forced repatriation to Eritrea, after having been smuggled by human trafficking organisations to Kenya, while they were attempting to flee to South Africa. (Garowe Online, 2023). The overall situation in Eritrea is seen as a continuity of involvement in regional instability that is not ended by the end of the war in Tigray. The research shows that conditions for return are not in place as long as Eritrea remains active in regional instability through the indefinite and forced national service regime that it applies to all of its citizens.

The outbreak of war in Sudan in April 2023 has made the position of refugees in Sudan significantly worse. Conversely, the Cessation of Hostilities Agreement between the federal government of Ethiopia

and the Tigray People's Liberation Front (TPLF) was signed in November 2022, putting an end to the hostilities. On 6 November 2023, the Ethiopian government announced that a referendum would settle the ongoing issue of the occupation of Western Tigray, offering the possibility for the normalisation of the situation in Tigray. However, a recent article in Africa Intelligence (Africa Intelligence, 2023) suggests that a 'brain drain' from Tigray is continuing amidst adverse conditions, including economic conditions.

Information black holes

In a recent publication on human trafficking of Eritrean refugees in Libya, the authors describe black holes in the digital landscape – places where access to connectivity is limited or deliberately controlled, as an explanatory factor for vulnerability to human trafficking (Van Reisen, Smits, Wirtz & Smeets, 2023). The deliberate control over connectivity was apparent in the stories of Tigrayan and Eritrean refugees in this research. The complete communications blackout in Tigray caused refugees to be unable to contact their families; some stayed in makeshift reception centres at the border hoping for the chance that networks might return. Eritrean refugees related that they had no information about the war, even as Eritreans were being deployed. The soldiers were allowed no phones, and the Eritrean government closed off connectivity with Tigray. In addition, one refugee described how his friend left for Libya – leaving his phone behind. Van Reisen, Smits, Wirtz and Smeets (2023) describe how those in black holes are forced to rely on others for information, putting them in a more vulnerable position. This chapter has documented that this is also visible in the situations of Eritrean and Tigrayan refugees, where deliberate denial to connectivity has put people at an even greater disadvantage.

Conclusions

This chapter sought to assess whether Eritreans and Tigrayans fleeing after the war in Tigray broke out would be willing to return. The chapter looked at the perspectives of the refugees through the lens of whether the war in Tigray constituted a critical shift in the system causing a transition from one system into an alternative system. It did

so by analysing the refugees' perspectives on their 'baseline' situation, the 'disturbance' i.e., the Tigray war, and the 'assessment of the system' in which the refugees expressed their current situation as refugees and their next steps.

Eritreans described how the Tigray war was another factor in an already dire human rights situation. None of them indicated that they were considering returning. For the Tigrayan refugees, while some spoke of return (to fight, or when the war would be over), many others spoke about moving on. Furthermore, the refugees stated that the new refugee camps were already the target of intermediaries for human traffickers, and that many of the youth were thinking about – or had already – tried to move on to Europe via Libya.

The chapter found that refugees described situations in which human rights abuses, violence, impunity, and human trafficking were worsening and becoming normalised. However, the refugees may feel that they cannot return without a significant improvement in the conditions compared to the 'baseline'. With the Cessation of Hostilities in Tigray in November 2022 and outbreak of war in Sudan in 2023, the refugees whom we interviewed in 2021 are now stuck in an even more complicated situation. It is important to do further research and to see if the theoretical model based on the theory on critical transitions can further help to explain why refugees return – or why they do not.

In the meantime, immediate measures should be taken, including targeted sanctions, by the international community to force the perpetrators of severe human rights abuses against civilians, refugees in particular, to be brought to justice.

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Authors' contributions

This work was carried out as part of a PhD study. Both authors cooperated on the collection and the analysis of the data for this chapter. Both authors collaborated on the drafting of the first version of the chapter. The first author designed the conceptual framework, completed the final draft of the chapter and addressed the comments from reviewers. The second author reviewed the chapter.

Ethical considerations

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'. This research was carried out under ethical clearance obtained from Tilburg University Identification code: REDC #2020n13 on "Social Dynamics of Digital Innovation in remote non-Western Communities"

Disclosure statement

No potential conflict of interest was reported by the authors.

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Chapter 6

Humanitarian Crisis and Response of Non-Governmental Organisations in the Tigray War

B. G. Kahsay

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Water be for those thirsty; advice be for those who listen.

Abstract

This study explores the response to the humanitarian crisis, due to the siege and communication blackout during the Tigray war. People suffered from lack of food, water, shelter, and healthcare, leading to malnutrition, starvation and disease. Despite efforts by non-governmental organisations (NGOs) and United Nations agencies to respond, challenges like access issues, lack of funds and fuel, and political tensions hindered aid delivery. The international community's response fell short, with the government exacerbating the crisis through actions like blocking aid. Key shortcomings included gaps in protecting civilians and addressing urgent needs, with a call for further studies on the relevance of the involvement of local NGO in humanitarian efforts. It was found that the local NGOs were in a better position to meet needs in the situation and deal with the security issues. Recognising the vital role of local NGOs, this study concludes that the collaboration of large humanitarian organisations with local NGOs is crucial for an effective humanitarian response and long-term recovery in Tigray.

Keywords: Tigray war, humanitarian aid, Ethiopia, NGOs, INGOs, human rights-based approach

Introduction

Ever since World War II, the world has witnessed some of the worst and intense humanitarian crises (Lopour, 2016). In 2020, almost 82.4 million people worldwide were forcibly displaced from their homes, out of which 48 million were internally displaced persons (UNHCR, 2021a). The number of people in need of humanitarian assistance is growing (OCHA, 2015). Protracted conflicts are a major driver of current humanitarian needs (ICRC, 2016). The United Nations (UN) estimated that at least 235.4 million people would need humanitarian assistance in 2021 (Care International, 2020).

The provision of humanitarian assistance in extremely political contexts such as war, is not a recent phenomenon (Lange & Quinn, 2003). In fact, the global capacity to respond to complicated emergencies has increased (Duffield, 1997). In 2018, for example, a significant investment by the United Nations and partners was made in utilising USD 15.1 billion of the demanded USD 25.2 billion to assist 97.9 million of the most vulnerable people globally (Ravishanker & Mwangi, 2019). The key objective of humanitarian aid is "to save lives, alleviate suffering and maintain human dignity with programming that adheres to the guiding principles of humanitarian action: humanity, impartiality, neutrality, and independence" (Hinga, 2018, p. 6). However, the ability of organisations to meet these objectives and deliver aid is often challenged in conflict situations.

The UN is the most important international body providing relief in war zones. However, it does not have the advantages enjoyed by other non-governmental humanitarian organisations in terms of access and local knowledge (Duffield, 1997). The ability of non-governmental organisations (NGOs) to provide humanitarian assistance is also substantial (Duffield, 1997), as they are often well established in remote areas where the UN agencies have partial or no operations. They are also often able to engage with local actors, including the parties involved in the armed struggle. Therefore, they should be treated as equal partners, equivalent to UN agencies, and be involved in all aspects of humanitarian assistance, including strategic decision-making (OCHA, 2015).

Whenever an emergency or crisis has occurred because of manmade or natural disasters, coordination of aid delivery is inevitable, and several humanitarian actors work to support the affected people (Reindorp & Wiles, 2001). Coordination is the delivery of humanitarian aid in a combined and effective way through the systematic use of policy instruments including strategic planning, information management, enlistment of required resources, ensuring accountability, segregating labour, negotiations, and preserving a functional framework with local political authorities and plays a leadership role (Minear *et al.*, 1992). Furthermore, the coordination platform for international responders to humanitarian needs, instead of creating separate or parallel ones, are supposed to build on existing national and local level apparatuses (OCHA, 2015).

In many conflict-torn situations around the globe, constraints on humanitarian access continue to affect the ability of affected populations to receive adequate humanitarian aid from UN agencies as well as national and international NGOs (Harmer *et al.*, 2018). In the Tigray region of Ethiopia, several reports have highlighted the serious humanitarian crisis due to war and the fact that aid has not been delivered at the required level. At the end of February 2021, 4.5 million people in Tigray were reported to be in urgent need of humanitarian support; towards mid-May 2021, this figure was increased to 5.2 million people (Annys *et al.*, 2021). A Bureau of Agriculture and Rural Development led multi-agency assessment concluded that the total number of people in need of relief support for 2022 reached 6,525,097, being the sum of the Productive Safety Nate Programme (PSNP) and relief beneficiaries, and internally displaced persons in the Tigray region (Bureau of Agriculture and Rural Development, 2022). Despite the urgent need, access to Tigray for humanitarian actors from the start of the conflict was extremely constrained, mainly by the Ethiopian government, but also due to security issues posed by armed groups operating in the area (Stoddard *et al.*, 2021).

This chapter assesses the humanitarian crisis in Tigray and the responses provided by NGOs operating in the region in 2020–2022. It looks at the role that NGOs played in delivering aid to the people

in Tigray during the crisis. It examines whether advantages of NGOs have been of use in the delivery of aid to conflict-affected people. It also identifies the aid delivery approaches adopted and how the humanitarian assistance was coordinated in the very dynamic and unpredictable operational context of the Tigray war with shifting administrations.[18] This research aimed to investigate the challenges encountered by the NGOs in delivering humanitarian assistance.

This chapter explores the humanitarian support provided in response to the humanitarian crisis in Tigray during and after the war. The main research question is: *What was the role of NGOs in responding to the humanitarian crisis in Tigray during the war?*

This question is advanced through the following sub-questions:

- What humanitarian needs arose in the Tigray war and how did NGOs respond to these needs?
- What approaches were used to respond to the humanitarian crisis?
- How was the humanitarian assistance coordinated and what operational challenges hindered aid delivery?

Methodology

The study is based on both primary and secondary sources of data and has used a qualitative approach. Primary data was collected in two phases. The first phase was during fieldwork; the interviews and FGDs were conducted from November 2021 to January 2022. The second phase was in June 2023, during which the researcher conducted eight interviews with selected informants who participated in the first phase to see the evolution of the humanitarian situation

[18] When the conflict occurred in November 2020, the Tigray People's Liberation Front (TPLF) was administering the Tigray region. After the conflict started, the TPLF-led government of Tigray fled, and the Tigray region came under the interim administration from the federal government of Ethiopia. In June 2021, the government of Tigray (TPLF) again came to power. On 2 November 2022 a Cessation of Hostilities Agreement was signed in Pretoria between the federal government of Ethiopia and the TPLF. In March 2023, the elected government of Tigray was dissolved after the Pretoria Agreement, and the Interim Regional Administration (IRA) of Tigray Region was formed.

and the support provided by the NGOs. Throughout the data collection period, the researcher was immersed in the daily life of the crisis with the affected people in Tigray. This placed the researcher in a position to gather data on the humanitarian needs and responses in the Tigray region. The researcher interacted with personnel from NGOs and International NGOs (INGOs). The term NGOs is used for the generic term of NGOs in general; where relevant in the text these are specifically divided between national or local NGOs and INGOs.

Table 6.1. Data collection method, sampling techniques, and locations

Method	Selection	Location
30 interviews with heads[19] of INGOs based in Tigray	Purposive	Mekelle
5 interviews with heads of local NGOs working in Tigray	Purposive	Mekelle
3 interviews with heads/representatives of UN agencies in Tigray	Purposive	Mekelle
3 interviews with cluster and working group coordinators	Purposive	Mekelle
4 interviews with experts from the Government of the State of Tigray under the TPLF administration	Purposive	Mekelle
8 follow-up interviews	Purposive	Mekelle

[19] The word 'heads' is used for uniformity because the real positions of the interviewed representative of INGOs were various that include 'head of sub-office', 'head of regional office', 'field coordinator', 'area coordinator', 'regional coordinator', 'regional manager', 'area manager', 'emergency response manger', 'program manager' and 'team leader'.

Method	Selection	Location
3 FGDs[20] with IDPs	Spontaneous	Mekelle, Shire and Adigrat
Observation	Systematic	Mekelle, Shire and Adigrat

Moreover, the researcher was in Tigray throughout the crisis working on the delivery of humanitarian aid to the war affected people in Tigray. In providing aid, the researcher physically visited several locations observing the situations of crisis-affected people and the responses provided by different organisations. Moreover, the researcher attended several aid coordination sectoral meetings from which a large amount of updated information about humanitarian support in Tigray was obtained.

In addition to these observations, key-informant interviews and focus group discussions (FGDs) were conducted as primary data collection methods. The below table presents the details of the methods, selection techniques, and locations of data collection.

All the interviews and FGDs were conducted face-to-face, except for four interviews which were conducted through email communication. Semi-structured questionnaires were prepared for the interviews and administered to collect primary data. Purposive sampling technique was used to select heads of NGOs, UN agencies, and local government representatives as key-informants. This technique was used purposively based on the researcher's prior knowledge of NGOs, their humanitarian interventions, and the period in which they have been operating in Tigray. For the government representatives, their role in the cluster-based coordination of the humanitarian assistance was used to select them as respondents.

The FGDs were randomly conducted with people from different age groups and sexes, hence heterogeneous groups. The FGD

[20] The FGD participants were 11, 14, and 9 in Mekelle, Shire and Adigrat, respectively.

participants were 11, 14, and 9 in Mekelle, Shire and Adigrat respectively. The locations for the FGDs were also selected purposefully, as some of the top Internally Displaced People (IDP) hosting locations in Tigray.

The data from the observations was captured using field notes and photographs. The FGDs were conducted in Tigrinya, and summaries of the FDGs were made to mainly present the perspectives of the conflict-affected people, but also to substantiate the other data. The interviews were conducted predominantly in Tigrinya but some in English. All the email interviews were in English particularly informants from UN agencies and cluster coordinators. There was no digital equipment used to capture the interviews. The data first collected in Tigrinya from FGDs, and interviews were translated to English, after which it was coded, processed and labelled.

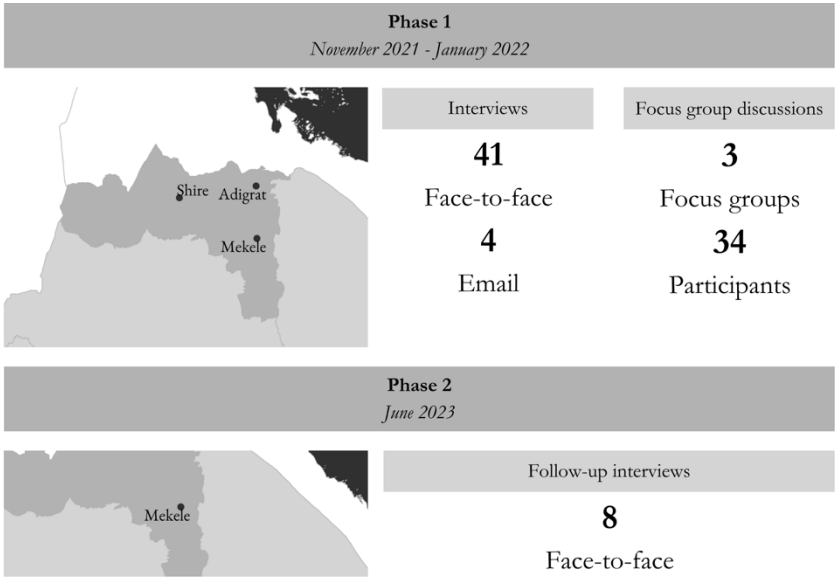

Figure 6.1. Location, date and number of participants in the interviews and focus group discussions

Throughout the research, no major ethical concerns arose. The respondents were asked for their consent to participate and provide their thoughts on the topics being researched, and for their contributions to be reported. The anonymity of respondents was ensured.

While conducting this study, the researcher was an employee of an INGO working in Tigray. This enabled the researcher with ample information and data on the research theme and access to study subjects. However, this research was undertaken independently and was not part of the official assignment of the author as staff of the INGO. The views and analysis presented in this chapter are solely those of the researcher and not the INGO with which he is associated.

The following sections set out the literature review on the role of NGOs in humanitarian crises and the rights-based approach.

NGOs and their role in humanitarian crises

The World Bank's Operational Directive 14.70 defines NGOs as private organisations:

> *[…] characterised primarily by humanitarian or cooperative, rather than commercial, objectives […] that pursue activities to relieve suffering, promote the interests of the poor, protect the environment, provide basic social services, or undertake community development.* (World Bank, cited in Werker & Ahmed, 2007, p. 3)

NGOs share common characteristics: they are not created to generate personal profit; they operate voluntarily; have some degree of formal or institutional existence; are independent; are not self-serving; and function in the public arena (Adibe & Obinne, 2021). However, the fundamental nature of NGOs as self-mandating and not operating under the control of any state or international body has made them susceptible to criticism as 'ungovernable' and 'unaccountable' (Adibe & Obinne, 2021). Unlike states and democratically elected governments, NGOs are accountable only to their donors and sponsors (Adibe & Obinne, 2021), and to some extent to the people they support.

NGOs work independently and alongside bilateral assistance organisations, private-sector infrastructure operators, self-improvement associations, and local governments (Werker & Ahmed, 2007). They play a vital role in humanitarian crises in reaching people in need of emergency support. While INGOs have long been

acknowledged for the part that they play in the global humanitarian system, national NGOs are often the first to respond when a humanitarian crisis occurs (Ferris, 2011). International organisations can be limited by security concerns or political constraints. By working with national NGOs and civil society groups, international actors can gain contextual information about affected people and relatively better access to affected people (Saavedra & Knox-Clarke, 2015).

Conflict and disaster-affected people have the right to receive services from the international community, which are usually delivered through NGOs. However, it is still fundamentally important that people continue to obtain services from the state. The Kampala Convention, under Article 4, clearly states that state parties are obliged to "ensure assistance to internally displaced persons by meeting their basic needs as well as allowing and facilitating rapid and unimpeded access by humanitarian organisations and personnel" (African Union Convention for the Protection, 2009, p. 6). Article 7 (5-g) of this Convention states that, specifically in the situation of armed conflicts, members of armed groups are prohibited from "impending humanitarian assistance and passage of all relief consignments, equipment and personnel to internally displaced persons" (African Union Convention for the Protection, 2009, p. 7). The first regional convention of its kind, the Kampala Convention overtly protects the rights of people affected by natural disasters, armed conflict, general violence, desecrations of human rights and displaced persons affected by development projects (African Union & IDMC, 2010).

In any humanitarian crisis, NGOs can experience challenges in delivering aid to the affected. These include security risks, restrictions on access to certain locations, aid diversion, politicisation of aid, and influence of donors. In addition, there is an overlap between crisis response and development programmes, which can lead to lack of clarity about their role. Other challenges are posed by the relationship between NGOs and state and non-state actors, including armed groups (Norwegian Refugee Council & Handicap International, 2016). Working with the state in situations where the state by itself is

involved in an armed conflict, or is the trigger for the humanitarian disaster, can create concerns about the ability of the NGO to adhere to the humanitarian principles of independence and neutrality (Saavedra & Knox-Clarke, 2015).

INGOs have operated in Ethiopia for at least half a century – since the famines of the 1970s and 1980s (Clark, 2000). The NGOs of those years, largely foreign organisations, focused on emergency relief operations, which helped prevent massive loss of life (Clark, 2000). According to Stoddard *et al.* (2021), in the crisis of 2021, Tigray had the highest percentage of people in need, as a proportion of the whole population, but the lowest number of assistance providing organisations and the lowest percentage of people in need reached by humanitarian support. However, 7 months into the crisis, more than 50 national and international NGOs and UN agencies had an operational presence in the region (Kahsay, 2021).

Rights-based approach

The 'rights-based approach' is a concept that emerged as a development paradigm in the late 1990s, when the two elements of foreign assistance and global policy – human rights and development – merged, integrating the principles of human rights with those of poverty reduction (Kindornay *et al.*, 2011). The rights-based approach is a theoretical outline for the course of human development, which is normatively based on universal human rights standards and operationally engaged in promoting and defending human rights (UNHCHR, 2006). Under this conceptual framework, "human rights are the means, the end, and the mechanism of evaluation, and the central focus of sustainable human development" (Ferris, 2011, p. 102).

Rights-based development is all about incorporating human rights while framing plans and projects, i.e., recognising 'rights holders' and 'duty-bearers', confirming local participation, establishing and reinforcing ways of 'citizen-government accountability', and decreasing discrimination against marginalised groups (Kindornay *et al.*, 2011). It is also a means of emphasising the importance of the development process in addition to the results (Kindornay *et al.*,

2011). In this approach, people are seen as holders of privileges and rights, instead of as 'beneficiaries' of assistance and aid (Ferris, 2011).

A rights-based approach is:

> *[…] a conceptual framework and methodological tool for developing programmes, policies, and practices that integrate the rights, norms, and standards derived from international law.* (Dufvenmark, 2015, p. 16)

It provides a different approach to development and is contained in globally approved legal documents (Nyamu-Musembi & Cornwall, 2004). It empowers rights-holders to claim and exercise their rights and clarifies the position of duty-bearers as having a duty "to respect, protect and fulfil the rights of the poorest, weakest, most marginalized and vulnerable, and to comply with these obligations and duties" – these are the two dual aims of the human rights-based approach (Hausen & Launiala, 2015, p. 8).

A Common Understanding of the Human Rights-Based Approach to Development was established by three UN agencies, namely, the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), and Office of the High Commissioner for Human Rights (OHCHR) (Kindornay *et al.*, 2011). These agencies were the foremost champions of the rights-based approach, while Oxfam and Care were the first INGOs to adopt this approach, followed by others, like Save the Children and Lutheran World Federation (Kindornay *et al.*, 2011). In the Common Understanding of the Human Rights-based Approach to Development Cooperation, the United Nations identified six rights principles that should guide all programmes, i.e., universality and inalienability, indivisibility, interdependence and interrelatedness, equality and non-discrimination, participation and inclusion, and accountability, transparency, and rule of law (Dufvenmark, 2015).

Much of the focus of the rights-based approach has been on development support and programming (Cotterrell, 2005), because humanitarian crises can result in massive human suffering and the

violation of international human rights and humanitarian law (OHCHR & UNHCR, 2013). However, in recent years:

> *[…] humanitarian actors, including governments, donors, UN agencies and NGOs, have adopted the language of human rights and human rights-based approaches […] in their policies and programming.* (Cotterrell, 2005, p.1)

This tendency has served as a response to criticisms that humanitarian action has often failed to promote human rights (Cotterrell, 2005), given that the protection of human rights is vital to effective humanitarian assistance (OHCHR & UNHCR, 2013).

In the humanitarian crisis in Tigray, this research studied how the rights-based approach was mainstreamed in the work of NGOs.

Results of the study

In this section the main findings are discussed in relation to:

- The humanitarian needs in Tigray
- An inventory of NGOs operating in the region
- A detailed analysis of the humanitarian response of NGOs
- The major challenges in providing humanitarian assistance

Humanitarian needs in Tigray

The people of Tigray have experienced multiple shocks, including failure to properly harvest their agricultural products of that harvest season. The collapse of the market system has seriously disrupted the demand and supply chain, complete interruption of communication and transportation due to seizure and the closure of banks has obstructed people from accessing their savings. In addition, there has been massive internal displacement within Tigray (Kahsay, 2021). At the same time as the war broke out, there was also a desert locust attack[21] (Kahsay, 2021). The beneficiaries of Ethiopia's Productive Safety-Net Programme have been blocked from receiving services since the war began, which means that highly vulnerable people have not been receiving the monthly ration that they are entitled to get

[21] Just before the war occurred and partly during the initial time of the war, several parts of Tigray were attacked by desert locusts.

from the government (Kahsay, 2021). These shocks have given rise to massive humanitarian needs in the Tigray region. The people of Tigray, regardless of their social status or economic condition before the crisis, have had to look to humanitarian aid to survive.

The war in Tigray has resulted in the displacement of more than 2.2 million people (OCHA, 2021g). According to one interviewee from an INGO in Tigray, several factors are driving internal displacement. First, there was an ethnic cleansing in the western part of Tigray, which pushed people to move to the North Western and Central zones. The people who were sheltered in major towns[22] in these zones were displaced again because the fighting escalated towards the end of 2022, when the Ethiopian National Defence Force (ENDF) and its allied forces controlled the whole North-western Zone and part of the Central Zone. Second, the fighting has pushed people to leave their homes and villages, especially in the areas bordering Eritrea and the state of Amhara and in pockets where the armed struggle continues. Third, many people have moved to the major towns in search of aid, where humanitarian organisations can reach them (Interviewee SS, interview by Kahsay, face-to-face, December 2021, Mekelle).

The displacement dynamics in the southern part of the region are a bit different from other parts. None of the internally displaced persons (IDPs) who moved from *woredas* (districts) in the Southern Zone to major towns like Alamata, Michew and Mekoni were classified as IDPs, as they stayed within the same zone (ESNFI cluster, 2021). However, those who moved from other zones in Tigray and from other parts of the country were categorised as IDPs by the zonal interim administration.

In Tigray, the IDPs were initially the major recipients of humanitarian aid. However, later the situation changed, as local people also received aid due to the disruption of basic services, including banking services, and the siege on Tigray. Hence, almost the whole population of Tigray needed food aid. The United Nations issued several warnings about the alarming situation of food insecurity in Tigray and the risk

[22] Towns such Sheraro, Adi-Daero, Shire, Aksum etc.

of malnutrition, in a joint statement on 10 June 2021 by the World Food Programme (WFP), the Food and Agriculture Organization (FAO), and UNICEF (UNHCR, 2021b). From the total population of 5.7 million in Tigray, it is estimated that 91% (or 5.2 million) needed urgent food assistance in 2021. Although there were clusters that did not target all the people in need of food and water, sanitation and hygiene clusters did attempt to reach all 5.2 million people from May to December 2021. The required budget for the plan was USD 853.4 million, which was later revised to USD 957.0 million; out of this the funding gap was USD 373.6 million (OCHA, 2021e).

A UN press briefing on 2 June 2021 clearly stated that while humanitarian partners were scaling up the relief response, they were not yet meeting the escalating needs (UNHCR, 2021b). In relation to this, a middle-aged man who participated in an FGD in Shire Town in Tigray stated the following, describing the first year of the crisis, although the situation was even worse in the consecutive two years:

> *It has been a year since we [IDPs in the Shire] come to this town. We had a good life before the war. Many of us had land and animals on which our means of subsistence depended. Living as IDP, we have nothing…just nothing. No food, water, shelter, health service, education etc. Look [pointing at a school compound full of people] at the shelter that we are living in. There has never been food distribution that covered all the IDPs, and the food rations supplied were not sufficient, hence, never sustained us beyond a few days. We did not have basic non-food items such as a sleeping mat, blanket, cooking dish, and Jerri cans. There is also no medical assistance.* (Interviewee A2, FGD with Kahsay, face-to-face, December 2021, Shire)

Humanitarian partners estimate that 100 trucks of food, from which 90 trucks or 3,600 metric tonnes of food, non-food items, and fuel, must enter Tigray every day to sustain an adequate humanitarian response (OCHA, 2021f). However, the incoming aid to Tigray has never met this need, placing people in a desperate humanitarian situation. That was why an interviewee from one of the INGOs said, "the humanitarian need in Tigray stands hard to explain in the common humanitarian language […]" (Interviewee SS, interview by Kahsay, face-to-face, December 2021, Mekelle). For the period May 2021–May 2023, only six rounds of food distribution took place in

Tigray.[23] This means that the people in need had received a food ration that would meet their requirement only for a period of six months; as one round means a monthly food ration, the people had to suffer the remaining 18 months of the crises without food assistance.

Adequate shelter and non-food items were pressing needs in the Tigray humanitarian crisis. By the end of 2021, a total of 4.2 million people, including 2.2 million IDPs, needed assistance with emergency shelter and non-food items in the Tigray region in addition to food assistance (OCHA, 2021g). In December 2021, it was possible to support about 35% of the targeted 2.4 million population (OCHA, 2021g), which was less than 20% of the total people in need. Camp coordination and camp management support were also needed for the 1.8 million people living in camps. By May 2023, over 2 million people needed emergency shelter, food, nutrition and non-food items, and repair kits. Over 51,000 IDPs were accommodated in schools and needed alternate shelter, for which more than USD 10 million was required to support the relocation of IDPs from schools.[24]

In addition to the displacement of millions of people, the conflict has destroyed public service centres, infrastructure, and private property. Agricultural assets valued at more than USD 30 million, equivalent to 84% of agricultural property in the state, have been looted (70%) and destroyed (14%) (Bureau of Agriculture and Rural Development, 2021). Agricultural support is estimated to be needed for 3.7 million people (OCHA, 2021g). In addition to the immediate damage during the war, the Agriculture Cluster reported 9 of 15 known transboundary animal diseases including Foot and mouth disease, Peste des Petits Ruminants (goat plague) and lumpy skin disease (LSD) had been registered in Tigray, resulting in a total of 83,259 animals falling sick while 15,547 died.[25] Moreover, the sudden death

[23] Tigray Region Emergency Coordination Centre. (2023). Meeting PPT, 19 May 2023.
[24] Tigray Region Emergency Coordination Centre. (2023). Meeting PPT, 19 May 2023.
[25] Tigray Region Emergency Coordination Centre. (2021). Meeting minutes, 24 December 2021 (internal document).

of animals due to metabolic disorder has been reported, the suspected cause of which was toxic substances in the plants eaten by the animals, which may have been due to war-induced chemical accumulation from weapons.[26] As of mid-May 2023, an estimated 36,900 metric tons of fertilisers, 228,750 litres of pesticides, 12,200kg of agrochemicals, 18 million livestock drugs, more than 16 million animal vaccines, and livestock feed were needed to support the agriculture sector.[27]

By mid-December 2021, the severe acute malnutrition and moderate acute malnutrition rates in children under five were at critical levels (about 3% and over 24%, respectively), while the gestational acute malnutrition rate in pregnant and lactating women reached an alarming level of 73% (Interviewee ZL, interview by Kahsay, face-to-face, Mekelle, December 2021). The malnutrition status has worsened in 2022 and 2023. The number of children under five years of age and pregnant and lactating women requiring malnutrition preventative and treatment interventions in Tigray was estimated at 1.6 million people (OCHA, 2021g).

The Education Cluster is another sector that was severely affected by the conflict, resulting in millions of children out of school. More than 30,000 schools in Tigray, comprising high schools and elementary schools, excluding the Western Zone, have been damaged (Bureau of Education, 2021). More than 20,000 chalkboards and 300,000 student desks were looted, burned, or destroyed (Bureau of Education, 2021). In addition, the region's four universities were closed, with more than 7,500 academic staff and 72,000 students, had to stop working and attending classes respectively because of the war(Nyssen *et al.,* 2021). Even after the Pretoria Agreement was signed, the resumption of education in Tigray was challenged by several factors, including schools being occupied by IDPs, land mines that affected the free

[26] Tigray Region Emergency Coordination Centre. (2021). Meeting minutes, 24 December 2021 (internal document). The report of the Agriculture Cluster (given at this meeting) further explained the chemicals possibly were accumulated in water, soil, different plants, animal, and humans and might result in serious health effects of animal and human in the future.

[27] Tigray Region Emergency Coordination Centre. (2023). Meeting PPT, 19 May 2023.

movement of students, limited human resources, a shortage of school equipment and supplies, scarcity of scholastic materials, shortage of food, traumatised school community, increased students with special needs, mixed-age and over-aged school students, and an increased number of students. As of May 2023, more than 1,179 schools had not opened, while only 1,313 schools had started operating.[28]

Water supply systems were damaged in five zones in the region (nearly 55% of the assessed water schemes), at an estimated value of more than USD 74 million, affecting 2.3 million people (Water Resource Bureau, 2021). By mid of 2021, approximately 54% of water points in Tigray were not functional, depriving more than 3.5 million people of access to safe drinking water (OCHA, 2021g). There were 2.7 million people who required protection assistance, out of which the concerned cluster targeted only 1.4 million (OCHA, 2021e). By May 2023, over 70% of water points were non-functional.[29]

Regarding health facilities, 85% of the health centres and 70% of the hospitals have been rendered partly or entirely non-functional, leaving only 15% of health centres and 30% of hospitals to provide services to those in need, including mothers and children (Gesesew *et al.*, 2021). The destruction of these facilities together with enormous internal displacement and the obstruction of basic utilities has resulted in massive health needs in the region. An estimated 3.9 million people required health services in Tigray in 2021 (OCHA, 2021g). As the crises continued through 2022 and was sustained in 2023, almost all health facilities ran out of medical facilities and could not provide even the most basic services, including those in major cities and towns.

NGOs operating in the region

Seven months into the Tigray crises (by June 2021), there were 54 humanitarian actors, including UN agencies, the International Committee of the Red Cross (ICRC), and government bureaus

[28] Tigray Region Emergency Coordination Centre. (2023). Meeting PPT, 19 May 2023.

[29] Tigray Region Emergency Coordination Centre. (2023). Meeting PPT, 19 May 2023.

(Kahsay, 2021). However, this number excluded national and international NGOs that did not have completed or ongoing project activities before June 2021. Another 6 months later, by December 2021, in addition to 11 UN agencies, there were 55[30] INGOs and 34 local NGOs with emergency projects operating in the Tigray region.

Many of the INGOs had a presence in the Tigray region before the crises, working in development interventions or humanitarian assistance or both. There were about 15 national and international NGOs working in refugee protection in the region. Independently or through government structures and local partners, a significant number of INGOs had development projects in the region. Those that had development projects had to shift their budget to emergency interventions. However, some came to Tigray following the crises. For example, 3 of the 30 INGOs whose heads were interviewed had no presence in Ethiopia before the crises. Even among the national NGOs, there were those that did not have a presence in the Tigray region before the crises. Only, 2 of the 34 local NGOs with a strong presence and humanitarian assistance in the Tigray crisis in December 2021 were established by the end of 2020; most started working after the war started in response to the humanitarian situation in Tigray (Interviewee YY, interview by Kahsay, email, December 2021). Ditto

Many of the NGOs working in the Tigray crisis had their regional offices in Mekelle, although some were based in other towns, like Shire and Adigrat. Those that had coordination offices in Mekelle often had field offices in zonal and *woreda* (district) headquarters. To carry out their projects, many had rented vehicles in addition to their organisational cars. Excluding the UN agencies, on an average, there were 6 vehicles per organisation of the total 35 INGOs and NGOs contacted, the major organisations having more than 20 cars in their Tigray offices.

The 30 INGOs whose heads of sub-office for Tigray were interviewed for this study had a total of 2,783 national staff as of

[30] The Tigray Regional Humanitarian International Non-Governmental Organisation (HINGO) Forum had participants from 55 INGOs operating emergency relief projects in Tigray, however, not all were actual members of forum.

December 2021. The maximum number of staff per organisation was 498, and the minimum was 5. The number of staff hired in the international organisations decreased towards the end of 2022 and the beginning of 2023 as many of the NGOs faced funding challenges to continue with humanitarian operations mainly because of the blockade. This figure excluded incentivised community workers of any type. Very few NGOs had expatriate staff based in Tigray, although many of the organisations had support teams from their respective country offices or/and headquarters. Given that there were transportation blockages and non-Tigrayan staff were frequently evacuated, many of the INGOs had chosen to hire staff from the Tigray region, including at the managerial level (Interviewee DD, head of INGO in Tigray, interview by Kahsay, face-to-face, 1 December 2021, Mekelle). This helped these organisations to manage the recruitment process and minimised the need to evacuate staff throughout the crisis. There was no external influence on NGOs during their recruitment process.

As of 26 August 2021, there were 472 UN staff from 10 UN agencies, including national and international staff, based in Tigray (OCHA, 2021g). This number dropped to 450 by the end of December 2021, as many international staff had to leave Tigray after the war spread to Amhara and Afar regions. The local NGOs had 15,724 staff, of which 32% were volunteers; a significant portion had been hired before the war (Interviewee RR, head of local NGO in Tigray, interview by Kahsay, face-to-face, 25 December 2021, Mekelle).

Many of the NGOs were operating in more than one sector; a few even had projects in six of the eight clusters. The NGOs in Tigray did not have sufficient funds from the international community, yet many had budgets to utilise to support people in need in Tigray. On average, 55% of the budget allocated for 2021 was not used by the NGOs contacted for this study. UN agencies had partners to implement their sectoral focuses, although some of them directly implemented some projects. The major responsibility of the UN agencies was coordinating the assistance provided through their respective sectoral mandates, as in the case of International Organisation for Migration (IOM), which provided funding to many national and international

partners; directly implemented shelter, water, sanitation and hygiene, and camp coordination and camp management projects, in addition to coordinating the camp management and Emergency Shelter/Non-Food Item clusters (Interviewee II, interview by Kahsay, face-to-face, December 2021, Mekelle).

The local NGOs in the Tigray region had a larger staff than the INGOs. The local NGOs had better contextual understanding and existing ways of working. Hence, they were able to reach remote areas, which were challenging for UN agencies and INGOs due to the security situation and the security protocols they had to follow. Their existing capacity helped them reach many people, as in the case of Relief Society of Tigray, which distributed food for the majority of the Tigray *woredas*, and Emahoy Tsige's local charity organisation, which was feeding more than 20,000 people in Temben (Interviewee YY, interview by Kahsay, face-to-face, December 2021, Mekelle). This capacity of NGOs was noticed by INGOs and donors, which tried to utilise it by partnering with the local NGOs (Interviewee YY, interview by Kahsay, face-to-face, December 2021, Mekelle). In addition to the formally registered local NGOs, there were several local initiatives, such as End-Thesh Dram crew members together with Keradion local organisation, Kebron (a group of Mekelle youth), and Adey charity local initiative, who were mobilising resources locally and providing daily meals for vulnerable people, especially children and women, in Mekelle (Observation, Kahsay, 11 January 2022, Mekelle,).

However, there was no clear platform for the local NGOs to interact and discuss issues with INGOs and donors, except the 'open for all' cluster approaches and the government-led Emergency Coordination Centre (Interviewee RR, interview by Kahsay, face-to-face, December 2021, Mekelle). However, towards the end of December 2021, consultative meetings were arranged that included local charities and civil society organisations, UN agencies and INGOs, as well as government offices, to strengthen the relationship between these three groups, mainly to coordinate and cooperate in the humanitarian response and development work.

NGOs and humanitarian response

IDPs and the conflict affected host community had to wait for humanitarian assistance. There were external factors that delayed the delivery of aid in the Tigray crisis. Consequently, the support provided by NGOs came months after the crisis began. It was two months after the crisis started that INGOs conducted an Interagency Emergency Response Needs Assessment in Mekelle City, which was their first assessment before delivering any kind of assistance (Interviewee HA, interview by Kahsay, face-to-face, Mekelle, December 2021). Many of the NGOs started their formal operations in February 2021, a quarter of a year after the crisis began, although food distribution had started in Mekelle and some *woredas* (districts) in the Southern Zone earlier than this (Interviewee YY, interview by Kahsay, face-to-face, December 2021, Mekelle).

Soon after the crisis occurred, preparation to respond to the needs and securing emergency funding or transferring development budgets to relief support had taken months for many of the NGOs. Organisations that did not have a presence in Tigray took even more time to establish an office in Tigray and hire staff. Relatively, the local NGOs that had a strong presence and had stock-piled resources, such as Relief Society of Tigray, were quick to deliver aid, at least to IDPs in Mekelle (Interviewee GB, interview by Kahsay, face-to-face, December 2021, Mekelle).

One of the critical external factors that affected the ability of NGOs to deliver effective assistance were the restrictions on reaching locations outside of Mekelle. For the period November 2020 to February 2021, none of the national or international organisations or UN agencies could travel to *woredas* outside of Mekelle, due to the serious security issues due to the ongoing fighting (Interviewee YY, interview by Kahsay, face-to-face, December 2021, Mekelle). Later, it was possible to reach *woredas* in the Southern Zone, commuting from Addis Ababa though not from Mekelle (Interviewee YY, interview by Kahsay, face-to-face, December 2021, Mekelle).

The response to the humanitarian needs from the national and international NGOs and UN agencies was very challenging to even appraise. Despite some improvement, the Office for the

Coordination of Humanitarian Affairs' (OCHA's) situation report published in February 2021 stated that the humanitarian response was inadequate, compared to the needs on the ground particularly in relation to food and nutrition assistance (OCHA, 2021c). The insufficiency of humanitarian aid continued over the subsequent months. Hence, on 27 May 2021, the UN humanitarian Chief, Mark Lowcock warned of the worsening humanitarian condition in Tigray, stating that there would be a serious risk of famine if required aid was not delivered in June and July 2021 (Lederer, 2021).

Before June 2021, there were some attempts made to respond to the needs of conflict-affected people. During this period, there was relatively better passage of aid carrying trucks, flights to Mekelle City, banks were operational in Mekelle, and communication resumed, although only in major towns in the region. At the end of June, after Mekelle came under the control of Tigray forces, the humanitarian response worsened (Interviewee BW, interview by Kahsay, face-to-face, December 2021, Mekelle). For instance, out of the estimated 100 trucks per day of assistance supplies needed, only 12% reached Tigray, which forced relief organisations to decrease and/or suspend life-saving support in Tigray (OCHA, 2021d).

The NGOs found it challenging not only to provide the required humanitarian assistance, but to even pay salaries to their staff (Interviewee YY, interview by Kahsay, face-to-face, December 2021, Mekelle). The response was not enough to resolve the humanitarian crisis on the ground. For various reasons, the people in need were not receiving what they should get. For example, food distribution was scheduled to reach its 6th or 7th round by December 2021, but round 2 was not even completed by the end of the year. As a result, many people died due to hunger and put thousands of children and pregnant and lactating women in a malnourished status (Interviewee KC, interview by Kahsay, email, December 2021).

Of the 2.2 million IDPs, nearly 70% of them were sheltered in the local community[31]. Hence, they were supported by the local community, even though inconsistent and insufficient aid was provided by NGOs (Interviewee F9, FGD with Kahsay, face-to-face, December 2021, Mekelle). Only 30% of IDPs were sheltered in the public service centres throughout Tigray. Almost all the NGOs focused on supporting IDPs in these collective centres – some aid was forwarded to those housed in the host community and to the local community itself. Surprisingly, 70% of the humanitarian needs of those IDPs in the collective centres were also covered by the local community. It would be, therefore, unfair to even compare the aid provided by the NGOs with community contributions to support those in need (Interviewee BW, interview by Kahsay, face-to-face, December 2021, Mekelle).

Participants of the FGDs conducted among IDPs in Mekelle asserted that the assistance they received from the residents of the city by far outweighed the aid received from NGOs. One FGD participant stated the following:

> *When we [IDPs] first came to Mekelle, we had the hope that the government of Tigray would help us. But days after we arrived [in Mekelle], the government left the city. Then, we did not have anyone to provide food and water; it was the residents of Mekelle city who fed us for months. From the very beginning, we were seeing many UN and NGO cars with nice stickers and flags on them which had boosted our expectation of getting aid from them. But it was months after we started living in schools and other structures that some NGOs came with food and other items. Yet, the aid was significantly insufficient.* (Interviewee F1, FGD with Kahsay, face-to-face, December 2021, Mekelle)

The IDPs in almost all towns were sheltered in schools, with colleagues, clinics, and churches, as there were no emergency shelters constructed for them. The service provision was not at the required level. The State failed to fulfil the required services to the people and contributed to their suffering by blocking the major public services

[31] About 70% of the IDPs were staying with people they knew, i.e., relatives, friends, people from similar villages living in the towns, etc. This also included IDPs who live in rented houses or are provided shelter by people living in the towns.

like banking, electricity, and communications, which increased the suffering and trauma of people in need of aid (Interviewee NN, interview by Kahsay, face-to-face, December 2021, Mekelle). In some cases, the government of Ethiopia also refused to open access to humanitarian support, thereby violating Article 7 (5-g) of the Kampala Convention. On this, a participant in the FDG in Adigrat stated the following:

> *The NGOs supporting us repeatedly say they could not bring aid items from Addis Ababa. The boundaries of Tigray, through which aid could have entered from any country, were closed, and their rights were denied. This is an absolute denial of our right to be protected by the international community. The closure of services was completely unforeseen. We have the right to use our saved amount, money that we put in the banks, trusting in the government. The government has failed to give us what we need, hindering the NGOs seeking to assist us. […] it also aggravated the humanitarian situation by denying our rights to get basic services including our own resources.* (Interviewee F2, FGD with Kahsay, face-to-face, December 2021, Adigrat)

The number of NGOs supported declined from time to time after June 2021. The restriction made by the Federal Government on NGOs to transport aid resources into Tigray stopped NGOs from being able to provide the assistance that they had procured in Addis Ababa and Samara (Interviewee BW, interview by Kahsay, face-to-face, June 2023, Mekelle). The cash transfer using the UN humanitarian air service was also stopped, which affected the NGOs to the point of not paying the salaries of their staff. At the end of 2022, staff of national and international NGOs based in Tigray had to receive food aid for survival, *let alone* support the crisis-affected people (Observation, Kahsay, 15 November 2022, Mekelle).

Cluster approach and working groups

Table 6.2 presents the clusters, lead UN agency, and counterparts from the respective regional government bureaus, along with the total number of implementing partners they had in Tigray. The official arrangement of the clusters was that the government counterparts led the clusters, while the UN agencies served as secretaries. Hence, the cluster approach in the Tigray crisis was a formal, government-led

system (Interviewee GG, interview by Kahsay, face-to-face, December 2021, Mekelle).

The clusters in Table 6.2 were aimed at coordinating the delivery of services in their specific sectors. The fundamental purpose of the clusters included the mapping of resources from the government and partner NGOs, the assessment of needs, the prioritisation of locations with pressing needs, the allocation of mobilised or mapped resources, post-distribution monitoring, and the preparation of response plans and generation of reports to OCHA and the government. Unlike clusters that exclusively worked in a specific sector, the Camp coordination and camp management cluster managed multi-sector services in IDP and collective centres (Interviewee TR, interview by Kahsay, face-to-face, December 2021). The Logistics and Emergency Telecommunication[32] clusters, led by WFP and OCHA, respectively, also supported the delivery of other sector-based assistance and, hence, did not have implementing partners.

All the above clusters were coordinated under the Inter-Agency Coordination Group (ICCG). In the ICCG weekly meeting, which excluded government bureaus, all cluster leads, and co-leads were expected to raise any specific issues that required a solution from OCHA's senior staff. Usually, issues common to all clusters were entertained in this platform. Specific themes, even being a subject matter of one cluster that required the attention of the humanitarian senior management, was discussed at the ICCG meeting. The ICCG was led by OCHA's sub-office head but had strong support from humanitarian coordinators and deputy humanitarian coordinators. The HCs played a significant role, especially in resource mobilisation, the preparation of response plans and engaging with government authorities (Interviewee GE, interview by Kahsay, face-to-face, December 2021).

[32] The Emergency Telecommunication Cluster was established in around May 2021, but has not continued functioning

Table 6.2. Clusters, lead agencies, and government counterpart

Cluster	Lead agency[33]	Government counterpart	No. of Implementing partners[34]
Shelter and Non-Food Items	IOM	Bureau of Agriculture and Rural Development[35]	31
Food	WFP	Bureau of Agriculture and Rural Development	7[36]
Health	World Health Organization (WHO)	Bureau of Health	30
Water, Sanitation and Hygiene	UNICEF	Bureau of Water Development	49
Agriculture	FAO	Bureau of	14

[33] The assignment of the lead agencies is based on the cluster approach endorsed by the Inter-Agency Standing Committee (IASC).

[34] The number of implementing partners refers to the sum of UN agencies, INGOs, and national NGOs operated in the implementation of the project related to the specify cluster. It is also possible for one organisation to work in multiple clusters. The partners might have supported once or continued to work through the year, depending on their level of funding.

[35] The Bureau of Agriculture and Rural Development participated through its Early Warning Response and Food-Security Coordination Directorate. The government counterpart for this cluster was assigned from this specific office.

[36] The food aid was donated by WFP and the Joint Emergency Operations Program of the United States Agency for International Development (USAID). WFP, in addition to its direct implementation, had three implementing partners. The Joint Emergency Operations Program was channelled by the Catholic Relief Service and had four implementing partners, of which two were partners of WFP at the same time.

Cluster	Lead agency[33]	Government counterpart	No. of Implementing partners[34]
		Agriculture	
Education	UNICEF	Bureau of Education	13
Nutrition	UNICEF	Bureau of Health	14
Protection in Conflict Situations	UNHCR	Bureau of Labor and Social Affair	22
Camp Coordination Camp Management	IOM and UNHCR	Bureau of Agriculture and Bureau of Rural Development[37]	5
Logistics	WFP	N/A	N/A
Emergency Telecommunication	OCHA	N/A	N/A

Source: Interviews with cluster leads and government experts, December 2021

In addition to clusters, there were working groups aimed at smoothing humanitarian assistance. The Access Working Group, led by OCHA, functioned since the beginning of the crisis to inform the humanitarian partners about the situation of access in the Tigray region. The fundamental role of this working group was to gather information from humanitarian partners and share it (Interviewee GE, interview by Kahsay, face-to-face, December 2021). The Cash Working Group coordinated cash-based interventions. Among

[37] Like the ES/NFI cluster, this cluster was also led by the Bureau of Agriculture and Rural Development through its Early Warning Response and Food-Security Coordination Directorate.

others, the Cash Working Group determined cash transfer values for different services, led cash related assessments, and mapped the cash assistance resources of humanitarian partners. This working group did not have a designated lead but was led by different partners on a rotational basis.

The Information Management Working Group, led by OCHA, consisted of experts on information management from all clusters involved. The main mandates of this working group included gathering information from the clusters based on standard templates, creating common data sets, and endorsing data for publication. It adopted tools for information sharing platforms and documented segregated figurative data and map supported information. It strengthened the information management procedures of the clusters (Interviewee HA, interview by Kahsay, face-to-face, December 2021, Mekelle).

There were working groups focused on ensuring the accountability of the humanitarian assistance, namely, the Prevention of Sexual Exploitation and Abuse (PSEA) and Accountability to Affected Population working groups. The PSEA Working Group, run by OCHA, requested all staff of NGOs and UN agencies to sign a PSEA code of conduct and train focal persons in each organisation to mainstream the concept. The Accountability to Affected Population Working Group aimed at strengthening feedback and complaint mechanisms; ensuring that they were functional and accessible to the affected population; that information was shared with the affected population effectively and in a timely manner; that community members were fully engaged and involved in decisions and representation; and that project activities were designed and monitored through a participatory process (Interviewee MT, interview by Kahsay, face-to-face, September 2021, Mekelle). A Gender-Based Violence Working Group run by the United Nations Population Fund (UNFPA) was another platform that worked exclusively on gender-based violence (GBV) case management.

The NGOs in Tigray, in addition to the cluster approach, had a separate coordination forum called the Tigray Region Humanitarian International Non-Governmental Organizations Forum, which is a

sub-set of the national Humanitarian International Non-Governmental Organisation forum. The forum helps its members to receive major operational updates and serves as a platform for entertaining shared challenges. For an organisation to be a member of this forum, membership of the Humanitarian International Non-Governmental Organisation at the national level is a precondition (Interviewee GB, interview by Kahsay, face-to-face, December 2021, Mekelle). The local NGOs also had a separate platform called the Alliance of Civil Society Organizations of Tigray. This association had about 64 organisations registered as members in the Tigray region, but only half (34) were active. From this list, about 20 were engaged in the emergency response (Interviewee FK, interview by Kahsay, face-to-face, December 2021, Mekelle).

Rapid response mechanism

The Rapid Response Mechanism (RRM) approach was adopted as one of the aid delivery methods to ensure an effective and timely frontline response in the hard-to-reach areas that were inaccessible to most humanitarian partners operating in Tigray, targeting IDPs and vulnerable communities. According to the Operational Concept Note (OCHA, 2021i), this approach aimed to provide lifesaving multi-sectoral assistance to the most vulnerable populations within 96 hours of activation, continuing for up to seven days as a rapid response, then for 3 days as emergency assistance, until a full cluster response could be mobilised, and operations merged into a revised humanitarian response plan.

The RRM approach in Tigray started in mid-June 2021, eight months after the crisis occurred, and only lasted for a few weeks. According to the intended scope of operation, only two locations – Wajrat and Yechila – were provided with humanitarian assistance using this approach. The approach was evaluated to be a less effective, less coordinated, and a less funded approach in the context, hence it failed to last long (Interviewee RN, interview, face-to-face, 10 December 2021, Mekelle). In Wajrat, for example, 600 households were selected by partners that had an operational presence in that area. The selected households were assumed to be in need of urgent humanitarian assistance. However, it was later learnt that the 600 households did

not have equal need for services in all sectors (Interviewee RN, interview by Kahsay, face-to-face, 10 December 2021, Mekelle). Hence, the RRM approach did not continue as an approach to aid delivery in 2022 and 2023, although some rounds were made towards the end of 2023 to support IDPs in Temben and Maichew towns.

Context-based approaches

The cluster approach served as a system in which any national or international NGO could provide an update about the resources available on hand, secured funding and opportunities in pipelines. The cluster lead provided prioritised locations for assistance. As in the case of the Emergency Shelter/Non-Food Item cluster, the cluster lead organisations had the chance to select implementing partners from NGOs working in Tigray, using selection criteria like project implementation capacity and operational presence in the identified locations (Interviewee GB, interview by Kahsay, face-to-face, December 2021, Mekelle).

Usually, the NGOs identify locations with high humanitarian needs for their specialised sectors and chose a location where they can implement from their coordination offices. Depending on the funding level, the NGOs opened new offices in locations where the humanitarian needs were observed to be high and pressing. The zonal capitals, namely, Mekelle (both for the city and Southern-Eastern Zone), Adigrat (Eastern Zone), Maichew (Southern Zone), Aksum (Central Zone) and Shire (North Western Zone) had served as major aid coordination centres for many of the NGOs and UN agencies; the Western Zone was inaccessible from Tigray until after this study was completed (Interviewee TG, interview by Kahsay, email, November 2021).

Capacitating the potential of the services in the host communities, as in the case of water, sanitation and hygiene, was used as an aid delivery approach to the IDPs and conflict-affected local communities residing in the major towns. The shortage of safe water in Mekelle city, for example, would not have been minimised using the water trucking method, because water trucks require fuel and cash to fully serve people in need. As a solution, existing boreholes were rehabilitated, and new ones dug and fitted with necessary equipment

and powered by electricity to increase their production capacity. The solution was preferred both in terms of the quality and amount of water added to the system, cost-effectiveness, and sustainability. Of course, in times of power blackout or during which the shortage of clean water became critical, water trucks were used to fill the gap (Interviewee YG, interview by Kahsay, face-to-face, November 2021, Mekelle).

The utilisation of public service centres, mainly schools, health centres, college and university compounds, and unfinished buildings, was another aid delivery approach applied in the Tigray crisis, as constructing emergency shelter for more than 2.2 million IDP was not manageable (Interviewee SE, interview by Kahsay, face-to-face, December 2021, Mekelle).

Coordination platforms and power dynamics

Throughout the crisis, there was an Emergency Coordination Centre. The Centre was established before the start of the war in response to other disasters, mainly drought and a desert locust swarm. The Tigray Regional Bureau of Agriculture and Rural Development was the lead for this coordination platform. This role of the Bureau was further strengthened soon after the crisis occurred. It looked after the displacement situation and coordinated humanitarian partners to deliver urgent assistance to conflict-affected people. The Bureau requested all NGOs that had development projects in the region to shift their budget to emergency response. It issued a formal letter to the NGOs to help them with discussions with their respective donors (Interviewee SE, interview by Kahsay, face-to-face, December 2021, Mekelle).

The Emergency Coordination Centre, under the Tigray People's Liberation Front (TPLF)-led regional government, did not last long, as the government structure collapsed when the TPLF-led government left Mekelle city. There was a gap for weeks before a new Emergency Coordination Centre could be re-established. OCHA played a key role in contacting the new interim administration and re-establishing the Emergency Coordination Centre. Former experts from the previous government were assigned to continue facilitating coordination, although politically assigned people from the interim

administration had to lead the coordination platform (Interviewee AA, interview by Kahsay, face-to-face, December 2021, Mekelle). The heads of the government bureaus assigned to lead the clusters were not consistent over the period of the interim administration, except for a couple of bureaux. This turnover and firing of the bureau heads affected the coordination process, as it weakened responsibility and accountability (Interviewee AB, interview by Kahsay, face-to-face, December 2021, Mekelle). Concerning the coordination procedures of the period from January to June 2021, one of the key informants stated as follows:

> *An attempt has been, and is being, made to map available resources among humanitarian organisations. The cluster-based arrangements played a significant role in aid coordination. However, the public sector, which was expected to play a role in beneficiary selection and prioritisation, was not promising. Different assessments were done by different parties to define the needs in all sectors. But the cluster approach in charge of analysing the data and building a case for prioritised intervention has not equipped itself to that level in some sectors. That was why, almost eight months into the war, we were struggling to figure out, for example, how and who to manage facilities at IDP centres and ensure the quality of services communities require in an emergency. We also noticed that the intervention of NGOs in Mekelle and its surrounding areas was much more than other places where the emergency need was so high.* (Interviewee YG, interview by Kahsay, email, November 2021)

The interim administration did not have a strong structure at all levels, except at the regional and zonal levels. This was why the administrator of the transitional government handed his letter of resignation at the end of January 2021, citing that the interim administration had no power to respond to the needs of the people of Tigray who were starving to death and sexually harassed by external forces (EEPA, 2021, SR 66).

The decision-making power of bureau heads in their respective sectors was very limited, as they did not have an allocated budget to address the systems that had been destroyed. There was no clarity on the assessments they were given by some of the bureau heads, and there was a high turnover of the bureau heads. Hence, the role of the interim administration in leading the emergency response process was not at the level required.

For the period before June 2021, NGOs had relatively better access to the region, which enabled them to bring aid supplies into Tigray. After June 2021, when the TPLF-led government came to power, the situation changed. The coordination platform was relatively strengthened from regional to *woreda* (district) level, as the former government structure resumed its position. Most former bureau heads regained their previous positions with some changes (Interviewee GB, interview by Kahsay, face-to-face, December 2021, Mekelle). This governing structure continued until the Pretoria Cessation of Hostilities Agreement, after which the elected government of Tigray had to be dissolved and the Interim Regional Administration of Tigray Region was formed. The aid coordination platform has continued with the preceding form (Interviewee BW, interview by Kahsay, face-to-face, June 2023, Mekelle).

For the period June 2021 to the beginning of 2022, the government of Tigray had to support NGOs and UN agencies by supplying fuel, in addition to its coordination role, as NGOs were challenged to bring resources into Tigray because of the siege imposed in June 2021. It also gave clear instruction to the banks in Tigray to give the NGOs access to cash for humanitarian aid, however, the banks did not make cash accessible at their branches in Tigray (Interviewee GB, interview by Kahsay, face-to-face, December 2021, Mekelle). However, the access to fuel and cash within Tigray did not last long; the siege affected the cash and fuel flow during the second half of 2021 and almost the whole year of 2022.

Major challenges encountered by NGOs in Tigray

As clearly stated by OCHA, the ability of humanitarian partners to deliver assistance was heavily hindered by the inadequate volume of both humanitarian and commercial supplies reaching the Tigray region, insufficient fuel to transport the aid and offer services, limited telecommunications, and a shortage of cash (OCHA, 2021b). For the first eight months of the crisis, access and the security situation in the region played a significant role in hindering humanitarian assistance. How the challenges affected the operations of NGOs to effectively provide the aid are discussed in detail as follows.

Access and security situation

There were operational challenges that affected the humanitarian assistance for the period before June 2021. Constraints on access was the main one. Accessing Tigray from central Ethiopia was very challenging for all NGOs and UN agencies. Application to federal entities and approval was required for any media and NGO personnel to visit Tigray. The movement of food and non-food aid was also denied for some months. Later, the movement of people and aid was allowed. However, within Tigray, the security situation continued to be challenging in terms of access conditions for humanitarian assistance. Humanitarian access was very dynamic and hindered, although governments, the UN, and NGOs called for unrestrained humanitarian access (Kahsay, 2021).

From November 2020 to June 2021, "the ongoing hostilities, with clashes and ambushes reported in most parts of the region, not only impact[ed] safety and the wellbeing of millions of civilians but also constrain[ed] humanitarian actors' ability to operate and support people affected" (OCHA, 2021a). Because the fighting was back and forth, the security situation in Tigray, especially for the period before June 2021, seriously affected the aid delivery process. There were several locations assumed to have live fighting, which made reaching out being impossible and aid never reached these places. The severity of the security situation was highlighted by the killing of 23 humanitarian workers from different NGOs, most from Relief Society of Tigray, an NGO based in Tigray. The escalation of fighting towards the end of 2022 has again affected the security situation of the region.

For the period from June 2021 to the end of 2023, there were several areas that were not accessible to Tigray Administration, including the whole Western Zone, part of the Southern Zone, part of the North Western Zone, which were occupied by Amhara forces, and the northern periphery of the Central and Eastern zones, where they were controlled by Eritrean troops. Delivering aid to those areas from the Tigray Emergency Coordination Centre was not possible (Interviewee GB, interview by Kahsay, face-to-face, June 2023, Mekelle).

Humanitarian partners relationship with conflict actors and aid diversion

The humanitarian partners in the Tigray region had to engage with multiple actors in the war including the Ethiopian National Defence Force, Eritrean Military, Tigray Defence Force,[38] and Amhara Forces. Based on their engagement with these actors, these humanitarian partners were accused by the state of wrongdoing. The Ethiopian Government accused foreign aid organisations of sending weapons and equipment to rebel groups and an official from the Ministry of Foreign Affairs once said that unnamed UN agencies were "fabricating facts and figures" in a campaign aimed at "disrespecting and defaming Ethiopia" (Kleinfeld, 2021).

The Government of Ethiopia continuously accused humanitarian organisations of supporting the Tigray forces – however, the specific NGOs and the kind of support given was not specified (Interviewee GB, head of INGO in Tigray, interview, face-to-face, 11 December 2021, Mekelle). In response, Martin Griffiths, the United Nation's humanitarian chief during that period, said to reporters that "blanket accusations [against] humanitarian aid workers need to stop … they need to be backed up by evidence if there is any and, frankly, it's dangerous" (Jerving, 2021).

The activities of three organisations – Médecins Sans Frontières (MSF) Holland (Doctors without Borders), the Norwegian Refugee Council, and Al Maktoume Foundation – were suspended for three months for breach of rules[39] (Addis Standard, 2021). The first two had operations in Tigray and were kept way for what the government called 'misrepresentations' on social media and other platforms that

[38] The Tigray Defence Forces were also called TPLF Forces, Tigray Rebel Groups, and Tigray Armey depending on who calls them.

[39] According to the Ethiopian Agency for Civil Society Organizations, there were four reasons for such an action: MSF Holland and Norwegian Refugee Council have been disseminating misinformation assumed to be out of their mandate; all of three organisations hired foreign nationals without the required work permit from the Ethiopian government for more than six months; MSF Holland unlawfully imported and used satellite radio equipment that was not authorised by the relevant government authority; and Al Maktoume Foundation failed to fulfil COVID-19 Procedure, and misused the budget.

were deemed to be beyond their mandate and the purpose for which these organisations were allowed to function (Addis Standard, 2021).

The Government of Ethiopia also accused the UN agencies and USAID of having connections with Tigray forces and the TPLF party, a political party labelled as a terrorist group by the House of Peoples' Representatives of Ethiopia and, hence, the government claimed that it was inappropriate for them to have relations with these groups (Interviewee GB, interview by Kahsay, face-to-face, Mekelle, December 2021). On 30 September 2021, a letter was issued declaring a *persona non grata* status for seven UN staff, requiring them to leave the country within 71 hours, as the Ministry of Foreign Affairs of Ethiopia said that they had meddled in the internal matters of the country (Addis Standard, 2021).

The other actors in the conflict, namely, the Tigray allied forces, Amhara forces, and Eritrean military have affected the aid delivery process differently. The Tigray forces supported humanitarian assistance in the areas they controlled (Interviewee LP, interview by Kahsay, face-to-face, December 2021, Mekelle). The Amhara forces, because they had controlled some areas in Southern Zone, part of North Western Zone, the whole Western Zone, did not allow the passage of assistance from the Tigray side (Interviewee ZV, interview by Kahsay, face-to-face, December 2021, Mekelle). The Eritrean forces in Tigray were strong at the checkpoints, and were not against the distribution of aid, but took some of the distributed assistance, especially food, for themselves (Interviewee LP, interview by Kahsay, face-to-face, December 2021, Mekelle).

The State accused NGOs and donor agencies of diverting aid to the 'non-state' actors, such as the Tigray allied forces. For example, in one of the Emergency Coordination Centre sessions, a military general from the Ethiopian National Defence Force (ENDF) said they had found high energy biscuits meant to be given to malnutrition children in the fighting bases of the Tigray forces (Interviewee EE, head of national NGO in Tigray, interview, face-to-face, 8 December 2021, Mekelle). For many of the humanitarian partners, however, these allegations were false accusations (Interviewee EE, interview by Kahsay, face-to-face, December 2021, Mekelle).

Another incident is the WFP and USAID announcement to stop food distribution in May 2023, stating that it was discovered that food intended for people in Tigray, millions of whom are in desperate need of aid, was being diverted and sold. The interim government of Tigray then announced, calling the reported theft a crime against children, the elderly, and the disabled, that it had established a task force to investigate the matter (Reuters, 2023). At the beginning of June 2023, both USAID and WFP accused Ethiopia of diverting aid, evidenced by massive government theft throughout the country, after which both organisations had to cut food aid supporting millions of Ethiopians (Houreld, 2023). Moreover, the senior leadership of the World Food Programme in Ethiopia had resigned since the findings of a probe into the misappropriation of food aid in the country were due to be made public (Anyadike, 2023).

Blockage of public services

Throughout 2021, the blockage of basic utilities, mainly banking services, communication, electricity, fuel, and transportation severely affected aid delivery. The obstruction of these services continued throughout the year but was severe for the period June to December 2021. In November 2021, the weekly requirement of cash, fuel, and aid supplies was Ethiopian birr 300 million, 200,000 litres, and 100 trucks, respectively (OCHA, 2021g). However, the maximum cash transfer allowed per organisation per week was only 2 million Ethiopian birr through the United Nations Humanitarian Air Service (UNHAS) flight. For the period July to December, a total of 525 million Ethiopian birr (USD 11.4 million) cash was transferred to Tigray using the UNHAS flight (OCHA, 2021h).

There was no fuel coming into Tigray for almost four months (August to November 2021). From July to December 2021, 1,317 trucks arrived, accounting for 54% of the requirement (Interviewee GE, interview, face-to-face, 8 December 2021). About 10 INGOs and almost all national NGOs, especially local NGOs that had an operational presence only in Tigray before the occurrence of the war, could not bring cash to Tigray for almost six months (from June to December 2021). This meant that some organisations, such as the Relief Society of Tigray, which carried 50% of the food distribution

caseload, could not access cash from June to December 2021 (Interviewee EE, interview by Kahsay, face-to-face, December 2021, Mekelle). While the passage of fuel along with other relief items and cash transfers using the UNHAS flights was blocked towards the end of 2022 until the Pretoria peace deal was agreed, the blockage of the public service continued throughout 2022 and the beginning of 2023. This severely affected the aid delivery process.

Limitation of resources

Another fundamental challenge that affected the NGOs in their response to the humanitarian needs in Tigray region was the limitation of resources. All clusters had funding gaps to fully reach the people in need. The Northern Ethiopia Response Plan identified a funding requirement of USD 853 million, with a funding gap of 55.6%, of which the gap for the period May to July 2021 was USD 197 million (Kahsay, 2021).

Although NGOs had resources that they were unable to fully utilise to provide the assistance they planned, there was a major resource shortfall for the overall operation. The revised Northern Ethiopia Response Plan for the period May to December 2021 identified and targeted 5.2 million people in need of humanitarian assistance. The financial requirement was calculated to be USD 957.0 million, with a funding gap of USD 373.6 million (OCHA, 2021e).

In addition to the above-described major constraints, a lack of clarity about relief and recovery interventions also hindered humanitarian support. More than half of the INGOs in Tigray were development project implementers. Some of them had to change their development projects to emergency relief, while some had to continue with the pre-planned activities. In the sectorial discussions and coordination platforms, and especially while developing response plans, there has always been confusion about the intersection of relief with development. Some sectors, such as agriculture and education, had prepared resource requirements for the whole service delivery, not specific to emergency needs.

Discussion

This study was conducted in the Tigray region during the humanitarian crisis that started at the end of 2020. The primary data was collected at the end of 2021 and the start of 2022. In addition, a second phase of the primary data collection was collected in June 2022, and the major humanitarian assistance-related events have been reflected from secondary sources up until June 2023. The primary data sources had two dimensions: one from the assistance-provider and coordination agencies perspective and the other from the conflict-affected people's perspective.

Many of the interviews with assistance-providing and coordination agencies and with government offices were conducted in Mekelle. In addition, the data was collected from IDPs at selected major IDP hosting locations, namely Mekelle, Shire, and Adigrat; hence, it did not cover every location where people in need of humanitarian assistance stayed. The interviews with humanitarian assistance-provider agencies covered UN agencies and international and national non-governmental organisations. Donor agencies, including the major humanitarian assistance-provider organisations like WFP and USAID, were not directly contacted, but rather their implementing partners.

The humanitarian crisis in Tigray had a wide range of effects on the people. The humanitarian needs of all sectors have extremely worsened throughout the crisis period, from the end of 2022 to mid-2023, as the siege has affected the aid delivery process. In March 2022, a cessation of hostilities was agreed by the conflicting parties, which resulted in the passage of humanitarian convoys into Tigray. Although there has never been an easy way for humanitarian aid to come into Tigray, the process became extremely tight from August 2022 until the Pretoria Cessation of Hostilities Agreement was signed on 2 November 2022. Basic public services like banking and telecommunications continued to be closed until the beginning of 2023.

To assist the crisis affected people of Tigray, 11 UN agencies, 55 INGOs as well as 34 local NGOs were found to have operational

presence with varied capacity. These humanitarian organisations tried to respond to the crisis. Although there were funding gaps, they had resources that could have assisted millions of people who required urgent assistance. However, because of operational challenges, NGOs and UN agencies were hindered in providing the planned services for which they had the resources.

Using the opportunities and addressing the operational challenges in the Tigray humanitarian crisis, the cluster approach, rapid response mechanism, and other context-based aid delivery approaches were pursued by NGOs. The cluster approach was endorsed by the Inter-Agency Standing Committee in 2005 and began with eight 8 clusters, later increased to 11 (Ferris, 2011). The approach aimed to ensure a predictable coherent method and address any humanitarian gaps that were beyond the capacity of any one agency (Ferris, 2011). A total of 11 clusters were operational in the Tigray crisis. Their activities and time of establishment varies from cluster to cluster. As in other humanitarian situations, the designated UN agencies had the coordination role of holding weekly meetings with all their partners. The RRM approach was less effective as it was not suitable for reaching people in need, especially in a conflict-torn situation, and entailed the duplication of resources. This was fundamental because the humanitarian needs of groups of people residing in specific locations varies.

In principle, the state is responsible for protecting those who are displaced and support disaster-affected people. In the Tigray context, however, the federal government created obstacles to the delivery of aid, and this contributed to the violation of the rights of its citizens. The rights of IDPs were violated as they did not receive the assistance needed for their survival. Hence, the Kampala Convention was violated in the Tigray humanitarian context.

The ordinary people of Tigray were denied access to public services; hence, they could not exercise their rights and children were left without their basic needs being met, including the right to a safe education, medical supplies, and food and nutrition items. The State failed to provide necessary inputs for the survival of the people, and

NGOs could not realise the rights-based approach as they were severely challenged even to protect their own staff.

When designing programmes and projects that affirm local engagement and construct and reinforce systems that minimise prejudice against marginalised groups, the human rights approach should be taken into consideration. It implies that any violation or obstruction in the exercise of rights must be outlawed, prevented, and removed, and that those who are most at risk of experiencing serious hindrance in exercising their rights should receive precedence. In any development or emergency intervention, people are viewed as having rights and privileges, rather than as 'beneficiaries' of help and support. In the Tigray context, the human rights approach was not realised to the required extent. In this situation, eliminating, prohibiting, or preventing all forms of impediments in the realisation of rights was not possible. Despite the hindrances, the INGOS and NGOs endeavoured to uphold the rights of people in Tigray.

The humanitarian intervention faced several challenges including access and the security situation, blockage of public services, and funding limitations, which were aggravated by the Ukraine war. In addition, administrative restrictions on the use of secured funding, such as cash transfer restrictions, and the blockage of humanitarian corridors for the transportation of humanitarian items including fuel severely affected the humanitarian operation from reaching the affected population. Although improvement was seen after the signing of the Pretoria Cessation of Hostilities Agreement, the funding gap for 2022 was even greater because of the Ukraine war, which shifted the global funding environment and influenced the priorities of the donors.

Conclusion

The humanitarian crisis in Tigray resulted from a combination of multiple shocks, mainly caused by the war that broke out in November 2020 (ICHREE, 2023). In addition to the displacement of millions due to the conflict, the siege of Tigray and the closing of borders, dire humanitarian conditions emerged. The siege, the communication blackout, lack of electricity, lack of cash, shortage of

fuel, restrictions on ground and air transport, and decreasing supplies of basic commodities in local markets due to broken supply-chains, all contributed to the crisis (Gebreslassie *et al.*, 2024).

The people of Tigray have suffered greatly, and many have died from starvation and due to the lack of medical supplies. The humanitarian needs in the Tigray crisis concerned almost every aspect of survival, including food, water, sanitation and hygiene services, medicine, nutrition, emergency shelter, non-food items, education, and agricultural inputs. Humanitarian needs around protection in the conflict situation were also acute. Access to emergency telecommunications, camp coordination and camp management, and logistics were also severely affected, contributing to the delay in addressing the urgent humanitarian needs in the region.

National and international NGOs, together with the UN agencies, mobilised resources to respond to the humanitarian crisis in Tigray. NGOs had an advantage over international organisations (in terms of access and relationship with local actors) and were motivated to play their part in responding to the crisis. To coordinate the aid delivery process, the humanitarian partners adopted a rapid response mechanism and employed a cluster approach. The cluster approach was the main coordination mechanism, in which needs were prioritised, locations identified, and available resources mapped and allocated. However, the goal of the coordination process – delivering well-coordinated, efficient, and sufficient lifesaving services – was not achieved at the required level. Despite all these efforts, the humanitarian needs of the people of Tigray were not met throughout the crisis years. The humanitarian work was affected by several external challenges.

The fundamental challenges that hindered the delivery of humanitarian aid included, but were not limited to, access and security issues, administrative challenges regarding movement of staff, cash and other aid items, and the failure to clearly distinguish between development and emergency interventions. Lack of cash and fuel were reported to be among the greatest obstacles to aid delivery. The findings of the study support other research on a similar subject in relation to the challenges faced by humanitarian interventions.

Insecurity and restrictions, aid blockage and denial of access to humanitarian assistance, the intersection of development and relief interventions, and resistance to NGO/UN agencies' relationships with state and non-state actors/armed groups were the main challenges in the aid delivery process in Tigray. Moreover, the independence and neutrality of NGOs and UN agencies was seriously threatened with the state accusing humanitarian actors of supporting the armed struggle, culminating in the expulsion of seven UN high officials from the country.

Some organisations used the rights-based approach in programming, mainly the UN agencies and INGOs. Several needs assessments and consultations with people in need were conducted to ensure that conflict-affected people had a say in the decisions made about them. However, typically, the responses plans and the aid delivery approaches were determined by humanitarian professionals, rather than initiated by rights-holders. Resource constraints had a severe impact on the rights-based approach, as almost all conflict-affected people were unable to obtain essential protection or have their needs for food and basic services met. This continued, even though the violation of their human rights was reported by media and several concerned organisations.

Overall, the international community has, to some extent, provided aid to meet the requirements of conflict affected people in Tigray. The international community has international instruments and conventions in place to protect mankind against suffering and human rights abuses in humanitarian crises. However, in Tigray, it failed to take effective action, other than publishing media reports and announcing repeated concerns about the situation. The government of Ethiopia did not play its role to protect its citizens, but instead escalated the humanitarian situation by imposing a siege on Tigray, with the support of its allied forces, and blocking aid delivery.

The major shortcoming of the humanitarian response in Tigray was the gap between the urgent humanitarian needs related to the protection of civilians and the response of the I/NGOs in each cluster. There were several serious protection issues reported in the Tigray crisis, including, but not limited to, the separation of families,

gender-based violence, and the killing of civilians. Further research on the protection needs of conflict-affected people is needed, including on the role of NGOs in responding to such needs.

This makes the conclusion of this study even more relevant, namely, that local NGOs may be in a better position to respond to such needs. The humanitarian sector may be better able to respond to protecting civilians if the sector acknowledges the role that local NGOs can play in this regard. In Tigray, local NGOs were in a position and had the capacity to respond to the difficult situations on the ground in the complex situation of war under a siege. This research suggests that in humanitarian crises like the Tigray war, UN agencies and INGOs work closely with local NGOs in providing humanitarian assistance, as well as in peace building and reconstruction and rehabilitation activities.

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Ethical clearance

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 7

The Impact of the War in Tigray on Undernutrition among Children Under-Five

Znabu Hadush Kahsay & Araya Abrha Medhanyie

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The one who hides his wound, hides his medicine.

Abstract

This study examined the impact of the war in Tigray on undernutrition among children under five in the Tigray regional state of Ethiopia. Applying the conceptual framework Impact of Armed Conflict on Health by Guha-Sapir and Van Panhuis (2002) as a theoretical foundation, the findings indicate that war-induced severe acute malnutrition is prevalent among young children in Tigray, with food shortages directly linked to war-related agricultural damage, the destruction of health infrastructure, and the mass displacement of people, all of which have significantly increased undernutrition. Children from displaced families, government employees facing salary cuts, and mothers experiencing war-related stress are at high risk. Immediate food shortages, compounded by issues like lack of clean water and sanitation have created a dire situation for children under five in Tigray, necessitating urgent intervention. Rebuilding health facilities, providing support to displaced caregivers and trauma survivors, implementing food security programmes, and ensuring access to nutritious food supplements are crucial steps to address the undernutrition crisis and prevent further harm to children in Tigray.

Keywords: Tigray, malnutrition, hunger, Ethiopia, food shortages, children's health

Introduction

Nearly 60% of people in desperate need of food are from countries experiencing conflict (Von Grebmer *et al.*, 2021; Welthungerhilfe, 2020). The correlation between war and undernutrition is well recognised (WFP, 2018; Von Grebmer *et al.*, 2021; United Nations, 2022a). According to a global report, war was a main contributor to undernutrition in eight of the ten countries studied, with an alarming to an extremely alarming risk of hunger in 2020 (United Nations, 2022a). Children under five are one of the most vulnerable segments of the population in terms of war-led undernutrition, which threatens their lives, as well as their physical growth and development (Kinyoki *et al.*, 2017). As defined by Wiesmann *et al.* (2015), the Global Hunger Index is a tracking measure that looks closely at global, regional and national trends in hunger in relation to achieving Sustainable Development Goal (SDG) 2, which aspires to end hunger globally by 2030. The global hunger index considers children's nutritional and health status as a reliable indicator of hunger in a specific region or country. More specifically, the index sums up the score for undernourishment in the general population, child wasting, child stunting and child mortality to predict risk of hunger. Child wasting is measured by severe acute malnutrition, which is also used as an eligibility criterion for admission to hospital for care and treatment, independently or with other medical complications (Von Grebmer *et al.*, 2021).

People in places affected by war are also at greater risk of infection and diseases attributed to undernutrition. Moreover, the association of undernutrition with poor health, social and economic outcomes is well recognised. Globally, each malnourished individual (both over-nutrition and undernutrition) costs the globe an estimated USD 500 per year (Global Panel for Agriculture and Food Systems for Nutrition, 2016).

Ethiopia is among the countries with the highest prevalence of undernutrition in the world, accounting for an estimated 16% of its national GDP (WFP, 2017). The most recent Ethiopian Demographic and Health Survey, which was conducted in 2019 shows that, before the war in Tigray started, 37% of children under

five in Ethiopia were suffering from chronic malnutrition (stunting), peaking at 49% in Tigray regional state (EPHI & ICF, 2019). In addition, severe acute malnutrition, which is used as an indication of short-term poor food intake, was 7% in Ethiopia, with the prevalence stepping up to 9% in Tigray regional state (EPHI & ICF, 2019).

The war in Tigray, the northern-most province of Ethiopia, which began in November 2020 and ended with the Cessation of Hostilities Agreement in November 2022 (ICHREE, 2023), happened in conjunction with a severe locust pest affecting farming in the region, as well as the global COVID-19 pandemic, which began in early 2020. In addition, the Tigray war caused great stress on the region, including on the availability of food.

All of this caused a greater risk of morbidity and mortality among children under five years. During the war, basic infrastructure was destroyed, including health facilities (Gesesew *et al.*, 2021; Medhanyie *et al.*, 2024; Taye *et al.*, 2024), and property was looted, including agricultural products (Welday *et al.*, 2022). In addition to the loss of life and destruction of property, the war caused massive displacement, putting millions of residents in Tigray in desperate need of humanitarian assistance (Amnesty International, 2021; Kahsay, 2024). When the Tigray regional government returned to Mekelle, the capital of Tigray, on 28 June 2021, the federal government imposed a complete siege, including on basic services such as communication, banking, transportation, fuel and food, with humanitarian aid severely restricted (Amnesty International, 2021; Melicherová *et al.*, 2024; Gebreslassie *et al.*, 2024). Still, there is an ongoing siege in parts of Tigray which are still occupied by Amharan and Eritrean forces (OMNA Tigray, 2023).

The incidence of undernutrition in Tigray is expected to have risen exponentially due to the war and siege. The sustained siege has blocked humanitarian aid including food, essential drugs and medical supplies; fuel; and basic services such as banking, transport and telecommunications; this includes severe damage to health facilities (Tigray Regional Health Bureau, 2022), deepening the risk of

undernutrition. This study looks at the following research question: *What was the impact of the war in Tigray and the siege on the undernutrition among under-five years old children in 2021–2022?*

Theoretical framework

This study adopted a conceptual framework based on the impact of armed conflict on health developed by Guha-Sapir & Van Panhuis (2002). This theoretical framework has been used over the last two decades to explain the main pathways by which conflict can affect the health of civilians (Guha-Sapir & D'Aoust, 2011). Specifically, the framework assumes that armed conflict results in three interrelated negative consequences: primary consequences, secondary consequences and impacts. The primary negative consequences consist of:

- Damage to agriculture
- Population displacement
- Damage to healthcare infrastructure
- Decreased health expenditure (Guha-Sapir & D'Aoust, 2011)

The secondary negative consequences, which are considered to be meditators between the primary consequences and the individual level impacts, are:

- Food shortages
- Lack of clean water, sanitation and shelter
- Low immunisation coverage
- Low access to healthcare
- Lack of resources (Guha-Sapir & D'Aoust, 2011)

Finally, the actual impacts of the war on individuals, which are specified and individualised consequences that happen to individuals, fall into the following categories:

- Death, injury and disability due to direct impact of armed conflict
- Mental damage

- Malnutrition
- Increased infectious diseases (Guha-Sapir & D'Aoust, 2011)

Most importantly, the conceptual framework recognises the high proportion of deaths in armed conflict settings from undernutrition and disease immediately after the active war deescalates, in comparison to violent deaths during the war (Guha-Sapir & D'Aoust, 2011). Figure 7.1 shows Guha-Sapir & Van Panhuis' framework:

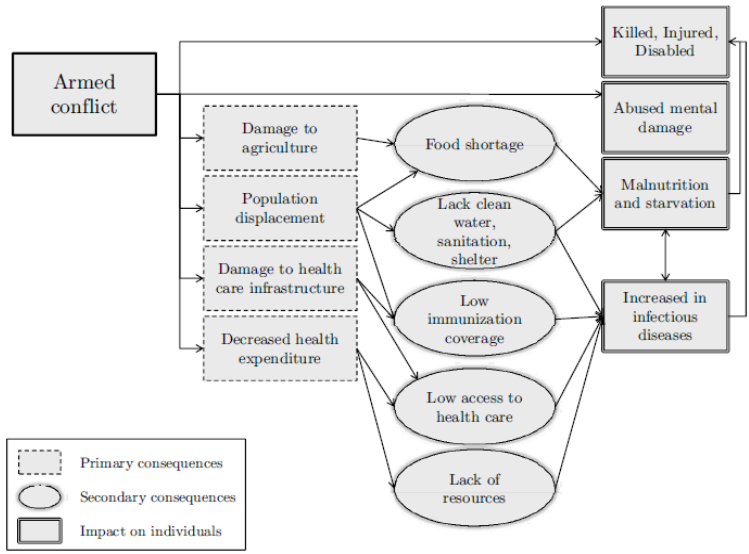

Figure 7.1. Conceptual framework: Impact of armed conflict on health

Source: Guha-Sapir & Van Panhuis (2002)

Methodology

Study design

This research was carried out as a case study with multiple data sources to describe the impact of the war in Tigray on undernutrition among children under five (0–59 months). Undernutrition was defined as the existence of severe acute malnutrition among children under five. In this case undernutrition is operationalised as severe acute malnutrition.

Data sources

The study included: a review of (1) existing reports on undernutrition in Tigray before and after the war and (2) health facility records on undernutrition in children under five admitted for severe acute malnutrition, as well as interviews with; (3) healthcare providers from selected health facilities and (4) caregivers of children under five (0–59 months) admitted to health facilities for severe acute malnutrition.

Table 7.1. Data sources and data collection period

Data Sources	Aim	Description of data sources	Time of data collection
Review of existing reports	To review existing reports generated preceding the current study	Published and unpublished reports were reviewed	15–27 June 2022
Interviews with caregivers	To explore caregivers' opinions on the impact of war on the nutritional status of their child	Interviews were conducted with caregivers with a child admitted in hospital mainly for severe acute malnutrition	2–3 July 2022
Key informant interviews	To explore health workers' observations on the impact of war on the nutritional status of their child	Interviews were conducted with healthcare providers and experts	12 July –13 August 2022
Health facility records	To assess the trend of undernutrition among under-five	Data about severe acute malnutrition were extracted from six hospitals	14–19July 2022

Data Sources	Aim	Description of data sources	Time of data collection
	children since the war		

Document review

Existing reports on undernutrition among children under five before and after the war in Tigray were reviewed including reports from the Ethiopian Demographic and Health Survey, the Tigray Statistical Agency, and the Tigray Institute of Policy Studies, among others. In this regard, five reports were identified that include Gesesew *et al.* (2021), Mulugeta & Gebreegziabher (2021), Mulugeta *et al.* (2019), Tigray regional health Bureau (2022), Welday *et al.* (2022). One of the reports was published before the war and four of them were after the onset of the war. A checklist was developed to extract data from the documents reviewed in this study regarding severe acute malnutrition at the community level in Tigray.

Interviews

A total of 20 interviews were conducted in 3 rounds of data collection. In the first round, six key informant's interviews (two senior paediatricians, two paediatrics residents, a nutrition focal person in the under-five paediatric ward, and a nurse in the neonatal intensive care unit) were conducted with healthcare providers in Ayder Comprehensive Specialized Hospital, as this hospital was the only referral hospital admitting children with severe acute malnutrition at the time of the study. In addition, a key-informant interview with a public health nutrition expert from the School of Public Health, Mekelle University, and two in-depth interviews with mothers with children admitted to Ayder Hospital for severe acute malnutrition were conducted in this round.

In the second-round of data collection, additional eight interviews were conducted. Six of the in-depth interviews were with the focal person from the paediatric ward at each hospital (one each from

Mekelle General Hospital, Lekatit 11 Primary Hospital, Lemlem Karl General Hospital, Wukro General Hospital, Mekoni Primary Hospital, and Adigrat General Hospital) as well as two mothers with children admitted to hospital for severe acute malnutrition (one from Mekoni, one from Mekelle Hospital). The final round of data collection consisted of three in-depth interviews with mothers whose children has been admitted to hospital for severe acute malnutrition (one at Adigrat General Hospital, one at Wukro General Hospital and one at Lemlem Karl General Hospital).

Two semi-structured interview guides were developed: one for the healthcare providers and one for caregivers whose children had been admitted for severe acute malnutrition. Interviews from key informants were transcribed, translated and analysed using Atlas.ti software. The researchers conducted interviews with purposively selected key informants (healthcare providers) and caregivers/mothers. Each interview lasted at least for 45 minutes and was audio-taped with a digital recorder. The data were thematically analysed using back and forth review of the transcripts. The qualitative data analysis process followed a mixed deductive-inductive approach. Firstly, the data were deductively coded against the main categories of the conceptual framework as primary consequences, secondary consequences and the impacts on individuals. Then, emerging insights in each category were captured inductively.

Review of medical records

The medical records of several cases of undernutrition in children under five were reviewed. The reports of the patients of two years before the war versus two-year after the onset of the war were compared. The review of records was conducted in six general and referral hospitals (Ayder Hospital, Mekelle General Hospital, Quiha General Hospital, Lemlem Karl General Hospital, Mekoni Primary Hospital, and Adigrat General Hospital).

A checklist was prepared by experts for the medical review in health facilities to extract information on the number of children under five who visited health facilities for severe acute malnutrition in the two years before and two years after the war in Tigray had started. The

trends were assessed in relation to the number of children under five who had visited a health facility for undernutrition in the two years before and two years after the war in Tigray had started (using the Ethiopian fiscal year: July through June).

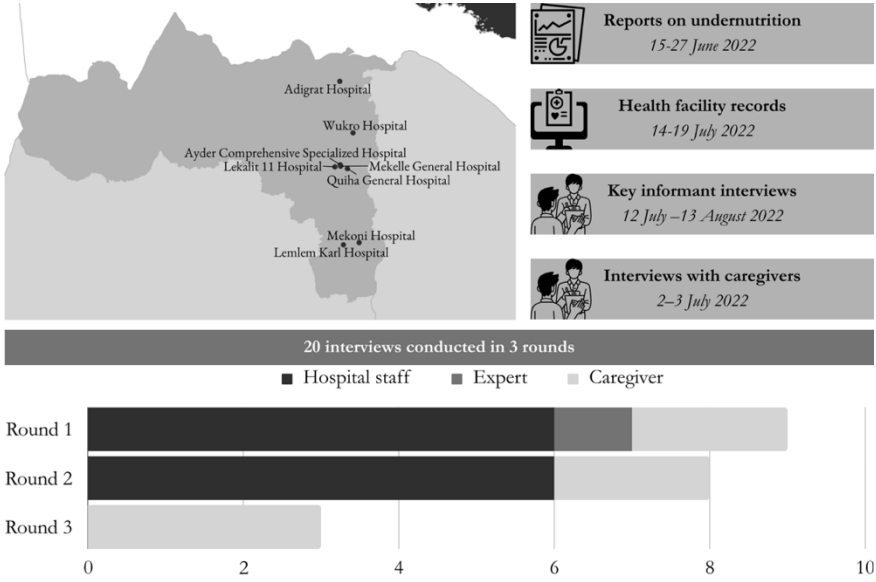

Figure 7.2. Overview of data collected for this study

Findings

The findings are presented in the order of the primary, secondary and tertiary consequences of the war on undernutrition of under five-year-old children.

Theme 1: Primary consequences of the war in Tigray

The primary consequences of the war in Tigray, concern the following categories:

- Damage and destruction of agricultural assets
- Displacement
- Damage to health infrastructure
- Reduced health expenditure

The findings with regards to these elements are discussed below.

Damage and destruction of agricultural assets

An unpublished study conducted by the Tigray Institute of Policy Studies found that 86.5% of 3,262 households surveyed in Tigray experienced war related damage such as destruction of property, looting, and deprivation of basic services (Welday *et al.*, 2022).

As a result of the destruction of household assets, children under five from such households were at risk of undernutrition. A mother from Hagere Selam stated her situation as follows:

> *The Eritrean soldiers looted our assets. On 27 April 2013 [Ethiopian calendar, which corresponds to 13 April 2021 AD], we left our homes for them and they looted everything they could get, believing that there was nobody to guard them. They destroy all the domestic animals! All the crops! Everything relevant to the household and all the household equipment; just whatever they found in the house. We had a farm, but how can we make it now? There are no crops left, no ox left to do the work.* (Interviewee 2020, interview by Znabu H Kahsay, face-to-face, 2 July 2022)

Participants mentioned that their household assets, including agricultural assets and crops, domestic animals, and household equipment were looted and destroyed during the war.

Internal displacement

The war in Tigray caused mass internal displacement of people, with people often moving hundreds of miles away from their homes. These families had much hardship to overcome and could pay little attention to the dietary needs of their children during the time of the war:

> *Last year, most of the undernutrition cases [admitted at a hospital for severe acute malnutrition] were children from internally displaced families. When they [the parents] left their homes, they had to walk great distances, crossing the ups and downs, with little attention to feed their children.* (Interviewee 2021, interview by Znabu H Kahsay, face-to-face, 15 July 2022)

Food access was a challenge in centres for Internally Displaced persons (IDPs), and mothers with children under five were forced to

beg for food for themselves and their children outside the camps. A public health expert explained this situation as follows:

> *At this time, every household in Mekelle town is being visited by 30 to 40 internally displaced individuals begging for food daily.* (Interviewee 2022, interview by Znabu H Kahsay, face-to-face, 12 July 2022)

Families also had limited financial capacity to cover food expenditure after arriving at the centres established for IDPs, placing their children at risk of severe acute malnutrition. Participants in this study shared that war-led food insecurity in households was causing disintegration of families, with members using their own ways to seek food to save their lives independently, which puts children under five at further risk of undernutrition:

> *At this moment, how can he [her husband] earn an income? Now, he has already joined his parents to save his life. We are considered as divorced because of this undernutrition. He joined his family and I came to the hospital without communicating with him. He didn't know where I was and he has not tried to find me; I spent three weeks here in the hospital with my infant.* (Interviewee 2020, interview by Znabu H Kahsay, face-to-face, 2 July 2022)

As a result of lack of access to food, families and social support networks disintegrated, putting further strain on the nutritional needs of the infants.

Damage to health infrastructure

In addition to published reports about the damage to healthcare infrastructure during the war in Tigray (Gesesew *et al.*, 2021; Tigray Regional Health Bureau, 2022; MSF, 2021), a recent unpublished assessment of health facility damage (Tigray Regional Health Bureau, 2022) indicates that 71% of the health facilities in Tigray were vandalised and damaged.

The damage to health facilities had a considerable effect on neonatal and child health services. A mother explained how the absence of basic services has affected her infant more than her older child:

> *The situation is incomparable with my older child. The older one has grown in a better way. When it comes to this child [4-month-old infant], his weight at birth was too low. From the very beginning, I gave birth at home, because I couldn't get an*

ambulance. Consequently, I have experienced severe bleeding and I nearly died. If the youth in our village had not taken me to the referral hospital on a traditional stretcher, it was obvious that I would lose my life, and the baby too. (Interviewee 2023, interview by Znabu H Kahsay, face-to-face, 2 July 2022)

Another mother explained that there were no services available in the health facility near her:

I gave birth at home, as there was no service in the nearby health facility at that time [10 months prior to the interview]. The drugs and equipment at the facility were totally looted. By the way, the care providers have not returned to their duty, because they have nothing to eat. You can't get even one provider at the health facilities to get an injection. (Interviewee 2024, interview by Znabu H Kahsay, face-to-face, 3 July 2022)

Participants in the current study emphasised that the unavailability of primary healthcare in their nearby health facility has led to an increase in home deliveries, delays in seeking treatment for sick babies, and a lack of immunisation services for children.

Reduced health expenditure

Participants repeatedly mentioned that parents used their daily allowance (from daily labour) or monthly salary earnings to cover caring and feeding expenditure for their children. However, following the war Tigray and the siege, it has been problematic for parents to access healthcare, as medical supplies are rarely available in health facilities and usually unaffordable. Participants mentioned that the available services are too expensive for parents and there are other survival priorities. Lack of availability and affordability has substantially reduced health expenditure by parents and care givers.

Theme 2: Secondary consequences of the war in Tigray

The main secondary consequences reported were food shortages for pregnant and lactating women, lack of clean water, hygiene and sanitation, and inadequate shelter, as well as lack of immunisation services at health facilities.

Shortage of food for pregnant and lactating women

Children under five were particularly vulnerable to undernutrition during and after the war, as shown in the following excerpt:

> *I was not able to get adequate food during my pregnancy. I know even additional meal should have been eaten during pregnancy, but I was eating only injera (fermented pancake-like bread often made up of Teff) with salt (with no stew).* (Interviewee 2024, interview by Znabu H Kahsay, face-to-face, 2 July 2022)

A lactating woman also added here reflection as:

> *What I am thinking is, If I could be able to get food, my breastmilk might have had enough milk production for my baby. That is what makes me anxious about my baby.* (Interviewee 2023, interview by Znabu H Kahsay, face-to-face, 2 July 2022)

Food shortages among pregnant and lactating mothers are especially of concern. Care providers reported that an increase in miscarriages, still births, preterm births, and babies with low birth weight:

> *Since the war in Tigray started, we are observing complications that were less common among children less than five years. I personally assume that the reason for the rise is because the mothers are less nourished.* (Interviewee 2025, interview by Znabu H Kahsay, face-to-face, 2 August 2022)

Thus, it was observed that it resulted in the death of neonates which can be attributed to undernourishment of mothers. Participants have repeatedly mentioned that the war and siege compromised the feeding practices of caregivers for their children under five in three ways. Firstly, mothers tended to be unable to produce adequate breastmilk for their infants, making timely initiation and the continuation of breastfeeding problematic. Secondly, as a result, mothers tended to supplement breastfeeding with breastmilk substitutes and complements, which hampers exclusive breastfeeding. Thirdly, mothers faced difficulty introducing appropriate complementary feeding for infants aged six-month, due to the shortage of food.

Participants mentioned that children under five from parents whose primary income had been based on daily labour, small trade, and government employment were particularly at greater risk. Children

from educated, higher income, and urban households were increasingly admitted to paediatric wards for severe acute malnutrition, which was not common previously. A public health expert shared the following:

> *I have never seen such conditions, in which children of government employees are suffering from severe acute malnutrition. Consequently, they [the family] are sending their children to relatives who can afford to care for them and feed them.* (Interviewee 2026, interview by Znabu H Kahsay, face-to-face, 12 July 2022)

A paediatric resident shared the following observation:

> *One month ago, a child of parents who were both employees of Ayder Comprehensive Specialized Hospital was admitted to the paediatric ward for severe acute malnutrition.* (Interviewee 2027, interview by Znabu H Kahsay, face-to-face, 15 July 2022)

A midwife from Ayder Hospital also said that his colleague's two children were admitted to the paediatric ward for severe acute malnutrition. He expressed fear that his children were also at risk of developing severe acute malnutrition:

> *When I took my children with me for shopping, what my older child is currently asking me to buy for him, which is never like before, is bread. I believe that this because we are not providing him adequate diet. […]. If I should speak honestly, what we are eating at home is only one monotonous food; just if there is wheat powder it is so. No salt, no stew, no tea with it! What concerns me a lot is the children will become undernourished. In fear of this, I measure the weight of the older baby at weekends because I feel that he is becoming more wasted.* (Interviewee 2028, Interview by Znabu H Kahsay, 3 August 2022)

Health workers and their children were themselves at risk of severe acute malnutrition for which they needed immediate treatment.

> *Population displacement due to the war has created an unbalanced distribution of people around urban centres in Tigray, particularly in Shire, Aksum, Adigrat, and Mekelle, which has placed an additional burden on access to safe drinking water, hygiene and sanitation facilities, as well as shelter. These conditions have created a favourable environment for infections and undernutrition among children under five.*

(Interviewee 2022, interview by Znabu H Kahsay, face-to-face, 12 July 2022)

Unsafe drinking water, hygiene and sanitation and inadequate shelter contributed to the risks.

Lack of immunisation services

Furthermore, the destruction of health services resulted in a lack of routine and outreach immunisation services, which increased the risk of infectious disease among children under five. Services expected to be provided by primary healthcare were interrupted due to a shortage of medical supplies, lack of transportation, displacement of healthcare providers and no monthly salary for healthcare providers. Consequently, vaccine preventable diseases including pneumonia and measles were common in children under five in Tigray, either independently or combined with severe acute malnutrition. (Interviewee 2027, interview by Znabu H Kahsay, face-to-face, 15 July 2022).

Theme 3: Impacts of the war on children under five and their caregivers

The main individual impacts reported in this study were an increase in severe acute malnutrition among children under five, an increase in communicable diseases among children under five, and a high risk of undernutrition among children of mothers with war-related mental health problems.

Severe acute malnutrition among children under five

A review of existing reports generated by Mekelle University shows that severe acute malnutrition in Tigray reached 28% (Tigray Regional Health Bureau, 2022).

Unlike the situation before the war, care providers repeatedly stated that the war led to an increase in the number of children admitted and readmitted to hospital primarily for severe acute malnutrition. There had been a rise in the number of malnourished children aged less than six months, including neonates (aged less than 28 days). The quantitative reports from health facility records are in line with the observations of care providers collected in this study. A report from

Ayder Hospital comparing data over a period of eight years, indicates that the number of children admitted for severe acute malnutrition per month increased threefold after the onset of the war in Tigray. As hospitals admit only children with severe acute malnutrition, many more children with moderate malnutrition received care in an outpatient department. A paediatric resident explained as follows:

> *When we see the trend in the last three months [February to April 2022], almost half of the 80 beds in the paediatric ward are occupied by children with severe acute malnutrition. Furthermore, there were times where almost all of our beds in the paediatric ward were occupied by malnutrition cases.* (Interviewee 2021, interview by Znabu H Kahsay, face-to-face, 15 July 2022)

Beyond the individual causalities of children under five because of the war, the war in Tigray and the siege increased the risk of undernutrition among children under five. A mother whose husband had been earning income from daily labour whose child had been readmitted for severe acute malnutrition stated the following:

> *I have been here [in hospital] for a month and a half while he [the baby] was two months old. They told me that he shall be discharged to prevent infection due to prolonged stay in the hospital. Now at his fourth month, I am here for the last two weeks attending to him. There is nothing at home to eat for myself and to feed the baby. Nor am I able to buy the replacements [breastmilk supplements].* (Interviewee 2029, interview by Znabu H Kahsay, face-to-face, 3 July 2022)

In addition, an interview with a nutrition expert in the school of Public Health at Mekelle University described severe acute malnutrition among children under five in Tigray in reference to the global standards as follows:

> *As per the Integrated Food Security Phase Classification, a community is regarded as in the final stage of a crisis, called catastrophic stage, if the prevalence of acute malnutrition has reached 15% and if there are exacerbating situations like food shortage, displacement, drought and compulsive/forced selling of assets. With all the exacerbating situations, the prevalence in Tigray reached 30% four or five months before. I am not sure if there is any standardised category to capture the situation in Tigray.* (Interviewee 2022, interview by Znabu H Kahsay, face-to-face, 12 July 2022)

A review of the health management information system reports from six severe acute malnutrition hospitals revealed a 63% increase in the number of children under five admitted to health facilities for severe acute malnutrition. A total of 600 children were admitted for severe acute malnutrition over the two Ethiopian fiscal years preceding the war (July to August 2018/19 and 2019/20) and the number increased to 1,351 for the two years 2020/21 and 2021/2022. Table 7.2 illustrates hospital admissions of children under five due to acute malnutrition in selected hospitals during the four fiscal years.

Table 7.2. Number of children under five admitted for severe acute malnutrition in selected hospitals

Name of hospital	**Year (Ethiopian fiscal year July to August)**			
	2018/19	***2019/20***	***2020/21***	***2021/22***
Adigrat Hospital	12	0	85	169
Quiha Hospital	0	0	14	60
Ayder Hospital	140	134	216	325
Mekelle Hospital	147	161	108	117
Lemlem Karl Hospital	239	75	53	56
Mekoni Hospital	47	58	72	176
Total	**600 (Before the war)**		**1,351 (After the war)**	

Source: Health Management Information System Reports (2022)

Communicable diseases among children under five

Due to the interruption of immunisation services in primary healthcare facilities, the prevalence of infectious diseases among under five-year-old infants increased: pneumonia, diarrhoea, and

sepsis were frequently identified, while malaria, dermatosis and measles were also mentioned by a few informants. In addition, care providers working at the neonatal intensive care unit also specified congenital abnormalities, prematurity, low birth weight and hypothermia as being the most common complications among children aged one month (28 days) and below. A care provider from Adigrat Hospital and a nutrition expert in the School of Public Health (Mekelle University) specified upper respiratory tract infection as the most frequently reported illness among children aged less than five years followed by diarrhoeal diseases. A nutrition expert also stated the following:

> *According to my observations during field visits, there is increasing number of children infected by water-borne diseases related to poor hygiene and sanitation. The sanitation facilities were looted and damaged during the war and access to safe water is limited. Consequently, diarrhoea is on the rise to the level of outbreak, which has led to the sickness and death of children.* (Interviewee 2022, interview by Znabu H Kahsay, face-to-face, 12 July 2022)

Medical complications were commonly reported among children admitted to the hospital with undernutrition, which is consistent with the bidirectional effect of undernutrition on complications among children.

Undernutrition among children of mothers with war-related mental health problems

Participants mentioned that the war in Tigray also created critical war-related stress factors on children under five from mothers who experienced mental health problems. Being victims of rape during the war in Tigray, psychological trauma related to bombardments, stress concerning a family member who joined military service, and other stresses related to the ongoing war were specified as reasons for mental health problems among mothers (Kidanu & Van Reisen, 2024; Kidanu & Tefera, 2024). The review of available evidence on gender-based violence in the war in Tigray shows that more than 22,000 women and girls had been reported as survivors of rape since the war commenced (Tigray Regional Bureau of Health, 2022).

Consequently, depression and anxiety among mothers in Tigray has reduced their ability to care for and feed their children. A mother shared her experience as follows:

> *I was pregnant when the Ethiopian defence force arrived in our area. They were bombing everything […]. I heard a heavy explosive near my home while I was sleeping, as I am suffering from morning sickness. I saw many of our neighbours die and those remained were running out of their homes. Instead of running with them, I froze and sat there. Since that event, I have not been able to be myself.* (Interviewee 2024, interviewee with Znabu H Kahsay, face-to-face, 2 July 2022)

A mother with a child who had been admitted to hospital for severe acute malnutrition reported that women in Tigray, in general, are experiencing a stressful situation due to the ongoing war, which is especially so for women whose husbands or other family members have joined the military service. They lack the support they are used to in feeding and caring for their children and family.

Related to these situations, care providers also frequently mentioned that the psychological distress and anxiety related to the war and food shortages affected the initiation and continuation of breastfeeding. A public health expert said that he knows mothers who had attempted suicide after being raped and, subsequently, became pregnant. It was indicated that mothers who are rape survivor tend to be less willing to breastfeed their new-borns. Meanwhile, some new-borns from rape survivors were abandoned at hospitals and in the community. A nurse working in the neonatal intensive care unit shared the following on how war-led anxiety created serious problems in caring and feeding new-borns:

> *Soon after the war started, there were five children admitted to this hospital who were found unattended by mothers. Three of them were found in open fields in the community and two mothers who were rape survivors abandoned their children, because they were not willing to feed their child due to the mental trauma they were experiencing related to the rape.* (Interviewee 2022, interview by Znabu H Kahsay, face-to-face, 12 July 2022)

A mother also shared the following about the stress related to food insecurity as:

> *The care providers always tell me that I should not be anxious about food insecurity, as it affects my breastmilk production. However, how could I forget for a while that there is no mouthful of food at home to eat for myself and my children?* (Interviewee 2023, interview by Znabu H Kahsay, face-to-face, 2 July 2022)

The delayed initiation or discontinuation of breastfeeding has put children in Tigray at greater risk of undernutrition. This is a concern that in part stems from the trauma experienced by the mothers.

Discussion

The connection between war and child undernutrition is well established (Dahab *et al.*, 2020; Malik *et al.*, 2021), as children under five are dependent on their caregivers to meet their nutritional and energy needs. War exerts substantial pressure on the ability of families to meet these needs, reducing food intake and care, which hampers children's growth and development. In countries like Ethiopia, which already have a high prevalence of undernutrition, conflict and war considerably worsen the magnitude of undernutrition and its negative health consequences. Furthermore, the 2023 decision of the United States Agency for International Development (USAID) and United Nations World Food Programme (WFP) to stop all food aid to Ethiopia, including Tigray, due to alleged misappropriation of food aid may have added vulnerability to malnutrition (The Guardian, 2023; Associated Press, 2023).

Tigray is one of the regions in Ethiopia with a high prevalence of acute and chronic malnutrition (stunting) (Mulugeta *et al.*, 2019; EPHI & ICF, 2019), and the food shortages associated with the war in Tigray and the siege have, and will continue to, impact on the nutritional status of children under five. Evidence shows that the prevalence of severe acute malnutrition in Tigray tripled, from 9% before the war in 2019 (EPHI & ICF, 2019) to 28% in 2021 (Mulugeta & Gebregziabher, 2021). According to the Integrated Food Security phase classification, such a sharp increase in severe acute malnutrition is often a precursor to catastrophic famine (IPC Global Partners, 2021; Mulugeta & Gebregziabher, 2021). Not only is severe acute

malnutrition a major contributor to the death of children under five, it also results in long-term physical, cognitive and social impairment in survivors (Bwakura-Dangarembizi *et al.*, 2019). As the figures of severe acute malnutrition in Tigray are likely to be underreported, its prevalence may have crossed the 30% threshold for catastrophic famine.

As with wars elsewhere (Zurayk, 2013), the damage and destruction of agricultural assets in Tigray has exacerbated the risk of undernutrition among children under five. War is a main factor in disrupting the stability of food systems, affecting food from production and distribution to consumption, with considerable risk of undernutrition locally and globally. Armed conflict often leads to the destruction of crops, livestock, land, and water systems, as well as infrastructure.

Denying vulnerable segments of a population, such as children and IDPs, access to food during and after war contributes to undernutrition (Lafta *et al.*, 2017). During and after the war, IDPs from different parts of Tigray were gathered in and around urban centres, creating additional demand for food, water and sanitation, as well as healthcare. This aggravated the spread of COVID-19 and other communicable diseases. Although the war ended in November 2022, IDPs have not (as at time of writing) all been able to return to their homes and people living in areas under external forces have been denied access to humanitarian aid. Children of IDPs in Tigray have faced critical food shortages, leading to undernutrition, before and after arrival at IDP centres. In addition, mothers who temporarily reside in IDP centres are less likely to have adequate food intake, which can hamper breastmilk production and breastfeeding. The negative consequence of conflict-driven displacement on access to health services is also reported elsewhere (Malik *et al.*, 2021).

Another negative consequence of war on under five undernutrition is caused by damage to health infrastructure (Das *et al.*, 2020; Medhanyie *et al.*, 2024). The destruction and closure of a high number of health facilities, which are supposed to provide basic and indispensable services in primary healthcare, has worsen the negative health and nutritional outcomes for children. The war in Tigray, siege and

continued occupation of some areas have resulted in direct war-related damage to healthcare facilities, lack of healthcare providers, many of whom fled health facilities, and lack of and inadequate supply of drugs and medical equipment. This situation has prevented the Tigray Regional Health Bureau from resuming healthcare services in many areas that are still under Eretria and Amhara forces. At the time when severe acute malnutrition was prevalent, a substantial proportion of displaced people from Western Tigray continued to live in IDP centres. This has made it difficult for pregnant and lactating mothers to access healthcare. The reduction in human resources and shortage of medical supplies has affected the provision of basic services, including antenatal care, skilled birth attendants, and immunisation services.

Due to the bidirectional effect of infection and undernutrition, the situation in Tigray has put children under five at high risk of infection of vaccine preventable diseases and undernutrition. The literature also indicates that deaths from disease and undernutrition often account for a higher share of total deaths in (and directly after) a war than direct violent deaths (Guha-Sapir & D'Aoust, 2011), as the negative health consequences increase if initiatives for the restoration of damaged health facilities are not implemented quickly. A previous study showed that after six months into the war, none of the 712 health posts and 17.5% of health centres in Tigray were functional (Gesesew *et al.*, 2021). Consequently, child diseases and deaths in Tigray increased at an alarming rate.

The preliminary results of a maternal and child autopsy study from Tigray shows that under-five mortality has increased twofold since the war, while neonatal mortality has increased fourfold. The severe acute malnutrition report found that the maternal mortality rate has relapsed back to where it was 22 years ago, to 840 per 100,000 women who give birth. Immediately before the war, the rate was estimated to be 186 in 2019 and increased to 840 in 2022 (Tigray Regional Health Bureau, 2022). A study from Pakistan also highlighted the specific consequences of war on the healthcare system in general and mainly the lagging behind of antenatal care, skilled birth attendants, and infant and young children feeding services (Das *et al.*, 2020). As

primary healthcare services are a basic and indispensable intervention for the health and nutrition of children under five, ensuring access to these services demands further initiatives by governments and humanitarian organisations.

The current study also found that there is a greater risk of undernutrition among children under five who have traumatised or psychologically stressed mothers, which is not reflected in the theoretical framework. A mother's psychological distress from experiencing sexual and other violence during the war, as well as the uncertainty around access to food for themselves and their children, considerably affects their child's nutritional status. More specifically, infants and young children who are dependent on breastfeeding suffer from inadequate breast milk caused by stress and lack of food intake for mothers, either temporally or permanently. In line with the current study, previous studies also indicate that caregivers from food insecure households are more likely to fail to sustain exclusive breastfeeding, in comparison to their counterparts (Frazier *et al.*, 2021; Orr *et al.*, 2018). Mothers who are survivors of rape and suffering from psychological distress were also reported to be unable to provide the necessary care for their children, hence, affected their nutritional status. The mental health status of caregivers affects their feeding practices of their children. Evidence from a review of studies in countries experiencing conflict indicates that caregivers' feeding practices for children tend to be suboptimal during times of conflict, which is attributed to displacement, stress and maternal undernutrition caused by the conflict (Rabbani *et al.*, 2020).

Implication of findings for Sustainable Development Goals

According to a report by Global Hunger Index, achieving zero hunger by 2030 is becoming distant for many countries and it predicts that 47 countries will fail to achieve the SDG 2, resulting in the world as a whole not achieving the target (zero hunger by 2030) (Von Grebmer *et al.*, 2021). Protracted wars, such as the ongoing war in Ukraine (FAO, 2022; United Nations, 2022b) and the war in Tigray, make it even more unlikely that we will reach the SDGs, especially targets that are directly or indirectly related to food security. The data collected for the current study shows clear evidence of the negative

consequences of the war in Tigray on undernutrition among children under five. The findings underline that the war in Tigray, as well as ongoing wars elsewhere, are undermining efforts to meet the SDG targets at national and international levels.

Implication of findings for using hunger as weapon of war

The use of starvation as a weapon of war is a grave concern (Von Grebmer *et al.*, 2021; Welthungerhilfe, 2020; Save the Children, 2018). The pathways to undernutrition in the current study show that the massive displacement of people, destruction and looting of agricultural products, and blockage of access to basic health services all amount to the use of starvation as a weapon of war. However, further studies should be undertaken to substantiate this claim. It is important to note that some aspects of the siege have lingered in Tigray and basic services have not been fully restored. Communication services have also not fully resumed in all areas of Tigray, and humanitarian access has been denied to areas still occupied by Eritrean forces, and Amhara forces, which have not yet left Tigray, as per the Cessation of Hostilities Agreement signed in Pretoria on 2 November 2022. United Nations Security Council Resolution 2417 in 2018 stipulated that using deliberate hunger as a method of war and blocking the delivery of humanitarian aid is a war crime (Security Council Resolution 2417, 2018).

Limitations of study

The ability to furnish live and contextualised data about the effect of the war is crucial, so as not to miss an important element. This study was able to collect data while the war was taking place, which sets it apart from most the studies, which are usually conducted after war and armed conflicts have happened.

However, the study has the following limitation. Firstly, the consequences investigated were limited to the immediate and short-term consequences of the war in Tigray, focusing on severe acute malnutrition in children under five as a proxy for undernutrition. The long-term impacts of the war on under five years children who have suffered undernutrition, including cognitive impairment and decreases in learning capacity, as well as the economic burden linked

to these, have not been addressed. Secondly, only internal displacement was considered in the current study, while the negative consequences could be worse in the case of war-led displacement that crosses state and federal borders. Thirdly, the figures from health facility reports should be used cautiously, as the percentages could be underestimated for two reasons: the hospitals included in the study do not always admit all children in need of care and treatment because of the shortage of medical supplies, and only children of parents who have access to transportation and can afford to cover transportation expenses are likely to seek care and treatment at health facilities.

Conclusions

This study aimed to understand the impact of the war in Tigray on undernutrition among children under five in Tigray regional state, Ethiopia. The study used severe acute malnutrition as a proxy for malnutrition and applied the theoretical framework of Guha-Sapir and Van Panhuis (2002) to explore the pathways of the impacts of the war on undernutrition. The study found that war-induced severe acute malnutrition is evident among children aged under five in Tigray. The food shortages in Tigray can be directly attributed to war-related damage to agriculture, which, combined with damage to healthcare infrastructure and massive displacement, have substantially increased undernutrition in the state. The study found that the displacement of people, the destruction of agricultural products, and damage to healthcare infrastructure were the pathways to the crisis.

A greater risk of severe acute malnutrition was reported among children from displaced families, who are especially prone to severe acute malnutrition; children with parents who are government employees, as their salaries have been cut; and children whose mothers have suffered psychological stress due to the war. While food shortage was found to be an immediate factor causing undernutrition due to the war in Tigray, it was also accompanied by other aggravating factors, including lack of clean water and sanitation and limited access to primary healthcare (such as skilled birth attendants and immunisation).

The blanket food shortages in Tigray are yielding a new normal for children aged less than six months, who are being admitted and readmitted to health facilities for severe acute malnutrition. The risk of severe acute malnutrition is endangering millions of children under five in Tigray, including children from urban areas and of government employees. In addition, the mental health problems faced by mothers who are survivors of rape or other war-related trauma are further increasing the risk of undernutrition among children under five in Tigray.

Reconstructing damaged health facilities to ensure access to basic healthcare services and supporting displaced caregivers and rape survivors is necessary to address child undernutrition in Tigray. This situation calls for more food security resilient programmes, which links to immediate relief interventions to support long-term sustainable agricultural growth. Food supplements must be brought to meet the nutritional demands of children under five. This is urgently needed to avert the ongoing catastrophic situation in Tigray.

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Authors' contributions

This chapter is conducted in the framework of a PhD research. Znabu Hadush Kahsay is the primary author, he designed the study, set up the theoretical and methodological framework, carried out the data collection and analysis and wrote and reviewed the different versions of the chapter. Araya Abrha Medhanyie is the second author participated in designing the data collection tools, guiding the data collection and analysis. In addition, he critically reviewed the first and second drafts of the book chapter. Finally, he reviewed and approved the final draft of the book chapter.

Ethical considerations

Approval of the study was secured from the ethical review committee of College of Health Sciences, Mekelle University (Notification of Protocol Approval: MU-IRB 1985/2022). A letter of cooperation was sought from the management body of the respective health facilities to extract data from medical review. Data owners of previous reports were acknowledged and consulted for re-use of the available data. Consent was sought from key informants after explaining the purpose and confidentiality of the study. This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Chapter 8

Sexual Vulnerability, Sexual Violence, and Reproductive Health of Adolescents Girls and Young Women in Internally Displaced Persons (IDPs) Camps

M. M. Abrha & Mirjam Van Reisen

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A fire covered in ashes looks as if it is extinguished.

Abstract

This study investigated the impact of war on female adolescents and youth in Tigray, focusing on intrapersonal, interpersonal, and institutional levels using constructs from the social ecological model of health and the theory of planned behaviour. Conducted during the Tigray war in 2020, the study used in-depth qualitative research to validate these constructs, finding them useful for analysing data and explaining the prevention and utilisation of health services by female youth in wartime. The research highlights the dire conditions in which displaced youth and adolescents in Tigray lived during the war, including food and resource shortages, forced sexual relationships, and poor sexual and reproductive health conditions. These conditions, in turn, lead to poor sexual and reproductive health outcomes for youth and adolescents, including unwanted pregnancies, sexual transmitted diseases, and unsafe abortions. The study emphasised the need for integrated services to address food insecurity, famine, and financial challenges to improve sexual and reproductive health for youth and adolescents.

Keywords: Tigray war, sexual and reproductive health, healthcare, social ecological model of health, IDPs, Ethiopia

Introduction

War is associated with unsafe sexual and reproductive health outcomes (McGinn, 2000; Hedström & Herder, 2023). Displacement, military activity, economic disruption, psychological stresses, caused by war, may increase the risk of the population's exposure to sexually transmitted infections (Zwi & Cabral, 1991). Inconsistent condom use among sexually active adolescents, unwanted pregnancies, and sexual violence were common in refugee camps (Ivanova *et al.*, 2019; Ivanova *et al.*, 2018). Sexual violence and killings were also reported in a study in Nigeria (Marlow *et al.*, 2021) where the Boko Haram insurgency made young people flee their homes. Complications of unsafe abortion including death have been reported in a study in Nigeria (Marlow *et al.*, 2021) where young women took abortion pills, metronidazole, Flagyl, and salt to induce an abortion. On a similar note, adolescent girls living in refugee camps in Congo were reported to be having transactional sex in exchange for money (Harrison *et al.*, 2009) and other such gifts.

The 2020–2022 conflict in northern Ethiopia's region Tigray has resulted in the internal displacement of 2.6 million people (UNHCR, 2022). The United Nations High Commissioner for Refugees (UNHCR) reports 7 internally displaced people (IDP) sites in Mekelle, with an estimated 52,000 IDPs present (EEPA, 2021, SR 88). Tigray has been under a complete siege and in a communication blackout from the start of the war in November 2020 up to the Cessation of Hostilities Agreement signed in November 2022. The war in Tigray has destroyed health facilities and disrupted healthcare services such as maternal and child health services (Gesesew *et al.*, 2021, Medhanyie *et al.*, 2024; Niguse *et al.*, 2024). However, there is scarce information about young women and adolescents who have been displaced due to the war. This study investigated the following research question: *What were the increased risks to the sexual and reproductive health of adolescents and youth during the war in Tigray?*

Methodology

This qualitative explorative study explored the sexual and reproductive health challenges faced by female youth and adolescents in Tigray. The study was conducted in the one Care IDP camp, called Mizer Sub-city located in Mekelle, the capital of the Tigray region, in June 2020.

Participants

Source population: The source population for the study are all female youth and adolescents in Tigray who have been affected by the war. The respondents were adolescents and youth aged 17-22 who were displaced from their hometowns after the war broke out in Tigray in November 2020.

Study participants: Female adolescents and youth who have been exposed to any sexual and reproductive health problem in internally displaced people camps and sexual and reproductive health clinics.

The study followed a snowball sampling technique, which was based on recommendations from the contacted participants. The participants were selected by community mobilisers who were working close to them. The selected female adolescents and youth were willing to participate. After identifying the initial case, the next one was recommended by the initial participant.

Sampling for the study was six in-depth interviews and two key informant interviews. The study explored the situation based on these interviews to serve as a pilot for further research.

The six in-depth interviews were conducted with the female youth and adolescents and the two key informant interviews with female community mobilisers who are working on the issue of sexual and reproductive health at the camp.

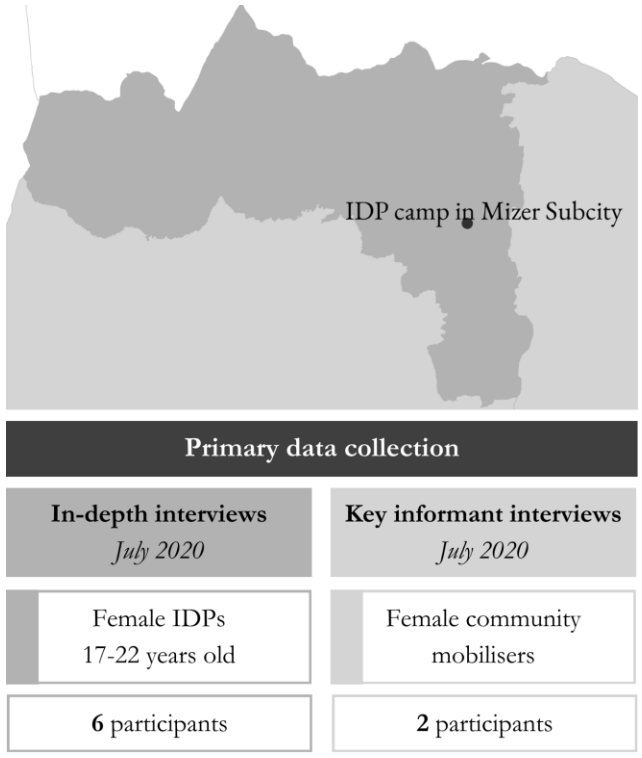

Figure 8.1. Overview of data collected and used in the study

The six female adolescents and youth were interviewed face-to-face for the in-depth interviews and two community mobilisers were interviewed for the key informant interviews. The interviews were conducted by the principal researcher. The interviews were conducted inside the IDP camp in the homes of the study participants, which was a safe place for the participants. The interviews were conducted in the natural setting of the participants and were done in a quiet private context.

Data collection tool and procedure

Qualitative data was collected using interview guides with semi-structured and open-ended questions for both the in-depth interviews and the key informant's interviews separately. Given the sensitivity of the topic, the researcher focused on creating trust and ensuring that the respondents were confident not to be judged. The researcher created a space in which the respondents were able to speak freely and narrate their situation.

Data was collected from each participant after providing verbal informed consent and was conducted by the principal investigator. In cases where interviewees were minors additional consent was obtained from the adult caretakers. Data was collected and recorded with an audio tape after obtaining consent from the participants. The interviews were of 25-40 minutes duration each.

Data quality assurance

Data was collected using a semi-structured interview guide which was prepared in English and then translated into the local language Tigrinya. It was then translated back into English to ensure consistency. Data quality was ensured by the active engagement of the principal investigator throughout the whole process of the research work from preparing the interview guide, collection of data, analysis, and write-up. The principal investigator conducted the interviews and also took notes. Contents of the interviews were summarised before participants left and were verbally explained to enable them to comment or make any corrections, this is to form trustworthiness. Triangulation of the contents of the transcripts and field notes, the observation, and field notes were done to check the credibility of the information.

Data management and analysis

Recorded audio of the qualitative data interviews was repeatedly heard by the principal investigator and then transcribed and translated into English language. The translated transcript was coded into themes according to the content, categorised, and organised by content with thematic analysis using Atlas.ti software. The data was thematically analysed using a back-and-forth review of the transcripts.

Social ecological model of health and theory of planned behaviour

The study distinguishes intrapersonal (individual), interpersonal (group), and community levels of engagement (the environment) (CDC, 2002). The model emphasises that individual health is affected by the interaction between the individual, the groups to which the individual connects, as well as the broader community and

institutional environment within the broader range of ecological, physical, social, and political aspects of the environment (Salihu *et al.*, 2015).

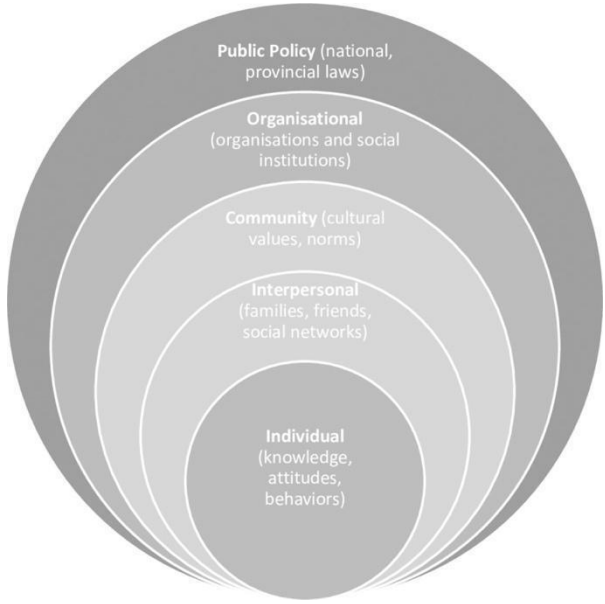

Figure 8.2. Socio ecological model and theory of planned behaviour
Source: Ngwenya *et al.* (2020)

The social ecological model (SEM) of Health is not dissimilar from the concepts of the theory of planned behaviour (TPB), distinguishing between attitudes, perceived social norms (the intrapersonal level) and the perceived behavioural control (factors that the individual cannot influence but which determine aspects of behaviour in the broader environment of the individual) (Ajzen, 1985; 2006).

Ngenwya *et al.* (2020) discussed young people's health service utilisation based on the number of youths accessing a facility, using a combination of the concepts of SEM and TPB (see Figure 8.2). This study advances their research in the validity of using these constructs in a model that links to different levels of SEM. This would shed additional understanding of the combined use of the SEM level and

TPB constructs, and the validity of using these in an African setting with its unique cultural set-up, and, in this study, in a war setting. This research builds on the findings of health service utilisation by Ngenwya (2020) which was carried out in South Africa.

Findings

The findings were first linked to the three levels distinguished in SEM, and within these levels, specific themes were identified.

Intrapersonal level

The findings show that the respondents have been separated from their parents and their families, though sometimes still being in charge of their younger siblings. They fled in fear of the heavy shelling near where they lived and left their homes by running and walking on foot. The narratives revealed the circumstances that were changing sexual and reproductive health behaviour at an individual level and the feelings surrounding these.

Forced displacement and trauma

Many of the respondents had a stable and calm life back home prior to the war. They lived with their families in peace and went to school, did business, and worked as teachers. But after the Tigray war broke out and attacks were coming their way, everyone had to flee without knowing where to go.

On the road from their hometowns to Mekelle, the respondents witnessed lots of civilian causalities due to the shelling and passed by many dead bodies lying in the streets. As most of the respondents reported, their journey from their hometowns to Mekelle was full of challenges. These challenges included being separated from their parents or caregivers, witnessing killings and rapes, going hungry for days, not having a change of cloth, going on foot for days, abductions of young people, and seeing many dead bodies on their way. On their journey from their hometown, they would stop at multiple towns to rest and sleep hiding in the bushes. Parents and children were separated. Since transportation was very costly, communication was not possible, and as they did not have any money at hand, they would walk for days, ending up with sore feet. While fleeing, the respondents

said that they found themselves in the middle of a war zone, saw lots of dead bodies and escaped a lot of heavy shelling and explosions. The memories of the journey were very traumatising:

> *I had never seen that many dead bodies in one place in my whole life. People were dying everywhere. They were women that were raped and gang raped and some were raped and killed.* (Interviewee 7, community mobiliser, interview by Mehari, face-to-face, 11 July 2020)

When they arrived in Mekelle many respondents were without a familiar supporting network. The context of the displacement and the displacement itself was traumatising. The uncertainty and traumatic nature of their situation created a circumstance for risky sexual and reproductive health behaviour. The negative feelings associated with the adverse circumstances account for the diminished value attached to beliefs associated with attitudes towards sexual and reproductive health. The feelings associated with the behaviour were a sense of despair, fear of not be able to survive or provide for loved ones in the care of the respondent, and a sense that other problems were of higher priority than the risks associated with sexual and reproductive health.

Unwanted pregnancy

Most of the respondents were unmarried young adolescents and encountered unwanted pregnancies, many of which occurred the first time a respondent had sex. They lived alone or with their younger siblings inside the camps. The reasons for the unwanted pregnancies were unplanned sex, lack of family planning medications (contraceptives) inside the camp clinics, condom tearing during sex, older men promising to provide them food and shelter, and some young women getting pregnant just to get food aid:

> *After coming to the IDP camp things got worse. The food aid that comes targets pregnant and lactating women. There weren't any benefits coming for younger girls. So some young women would get pregnant just to get food aid.* (Interviewee 7, female community mobiliser, interview by Mehari, face-to-face, 11 July 2020)

Some of the respondents who encountered unwanted pregnancy claimed that they went to the camp clinics to get contraceptives but

there was no contraceptive at that time in the clinic and they had to return home without getting contraceptives. A 17-year-old adolescent who got pregnant in one sexual encounter with her boyfriend, stated that she became pregnant due to lack of contraceptives:

> *I was a virgin and we only had sex once; my boyfriend left after that and after five months I found out that I was pregnant.* (Interviewee 3, interview by Mehari, face-to-face, 11 July 2020)

Other respondents were living with their partners and by the time the contraceptives were availed at the clinic they found out that they were already pregnant.

> *I have a boyfriend and we were living together. I had promised myself that I would have a child once normalcy returned and I went home to my family. I was using a contraceptive, but it was already past its working time then I suddenly got pregnant because there were no contraceptives in the camp clinic. By the time I went to get contraceptives another time I had a pregnancy test first and it was positive.* (Interviewee 4, interview by Mehari, face-to-face, 11 July 2020)

The unwanted pregnancies in an environment where the adolescents and young women were lacking support, exacerbated their problems.

> *Most of the young women who got pregnant do not know they could get pregnant and they do not pay much attention. They are around 16 or 17 years of age.* (Interviewee 8, interview by Mehari, community mobiliser, face-to-face, 11 July 2020)

The scarcity of food and livelihood, the responsibilities for siblings and other younger children, were now compounded with a pregnancy and the care for a newborn baby.

Transactional sex – sex work for survival

Sex for survival is sex that offers a benefit or 'transaction' to the person offering sex. This is usually carried out in a circumstance where there is little if any protection and needs are high and securing necessities is difficult to achieve.

A 22-year-old female respondent said that after being displaced from her hometown, she had severe financial problems. She said back home she owned a business and was a married woman. After the war broke out, she lost everything she owned. She did not have any idea

about the whereabouts of her husband. Losing everything and being displaced led her mother to become ill.

Her 2-year-old son was diagnosed with a heart problem. Her son required frequent and long hospitalisation and he needed medications. She was buying the medicines from private pharmacies for a high price. She said that she could not afford the medications and treatments required for her son and for her sick mother simultaneously.

In order to meet these pressing demands, she felt that the only solution was to have sex for money with different men. She recalls how this started when she was renting a house, because she could not live in the camp with her sick son and sick mother. However, she could not afford to pay the house rent, she stayed with one man for two days, and he then paid the rent. Then she would go with any man who asked her for sex as long as he paid her money. This happened whenever she needed money, but she said that she does not do this regularly. She would get some money and she would use that money to meet expenses for the treatment of her child and her mother.

> *After my son was diagnosed with a heart defect, he was getting sick repeatedly and he needed a lot of medication and treatment, we also had money problems and we would go hungry. I could not afford the expenses and I had no choice. As long as I got money, I would go out with any man whether in the camp or outside the camp. I did not have the luxury to choose.* (Interviewee 6, interview by Mehari, face-to-face, 11 July 2020)

Even though this female respondent originally had a good livelihood, transactional sex for survival was used as a temporary way out, to face the combination of adverse circumstances, which she could no longer address during the war.

Having sex with different men led to her having symptoms like, a foul-smelling discharge, itching, genital soreness and pain, and bleeding during sex, and she was diagnosed with a sexually transmitted infection. She has been treated for sexually transmitted infection in the camp clinic. She took injections, vaginal tabs, and pills and she recovered. However, she still has pain and is still bleeding

whenever she engages in sexual intercourse. She went to a referral hospital and she was treated another time.

The respondent said that she is afraid to be screened for HIV/AIDS. She is afraid that she might have the infection and that she would not know what to do with her life:

> *I know that the screening for HIV/AIDS is free. However, I do not want to be checked in case I have an infection.* (Interviewee 6, interview by Mehari, face-to-face, 11 July 2020)

Engaging in risky sexual behaviour such as transactional sex led to acquiring sexually transmitted infections and fear of a routine check-up on her HIV/AIDS status.

Young girls living inside the camp encounter unwanted pregnancies and seek different types of abortion. Some of them go to government hospitals and some to private clinics. Some even try traditional means to terminate pregnancy. A young girl found out she was pregnant and her boyfriend said that the pregnancy was not his. Then she drank bleach to terminate the pregnancy. However, the community helped her to go to a referral hospital because the camp clinic was out of medication and she then had an abortion in the referral hospital.

A female youth who does sex work for survival claimed that she would go with men for money and other benefits. She said that she had an occasion where a condom was torn in the middle of sex. Later she found out that she was pregnant. She needed to have an abortion at a government hospital.

> *When I was doing this job, I had an occasion where a condom burst in the middle of sex (crying) and I got pregnant. I had an abortion. After that, I was having heavy periods for about four months. I was referred to Ayder Specialized Hospital and I am taking my medications now.* (Interviewee 4, interview by Mehari, face-to-face, 11 July 2020)

Abortion was one of the reproductive health problems encountered by the young women living in the camp. Unsafe abortion was also reported as some of the young women tried to terminate pregnancy using bleach.

A respondent who does sex work for money also said that she encountered sexual, physical violence, and verbal abuse from the men she has sex with. She said that they would agree for one time and they would refuse to give her money unless she agreed for another round. The only choice she had to get the money was to agree to have sex without her will. She would hurt during sex and she would tell the men to stop but they insult her, slap her, and assault her for asking that. She said that the men have no mercy on her:

> *The men hit me sometimes. For instance, if I have pain during sex and if I ask them to stop. They slapped me and hit me. In addition, I have no choice but to go home.* (Interviewee 6, interview by Mehari, face-to-face, 11 July 2020)

Disrespect, insults, slaps, and threats were some of the problems encountered in the context of engaging in transactional sex for survival. The respondent claimed that she was treated badly because those men were paying her for sex.

Within the uncertainty of the situation and the insecure livelihoods, youth and adolescents opt for transactional sex to survive in the difficult circumstances they face. This leads to unwanted pregnancies, need for abortions which provide further health risks, and they also experience physical, verbal, and sexual violence. The violence experienced as a consequence of the war, translates to violence at an individual level affecting sexual and reproductive health. The respondents felt diminished and faced a lack of confidence in their ability to cope with the situation in which they felt divorced from support mechanisms.

Interpersonal level: Lack of support, discrimination and mental health challenges

Being a young single mother, being a teen and pregnant, and being a caregiver at a young age makes it hard to take care of a baby as well as themselves.

> *I fled home when the shelling started. I left with two friends and I had my baby with me. My parents were living in another town and they fled later. On the road, there was hunger, thirst, not having clothes to change and so many problems.* (Interviewee 6, interview by Mehari, face-to-face, 11 July 2020)

Some of them had to support their younger siblings on top of that. This led to going hungry for days, not having clothes, not having food on the table and not being able to buy medications when they were sick. A 17-year-old pregnant female narrated that her boyfriend broke up with her after the pregnancy happened. She had her two young sisters living with her. She said that she was sad when she found out that she was pregnant because her parents were not with her. They fled to a neighbouring country after the war broke out. She was vomiting and experienced severe nausea and morning sickness during the first four months and she did not have enough food to eat at home. The food she ate was wheat that was given as food aid. Then she became anaemic. She received iron supplements from the camp clinic that was run by a local Non-Governmental Organisation (NGO):

> *I would have been happy if my parents were with me. (crying) I felt really sad when I found out I was pregnant.* (Interviewee 1, interview by Mehari, face-to-face, 11 July 2020)

Being far away from home, lacking parental support and living in an IDP camp while not having enough food on the table was very hard. Being an unaccompanied adolescent pregnant girl becoming a single mother was a very difficult situation. Being young and pregnant, having a boyfriend at a young age, and doing sex work for survival, subject the young women to judgment, pointed fingers, and discrimination from the community in which they live. Having sex at a young age can be considered a sign of promiscuity by the community. The community mobiliser told the story of a young pregnant girl who cried continuously for being pregnant and being away from her family. She claimed that she wanted to help her wash her, do her hair, and provide her emotional support but some women were blaming the young girl for sleeping around and getting pregnant:

> *She wouldn't listen to us when we told her. She should have kept put. She was sleeping around and it's only her fault that she got pregnant, said the woman.* (Interviewee 7, community mobiliser, interview by Mehari, face-to-face, 11 July 2020)

The community mobiliser helped young women who encounter pregnancy by linking them to clinics and professionals for care and support. She also mobilised the community to provide emotional support for the girls. But she said that sometimes some people judged the young women and blamed them for being pregnant. A respondent who carried out sex work for money said that she felt very shy in her community and that she was scared that they may find out what she does for survival. She was worried about being frowned upon:

> *I don't feel confident while living here. I am afraid that people might find out what I do.* (Interviewee 6, interview by Mehari, face-to-face, 11 July 2020)

The norms of the community towards the sexual behaviour of the young women, resulting in societal judgment and leading to negative attitudes and behaviour of community members, unsupportive comments toward the young women who were engaged in risky sexual behaviours created conflicts in the minds of the victims.

The respondents of the study say they are subjected to a lot of emotional distress and worry because of their sexual and reproductive health problems. They worry about what to eat, how to care for the infants, how to face their communities' judgment, and how to care for their young siblings when to return home to their families:

> *I didn't want to get pregnant. But I found out I was pregnant. I wasn't able to take care of myself and the idea of adding a baby made me have suicidal ideations. But then my husband told me it was okay.* (Interviewee 3, interview by Mehari, face-to-face, 11 July 2020)

The respondents of the study faced difficulties in taking care of themselves, their younger siblings, and their children. Having to live away from family support and being unable to go to school or play with their peers created psychological distress and negative impacts on their mental health.

They feel their priority is to survive and that the sexual behaviour and challenges are the results of the circumstances they are in. They fear negative appreciation by the people around them while lacking support from the people whom they care about. This feeds loneliness and indifference and the sense that their situation clashes with what is expected of them from the people living around them. The study

suggests that lack of support caused psychological distress, mental health problems and thoughts of suicide among the participants of the study.

Institutional level: Living conditions

After they arrived in Mekelle the female adolescents and youth - who participated in this study, settled in an internally displaced peoples' camp in a school setting. They reported that they lived in a classroom full of people, of around 40-60 people. Men and women were sleeping in one room. The host community was very generous and helped the people in the IDP camp with food, clothes, and sanitary materials.

At the time of the research, the adolescents and youth had been relocated to another camp and had the freedom to live in separate shelters. They reported that they had more freedom as opposed to their initial shelters. But they claim that they live far from the host community and that they receive minimum support now. Since they live alone people don't share food, drinks or clothes anymore and they would get hungry and they would feel lonely. There is a problem with the shelters since they are made with temporary materials. There would be flooding into the shelters and they get cold and children get sick.

Security problems

While living in the IDP camps there were security issues with people from the host community and from the IDP fighting and some people trying to steal jewellery and money. Some of the respondents claimed that they felt uncomfortable sleeping alongside strange men and reported that they felt inappropriate touching while others reported that they heard and saw some drunk men rape young women inside the camp. A participant from the in-depth interviews claims the following.

> *Men and women slept in one room together and due to that there were problems because girls were being raped inside the camp; those survivors of rape were given health education and counselling, but I don't think those who committed the violence were caught.* (Interviewee 1, interview by Mehari, face-to-face, 11 July 2020)

While another participant added that sleeping arrangements caused inappropriate touching from men:

> *With men and women sleeping in one room, there were problems like unwanted and inappropriate touching, adult men luring very young women into sex with money, and a lot of rape cases of young women.* (Interviewee 6, interview by Mehari, face-to-face, 11 July 2020)

The respondents who fled their hometowns in fear of violence and heavy shelling had to live in a school compound in Mekelle. Since there were a lot of people the living conditions were exposed to different security problems.

Interrupted health services in the camp

The findings show that there was some health service provided in the camp and there were also referral linkages to health facilities outside the camp. The respondents of the in-depth interviews claimed that they had gone to the clinics inside the camps in need of antenatal care, family planning, and treatment of sexually transmitted infections. They also went to other higher government and private health facilities for delivery, child immunisation, cervical cancer screening, and abortion.

Despite the existence of health services and health education in the camp, there were interruptions of medications and medical supplies. The respondents of the in-depth interviews claim that they encountered unwanted pregnancy because there was no contraceptive at the camp clinic and, they also had to go to private clinics at a higher price for laboratory services.

The community mobiliser claimed that some of the young women living inside the IDP camp felt too shy to go to the camp clinics for family planning services or condoms. They were afraid that they would be judged by the community and the health providers if they were seen getting a condom or a contraceptive. So, they would skip going to the health facilities for those services. Then they encounter unwanted pregnancy and abortions.

Discussion

This study explored the increased risks to sexual and reproductive health among youth and adolescents during the war in Tigray in an IDP camp in Mekelle, Tigray. It was found that unwanted pregnancy, sexually transmitted infections, abortion, and sex work for survival were some of the increased risks. The study assessed what problems were encountered at the individual, interpersonal, and institutional levels by youth and adolescents and that in turn affected their sexual and reproductive health. The participants in the study encountered different sexual and reproductive health problems. The problems that arose were associated with:

- unplanned sex
- lack of access to health facilities
- engaging in risky sexual behaviour
- sex for survival due to a financial problem and uncertain livelihoods, including hunger

Young women living IDP camps faced the emotional burden of responsibility for younger siblings, in the absence of parents or older caregivers, and were afraid that they would be unable to care for them due to famine and lack of various items essential for survival. This responsibilities, in circumstances of hardship, came on top of the traumatic events that they went through when fleeing from their place of origin and the continued traumatic situations of the war.

The respondents were focused on survival, but realised that lack of care for sexual and reproductive health was resulting in problems, exacerbating their difficult situation. The youth and adolescents reported many challenges, including unwanted pregnancy. The most common cause of pregnancy was unplanned sex followed by lack of access to contraceptives. Having casual and unplanned sex and not using a condom or contraceptive was also a cause of unwanted pregnancies in this study.

Studies in Ethiopia and the Democratic Republic of Congo found that unwanted pregnancies were common in refugee camps among adolescent girls and the cause was usually sexual violence (Ivanova *et al.*, 2018). The study in Congo indicated that around 70% of sexually

active female adolescents did not use condoms the first time they had sex and around half of them encountered unwanted pregnancies (Ivanova *et al.*, 2019). This is also reported in the current study, in which unwanted pregnancies were reported by some respondents the first time they had sex. The causes of unwanted pregnancies in the current study were unplanned sex, lack of access to contraceptives, and condom-breaking during a sexual encounter. The youth and adolescents in the current study reported that they wanted to use contraceptives to avoid unwanted pregnancies, but there was poor access to contraceptives in the camp clinic. Although it is encouraging that youth and adolescents wanted to use contraceptives, the war affected access to contraceptive methods.

The occurrence of unwanted pregnancy also led to abortion among young women. These abortion generally occurred in government hospitals using pills, which caused side effects. Another respondent drank bleach to terminate the pregnancy and later she was referred to a hospital due to complications. Complications of unsafe abortion, including death, have been reported in a study in Nigeria (Marlow *et al.*, 2021), where young women took abortion pills, metronidazole, Flagyl, or salt to induce an abortion. Similarly, in the current study, it was reported that young women who had unsafe abortions had complications and had to be referred to referral hospitals. This shows that unwanted pregnancies in young women may lead to abortion and in a difficult conflict setting, where abortion services are not provided inside the camp, young women may opt for unsafe abortions. Collaborative efforts to enhance access to safe abortion services at camp clinics should be sought to alleviate this problem.

The study found that the youth and adolescents faced a lot of challenges like hunger, saw corpses on the street, and witnessed killings and rape while fleeing from their hometown to Mekelle after the war broke out. These traumatic feelings informed their sense of desperation and negative feelings, leading to greater risk-taking behaviour.

Being unable to feed themselves and their family, having a sick child and family members with urgent needs, and living unsupported in poverty in a displacement camp led to the practice of sex work for

survival. Transactional sex (sex for survival) was defined as the exchange of money, gifts, or favours for sex. This was also reported in the study in Congo (Harrison *et al.*, 2009), where adolescent girls living in refugee camps were reported to be having transactional sex in exchange for money.

Sex for survival in the current study led to unwanted pregnancies, abortion, and sexually transmitted infections. This can increase the risk and vulnerability of those adolescents and youth being exposed to HIV and other sexually transmitted infections. The practice of transactional sex, having multiple sexual partners, and the occurrence of condoms tearing during sex has led to youth and adolescents acquiring sexually transmitted infections. Foul-smelling vaginal discharge, genital soreness and itching, pain, and bleeding during sex were reported as symptoms of sexually transmitted infection in this study.

After the Tigray war broke out female adolescents and youth and their families were forced to leave their hometowns due to heavy shelling. The war had effects at an interpersonal level, with participants encountering challenges, such as travelling on foot for days, separation from parents, hunger, security problems, sleeping, and hiding in bushes. This exposed youth and adolescents to rape, sleeping with older men for survival, having unplanned sex, as well as witnessing killings and abductions. Rapes and killings were also reported in a study in Nigeria (Marlow *et al.*, 2021) where the Boko Haram insurgency forced young people flee their homes. Young girls were reported to have witnessed killings and rape of their close family members and they also followed older men around and slept with them for money due to hunger. Displacement and disruptions of lives traumatised the respondents and led to many health challenges. On top if those challenges, participants were afraid of discrimination, and feared being negatively judged by the surrounding communities for the health and reproductive challenges they were facing. This induced a sense of inadequacy to fulfil the standards of the immediate community, a fear of being treated negatively, and a fear that they would not receive the respect they deserve as human beings.

At the institutional level, due to the war, health facilities were destroyed, and healthcare services such as maternal and child health services were disrupted. The study participants said that they were unable to obtain services at the camp clinic and had to go to private clinics for higher prices.

The problems that were encountered due to lack of contraceptives at the camp clinic resulted in unwanted pregnancies. This shows how problems at various levels are related, and that what happened at the institutional level influenced what happened at the intrapersonal level. This can be referred to as panarchy. The protection of health facilities in war zones and the provision of unhindered health services to adolescents should, therefore, be a key priority of humanitarian agencies.

For this explorative research, which used the SEM, distinguishing intrapersonal, interpersonal and institutional levels, was a useful starting point. It allowed the researcher to distinguish the problems that were identified in the interviews at each level. It also helped to determine the inter-relationship between these three levels.

This study confirmed the usefulness of combining the concepts of SEM and TPB, as proposed by Ngwenya *et al.*, 2020, with the adaptation that the institutional level focused on the control beliefs.

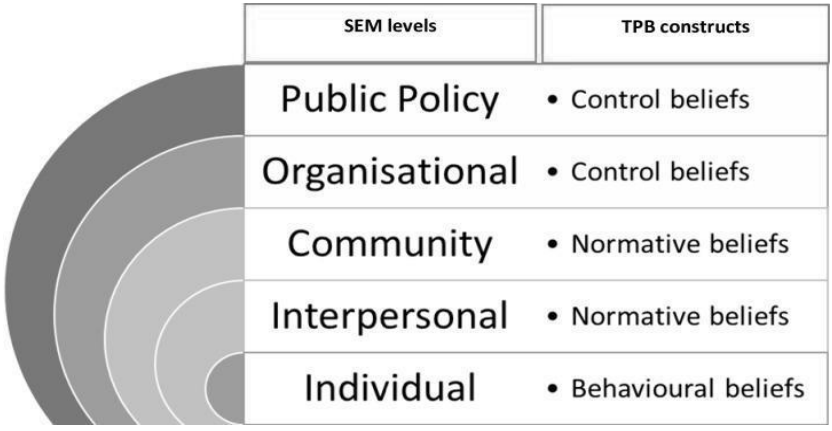

Figure 8.3. Constructs of SEM and TPB combined

Source: Ngwenya *et al.* (2020)

The matching of levels and constructs found in the current study was the following:

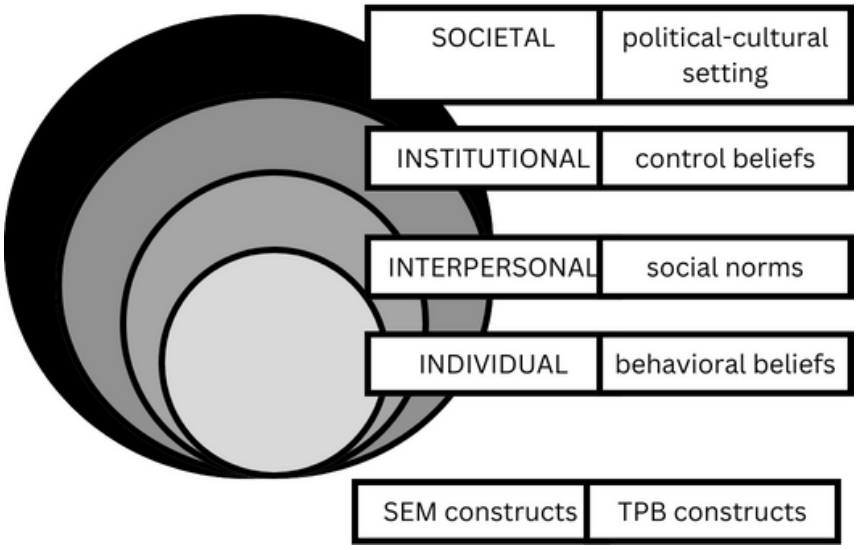

Figure 8.4. Matching of constructs of SEM and TPB

The study found that the individual level matched with the construct of attitude or behavioural beliefs from the TPB. The interoperation level matched the perceived social norms affecting individuals and the institutional level matched the perceived control, relating to enabling factors of behaviour. The importance of this finding is that it links the SEM to constructs predicting health behaviour. In addition, this research was carried out in a qualitative setting, an African cultural setting, and a war setting. The exploration of these constructs in this research found that it is valid for these combined settings. Further studies with larger sample sizes and diversity may be needed to address this further, particularly to explain the burning issue of poor sexual and reproductive health outcomes among female adolescents and youth living in IDP camps.

Conclusion

This study investigated the increased risks to the sexual and reproductive health of adolescents and youth during the war in Tigray. To do so it looked at what happened to female adolescents and youth at intrapersonal, interpersonal, and institutional levels, using the constructs of attitudes, perceived social norms and perceived behavioural control associated with these levels. The study was carried out in northern Ethiopia, using interviews carried out in 2020 during the war in Tigray.

The validity of the use of these constructs was confirmed across the SEM of health, which is not dissimilar from the concepts in the TPB in terms of levels and beliefs. The study tested the use of these theories in combination, in an emic explorative in-depth qualitative research, and within the specific circumstance of war in an African setting. It can be concluded that, for this small-scale study, the constructs were useful and helped in the analysis of the data. The constructs pointed to relationships with the social-ecological levels of analysis identified in SEM. Together, these concepts were found to hold explanatory power for the study in relation to the prevention and utilisation of health services by female youth in the situation of war, as studied in this research.

This study highlights the adverse conditions in which young IDP youth and adolescents lived during the Tigray war. The challenges were particularly related to food and resources. Due to family disruptions, lack of adequate health service access, hunger, and poverty, adolescents and young women in the IDP camp were forced into sexual relationships and transactional sex. These conditions in turn led to poor sexual and reproductive health outcomes for young women, including unwanted pregnancies, sexual transmitted diseases, and unsafe abortions.

The study explored the sexual and reproductive health challenges of young women, living in an IDP camp during a period of war. While some services were available, they were reported as not being enough to address the respondents' sexual and reproductive health needs. Collaborative and integrated services must address food insecurity,

safety, and financial insecurity these young women face, leading to sexual vulnerability and poor sexual and reproductive health outcomes.

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Authors' contributions

The first author designed the research, collected and processed the data, organised and conducted the coding and labelling, analysed the data, wrote the manuscript, and reviewed all the article versions. The second author reviewed and strengthened all versions of the manuscript including the theoretical framework.

Ethical considerations

This research was carried out under ethical clearance obtained from Mekelle University, reference number MU-IRB 1979/2022.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Chapter 9

A Reinforcement Feedback Loop: Medical Care Services in Ayder Hospital during War

Simret Niguse, Hale Teka Tseghay & Mirjam Van Reisen

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Don't be regretful for what was in the past,
don't be oblivious to what is to come.

Abstract

The war in Tigray severely damaged healthcare services, worsened by a 22-month siege, which caused extreme difficulties due to shortages and military interference. Tertiary medical at Ayder Comprehensive Specialized Hospital narrowly avoided collapse just before the Pretoria Cessation of Hostilities Agreement. The conflict resulted in significant human and infrastructure losses, resource depletion, and restricted patient access, leading to numerous preventable deaths and hampering rebuilding efforts. Despite these challenges, healthcare providers showed remarkable resilience. War and siege create a reinforcement feedback loop that triggers a tipping point, making recovery difficult and requiring higher conditions for restoration. Despite these challenges, healthcare providers showed remarkable resilience and dedication, continuing to offer care under dire conditions. Their commitment underscored the importance of support systems to maintain healthcare provision. The experience highlighted the critical role of health workers in adapting to and overcoming challenges. To build resilience, Ayder Hospital should focus on retaining health workers and integrating coping strategies learned during the crisis.

Keywords: Tigray war, healthcare, tertiary care, health resilience, hysteresis, feedback loop, health workers, Ethiopia

Introduction

Before the outbreak of the conflict, Tigray's healthcare system was recognised for its extensive primary healthcare initiatives led by health extension workers (Kloos, 1998) and was considered a model for the nation's healthcare efforts. Moreover, metrics such as institutional delivery, antenatal care, postnatal care, and neonatal mortality were all heading in the right direction towards meeting national and global targets (EPHI & ICF, 2019).

The Tigray region has a population of 6 million people. Ayder Comprehensive Specialized Hospital is the largest hospital in the region, based in Mekelle, the capital of Tigray. It is, or was, the second-largest hospital in Ethiopia before the war. Ayder Hospital is one of only a few referral hospitals across the whole of Ethiopia, a country with a population of over 100 million people. Ayder Hospital serves as the primary referral and specialised medical centre for a catchment population of 8 million people, including those from Tigray, Afar, and the south-eastern part of Amhara region state. Founded in 2008, the hospital provides a wide range of medical services to patients of all ages, both in and out-patients. Ayder Hospital is a teaching hospital and implements over 70 teaching programmes.

The hospital has 624 in-patient beds across its four major departments and other specialties. with over 100 specialists in various areas of medical specialisation and an adequate number of other health professionals, Ayder Hospital was able to offer quality care to patients in need. Notably, the hospital's major specialties include paediatrics and child health, as well as gynaecology and obstetrics, both with over 50 specialists and adequate staff members. Due to the influx of displaced people and new visitors from neighbouring Eritrea, the hospital was serving a much larger population than the 6 million people of Tigray – at least this was the situation before the outbreak of the war in November 2020.

During the war, Ayder Hospital remained one of the few active hospitals and continued to provide care to a significant number of patients. This research investigates how the siege was a critical factor

that affected the functioning of Ayder Hospital. This study seeks to provide a comprehensive understanding of medical care provision at the hospital during the siege. It focuses on the challenges faced by Ayder Hospital in providing and sustaining tertiary medical care services during the Tigray conflict. The research questions addressed is: *What were the challenges in providing tertiary medical care services in Ayder Hospital during the Tigray war and siege and how did the hospital adapt during the period from November 2020 through November 2022?*

Methodology

This is a qualitative deductive grounded theory case study. The data was collected from May 2022 to February 2023 in the Ayder Hospital. The methodology included in-depth interviews (IDI) and focus group discussions (FGD) with healthcare providers from the paediatrics and child health, as well as obstetrics and gynaecology departments at Ayder Hospital. In total 41 persons participated in the study.

Eligible participants were healthcare providers working in the maternal and child health departments at Ayder Hospital during the data collection period, categorised as senior practitioners, residents, nurses, or midwives. Concerning the sample size and sampling procedures the following criteria were used. Participants were purposively selected based on:

- Professional type
- Sex
- Department of work
- Work experience at Ayder Hospital
- Position within their service unit

An expert's discussion was conducted to identify relevant criteria for selection, resulting in a total sample size of 41 healthcare providers. To ensure professional diversity, participants were selected from:

- Nursing staff
- Medical trainees
- Senior practitioners

The administrative structure of Ayder Hospital was used to prepare a list of eligible potential participants who could provide rich

information on their experiences during the siege. Saturation of information was achieved at the 15th to 17th interviews. Table 9.1 provides a detailed breakdown of sample size determination for each criterion and Table 9.2 shows the description of FGDs and IDIs.

Table 9.1. Distribution of participants (n=41)

Participant groups (n=41)	Sex		Marital status		Experience in Ayder Hospital		Position in service unit	
	Male	*Female*	*Married*	*Single*	*<5 years*	*5 years & above*	*Yes*	*No*
Seniors	6	0	4	2	1	5	3	3
Residents	11	7	7	11	7	11	0	18
Nurses	3	6	6	3	2	7	2	7
Midwives	6	2	6	2	1	7	1	7
Total	**26**	**15**	**23**	**18**	**11**	**30**	**6**	**35**

Table 9.2 sets out the breakdown of participants in the study based on their sex, marital status, years of experience in the hospital, and position in the service unit. The total number of participants in each category is also provided, giving an overview of the composition of

the study participants. Table 9.2 shows that a total of 4 FGDs and 13 IDIs were conducted.

Each FGD consisted of 7 participants from paediatric residents, obstetrics and gynaecology residents, paediatric nurses, and midwives while the IDIs involved key informant interviews with each departments' heads, each departments' head nurses, and the hospital chief clinical director. Additional IDIs conducted with residents of each department who didn't participate on the FGDs.

Table 9.2. FGD description of participants (n=28)

FGDs (#=4, n=28)	Participants	Number	Age (minimum-maximum)	Experience in Ayder Hospital (years) (minimum-maximum)
FGD 1	PCH residents	7	27–34	2–7
FGD 2	PCH nurses	7	28–39	2–12
FGD 3	OBGYN residents	7	28–34	2–6
FGD 4	Midwives	7	26–38	2–10

Note: PCH=paediatrics and child health, OBGYN=obstetrics and gynaecology

Four focus group discussions were held, each consisting of seven members, with groups of nurses, midwives, and residents from both departments, followed by in-depth interviews with thirteen participants.

Table 9.3. IDI description of participants (n=13)

IDIs	Participants	Gender	Age	Experience in Ayder Hospital (years)
IDI 1	PCH head nurse 1	Male	35	8
IDI 2	PCH head nurse 2	Female	33	7
IDI 3	Midwives' vice head	Male	33	8
IDI 4	PCH department head	Male	38	12
IDI 5	OBGYN department head	Male	33	8
IDI 6	Chief clinical director	Male	37	10

IDIs	Participants	Gender	Age	Experience in Ayder Hospital (years)
IDI 7	OBGYN senior	Male	32	7
IDI 8	PCH senior	Male	30	3
IDI 9	OBGYN senior	Male	35	6
IDI 10	PCH resident	Female	28	4
IDI 11	OBGYN resident	Male	29	2
IDI 12	PCH resident	Male	28	3
IDI 13	OBGYN resident	Male	28	2

Note: PCH=paediatrics and child health, OBGYN=obstetrics and gynaecology

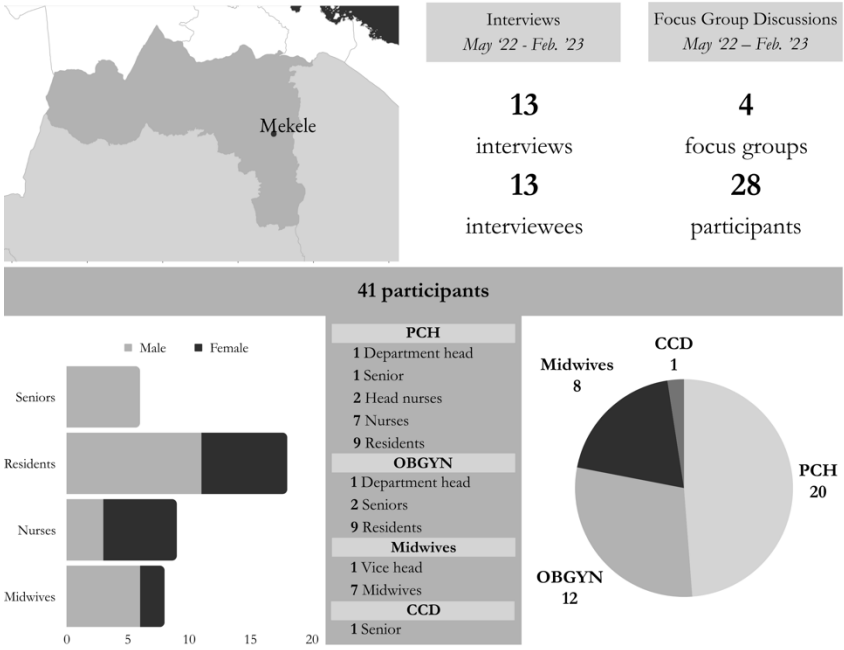

Figure 9.1. Data used and collected in the study

Data collection procedure

The investigator developed a semi-structured interview guide with open-ended questions for IDIs and FGDs. The interview guide was subject to modification to incorporate conditions, mentioned by participants, that were relevant for further investigation. The data were collected by four investigators, who were trained to conduct the interviews, and who transcribed each interview word-for-word and performed the coding of the interviews.

Data analysis

A coding-labelling analysis was carried out on the data. The data were imported into Atlas.ti qualitative data analysis software Version 9 for coding and analysis. Two investigators independently coded all the transcripts inductively, checked for the reliability of their codes, and resolved any coding differences with a third investigator. Field notes and investigator's memos were linked to respective files in the software for analysis. The investigators presented the list of developed codes for peer debriefing sessions with all investigators for labelling of codes in the data. The investigators refined the code

labelling together, systematically grouped similar codes into categories, and grouped similar categories into themes.

Findings

The results are presented in four parts: background, challenges in providing health services, coping mechanisms, and the negative loop that emerged due to the spiralling effect of challenges.

Background and context

This case study showed that health workers showed remarkable dedication. This corroborates with findings that health workers adapt to changing circumstances by developing new skills and finding innovative ways to deliver healthcare (Witter *et al.*, 2017). Health workers can develop resilience to cope with the challenges of delivering healthcare during war. This can involve developing coping strategies to manage stress and trauma (Elnakib *et al.*, 2021). These adaptations can surprisingly improve care, even under the most challenging situations.

During the war, an attack was launched on the health facilities in Tigray and many health facilities were destroyed and looted. When Eritrean troops invaded Mekelle, the Ayder Hospital was attacked to loot it. The following was reported on 5 December 2020, during a comprehensive communication blockade of the region:

> *Attempts by federal troops and Eritrean troops to loot the Ayder hospital, the main referral hospital in Mekelle, 80% of patients are wounded by the bombardment of the city. Two civilians were killed and four injured as they resisted.* (EEPA, 2020, SR 17)

It was reported that the community living around the Ayder Hospital defended the hospital to prevent it from being taken over by Eritrean troops. Two days later it is reported that:

> *Tigray doctor states in a text message that they are working with a severe lack of basic equipment, including lack of light, fuel, food, gloves, and antibiotics. Their ambulance was taken by soldiers.* (EEPA, 2020, SR 19*)*

On 17 January 2021, it was reported that "20,000 health workers and other government civil servants are not receiving their salary for over

two months with some exceptions" (EEPA, 2020, SR 58) On 19 February 2021, it was communicated that:

> *A letter is posted at Ayder Referral Hospital in Mekelle stating that patients who were beneficiaries of community-based health insurance, free, and other scheme users are no longer considered for health services if they are not able to pay.* (EEPA, 2020, SR 88)

The communication states that:

> *Previously patients who were unable to pay were able to get health services for free when they provided a support letter from their respective administration. At this critical time, free health services are stopped for people who are not able to pay.* (EEPA, 2020, SR 88)

The consequences of the siege were increasingly noticeable. On the 25 May 2021, it was reported that Ayder Hospital was using expired medication and that its medication supplies had run out:

> *The Guardian is reporting that Ayder Referral Hospital in Tigray is using expired medication and paracetamol to treat terminally ill cancer patients. According to one doctor, the hospital only has 16% of the medication it needs. In a letter, doctors said cancer care was "almost non-existent.* (EEPA, 2021, SR 211)

The consequences of the siege on transport were also reported:

> *And on the 2nd of June 2022 the chief clinical director, Dr Kibrom Gebreselassie was reported as stating that the Ayder Comprehensive Specialized Hospital had reached a stage where it "could not provide services to patients, after 19 months of conflict.* (EEPA, 2022, SR 215)

A few days later the chief clinical director Dr Kibrom Gebreselassie, said "that 32 people have died in just 12 days due to lack of oxygen, antibiotics, fuel and anaesthesia drugs" and "eleven of them were neonates" (EEPA, 2022, SR 220). Dr Amanuel from Ayder Hospital was reported as saying that "lack of fuel, medicines and supplies have made the situation unworkable for the hospital" (EEPA, 2022, SR 225). Specific reports were made of the hospital running out of insulin and patients arriving from far trying to find medication, are told these are not available (EEPA, 2022, SR 275). It was reported on 4 October 2022 by the BBC that hospital staff has not been paid for 17 months (EEPA, 2022, SR 282).

Imminent collapse

On 31 October 2022, Dr Kibrom Gebreselassie warned that Ayder Hospital will collapse soon "if left without support – with only 9% of medical facilities operational according to the World Health Organisation" (EEPA, 2022, SR 301). A few days later the Cessation of Hostilities Agreement was signed in Pretoria and the collapse was averted. However, the continued lack of supplies continued to trouble the hospital, and Dr Kibrom Gebreselassie reported in February 2023 that he is concerned that many health workers are leaving (EEPA, 2021, SR 337).

Challenges to service provision

The following themes were identified:

- Restrictions faced by healthcare professionals
- Challenges faced by the civilian population seeking assistance
- Lack of hospital supplies
- Lack of public facilities
- Military obstacles
- Curfew restrictions
- The inadequate response from humanitarian agencies

These challenges are discussed in more detail below.

Severe restrictions faced by healthcare professionals

A range of challenges came up in the interviews, restricting the availability of health workers involved in the health service delivery for patient care.

The healthcare professionals faced severe security concerns and healthcare staff members relocated for safety purposes, while others left to look for food or employment elsewhere:

> *I live 10 kilometres away from my workplace [Ayder Hospital]. There is no transport service provided by the hospital, nor can I afford public transport fee. So, I arrive at work one to two hours late on foot; then I start my duty without a proper handover from the previous team. Later, I leave work earlier than I should because*

it takes me 2 hours to reach home. (Interviewee 1007, a focus group interview by Teka, face-to-face, June 2022)

Unfortunately, some staff's whereabouts remain unknown, while others have been confirmed dead. The departments had to be run on significantly reduced teams:

In the department of gynaecology and obstetrics; 2 specialists, 22 specialty trainees and some midwives have left their work. One of our midwives was killed by soldiers while he was looking for a safer place to live with his family in the villages. (Interviewee 1001, interview by Teka, face-to-face, June 2022)

Hunger among health professionals was prevalent. Due to the war, the healthcare professionals were not paid their salary and they could not access their savings because of the banking services interruption. Most resident physicians claimed that eating three times a day was unthinkable and twice a luxury.

Who thought that I could be worried about what to eat? (Interviewee 1002, interview by Niguse, face-to-face, June 2022)

The lack of food would affect the ability of the health workers to provide services:

Once, while I was operating a mother in the OR [operating room], my assistant doctor collapsed to the ground. I had to continue my surgery alone telling the assistant midwife to take care of him. When we realised it was due to hypoglycaemia, he was provided with glucose and later we found out that he had not eaten his dinner because he couldn't afford. (Interviewee 1003, focus group interview by Teka, face-to-face, June 2022)

Health professionals also suffered from mental problems. Most participants stated that they found that the health professional was double burdened. Firstly, they lacked necessities for personal living and family support, as they did not receive salaries and could not look after their own families:

As a paediatrics specialty trainee, it has been a moral question for me to advise parents on how to feed their kids properly when I can't provide my baby with the things. It is such a haunting experience. (Interviewee 1002, interview by Niguse, face-to-face, June 2022)

Despite these challenges doctors and health workers continued to deliver services:

> *Once, I remember my colleague's gynaecology resident had to clean the operating room (OR), wash the OR drapes with a bare hand, and risk doing a caesarean section with bloody OR cloths all on his own because there were no cleaners and electric power to sterilize the OR drapes.* (Interviewee 1003, a focus group interview by Teka, face-to-face, June 2022)

Health workers felt the burden of having to respond to the suffering from the trauma they developed as the result of the failure to be able to take care of their patients:

> *At some moment of the time around December 2021, when I couldn't provide my clients with the basic drugs they needed, I was in a dilemma about whether to withdraw myself from clinical practice or not. It is morally effective.* (Interviewee 1004, interview by Niguse, face-to-face, June 2022)

The helplessness with access only to limited resources while facing overwhelming needs led to despair and moral injury. This included having to deal with the triggers of the military operations causing trauma to the health workers:

> *There have been frustrations since the onset of war specially when there is air strikes and heavy artillery shelling. Even the sound of a moving oxygen cylinder and stretcher in the hospital freaks me out because it resembles the sound of a fighting aircraft.* (Interviewee 1008, a focus group interview by Niguse, face-to-face, June 2022).

Health professionals also had feelings of helplessness and frustration from observing their patients dying from preventable causes, and situations which were also dangerous for the health workers who had to deliver services without the ability to protect themselves against infection from the patients:

> *We have been engaged barehanded with labouring mothers whose Hepatitis and HIV status is unknown without wearing any gloves since it was not available in the hospital.* (Interviewee 1007, a focus group interview by Teka, face-to-face, June 2022)

Moreover, the constant threat of violence and danger and lack of safety, added another third layer of stress, making it difficult to find moments of relief or peace.

Challenges faced by the civilian population seeking healthcare

The communications blackout, interruption of banking services, military curfews, and aerial and drone bombardments during the active war period brought serious impediments to patient care. Patient flows decreased, and those who came to the hospitals seeking care usually presented late in the course of their disease:

> *A 4-year-old had a severe headache. His parents understood the seriousness of his condition. However, they could not bring him for fear of being targeted as they transported him to our hospital. As time went by, the child's condition deteriorated and he finally lost consciousness. Then the family had to take a risk to come to our hospital. After he received medical support at our hospital he survived. However, in my professional opinion, the baby will live with permanent disabilities.* (Interviewee 1004, interview by Niguse, face-to-face, June 2022)

Many clients (patients) with known illnesses who had follow-up in the hospital were lost from follow up.

> *I used to see a minimum of 20 cardiac patients per day on follow-up before the current situation. But now, I see four to five cardiac patients only. I am not sure what could have happened to the majority of our patients.* (Interviewee 1005, interview by Niguse, face-to-face, July 2022)

Similarly, there were incidents of patients fleeing from the hospital whenever there was an airstrike and shelling around the hospital or the city.

Lack of hospital supply

Most participants reported that lack of hospital supply had been a major challenge. Lack of basic laboratory services due to interruption of supply of reagents, a malfunctioning CT scan and MRI machines facing maintenance issues, and the lack of spares impacted diagnostic services. The absence of basic childhood vaccines deeply concerned childcare providers. Shortage of consumables like detergents, basic medications like antibiotics and Intravenous (IV) fluids, oxygen

supply, medical gloves, and gauze in the hospital had negatively affected service provision:

> *We don't have any budget to buy drugs, the stores of our providers in the region are empty, and humanitarian agencies bring a negligible amount in type and quantity. It is difficult to sustain service in this manner.* (Interviewee 1006, interview by Niguse, face-to-face, July 2022)

Lack of basic supplies contributed directly to avoidable deaths:

> *There is frequent interruption of basic lifesaving services during the siege. In six six-month period, lack of oxygen has directly contributed to the death of 40 paediatrics patients.* (Interviewee 1004, interview by Niguse, face-to-face, June 2022)

The other major challenge was a total lack of fuel to run backup generators during power outages.

Lack of public facilities

Bank, electric, communication, and transportation blackouts in the siege that was imposed during the war, caused great problems to the provision of services in Ayder Hospital. The siege in the region resulted in the complete closure of the government and privately owned banks which led to difficulty accessing savings for transportation and medical services. Salaries of civil servants were not paid from June 2021 onwards to the time the interviews were conducted, and health workers were not able to access their savings.

Frequent and prolonged electricity interruptions caused severe hypothermia leading to the deaths of new-borns, closure of operation theatres, and interruptions of most services, incidents that were reported by almost all participants.

The other main public facility challenge was communication blackout. Labouring mothers and critically sick children were not able to call for ambulances. First-line medical trainees and physicians had difficulties reaching their consultants for medical advice and decisions and situations ended up in extreme levels of health risks. Examples given included an open patient's abdomen brought to a consultant's home for further engagement. Another doctor recalled:

> *I live within the compound of the hospital. Previously, I used to hear a minimum of 5 ambulance alarms per day but now it has been more than 6 months since I heard*

the alarm of an ambulance. Emergency patients and labouring mothers are not able to call for the service. (Interviewee 1001, interview by Teka, face-to-face, June 2022)

Challenges with public transport were significant from the start of the war in November 2020 until the time of the research. Initially, the sudden interruption of public transport services at the onset of the war due to curfews significantly reduced the patient flow from different zones of the region to the Ayder Hospital.

Impact of military

After the war broke out on 3 November 2020, heavy artillery shelling around the hospital broke out. Doctors who lived within the compound of the hospital found that they had no choice other than to flee from the hospital after two strikes hit within 50 meters radius of where they lived in November 2020:

I live around the hospital. On 28 November 2020, while I was returning home from work, two heavy artilleries hit within a 50-meter radius of my home. I and my friends ran away to a far place immediately and returned home after a week. (Interviewee 1005, interview by Niguse, July 2022)

The presence of the Ethiopian National Defence Force (ENDF) military within the hospital compound in the first period of the war, influenced the care provision in Ayder Hospital.

One problem was the threats to health workers forced to treat the soldiers with health problems. Testimony of such a situation is as following:

There was one female ENDF who came with profuse bleeding from the genital area; we found out it was a spontaneous abortion. Her husband, military personnel himself, brought her a soft drink and she vomited it right away. Then he started to threaten us that he would kill us if anything bad happened to her. We were so scared of losing her. She was also accompanied by 6 more troops who had their guns in the procedure room. She survived the procedure, though it was so a scary moment. (Interviewee 1003, a focus group interview by Teka, face-to-face, June 2022)

The presence of the ENDF troops was also a deterrent for patients to come to the hospital, especially for victims of sexual violence perpetrated by the ENDF military:

> *Because ENDF has used the hospital as a camp, many health professionals preferred to stay at home. Many victims of gender-based violence who came to get service were obliged to back off from the hospital since the offenders' team was at the gate of the hospital. Moreover, medical students were raped by ENDF troops who resided within the hospital. The perpetrators were identified and taken by police. We have a recorded document if needed.* (Interviewee 1006, interview by Niguse, face-to-face, July 2022)

Misbehaviour and shooting led to incidents that further compounded to health concerns:

> *The ENDF who camped within the hospital compound used to fire guns just into the air in times of celebration. For example, in January 2021, they continuously fired for more than an hour following the capture of some higher officials. During the celebration, we and our patients were frustrated and there were incidents of child bullet injury from nearby houses, and the window of the PCH ward was also broken with a running bullet.* (Interviewee 1009, a focus group interview by Niguse, face-to-face, June 2022)

The perceived disrespect of the ENDF military vis à vis the people of Tigray further added to fear for both health workers and patients to come to the Ayder Hospital:

> *The troops in the hospital used to tell us that the ENDF came to safeguard the people of Tigray, but what they were doing is opposite to what they say. It was suffocating, cruel, and horrible.* (Interviewee 1004, interview by Niguse, face-to-face, June 2022)

A lack of sense of safety associated with military issues were abundant negatively affecting both the health workers and the patients.

Curfew restriction

Soon after the federal government took over Mekelle city in November 2020, curfew restrictions were set by the interim government of Tigray. The curfew restrictions included prohibited movements from 6 PM to 6 AM, which also applied to ambulance movements in the first two months of the interim government.

Labor and delivery unit care providers were extremely anxious about the curfew set by the command post considering the emergency nature of most of their duties. These providers claimed that they lost possibly salvageable cases as the mothers had to stay at home due to the curfew restrictions, resulting in avoidable complications causing maternal death secondary to bleeding. In response to this, pregnant mothers whose estimated date of delivery approached, used to come to the hospital early, preferring to stay in groups on the grounds within the hospital compound, before the onset of labour because they were afraid of labour starting overnight when there was a curfew restriction.

People who were injured during the night had to wait until the next morning to arrive at the hospital. Some physicians reported that they were forced to stay in the hospital overnight once it got late while working; while others said that they had to leave the hospital if curfew time approached, even if they had not completed their duties and had not made a proper handover. It was not without danger for health workers if they were caught outside during the curfew:

> *Most of the consultant physicians live in a compound next to the hospital which is five minutes' walk. Once upon a time, my colleague Obstetrician decided to help technically after he received a call from other staff in the hospital and went out at 9:30 PM. He was caught by the ENDF troops in the hospital and was told to bow down on his knees and he was threatened. So, we had difficulty assisting our colleagues in time of need.* (Interviewee 1001, interview by Teka, face-to-face, June 2022)

Patients who needed urgent management beyond the capacity of on-duty care providers that necessitated more senior consultation did not receive the care they needed.

The response from humanitarian agencies

Most health workers were disappointed by the delayed and inadequate response of national and international humanitarian agencies. The fact that the Paediatric wards were filled with malnourished children was a clear indicator of the hunger in the community, participants stated. Empty hospital pharmacy stores showed the lack of medicine, and health workers expressed

disappointment in the humanitarian agencies to assist. Some participants said that they had another perception of United Nations (UN) agencies and non-governmental organisations (NGOs) before the war and that they were disillusioned:

> *Patients come across many kilometres when they hear about a new drug supply arrival by humanitarian agencies on the media. They assume as if many drug items have arrived, but in actuality this was not the case. And as a consequence, at times arguments emerged between patients and care providers.* (Interviewee 1006, interview by Niguse, face-to-face, July 2022)

Disillusionment was also recorded, especially regarding what was interpreted as a political intention of the international community not to support the Tigray region with humanitarian aid when it needed it most:

> *I thought the world was civilised enough to differentiate between humanity and politics. Now am learning that foreign interferences are solely benefit-focused not humanity-focused. I have lost hope in the so-called multilateral organisations.* (Interviewee 1004, interview by Niguse, face-to-face, June 2022)

The interviews showed that most care providers believed that thousands of lives could have been saved if humanitarian aid had supported the hospital services.

Coping mechanisms

This section identifies the conditions that mitigated the collapse of the Ayder Hospital.

Emergency preparedness

The emergency preparedness level of the hospital was not good at the onset of the war in November 2020. Soon after the war started, the hospital ran out of emergency drug supplies including gloves and basic antibiotics. Following the federal forces taking over the Tigray region, and the resumption of public facilities like transportation, the hospital had a relatively better drug stock for the first 8 months of the war. The situation changed in June 2021 after Tigray forces took over Mekelle city and a total siege was imposed in the region. Since the hospital store had full stock, emergency preparedness was better

concerning supplies in the first few months of the siege until it reached a critical point in January 2022.

Building partnerships emerges as a crucial coping mechanism in addressing challenges in health service delivery within war-affected areas. Networking between hospitals becomes imperative, facilitating the sharing of resources, knowledge, and expertise. Collaborative efforts foster resilience, allowing healthcare providers to pool their limited resources, coordinate services, and mitigate the impact of conflict.

Changing treatment protocol

Physicians reported that changing treatment protocol to use second or third-line drugs to align with the available ones was a routine occurrence. Participants from the maternal health side also testified to using a single-use operation set for multiple deliveries since sterilized materials were scarce especially when the electric power was gone. Treating severe infections with oral antibiotics while intravenous antibiotics were needed, doing surgeries without a drape or operation room close, skipping medication doses, recycling disposable gloves, and using expired drugs to treat patients including cancer patients, were some of the solutions in the hospital. As sterile gauze was lacking for emergency surgeries, wound care, and delivery room care; initiatives were started by the hospital staff to collect cultural clothes from the society, which were cut and processed for use instead of gauze. Participants enjoyed the inventiveness of circumventing the challenges imposed on them and their ability to fulfil their medical duty in some way regardless of the challenges.

Inventive coping mechanisms and creativity

Coping mechanisms that were identified by the interviewees included:

- Use of expired drugs
- Recycling disposable gloves
- Employing local innovations
- Use of traditional medicine
- Focus on lifesaving measures only
- Non-standard practices

Table 9.4 below offers examples of citations related to each of these coping mechanisms.

Table 9.4. Coping mechanisms

Coping mechanisms	Elaborative quotes
Use of expired drugs	*I think it is worth trying to use expired drugs rather than seeing our patients gone for granted. We shall use the available outdated drugs until they are finished once we obtain informed consent from our patients. What choice do we have?* (Interviewee 1002, interview by Niguse, face-to-face, June 2022)
Recycling disposable gloves	*Starting in January 2022 and 5 subsequent months, we had no gloves at all. The direction given by the hospital administration was to wash and recycle the gloves. After recycling them, they become so sticky inside and we had to struggle to wear them back. At times, I prefer to give care with bare hands.* (Interviewee 1008, a focus group interview by Niguse, face-to-face, June 2022)
Local innovations	*Normal saline was prepared solely from tap water and salt for use in wound care.* (Interviewee 1005, interview by Niguse, face-to-face, July 2022)
Traditional medicine	*A practice that has never existed in the history of the medical world…. Since things are getting better and worse, we have started to read books written a century ago as to take a pearl of wisdom from traditional practice as all we have is our hands*

Coping mechanisms	Elaborative quotes
	only. We are pulled back to that era. (Interviewee 1006, interview by Niguse, face-to-face, July 2022)
Focus on lifesaving	*I had many labouring mothers on whom surgery was indicated for a ruptured uterus to give birth via caesarean section. The standard is to salvage the baby, the uterus, and the mother. Currently, the practice focuses on saving the life of the mother only as there is no room for the 'fantasy' of saving the uterus and the baby.* (Interviewee 1012, interview by Teka, face-to-face, June 2022)
Non-standard practices	*As lifesaving intravenous fluids are not available in the hospital, we try to treat the paediatric patients with other substandard and locally prepared fluids via nasogastric tube and at worst situations, we have treated dehydrated children with carbonated commercial soft drinks.* (Interviewee 1004, interview by Niguse, face-to-face, June 2022)

While the hospital reached a critical phase concerning supply, the presence of private pharmacies that were providing essential drugs, even if at extremely expensive cost, helped the hospital to continue giving service. Key informants stated that the redistribution of distributed medical supplies in the region also helped to balance the equity and maximized the use of available resources. The coping mechanisms were proudly seen as a form of resilience by most participants.

Personal dedication, courage, and pride

Health professionals in the hospital were not paid any salary during the war. The salaries fall under the Ministry of Health of the Ethiopian government and during the siege, the salaries were stopped. Despite this very difficult situation, the health workers dared to continue providing services. They had to do this under very difficult circumstances and few items available in the hospital.

The participants said that they believed that it would be part of the Tigray people's struggle to serve the people without any payment:

> *I know that I am losing many salvageable patients and it hurts to experience that. Still, if I can help one mother why would I stay at home? I should come and help to save that life.* (Interviewee 1003, a focus group interview by Teka, face-to-face, June 2022)

Contributing to the society: "I come here to support my society psychologically"

The dedication of the Ayder Hospital staff was a critical factor to tip the balance to continued professional services being provided by the hospital during the war and the siege. The courageous resilience of health professionals was a major factor in sustaining service provision expressed in different ways.

> *Even if we have nothing to provide to our clients, we have to be available in the hospital for those who come believing in us. At least we can support them psychologically.* (Interviewee 1009, focus group interview by Niguse, face-to-face, June 2022)

The inventiveness, the pride and the sense of achievement, that against all odds, the services were continued, can be seen as a critical factor of resilience, and delaying the tipping point towards the termination of tertiary health services in the region.

Reinforcement feedback loop due to spiralling challenges

As per a report released in November 2021, only 30% of the region's 47 hospitals, 17% of the 233 health centres, 11.5% of the 269 ambulances, and none of the 712 health posts were operational six months into the war (Gesesew *et al.*, 2021).

The trends in patient flows changed over time. In the first 8 months of the war, paediatric wards were filled with children who were victims of direct war related injuries like bullets, explosives, heavy artillery, air strikes, and drone injuries.

> *I work in the above-five paediatric wards. In the first eight months of war, half of the paediatric ward was occupied with direct war related injuries of children mostly due to shelling and explosive injuries. We had an average of 40 such paediatrics patients at a time.* (Interviewee 1010, interview by Niguse, face-to-face, June 2022)

Later, during the siege, cases of malnutrition significantly increased and the focus of the services were towards emergency cases of malnutrition:

> *I work in the under-five paediatric wards. The degree of malnutrition increased by three-fold. For instance, immediately before the war, we had a maximum of twelve malnutrition cases per month in the ward, but now we have 42 malnutrition cases per month.* (Interviewee 1011, interview by Niguse, face-to-face, June 2022)

Participants from the obstetrics and gynaecology side observed a higher rate of victims of sexual violence and rape which in turn increased the number of sexually transmitted diseases and the need for induced abortion. On the other hand, complications of neglected labour such as cephalopelvic disproportion (CPD), obstructed labour, intrauterine foetal death (IUFD), and fistula started to reappear in a higher number.

Food provision to patients was interrupted as the hospital food stock ran out of food supply. Treatment of chronic diseases became unaffordable by the hospital in terms of supply.

The challenges aggravated by other challenges can be considered a positive forward loop which precipitates a loop towards a tipping point, in which the situation transforms into a new entirely different situation governed by other conditions.

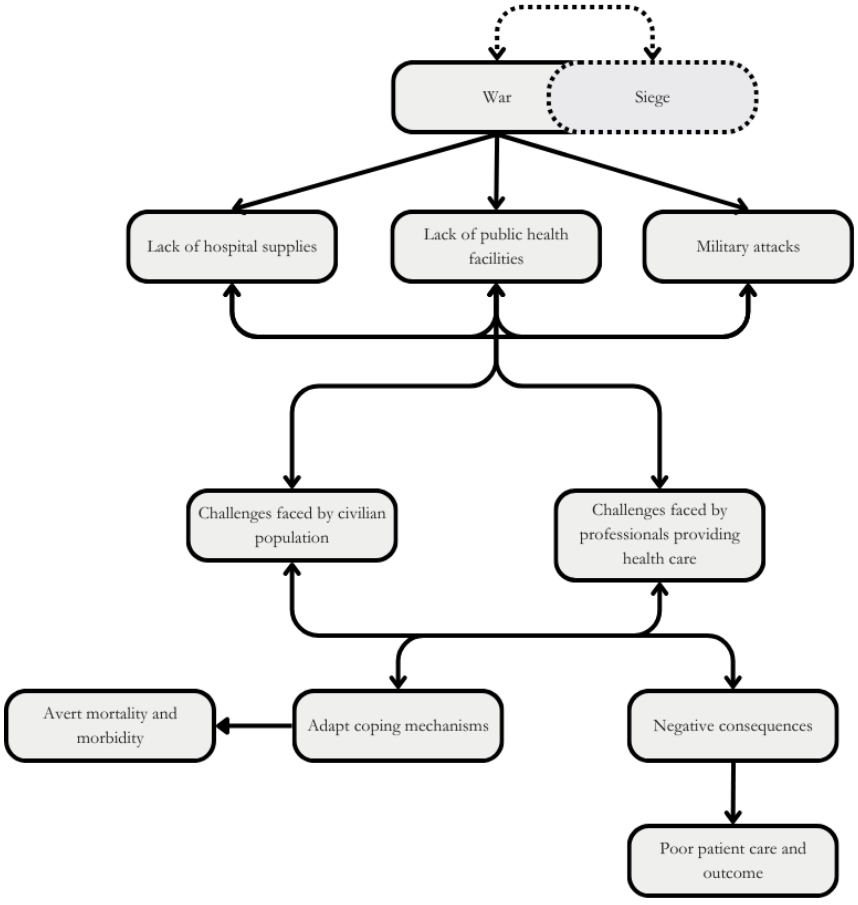

Figure 9.2. Framework showing the multidimensional effects of war and siege causing a reinforcement feedback loop on healthcare services

A reinforcement feedback loops caused by the multidimensional effects of war and siege triggers a tipping point transforming the situation in an alternative new situation. The concept of hysteresis hypothesises that critical factors contribute to the tipping point in which a situation transforms into a new one. To return to the original state, the critical conditions need to be restored to a higher level.

The model of Stocker (2024) predicts that a return to the previous situation is difficult. The concept of hysteresis explains that the conditions leading to the tipping point crashing the hospital into a new situation need to be met to a much further level than the level at

the tipping point, for the situation to return to the original one. The emphasis is on studying the conditions leading to the tipping point, in the specific situation of war and a long-lasting siege instilled during this war, and the conditions that prevent it from reaching the tipping point. This should increase the knowledge of resilience in healthcare provision during war and siege.

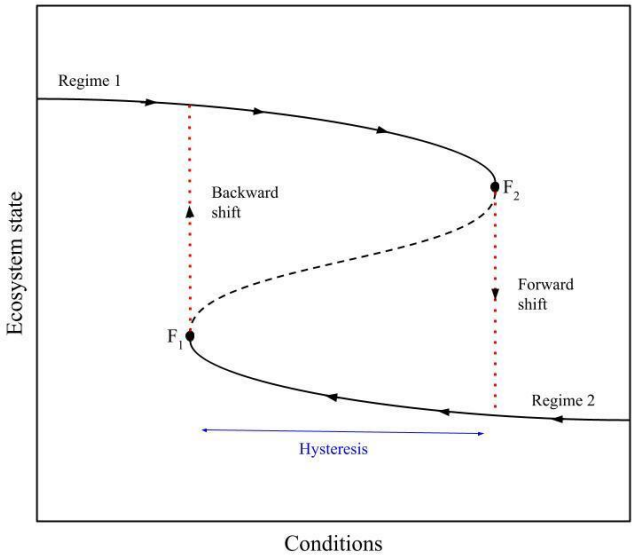

Figure 9.3. Critical transitions of a reinforcement feedback loop
Source: Stocker (2024) adapted from Scheffer *et al.* (2012)

Conclusion

The full-scale war in Ethiopia's Tigray region from November 2020 to November 2022 (ICHREE, 2023) caused significant damage to the provision of healthcare services. One of the major challenges facing healthcare provision was the siege, which lasted for 22 months. The participants reported extreme difficulties in all aspects of health service delivery due to issues with the availability of healthcare professionals, restrictions on the civilian population seeking treatment, lack of supplies, and military interference. Ayder Hospital struggled to provide and sustain tertiary medical care services during the conflict and siege, leading to numerous preventable deaths. The

situation worsened when the hospital lost access to resources such as savings, electricity, communication, and transport, as was the case in Tigray. The war and subsequent blockade have had a direct and indirect impact on health workers, staff, patients (including children), and overall service delivery.

Ayder Hospital only just managed to avert a total collapse. It was facing a complete failure, reported on 31 October 2022, just days before the Pretoria Cessation of Hostilities Agreement was signed. During the war and siege, the challenges faced by Ayder Hospital were numerous and profound. The unimaginable toll on human lives and infrastructure severely disrupted services at the Hospital, as well as in the entire healthcare system in Tigray, leaving communities vulnerable and in need of urgent medical assistance. Amid the chaos, healthcare providers found themselves wrestling with enormous obstacles, from limited resources and damaged facilities to security risks and population displacement. However, even amid such adversity, remarkable coping mechanisms emerged, as communities and healthcare professionals strived to ensure the provision of essential healthcare services at Ayder Hospital.

Moreover, the extreme shortage of circulating cash exacerbated the challenges, as individuals struggled to afford healthcare services and providers were unable to access necessary funds for the operation of their facilities. These economic and social disruptions amplified the impact of the war and siege on health service delivery, emphasising the need for comprehensive support and resources to mitigate these obstacles.

The study shows that reinforcement feedback caused by war and siege can trigger a tipping point, transforming situations irreversibly. The concept of hysteresis suggests that restoring conditions to a higher level than the tipping point is necessary for recovery. Stocker's (2024) model indicates that returning to the previous state is challenging, emphasising the need to understand conditions that lead to the tipping point, as well as the factors that prevent it being reached, to enhance healthcare resilience during conflicts.

One observation from this study is that despite these challenges, healthcare providers in Ayder Hospital showed remarkable resilience

and dedication, continuing to offer care under dire conditions. Their commitment underscored the importance of support systems to maintain healthcare provision. The experience highlighted the critical role of health workers in adapting to and overcoming challenges. To build resilience, Ayder Hospital should focus on retaining its health workers and integrating coping strategies learnt during the crisis in its system of service delivery.

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Authors' contributions

The first author designed the research, established the research framework, and implemented the study. The second author reviewed earlier versions, and conducted the interviews. Both authors collected the data, organised the coding and labelling, analysed the data and reviewed all the article versions. The third author carried out the coding-labelling of the entries of the EEPA Situation Report. The third author reviewed and edited all the article versions in detail and provided suggestions on the conceptual framework.

Ethical considerations

This research was carried out under ethical clearance obtained from Mekelle University, reference number MU-IRB 1976/2022.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Chapter 10

Genocide through Health Care Violence:

The Systematic Destruction of Health Facilities in the Tigray War

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The king is the protector of the citizens as the vulture is looking for meat.

Abstract

The study analysed the destruction of Tigray's health system, revealing that it was intentional, systematic, and widespread, affecting all levels and geographic areas. Eritrean forces were involved in most of the attacks in which health facilities were destroyed and looted in Tigray. In this research, we adopted the integrated, cross-sectoral, and multilevel (ICM) framework of health system resilience to assess the widespread destruction across all health system levels and related sectors. The deliberate destruction of Tigray's healthcare system calls for the urgent rethinking of health system resilience frameworks. The destruction led to the collapse of the health system in Tigray, reverting health profiles to conditions in the early 1990s. The attacks on health facilities reveal a deliberate targeting of Tigray's healthcare system. The study argues that these acts amount to war crimes, crimes against humanity, and genocide.

Keywords: health system destruction, genocide, war crimes, international law, Tigray war, Eritrea, Ethiopia

Introduction

War-induced violence against healthcare, including health facilities, healthcare providers, and transport, is a grave violation of human rights and international humanitarian law (Footer & Rubenstein, 2013; Jabre *et al.*, 2016). The World Health Organization (WHO) defines an attack on healthcare as any act of verbal or physical violence, threat of violence, or other psychological violence or obstruction that interferes with the availability, access, and delivery of curative and/or preventive health services (WHO, 2016).

Violence against healthcare and healthcare workers can happen in the form of deliberate targeting of health facilities with explosive weapons; burning down and looting of clinics and hospitals; the indiscriminate shelling and bombing of areas where health facilities are located; arrest and kidnapping of and threats against health workers; and the deliberate obstructing of patients' access to healthcare (Insecurity Insight, 2021). These acts contradict the rules of engagement provided under international humanitarian law, which strictly require parties under hostilities to adhere to the rules of distinction, precautionary measures, and proportionality (GC III & IV) (Jabre *et al.*, 2016). These attacks may vary across contexts and can range from violence with heavy weapons to psychosocial threats and intimidation. Moreover, in certain cases, the deliberate destruction of the health system can amount to the crime of genocide, provided that the intent element is substantially established under Article 2(c) & (d) of the Genocide Convention of 1951 (Radhakrishnan, 2020), as in the judgment of the International Criminal Tribunal for Rwanda Trial Chamber in the case of Akayesu (UN, 1998).

Healthcare violence is increasingly widespread. Since 2016, over 4,000 attacks on healthcare have been reported in contexts of armed conflict. In 2022, the Safeguarding Health in Conflict Coalition documented 1,989 instances of violence against or obstruction of healthcare in conflicts across 32 countries and territories (SHCC, 2020).

Tigray's health system, which was relatively well-organised and well-performing in Ethiopia before the war, virtually collapsed (Davies *et al.*, 2023; Kuhlmann *et al.*, 2023). An assessment of healthcare damage carried out during the war revealed that about 80% of the health facilities in the region were vandalised, looted, and/or destroyed. Transport such as ambulances were also damaged and looted. Health workers and patients were intimidated and killed (Gebregziabher *et al.*, 2022; Gesesew *et al.*, 2021; Human Rights Watch & Amnesty International, 2022), and access to and utilisation of services blocked for millions of people. The Health Resources and Services Availability Monitoring System (HeRAMS) Tigray Baseline Report 2023, an operational status of the health system carried out by WHO reported that about 89% of the health facilities buildings were partially or fully damaged (WHO, 2023). As a result, the maternal mortality ratio in Tigray has increased fourfold (Legesse *et al.*, 2023), and neonatal mortality two to threefold postwar (Tsadik *et al.*, 2024).

The extent and nature of the deliberate destruction of the Tigray health system has not been well documented. This study investigates the following research question: *What is the extent and nature of the destruction of the health system in Tigray?*

More specifically, this study aimed to answer four main sub-research questions:

Q1. What types of healthcare attacks took place in the Tigray war?

Q2. What was the extent of the healthcare attacks?

Q3. How systematic were the healthcare attacks?

Q4. Do the acts of attacking the healthcare amount to core international crimes?

Theoretical framework

To explore the extent and nature of the destruction of the Tigray health system, the interdisciplinary, cross-sectoral, and multi-level (ICM) framework for healthcare resilience was adopted (Tan *et al.*, 2023). This framework is the result of a meta-narrative systematic review and synthesis of reviews done on healthcare resilience, at the

organisational and system level. We chose this framework for four reasons. First, we found it helpful to explore the destruction of the Tigray health system at hierarchical levels. This framework recognises four hierarchical levels: individual (micro), facility or organisation (meso), health system (macro), and planetary or international (meta). This framework is the latest systematic review and synthesis of reviews of available and good quality reviews and frameworks on healthcare resilience that spans across a shift of paradigms from the Alma Ata Declaration in 1978 to WHO building blocks of health in 2010 and to Global Health Security Index in 2021.

The healthcare resilience framework gives a unified framework for incorporation of various shocks that may happen in healthcare organisations and systems such as a pandemic, natural disaster, armed conflict, financial crisis, or climate change. This is important since it was not only the health system that was destroyed during the Tigray war, but other sectors too such as education and agricultural. This framework is developed to allow analysis and synthesis for an interdisciplinary, cross-sectorial, and multi-level framework for healthcare resilience. The Tigray war also happened during the COVID-19 pandemic, and there was a danger of imminent hunger and starvation (Gebremariam, 2021). The destruction of the Tigray health system happened in the context of multiple crises. Resilience increasingly takes an all-hazards approach and a process-oriented perspective.

The four hierarchical levels are operationalized and contextualised for our investigation:

- **The meta (international) level** refers to the prohibition or denial of healthcare or humanitarian services from international organisations, violating global conventions and prohibiting global solidarity.
- **The macro level** refers to the attack on the healthcare system at the regional and national level. These include obstruction of healthcare services to a community in a given place or region and a violation of international norms or guidelines of global institutions such as WHO or a country's policy.

- **The meso level** refers to attacks on healthcare facilities, and teams of healthcare workers in health facilities such as the deprivation of patients or healthcare workers to safety prevention tools or resources, and the destruction of healthcare infrastructure.
- **The micro level** is the violence and attack at the individual level such as individual healthcare worker's psychological trauma, and violence against individual patients or healthcare workers.

In addition to the ICM framework, the chapter relies on normative frameworks to answer two of the sub-research questions: whether or not the attacks were deliberate and if the attacks violate international norms and standards. For these purposes, relevant international laws, standards, established concepts, and frameworks of intranational laws are considered as frames of analysis. More specifically, normative frameworks that govern the core international crimes (war crimes, crimes against humanity, and genocide) are considered in evaluating the acts committed against the health system in general (International Committee of the Red Cross, 2014; United Nations, 1948).

Research method

The compiled data for the healthcare system attacks covers a period of two years from November 2020 to November 2022. For this study, we used distinctive sources of data, which were compared and triangulated.

EEPA Situation Reports

The first data source is the European External Programme with Africa (EEPA) daily Situation Reports. The Situation Reports had daily records on the Tigray war. The EEPA Situation Report started on 17 November 2020 with daily reports on the status of events in Tigray. The aim was to provide a first warning of events reported from Tigray.

For the study a coding labelling was carried out on all the reports from November 2020 to April 2023. The database had 236 varied sources of reports on the health system attacks from 5 December

2020 to 12 April 2023. The EEPA Situation Reports include the following sources on health-related matters:

- Local witnesses, principally hospital medical directors and medical doctor's reports to media and visiting organisations
- Reports on social media
- Reports from local and international media were also used as sources of data for the attack
- UN organisations reports, Médecins Sans Frontières (MSF), International Committee of the Red Cross (ICRC), and other international organisations

The EEPA Situation Reports compiled events based on trusted sources but required that verification on the ground be done for further use. This study is one attempt to triangulate this with information compiled through other sources, particularly:

- **Autobiographical observations:** *During the war*, two of the research team members (GGA and AAM) documented and wrote notes on the destruction of health facilities as much as they could from the start of the war and throughout the war period.

- **Verification of autobiographical observations:** Additional data collected via phone calls, WhatsApp, Telegram, and emails. Additionally, this dataset collected photos and videos of the damaged health facilities including the healthcare system resources. This data was collected *after the war*, after the Pretoria Cessation of Hostilities Agreement was signed on 2 November 2022.

The records from the Situation Reports were compared with the autobiographical observations and verification of those.

Data collected on the ground in Tigray

Other data collected for this research was collected on the ground in Tigray by way of a field survey. For the field survey, a group of health workers coordinated by GGA collected data on the destruction of health facilities in Tigray. They used phone calls, WhatsApp, Telegram platforms, and personal memos to compile data on the

healthcare system attacks. This was implemented *after the war*. All healthcare professionals who have WhatsApp and Telegram addresses were asked to send the damage data that they had at hand through the platforms. Additionally, part of the data was also collected through phone calls. Additionally, the health workers who had images of the damaged health facilities were asked to upload the images to the WhatsApp and Telegram groups. The health workers indicated that they took the images after the armed forces attacked the health facilities and departed. The health workers were eyewitnesses. The datasets underwent a thorough data-cleaning process. The scope of the research included 160 health facilities which were assessed. From this group, 57 health facilities were collected for close examination. Among the selected facilities there was 1 tertiary hospital, 2 general and 4 primary hospitals, and f50 health centres from 2 zones – North Western and Central Tigray.

The data collection included survey-information obtained from the following actors:

- Doctors
- Health system leaders across all levels including health facility leaders
- Workers in NGOs,
- Members of professional associations
- Local charity organisations
- Health service providers
- University academics and researchers
- Senior specialists

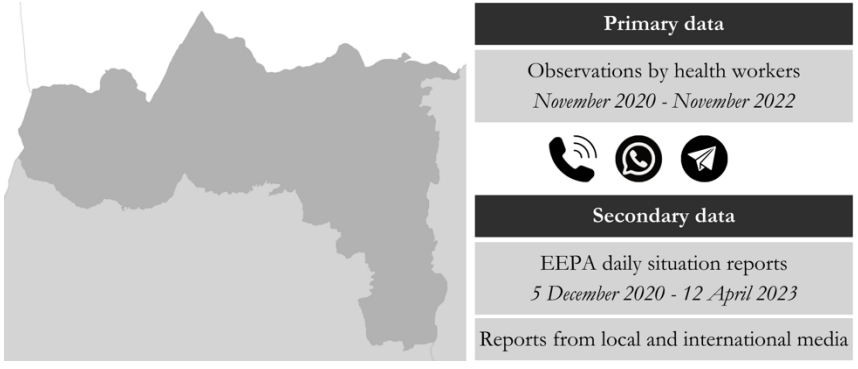

Figure 10.1. Overview of data used and collected in the study

Data analysis

We used a hybrid data analysis technique, deductive and inductive, to analyse the data compiled from both sources. The deductive analytical approach was used to analyse the types of healthcare attacks that took place during the Tigray war. We adopted the methodology of the WHO Surveillance System for Attacks on Health Care (WHO, 2018) to analyse the types of healthcare attacks. We also used this WHO methodology to assess the data certainty. This enabled us to validate the accuracy of the data, and the safety and confidentiality of data sources (WHO, 2018).

The WHO methodology assisted us in the definitions and selection of criteria of information certainty, type, and nature of the healthcare attacks. Accordingly, we used the WHO Surveillance System for Attacks on Health Care methodology, to classify the impact of healthcare attacks into the following four types.

- **Direct impact and targeted attack**: Incidents that directly target an aspect of the healthcare system, and have a direct impact on health service delivery, availability, and accessibility.
- **Direct impact, but not targeted attack**: Incidents that are not specific violence or targeted towards an aspect of the healthcare system, but have a direct impact on health service delivery, availability, and accessibility
- **Indirect impact but targeted attack**: Incidents that directly target an aspect of the healthcare system, but have an indirect impact on health service delivery, availability, and accessibility.
- **Indirect impact and targeted attack**: Incidents that are not specific violence or targeted towards an aspect of the healthcare system, and do not have a direct impact on health service delivery, availability, and accessibility. These types of events fall under the "grey area" and need to be considered on a case-by-case basis.

Additionally, we used the ICM framework (Tan *et al.*, 2023) for analysing the extent of the attack using the four hierarchical levels: micro, meso, macro, and meta levels. Newly emerged themes that did

not fall within these levels and categories of the WHO healthcare attack were thematised inductively. Moreover, we employed a doctrinal method of analysis (McConville & Chui, 2007) to evaluate whether the attacks amount to one of the core international crimes or not.

Two of the research team members (MVR and JS) designed the data set and extracted quotations for healthcare attacks from the EEPA daily Situation Reports for coding and analysis by the other two research members (AAM and ADW). AAM and ADW did the coding independently and produced the final themes together through discussion and consensus. The data was coded and analysed thematically using Atlas.ti qualitative software.

Results

The findings from the EEPA daily situation report are presented in seven themes that were identified: (1) source of information, (2) level of certainty of the information, (3) perpetrators of attack on health system, (4) nature (deliberate, systematic) and type of health system attack, (5) extent and level of the attack, (6) consequences and impact of attacks, and (7) what international crimes do these attacks amount to.

Source of information

Out of the 236 EEPA-reported incidents, 102 of the reports of attacks on the healthcare system came from United Nations (UN) agencies and international and national NGOs. The information for the 66 incidents reported in the Situation Report was provided by victims, eyewitnesses, or healthcare workers in locations where the attack took place. Additionally, 21 reports of incidents were obtained from mainstream or social media, 46 reports of incidents were obtained from regional, and a few incidents were from unspecified sources. The reports were compared with the observations made by the researchers on the ground during the war. Below the most salient points are discussed.

Level of certainty of information

We used four distinct categories by the WHO to assess the certainty of the attacks on healthcare systems: confirmed, probable, plausible, and rumours. Approximately 110 (47%) of the data sources recognised these attacks as confirmed. Additionally, results indicate that 84 (35%) of the attacks were rated as plausible, 9 (4%) as probable, and 33 (14%) of the reported attacks were classified as rumours.

Perpetrators of attacks

The report identified the perpetrators of the health system attack in Tigray. These were collectively called 'allied forces' that included the Ethiopian National Defence Force (ENDF), Amhara forces (Amhara special policemen, Amhara militia, and Fano-Amhara vigilante group), Special Forces from all regions of the country, and Eritrean Defence Forces (EDF) identified as the attackers of the healthcare system of the Tigray region jointly and on more than one occasion. Most of the reported incidents of attack on the health system, 217 (69%), were executed jointly by the allied forces, ENDF, Amhara forces, and EDF. The EDF and ENDF were identified as being responsible separately for 13 (5%) and 12 (5%) health system attacks, respectively.

Nature and type of attack

Regarding the type of attacks on healthcare resources inside the health system, 84 sources mentioned attacks on health facilities. In addition, it was reported that health facilities were changed into military camps and became fortresses for the armed forces. Within this dataset, 141 attacks targeted health services, while 33 attacks were directed towards health workers. The attacks on health workers were executed in the form of killings, kidnappings, tortures, and sexual abuse.

An example of a report of looting was:

> *Attempts by federal troops and Eritrean troops to loot the Ayder hospital, the main referral hospital in Mekelle, where 80% of patients were wounded by the bombardment of the city. Two civilians were killed and four injured as they resisted.* (EEPA, 2020, SR 17)

Additionally, 37 reports of attacks were on transportation infrastructure, including instances of ambulance looting and destruction. It was also reported that the armed forces blocked the transportation of casualties as a result of air or drone strikes. The observational reports matched the descriptions of the events in the EEPA Situation Reports.

There were also 33 reports of attacks on other infrastructure. Strikingly, reports indicated a cessation of patient referrals due to the unavailability and blockage of transportation, forcing pregnant women to deliver at home. It was reported that the armed forces confiscated the ambulances used for referrals at the healthcare facilities. In Adigrat town, around 20 ambulances were taken and reportedly seen being used by the soldiers to transport goods near the Eritrean border (EEPA, 2021, SR 104). There were 78 recorded civilian deaths recorded as a result of healthcare attacks, including attacks on the patients themselves.

Details and illustrations of the type of healthcare attacks are presented in Table 10.1. All WHO reportable types of healthcare attacks happened in the Tigray war.

Table 10.1. Types of attacks on the healthcare system in Tigray, based on WHO criteria

Type of attack	Illustrative quote on type of attack
Abduction	*Health professionals who were working in Western Tigray, and are still under occupation, remain unaccounted for. In early November 2020, some fled to Sudan, while those who remained and did not come to Tigray [zones under the Tigray Government administration] were abducted, their whereabouts unknown.* (Interview by a 38-year-old male nurse, displaced from Humera Hospital, interview by Abebe, 25 May 2021)

Type of attack	Illustrative quote on type of attack
The armed or violent search of healthcare personnel, facility, or transport	*The soldiers stormed the hospital in the early hours of Sunday morning, raiding the student dormitory, doctors, and patient wards. They were contaminating the operating room, and stopping all surgical operations* (EEPA, 2021, SR 151)
Arrest	*Ethiopian, Eritrean, and Amhara forces were arresting healthcare workers, particularly women and the elderly, who remained in the districts under their control instead of fleeing.* (Interview with a 30-year-old female midwife, interview by Abebe, 20 June 2023). *When the soldiers arrived, I stayed with my mother, who is a nurse. They asked us where did our father go; we said no, we are doctors. They took me away from my mother and detained me for two months, I experienced all kinds of suffering. There were also three other health professionals arrested.* (Interview with a 30-year-old female midwife, interview by Abebe, 20 June 2023).
Assault	*In March 2021, ENDF raped a medical student, and 10 female staff had been raped. In June 2021 Eritrean forces assaulted a vaccination team health worker, and later that month three MSF health workers were murdered by ENDF.* (The Hill; The assault on healthcare in Tigray, Document review, August 2021)
Chemical agent	*There are rumours that 40 tons of Phosphorus chemicals have arrived in Mekelle Airport on 06 June 2021 based on*

Type of attack	Illustrative quote on type of attack
	internal sources. This appears part of the preparation for what is called the "final" war. (EEPA, 2021, SR 163) *Three independent reports confirm that chemical weapons arrived in Mekelle. According to new information received tonight from a new source, 42 tons of chemical weapons have arrived on Mekelle through Djibouti. The chemical weapons arrived in Mekelle from Addis Abeba on flight ET3160 ETAUQ on June 5, B789 departing from Addis Abeba at 08:22. The place is reported to have delivered a phosphorus chemical. The carrying capacity of the plane is 51 tons.* (EEPA, 2021, SR 167)
Detention	*Tigrayans that have not been deported yet are being put under 'quarantine'. They have little to no access to food and emergency supplies.* (EEPA, 2021, SR 95)
Militarisation of civilian healthcare facility	*Every fifth health facility visited was occupied by soldiers. In some instances, this was temporary; in others, the armed occupation continued. In Muglat, east Tigray, Eritrean soldiers are still using the health facility as their base, and the hospital in Abi Addi in central Tigray, which serves a population of half a million, was occupied by Ethiopian forces until early March.* (EEPA, 2021, SR 104)
Obstruction to healthcare delivery (e.g., physical, administrative, or legal)	*…ambulances sent from Mekelle to help bring injured civilians to Togoga have been denied passage by ENDF soldiers who control the checkpoints.* (EEPA, 2021, SR 173)

Type of attack	Illustrative quote on type of attack
Psychological violence/ threat of violence/ intimidation	*Aid workers who were stopped by Eritrean troops in Adigrat, Tigray were told: "We don't care if you work for the UN or USAID, we will burn your cars if you go beyond this point.* (EEPA, 2021, SR 131)
Removal of healthcare assets	*Medical equipment and pharmacies of health centres in Wukro, Negash, Idagahamus, and Adigrat towns were destroyed and looted – allegedly by Eritrean troops.* (EEPA, 2020, SR 42)
Removal of healthcare personnel or patients	*16% of participants in a study were reportedly kidnapped and/ or imprisoned during the war and about 88% of healthcare workers witnessed sexual abuse, while 33% treated one or more victims of sexual abuse.* (EEPA, 2023, SR 401)
Setting fire	*Trucks that were transporting facemasks and other protective equipment for COVID-19 to the Tigray region were intentionally set on fire and destroyed by Ethiopian and Eritrean forces*. (EEPA, 2021, SR 129) *They confiscated medicines and medical equipment, including heavy machinery, and burnt and destroyed the remaining medical supplies. They also vandalized the premises by smashing doors and windows, leaving medicine and patient files scattered across the floor.* (Interview with a 45-year-old- male health centre director, interview by Abebe, 8 August 2023)

Type of attack	Illustrative quote on type of attack
Sexual assault	*At least eight health workers were killed, 13 were sexually assaulted, and 42 health facilities were attacked.* (EEPA, 2022, SR 237)
Violence with heavy weapons	*Artillery attacks at the start of the armed conflict struck homes, hospitals, schools, and markets in the city of Mekelle, and the towns of Humera and Shire, killing at least 83 civilians, including children, and wounding over 300* (EEPA, 2021, SR 95)
Violence with individual weapons	*The soldiers removed bandages and intravenous fluids from patients and pointed their guns at doctors and nurses who objected to them.* (EEPA, 2021, SR 151)

Source: EEPA Situation Reports

Extent and level of attack

The extent of the healthcare attack in the Tigray war covers all geographic areas of Tigray and all levels of the health system. Our analysis showed healthcare attacks from all zones of Tigray and across all levels of the health system and healthcare facilities. Hospitals and health centres were damaged, looted, and deliberately vandalized to make them non-functional which is reprehensible and has happened to almost 90% of the region's health centres. (EEPA, 2021, SR 106)

The findings of our analysis on the extent and nature of the deliberate destruction of the entire Tigray health system at the hierarchal level clearly show how it was systematic and targeted (Table 10.2). A total of 12 themes were identified across the four hierarchal levels. Four themes are under the meta level (international), three themes under the macro (national), three themes under the meso (health facility), and two themes under the micro (Individual person's) level.

Meta (international) level

Four themes were identified under the meta (international) level, violating basic human rights, targeting civilians that amount to war crimes, crimes against humanity and genocide, the irresponsibility of a government, and prohibiting global partnership and solidarity. The attacks on Tigray's health facilities had a devastating impact on people; health facilities and health staff who lacked protection from the Ethiopian government, under international humanitarian law (EEPA, 2021, SR 104). Despite this, the people of Tigray took desperate actions to protect the health facilities:

> *The source states Ethiopian defense force could not help protect the institution from the Eritrean defence forces. The information that the Eritrean soldiers were on their way to Ayder referral hospital went around very fast through the megaphone system. The elders instructed the community to block the road. "My house is ten minutes away from there and everything was blocked." The source concludes: "the community protected Ayder hospital from major looting. They did the same for the Telecom (TV and satellites)."* (EEPA, 2021, SR 71)

The observational reports matched the descriptions of the protection of the attack on the Ayder Hospital from the EEPA Situation Reports. The Ethiopian government did not intervene to stop the deliberate destruction of health facilities in Tigray while ENDF passively observed the damage:

> *The source states: "Eritrean soldiers came with vehicles to take goods. The soldiers were few. The source says that the elders asked the ENDF colonel at the hospital campus whether they would prohibit the looting and that they would follow orders from the ENDF. The ENDF colonel said they had no mandate to tell Eritrean soldiers what to do. The elders then asked ENDF to give weapons to defend the hospital which is a public property of the Ethiopian government."* (EEPA, 2021, SR 71)

The Eritrean troops transported the looted medical equipment to Eritrea. The observational reports correspond with the EEPA Situation Report descriptions of the protection of the attack on the Ayder Hospital. Further, witnesses indicated a substantial influx of

looted vehicles, university equipment, and other medical and factorial goods into Asmara.

> *Confirmation from Asmara that it is flooded with cars, university equipment, lab equipment, pharmaceutical equipment, and equipment from factories, including a textile factory, and food, brought from Tigray as looted by the Eritrean military.* (EEPA 2020, SR 18)

This evidence shows the involvement of Eritrean troops in the destruction of the Tigray health system and that they used a high degree of organisation to identify and transport the items that were stolen. The observations of the researchers indicated that the Eritrean soldiers were backed up with specialised teams who selected with knowledge what was of value and how best to transport the stolen equipment.

Macro (national) level

Three themes highlighting the healthcare attack at the macro (national) level are identified in this study. These are:

- Demolition of regional leadership and governance structure
- Blockage of banking services, and
- Complete communication shutdown

For instance, the blockage of banking services forced health facilities to stop health insurance and free medical services to those who would have been eligible:

> *A letter is posted at Ayder Referral Hospital in Mekelle stating that patients who were beneficiaries of community-based health insurance, free, and other scheme users are no longer considered for health services if they are not able to pay.* (EEPA, 2021, SR 88)

This was observed directly by the members of the research team. Due to the total siege and blockade of financial services, health facilities encountered shortages of medicines and diagnostic equipment. As a result, the facilities stopped providing free services to patients who could not afford to pay:

> *Previously patients who were unable to pay were able to get health services for free when they provided a support letter from their respective administration. At this*

critical time, free health services are stopped for people who are not able to pay. (EEPA, 2021, SR 88)

This report corresponded directly with the observations made during the war by the research team. This justifies the conclusion that the health system, which was under direct attack, was undermined further because of the collapse of other sectors such as banking, communication, and transportation.

Meso (health facility) level

Destruction of healthcare infrastructure or health facilities, the collapse of health services delivery, and looting of medical supplies and equipment are the three themes identified under the meso (health facility) hierarchical level. Many reports during the war showed similar situations:

Medical equipment, including ultrasound machines and monitors in Adwa Hospital, had been deliberately smashed. The health facility in Semema was reportedly looted twice by soldiers before being set on fire, while the health center in Sebeya was hit by rockets, destroying the delivery room. (EEPA, 2021, SR 104)

Additionally, another witness has reported that:

90–95% of the health facilities are not working and were especially struck by the "systematic aggression to the health facilities and looting of the facilities in the rural area's health posts. (EEPA, 2021, SR 90)

The damage to the Tigray health system is more pronounced and visible at the organisational or health facility level. All the WHO's six building blocks of the health system were damaged and affected. These building blocks are:

- Health systems governance and leadership
- Health services delivery
- Health workforce
- Healthcare financing
- Health information systems
- Medical supplies, technology, and medical equipment

The analysis of the EEPA situation report showed there is adequate evidence of incidents of attack on the health system in all the six building blocks of the health system.

Micro (individual level)

Two themes were identified under the healthcare attack that happened at the micro (individual) level. These themes are the violence against healthcare workers and criminalising healthcare. About 20,000 healthcare workers were denied their salary for about two years. Intimidation and the killing of healthcare workers were reported. It was also reported that Ethiopian soldiers armed with machine guns, sniper rifles, and grenades raided a hospital in the Tigray region twice. (EEPA, 2021, SR 151)

The invading forces seized control of healthcare facilities and used them as fortresses. Additionally, they conducted raids on patient wards, and student dormitories, contaminating operation rooms to halt service provision. Moreover, reports indicated that the forces were involved in threatening healthcare workers whom they perceived as uncooperative. For example, the soldiers were demanding a "list of the names of doctors who will not cooperate with the military's investigation into the hospital" (EEPA, 2021, SR 151). This was confirmed with the autobiographical notes of the researchers living in Tigray during the war.

The denial of salary for about two years, intimidation, and killing of healthcare workers by armed forces resulted in mental health problems, hunger, and anxiety of the healthcare workers, and their fear of going to health facilities to providing health services and staying at their duty stations. This was confirmed with the observations made by the team that worked in hospitals in Tigray during the war.

Table 10.2. Major themes and subthemes emerging during analysis of deliberate destruction and attacks on the health system in Tigray

Hierarchical level	Theme	Subtheme
Meta (international) level	Violating basic human rights	Right to life Inviting foreign forces and governments to attack their people Violating international human rights laws
	War on people (war crime, crime against humanity and genocide)	Total siege (no travel from and to Tigray, no land and air transport from and to Tigray, no banking services, communication blackout, no money transfer) Denying basic lifelines (no food, no water, no electricity, no market) Artillery and bombardment on public places/killing civilians/massacres (war on the people, forced displacement, hate speech, massacres, killing civilians)
	The responsibility of government	Not protecting health facilities Government not protecting its people Government not providing public health services to its people Lack of protection of healthcare workers
	Global partnership and solidarity	Red-cross could not distribute medical supplies Partners discouraged by the lack of protection for health

Hierarchical level	Theme	Subtheme
		facilities and continued looting. Allowing access to international humanitarian organisations
Macro (national level)	Demolition of regional leadership and governance structure	No functional government structures No police and security officers Managers and leaders of the health system targeted because of their affiliation
	Blockage of banking services	Backing services closed/no money No budget/no salary No risk protection/health security No humanitarian aid/no community-based health insurance (CBHI) / no free services Local organisations prevented from accessing banking services.
	Complete communication shutdown	No means of communication (Communication blackout, Internet shutdown, No electricity) No means of reporting and documentation (Computers looted and destroyed, health records destroyed along with health facilities destruction)

Hierarchical level	Theme	Subtheme
Meso (health facility/healthcare workers) level	Destruction of healthcare infrastructure or health facilities	Destroyed health facilities Health centres destroyed Hospitals destroyed All levels of the health system were attacked …hospitals, health centres, and health post. Widespread attack on healthcare in all zones, all cities, and throughout Tigray Burned health facilities Ambulances stolen
	Collapse of health services delivery	Occupation of health facilities by the military No place for service delivery No medical supplies and equipment No health workers No food and water at health facilities No referral service (no transportation, ambulance stolen, no fuel, curfew, no communication) Inaccessible hospitals/health facilities No immunisation
	Looting and destruction of medical supplies and equipment	Looting of medical equipment and supplies (health facilities looted and destroyed, medicine factory destroyed and looted) No medicine and equipment in cities (all drug stores and pharmacies closed, no money to buy, no medicine and supplies entered Tigray)

Hierarchical level	Theme	Subtheme
Micro level (individual healthcare worker/human resource for health)	Violence against healthcare workers	No salary for healthcare workers (20,000 healthcare workers without salary) Death of healthcare workers Killing health workers Trauma Victims of war Hunger of healthcare workers
	Criminalising healthcare	Intimidating healthcare workers Fear of intimidation going to health facilities and providing services

Consequences and impact of attacks

Tables 10.1 and 10.2 describe the types of healthcare attacks and almost all attacks were either direct attacks or had a direct impact on the health of the people. For example, Eritrean forces intentionally destroyed infrastructure including hospitals, schools, water services, and vocational training centres in the towns of Dewhan and Alitena. (EEPA, 2022, SR 281). Another example is that eyewitnesses reported that ENDF and the allied forces were systematically destroying cars carrying medical supplies such as oral rehydration solutions for children (EEPA, 2021, SR 129). The data demonstrates that direct attacks happened intentionally and had a direct impact.

All reported healthcare attacks in this study can be categorised into the three WHO classifications based on their impact: direct impact and target attack, direct impact but not targeted attack, and indirect impact but targeted impact. Our analysis showed three key direct consequences/impacts:

- Total collapse of the health system
- Reoccurrence of easily preventable diseases
- Death of hundreds of thousands of civilians

The collapse of the health system was across all levels of the healthcare delivery system, types of health facilities, and in all the geographic zones of Tigray.

> *A study reported that the invading forces made the healthcare facilities in the region non-functional. Nearly all facilities outside of the regional capital, Mekelle, were reported to be non-functional.*
>
> *A study assessed the geographical distribution of the health crisis due to the war in Tigray and found only 3.3% in Western, 3.3% in South Eastern, 6.5% in North Western, 8% in Central, 14.6% in Southern, 16% in Eastern and 78.6% in Mekelle are fully functional.* (EEPA, 2022, SR 213)

Similarly, other studies documented the non-functionality of the healthcare facilities in the region. This non-functionality refers to all types of health facilities.

> *A study by researchers from Mekelle University and various US universities exploring the impact of war in Tigray on health facilities revealed that only 9.7% of health centers, 43.8% of general hospitals and 21.7% of primary hospitals are currently fully functional.* (EEPA, 2022, SR 213)

Moreover, it was reported that the health system in Tigray had experienced a complete collapse. As a result of the total collapse of the health system, easily preventable diseases that were almost controllable before the war were reported and emerging as outbreaks during the time of war. Local health officials in Tigray warned of the rise of deadly diseases such as measles, tetanus, and whooping cough, as vaccination levels had fallen from over 90% before the war to under 10% in 2022. (EEPA, 2022, 272)

Some reports estimated that more than a million lives were lost in the two years' war in Tigray. However, there are no rigorous numbers on the total lives lost in Tigray due to the deliberate destruction of the health system and its consequences. The available reports showed that the death toll of civilians was high.

A high maternal mortality rate was reported because of limited access to medication for safe delivery and abortion. This had happened due to total siege and blockade. Women in Tigray were unable to access

medicines for safe delivery and abortion, resulting in 840 maternal deaths per 100,000 live births in 2022. (EEPA, 2022, SR 278)

Moreover, the Tigray war had used total siege and blockade as a means of warfare. Medical services were halted due to a lack of medication, and the expiry of drugs, leading to numerous deaths among pensioners and patients. Starvation was also reported as a cause of death. There had been a progressive decrease in drug alternatives to treat patients since July 2021. This had compelled patients to use expired drugs and Tigray ran out of all drugs in June 2022, costing the lives of many (EEPA, 2022, SR 230). The observations of the medical team of the researchers who lived in Tigray confirmed this situation.

The war and total siege in Tigray also had a significant effect on the cardiology services in the region. A call-to-action article published in the European Heart Journal highlighted that over half of the cardiac patients receiving life-saving treatment were lost. This article reported that the number of cardiac patients that had been treated had dramatically decreased by over 50%, leading to the untimely loss of lives with many preventable home deaths (EEPA, 2022, SR 230). This is corroborated by the notes of the situation recorded by the autobiographical notes. Healthcare providers were unable to save the lives of these patients due to a lack of medication and care. This caused much frustration and mental health strain on the health workers.

Survey through volunteered health workers

The survey through volunteer health workers inventorised the following:

- Description of the attacks, date of report
- Date of attacks, location (e.g., name of zones, district, facility)
- Type of attack (e.g., abduction, shooting, the threat of violence)
- Impact on health service delivery, (direct/indirect, targeted/not targeted)

- Health resources involved (e.g., health facility, ambulance, health worker, patient)
- Source of data
- Health system resources attacked
- Types of people affected in the attack: health workers, auxiliary health staff, healthcare personnel, healthcare workers and patients' causalities and perpetrators

The findings were coded and labelled for analysis.

Attacks on health system resources

The volunteer health workers reported a total of 62 attacks on healthcare resources. Attacks on health facilities accounted for 15 (25.4%), whereas 15 (25.4%) were attacks on health services. The attack on healthcare transport accounted for 12 (20.3%). There were also reported casualties of 15 (25.4%) health workers and 2 (3.4%) civilians.

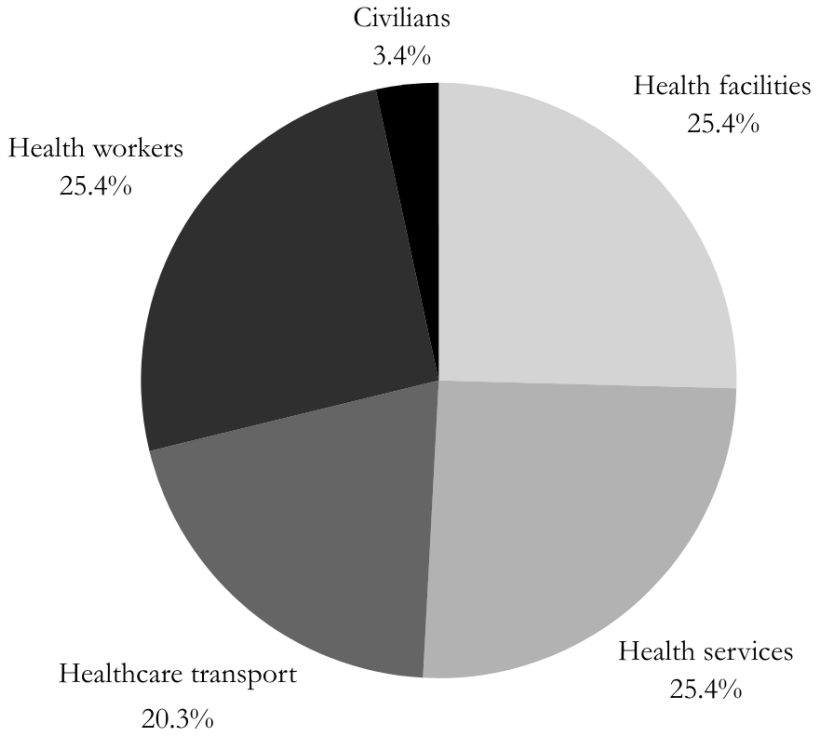

Figure 10.2. Overview of attacks perpetrated on healthcare resources

The attacks on the healthcare system happened in the form of drones, airstrikes, and shelling; deliberate damage, destruction, and looting of healthcare facilities; damage and looting of ambulances; intimidation and killings of health workers; and civilian casualties, including patients. According to the compiled dataset, out of a total of 57 reportedly attacked health facilities, 35 health facilities were reportedly destroyed, and the other resources were looted by the allied forces. Moreover, an additional 10 health facilities were subjected to destruction and burning, followed by looting of the resources of the health facilities. In 8 health facilities, the primary cause of the attack was looting. According to the dataset, all the attacks on the healthcare system of the Tigray region were direct and targeted.

Misuse of health facilities and ambulances for military purposes

General hospitals, along with approximately 86.5% of primary hospitals, were converted into military camps and housing facilities for the allies which invaded Tigray. This was particularly pronounced in the South Western and Central zones of Tigray, which were heavily occupied during the second intense and bloody conflict by both forces. Almost all hospitals were targeted and used as military camps.

Perpetrators of attacks

Close to half (42%) of the attacks on the healthcare system in Tigray were carried out exclusively by Eritrean forces. The ENDF and Eritrean soldiers carried out the remaining attacks jointly. The allied forces attacked the health facilities in phases, each of which was marked by a different attack. Furthermore, the health workers reported that the allied armed forces—EDF, ENDF, and Amhara forces—jointly attacked the health facilities in Tigray in various rounds. They added that the perpetrators used a variety of tactics to attack the healthcare infrastructure, including looting medicines, medical supplies, heavy machinery, generators, and ambulances. In the first round, they looted the medical equipment and supplies, including heavy machines such as generators, refrigerators, x-ray machines, ultrasound, oxygen suction, aesthesia materials, and

microscopes, and transported them to Eritrea. In the second phase, the Eritrean forces came and looted mattresses, tables, and chairs and damaged all the remaining materials and supplies. They deliberately looted and burned ambulances and motorcycles. They were also trying to destroy the buildings. The doors and windows were demolished. The forces were repeatedly visiting the health facilities to destroy them.

The health workers illustrated the attacks on the healthcare system as follows:

> *Eritrean forces severely damaged Adidaero Primary Hospital. In 2021, as a result, the hospital was out of service for the whole year. Again, in October 2022, the allied forces shelled the hospital with heavier weaponry once more and destroyed it. Over the same month, an Eritrean airstrike killed more than 50 civilians and injured more than 80 civilians.* (Interview with a 28-year-old female health officer, interview by Abebe, October 2023)

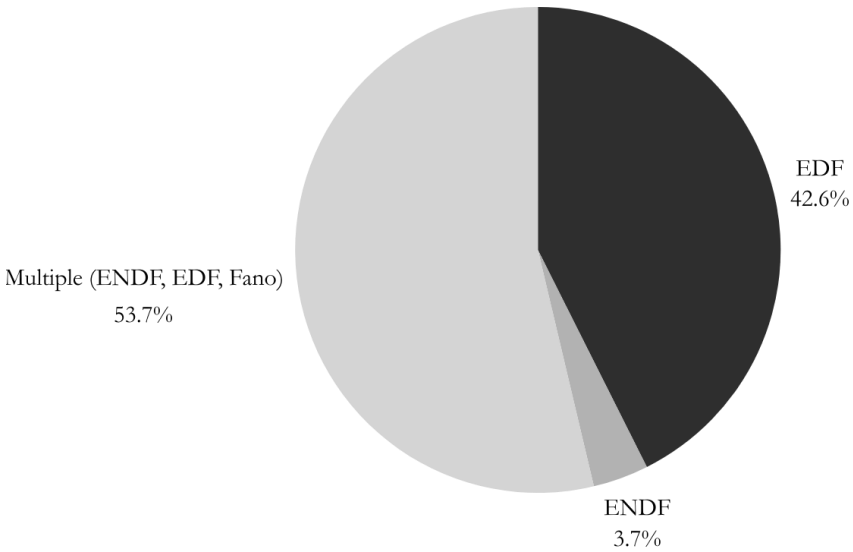

Figure 10.3. Overview of perpetrators of attacks on healthcare system in Tigray

Additionally, the joint forces also attacked the health centres.

> *Semema health centre was destroyed by joint forces – Ethiopian National Defence Force and Eritrean Defence Forces. The hospital rooms were destroyed, and heavy*

> *operating room materials, x-ray machines, ultrasound, oxygen suction, anaesthesia materials, patient beds, chairs, mattresses, and delivery materials were looted. The remaining were destroyed. Moreover, the Eritrean Defence Forces killed five clients at the hospital.* (Interview with a district [woreda] MCH head, interview by Abebe, 30 August 2023)

As a result of the deliberate and repeated attacks, the health facilities in Tigray were left without medical equipment drugs, and transportation access. This jeopardised the region's ability to deliver essential medical services. The healthcare system of the region stopped providing services to the population.

Additionally, the healthcare workers reported several civilian casualties including the killing of patients who had been admitted to hospitals. Health workers were also victims. It was reported that ENDF, upon occupying towns, were mercilessly killing anyone they found on their route to the towns. Eventually, after ENDF left the towns, the Eritrean forces reoccupied them. It was also reported that the Eritrean forces were very savage and massacred innocent civilians including health workers. They executed the killings by going from house to house. For example, Eritrean forces killed 60 civilians in Adihageray Tabia, Maekel Adiabo *woreda*, and North Western Tigray and left them unburied for weeks. An Eritrean jet also struck Adidaero town, North Western Tigray.

Our analysis of the healthcare attack on these 57 health facilities complements and strengthens the findings from the EEPA daily situation report.

Legal interpretation of the results

The acts targeting health facilities in Tigray were committed in the context of an armed conflict. Acts such as shelling, bombardment, and attacking healthcare facilities, and the killing and torturing of health workers, etc., are prohibited under the laws and customs of war. Acts targeting health systems are typically characterised as war crimes under Article 8 of the International Criminal Court (ICC) statute. The deliberate misuse of health facilities contravenes the rules and customs of war, as provided under Article 35 of the Additional Protocol I to the Geneva Conventions (United Nations-Human

Rights, 1999). Therefore, the acts targeting the health system in Tigray may amount to war crimes, as they are in contravention of the rules of engagement under international humanitarian law.

Evaluating the nature and pattern of the attacks, it can be argued that the above-mentioned acts reveal a deliberate targeting of Tigray's health system across the region. The destruction of 89% of the region's health system illustrates the scale of the attacks and shows the widespread and systemic nature of the attacks. One of the criteria for a crime against humanity is "causing widespread and systematic attacks against civilians" (ICC, 2002). Attacks on health facilities in Tigray directly resulted in attacks on civilians. Moreover, the attacks inflicted against health workers were committed as part of widespread and systematic attacks that included murder, rape, and torture, which may amount to crimes against humanity, as provided under Article 7 of the Rome statute:

> *In his opening remarks, (US) Senate Foreign Relations Committee Chairman, Bob Menendez (D-NJ), said that he sees "echoes of Darfur. There are reports of extra-judicial killings, sexual violence, and forced displacement of Tigrayans. Armed actors have looted and destroyed health and education installations and attacked refugee camps." and that "We appear to be witnessing war crimes and crimes against humanity."* (EEPA, 2021, SR 157)

The Rome Statute, in Article 8 (Melander *et al.*, 2021), states that attacks directed against health facilities are classified as war crimes. Moreover, the Geneva Convention protects civilians and civilian facilities, explicitly prohibiting attacks on health systems. Article 18 of the Geneva Convention (IV) on Civilians, 1949, stipulates "civilian hospitals, including those that provide care for the sick, wounded, maternity cases, and the infirm, should not be attacked. Instead, the parties to the conflict must protect and respect these hospitals" (Ristaino, 2022, p. 175).

The Tigray war was further characterised by the imposition of siege-induced starvation against the Tigray population. Siege becomes a violation of human rights and humanitarian law (rules and customs of war) or an international crime when it causes deprivation of indispensable items necessary for civilian life, such as food and

medicine. Article 8(2)(b)(xxv) of the Rome Statute states that denying such necessities is a crime, and impeding relief supplies, as outlined in the Geneva Convention, is prohibited. Impeding the delivery of relief to an encircled area is a violation of humanitarian law that can result in war crimes (Melander *et al.*, 2021). Accordingly, it is likely that the type and nature of the attacks on the health system in Tigray constitute war crimes and crimes against humanity. Tefera (2024) has shown that the perpetrators of these acts clearly understood the context under which the destruction was committed.

The context of the Tigray war was also characterised by anti-Tigrayan rhetoric and media propaganda by the federal government of Ethiopia. Subsequent actions by the government, such as the blockade and siege-induced starvation, which included the denial of necessities for survival, such as medical facilities, are circumstantial evidence of acts of health system destruction, which may amount to the crime of genocide. In line with this, the report published by New Lines Institute on para 287 indicates:

> *[…] complete collapse of Tigray's health system with the outbreak of the conflict is exceptional. While a decrease in medical coverage may generally be consequential upon armed conflict, targeted acts against health facilities, together with the imposition of a systematic blockade or siege, progressively led to conditions of life that are capable of bringing about the destruction of the Tigrayan group.* (New Lines Institute for strategy and policy, 2024)

Understanding that all attacks against civilians during the Tigray war were committed within a context that dehumanised and specifically targeted ethnic Tigrayans contributes to establishing the special intent required for the crime of genocide.

Here the legal action brought before the International Court of Justice (ICJ) by South Africa concerning the Application of the Convention on the Prevention and Punishment of the Crime of Genocide, Geneva Convention in the Gaza Strip (Alexander, 2024) is highly relevant. The case was motivated by Israel's acts of destruction of health facilities and denial of access to medical facilities, among other things, contrary to Article 2(C) of the Geneva Convention. Article 2(C) prohibits "deliberately inflicting on the [protected] group

conditions of life calculated to bring about its physical destruction in whole or in part". The case passed a clear message to the international community, adding to the existing jurisprudence on genocide, that the destruction of the health system is an instrument to wipe out a protected group under the Genocide Convention. This needs explicit recognition and condemnation as an act amounting to genocide.

Similarly, the siege-induced starvation imposed on the Tigray population by the government of Ethiopia was inflicted with the knowledge that the consequence of the siege could result in the partial, if not total, destruction of the Tigray population. This leads to the conclusion that there are reasonable grounds to believe that the destruction of the health system in Tigray was committed with genocidal intent, as a total blockade combined with the destruction of the health system would undoubtedly lead to mass destruction of the targeted population (Tefera, 2024).

Given the direct and indirect (foreseeable) knowledge of the aforementioned acts, the destruction of the health system Tigray falls within the definition of acts of genocide under Article 2 of the Genocide Convention. The genocidal intent of these acts is supported by other acts such as killings, torture, inflicting conditions of life aimed at bringing about the physical destruction of the targeted population, and even prevention of births. These actions are explicitly prohibited under Article 2 of the Genocide Convention (United Nations-Human Rights, 1999).

Discussion

A recent WHO assessment on the status of the health facilities in Tigray conducted in May/June 2023 showed that 89% are partially or completely non-functional (WHO, 2023). This corroborates the findings in the research here presented. The methodology of the WHO Surveillance System for Attacks on Health Care does not indicate the weaponisation of healthcare attacks. It identifies the types of attacks and categories as direct or indirect attack/impact. However, it does not set a criterion for understanding the intention behind the deliberate destruction of the health system. Similarly, the 1949 Geneva Conventions, which were ratified by all Member States

of the UN, and most international humanitarian laws consider the destruction of health facilities in times of armed conflict to be a war crim. However, such destruction is not necessarily considered a crime against humanity or a crime of genocide. This understanding of the destruction of health facilities as a war crime masks the extent and the nature of the crime that was committed against the people of Tigray through the systematic and widespread destruction of the health system.

The evidence presented in this study shows a clear violation of international laws and basic human rights. The attacks on civilian healthcare facilities in Tigray were committed in the context of armed conflict. Violating the rules of international humanitarian law that protect civilians and civilian facilities is regarded as a war crime (Ristaino, 2022). Moreover, the incidents and attacks described under the theme of meta (international) level illustrate the widespread and systematic nature of the attacks on health facilities, which amount to attacks on civilians, as they resulted in civilian deaths and torture (ICC, 2003). Hence, it is argued that these acts amount to crimes against humanity. Additionally, the acts may also constitute acts of genocide, as outlined in Article 2, in particular the first three acts (a–c): (a) killing members of the group; (b) causing serious bodily or mental harm to members of the group; and (c) deliberately inflicting on the group conditions of life calculated to bring about its physical destruction in whole or in part; and (d) imposing measures intended to prevent births within the group. To establish genocide, special intent must also be established, drawn from the context in which the attacks were committed, here resulting in the partial if not complete destruction of the ethnic Tigrayans (Tefera, 2024).

Studies have estimated about 600,000 lives perished during the two years of the Tigray war (Pilling & Schipani, 2023). This fact, coupled with the intentional destruction of the health system and weaponizing of the obstruction of healthcare in Tigray, calls for responsible international, regional, and domestic courts to investigate whether the destruction of the health system in Tigray amounts to a war crime,

crimes against humanity, or genocide. In line with this, the report published by the New Lines Institute (in paragraph 64) found:

> *[…] by intentionally destroying the health care system in Tigray, […] removing these necessities of life over an extended period not only severely endangered the civilian population but actually caused widespread harm and death.* (New Lines Institute for strategy and policy, 2024)

Similarly, the statement of the Director General of WHO mentioned

> *In Syria, Myanmar, Yemen and Tigray millions have been denied access to essential health services, where health facilities have been destroyed and health workers have been attacked and intimidated […].* (EEPA, 2021, SR 104)

"Imposing conditions of life calculated to bring about the destruction of the target population" is a material element of the crime of genocide under Article 2(c) of the Geneva Convention. In establishing the special intent of this act, it is an established precedent to adhere to objective standards even in the absence of direct evidence. For example, the International Criminal Tribunal for the former Yugoslavia, the Trial Chamber in the case of Prosecutor V. Radoslav Brđanin stated:

> *In the absence of direct evidence, in inferring whether the "conditions of life" imposed on Bosnian Muslim and Bosnian Croat detainees amounted to conditions calculated to bring about their physical destruction in part, TC has focused on the objective probability of these conditions leading to the physical destruction of the group in part. In evaluating this objective probability, the Trial Chamber has focused on the actual nature of the "conditions of life" and on the length of time that members of the group were subjected to them.* (*Prosecutor v. Radoslav Brdanin*, 2004)

Taking the above objective probability standard, the result of the destruction of health facilities in Tigray coupled with the complete siege, blockage of food and medicine, fuel, and electricity could be nothing more than the destruction of the target population in part. This intention can be inferred from the actions and possible consequences of the acts.

The importance of qualifying the intentional destruction of the healthcare system as crimes of genocide in the context of the Tigray war is more pronounced, as it was accompanied by the forced

displacement of close to 2 million people, ethnic cleansing, and rampant sexual violence towards an estimated 120,000 women (Fisseha *et al.*, 2023). This includes the deliberate transmission of HIV/AIDS (Kidanu & Tefera, 2024), deliberate starvation and famine as a weapon of war and total siege all of which are interrelated and contribute to the stress of the healthcare system and death of up to 700,000 people in Tigray (Pilling & Schipani, 2023).

Conclusion

This study adopted the ICM framework for health systems resilience to analyse the destruction that happened across all levels of the health system and related sectors in Tigray, to identify potential capacity for resilience. The deliberate destruction of the healthcare system in the Tigray war poses a unique scenario that requires an urgent need for the rethinking of health system resilience frameworks.

This study analysed and documented the types, nature, magnitude, and manner of the destruction inflicted upon the Tigray health system over the two years of the Tigray war. The destruction was intentional, systematic, and widespread across all levels of the health system, health facilities, and geographic areas of Tigray. All types of WHO reportable healthcare attacks occurred and were documented. The deliberate destruction of the health system in Tigray is unique, as it was executed by the government and its allied forces, including foreign forces of the EDF. Close to half of the attacks on the healthcare system in Tigray were carried out exclusively by Eritrean forces, making up most of the destruction. This deliberate destruction resulted in the complete collapse of the health system threatening the life and existence of the Tigray population. As a result, the achievements in the health profiles in the Tigray region made over the last three decades preceding the war were wiped out. Health profiles in the Tigray region have reverted to the status that they were in the early 1990s.

Taking the intention, context, consequences, and impact of the deliberate destruction of the health system in Tigray, it is argued that the acts amount to war crimes, crimes against humanity, and potentially genocide. So far, the literature on international

humanitarian law has characterised the destruction of health systems as a war crime. It is purported in this chapter that this understanding of the legal interpretation will undermine the efforts to ensure accountability and have ramifications for putting the appropriate legal and political measures in place to mitigate and prevent attacks against healthcare systems in times of war. Globally, attacks on healthcare are an emerging global health problem and are being used in modern warfare to commit genocide. Thus, building global solidarity among the health community to put the necessary legal and political measures in place, at global and national levels, is vital to mitigate and prevent the deliberate destruction of health systems in times of war, with the grave consequences this destruction has for civilians.

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Authors' contributions

Araya Abrha Medhanyie and Mirjam Van Reisen conceived the idea of the research. Araya Abrha Medhanyie designed and implemented the research. Initial preparation of the data set from the EEPA and coding of the data was made by Mirjam Van Reisen and Joëlle Stocker. Araya Abrha Medhanyie and Alem Desta Wuneh did a second round of coding, and analysis of the data set prepared by Mirjam Van Reisen and Joëlle Stocker. Araya Abrha Medhanyie and Alem Desta Wuneh identified the themes that are presented in the manuscript. Additional data was collected and analysed by Gebreamlak Gidey Abebe. A. H. Tefera provided the legal analysis of the chapter. Araya Abrha Medhanyie wrote the first version of the manuscript. All authors, including Gebru Kidanu, participated and contributed in the interpretation of the findings and write up of the subsequent versions of the manuscripts. All authors have read and approved the final version of the manuscript.

Ethical considerations

'The Tigray War and its Consequences on Health and Peace of the People of Tigray' (Reference Number CHS/DHC/020/22). The Tigray book project is reviewed and registered at the Institutional Review Board (IRB) office of the College of Health Sciences of Mekelle University.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 11

Measuring System Change: Shifts in the Health Landscape under the Tigray Siege

Joëlle Stocker & Araya Abrha Medhanyie

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System brings coexistence while reconciliation brings love.

Abstract

In this chapter, the nature of the change in Tigray's health system is studied, looking at how the war of 2020–2022 influenced shifts in the health landscape. This Fisher information model was used to analyse the stability of Tigray's health system during the war. The study identifies how the health system responded to various events that took place during the war. The research uses data on the prevalence of diseases and mortality, together with data on critical events in the war. The results show that the health system trends align with war events, especially when all zones were analysed together. Mekelle and North Western zones were the most stable, while the East, South, and South Eastern zones were the least stable, with many missing data points indicating instability. The Central Zone showed a gradual decline in Fisher information, reflecting the war's toll. Temporary increases in Fisher information suggest resilience, although the study could not conclude a significant bounce-back effect post-war. The findings highlight the utility of the Fisher information model in analysing the stability of health systems in war situations, but underscored the need for comprehensive data to understand long-term impacts.

Keywords: Tigray war, health system, Fisher information, critical shifts, resilience, hysteresis, Ethiopia

Introduction

Wars are defined by tipping points, specific events that instigate a transition from 'what was' to 'what is': peace, war, siege, famine, and, eventually, peace again. These definite moments in time may be critical points in the narrative we see and understand, but when looking at the transitions that complex systems undergo from one state to another, for instance, a state of peace to a state of war, these 'tipping points' are not straightforward. In health systems, for example, the tipping points related to war-caused disruptions may occur months after the onset of the war, when the effects on health facilities, medical supplies, hygiene, and disease control lead to a new state, defined by a very different health landscape.

Garry and Checchi (2020) studied the health effects of armed conflict, looking up to 20 years after the onset of the war. Their research shows how long-lasting the effects are, due to the large-scale changes, including those to the fabric of communities and societies. Important changes include problems with childhood development and lasting reproductive issues, disruption of disease control and increases in the burden of endemic infectious diseases, lack of vaccinations leading to epidemics, treatment interruptions leading to worse outcomes, and overall worse health due to limited education and employment (Garry & Checchi, 2020; Bendavid *et al.*, 2021).

The process in which systems move from one state to another after resilience has been eroded and a tipping point is reached is described by critical transitions (Scheffer *et al.*, 2012). The study by Garry and Checchi (2020) presents a clear alternative health state brought forth by conflict and war. Importantly, they show that it is difficult to return to the pre-war state once the shift to an alternative state is reached. In the theory of critical transitions, this is called hysteresis: once the transition to another state has occurred, it is difficult (and sometimes near impossible) to revert to the previous state (Scheffer, 2009). Thus, the system state defined and brought forth by war often outlasts that war by years, decennia, and sometimes entire lifetimes.

In this chapter, we study the nature of the change caused by the war with the health system in Tigray as a case study. We look at how the

war of 2020–2022 influenced changes in the health landscape through the prevalence of disease and mortality, when the transitions occurred, and how the system responded to various events that took place during the war.

Conceptual framework

Measuring the resilience of systems can be complicated, as measurements used within and across fields can vary wildly (Stocker, 2024). Many assessments have been created for different kinds of data and approaches. Qualitative research designs evaluating resilience fundamentally differ from quantitative designs, with different sets of limitations. Studies have found that combining qualitative and quantitative data provides more robust assessments of data, as they can constrain the respective limitations of the different approaches (Biddle *et al.*, 2020; Ungar, 2003).

One way of considering the resilience of a system is through the theory of critical transitions. These outline the process by which a system moves from one state to another, as the conditions in which the system exists, change (Scheffer *et al.*, 2012). This transition occurs as a system gradually loses resilience, due to disturbances or changes in conditions, until it reaches a tipping point. Past this point, the characteristics of the systems have changed to a degree that it is deemed to exist in an alternative state. However, it is notoriously difficult to pinpoint exactly when these tipping points occur. While there have been studies on assessing early warning signs for these critical transition, no robust assessment methods currently exist (Hewitt & Thrush, 2019).

In this study, we focus on Fisher information to analyse the stability of the Tigray health system during the war. In simple terms, Fisher information describes the measure of order and disorder within a system (Mayer *et al.*, 2006). Each system consists of several states in which it can exist, based on the conditions in which it is, defined by n variables. The n measurable variables define the system at any point in time, thus all variables have a value for a specific point in time. The states are characterised in two ways: a data point around which the states have centred, and a level of uncertainty for each dimension

which describes the breadth of the states (Eason & Cabezas, 2010). With these parameters, the probability of observing the system in any particular state is estimated.

A system is said to be orderly when it does not change from one state to another, thus staying within the levels of uncertainty around a specific point. In that case, the probability of observing the system in a particular state is high, and the Fisher information value will be high (Eason & Cabezas, 2010). Low Fisher information values on the other hand would indicate more disorder, as the probability of observing the system in a particular state would be low.

When using Fisher information to identify tipping points or critical transitions, we are looking at how steep the change is in the order and disorder of a system. To calculate how significant the deviation is from the usual behaviour of the system, the standard deviation and mean of the Fisher information over the total period of time can be calculated. A critical transition is deemed to occur when a variation exceeds two standard deviations above or below the mean (Gonzalez-Mejia, 2012; Vance *et al.*, 2017).

Problem statement

This study aims to accomplish two things. The first is to test whether Fisher information is reliable in measuring health system stability in times of conflict. The second is to look at the behaviour of the health system in Tigray during the war, and whether or not one can speak of a system collapse. In other words, can we identify catastrophic shifts or critical transitions in the system, and if so to what extent are they related to the events that took place?

Our research question is, therefore: *What was the impact of the events in the Tigray war on the stability of the health system?*

Two hypotheses were formulated on the behaviour of the system, reflected in the Fisher information values:

- Significant events in the war are noticeable through an increase or decrease in Fisher information.
- The collapse of the health system in Tigray is visible in a gradual, but significant, decrease in Fisher information.

Methodology

This study uses an explorative research design in looking at whether Fisher information is useful for evaluating the stability of the health system in times of war and identifying potential critical transitions. This is studied by triangulating the results with entries from the Europe External Programme with Africa (EEPA) Situation Reports, which recorded the events of the war systematically. The study was conducted with limited data available. Fisher information requires very regular longitudinal data, which is difficult to obtain in times of war.

The study is primarily quantitative, condensing large datasets into an index indicating a particular aspect of the system it describes. This study, therefore, aims at supporting results from qualitative and in-depth assessments that have been made in other studies on the resilience of the health system during the Tigray war.

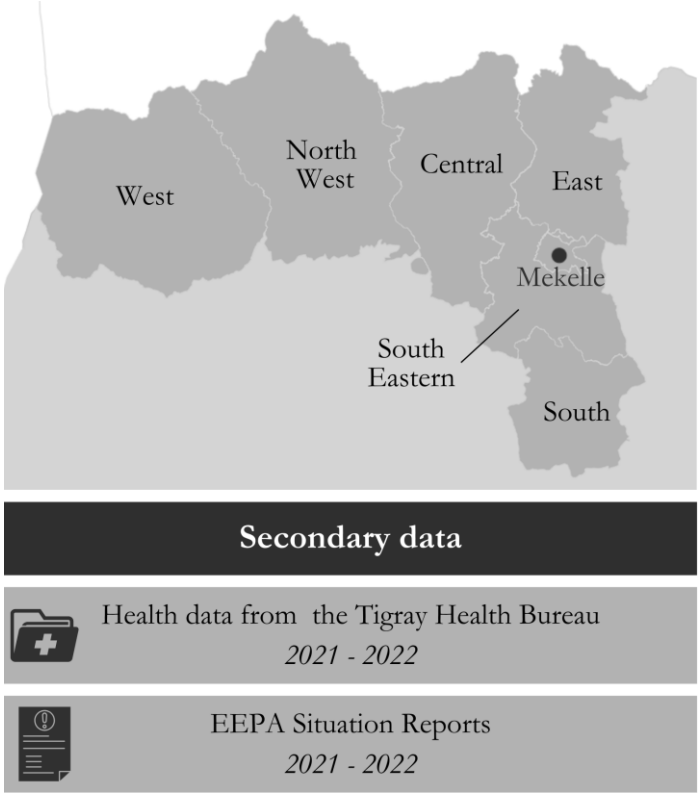

Figure 11.1. Study location and overview of data used in the study

Data collection

Secondary data was obtained from the Tigray Health Bureau on the prevalence of diseases and maternal and perinatal mortality rates spanning 2021 and 2022. The operational procedures for patient data collection were stopped as a consequence of their reliance on the central government, which was the main party to the war (Taye *et al.*, 2024). This data was thus collected by international non-governmental organisations (INGOs), in a limited capacity. The data was divided into the zones in Tigray: Mekelle, Central, North Western, West, South, South Eastern, and East. The variables that were used in the study were: malaria cases, microscope/Rapid Diagnostic Test, pulmonary fibrosis cases, polycythaemia vera (PV) cases, meningitis cases, meningitis deaths, dysentery cases, typhoid fever cases, rheumatic fever cases, typhus cases, severe acute malnutrition (SAM) cases, SAM deaths, acute flaccid paralysis cases, measles cases, anthrax cases, anthrax deaths, number needed to treat deaths, acute water diarrhoea cases, rabies cases, rabies deaths, maternal deaths, pre-natal deaths, hepatic veno-occlusive disease (HVOD) cases, HVOD deaths, scabies cases, and antibiotic use for acute respiratory tract infections (ARTI).

Data was also extracted from the EEPA Situation Reports. The Situation Report on the Horn of Africa was published daily during the Tigray war and published what was deemed credible information, which included published sources as well as information from the ground obtained through credible channels. During the Tigray war, the region was held under an information blockade and siege during much of the time. It was difficult, if not impossible, for journalists to enter or stay in the region. The Internet was down and the use of Internet through international organisations that remained during the conflict was extremely limited. Consequently, the information on the situation in Tigray was restricted within and outside the region. The EEPA Situation Report earned a position where it was well-informed and to date the most comprehensive overview of the events that took place in the region during the war. The EEPA Situation Reports provide a granular overview of information on the situation in Tigray during the war period. Entries from the reports of 2021 and 2022 were coded and labelled. 182 entries between 1 January 2021 and 1

November 2022 were used. In addition, the critical points in the war, as described by Melicherova *et al.* (2024)[40] were used to compare to the Fisher information trends.

Data analysis

Fisher information was calculated using the method outlined by Cabezas and Eason (2010). Values for Fisher information were measured for the zones separately, as well as together. The data were first binned into windows of 8 points, with the space between windows being 1 (each new window started at x_1+1). The uncertainty was found by calculating 2 standard deviations from the first 5 data points for each variable. Once Fisher information was calculated, an average of 3 data points was calculated to smoothen the trend line.

An important note to consider is that the data collected by the Tigray Health Bureau was not collected from a fixed number of health facilities, but rather from those that were able to report the number of cases. Thus, the number of health facilities that the data was collected from, altered over the 2 years (see Figure 11.2).

[40] The critical points were identified by Melicherova and Van Reisen (2024) by coding and labelling 8,171 entries from the EEPA Situation Reports and 522 from EEPA's weekly news highlights. This analysis was supported by a literature search.

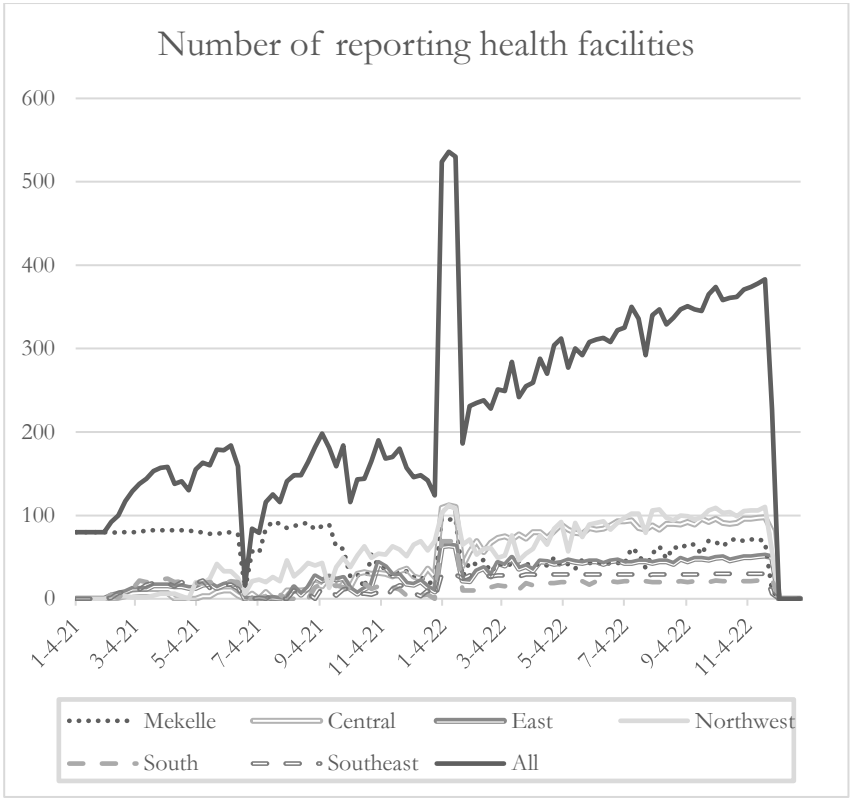

Figure 11.2. Number of reporting health facilities per week and zone

To understand the effect of this on the data, the Pearson Correlation on the variables and number of reporting health facilities was calculated. The majority of variables have a significant correlation. Based on this, a second Fisher information analysis was done on the dataset using the rate of cases, by dividing the number of cases by the number of reporting health facilities.

Missing data points were interpolated in Excel, considering 8 points before and after rather than the entire dataset, as this provided more accurate estimates. The Western Zone had almost no data for the second half of 2021 and 2022 and was, therefore, not included in the analysis. This zone is still under the occupation of Amhara forces and has not accessible to the Tigray Health Bureau since November 2020.

Two more statistical analyses were performed. First, a Kruskal-Wallis test and a Dunn test using the Bonferroni method was conducted to

compare the Fisher information results between zones. Second, to see whether specific variables strongly influenced the results, the Fisher information was calculated again (per zone and for all zones together) omitting one variable each time. The original Fisher information results were then compared to each result with a missing variable using a Pearson correlation test.

Results

Before looking into the Fisher information results, a background of the effect of the war on the health system is provided. It is important to provide context to support the interpretation of the quantitative analysis. This can help in the understanding of the results and indicate the trustworthiness of the analysis conducted.

Tigrayan healthcare system during the war

An idea of the conditions surrounding access to healthcare in Tigray during the war, can be obtained from the Situation Reports that were published by EEPA from the end of 2020 to the end of 2022. Tigray, a region in the federal democratic state of Ethiopia, governed by the Tigray People's Liberation Front (TPLF), was invaded by the Ethiopian National Defence Force (ENDF) of the federal government, together the with neighbouring country's military, the Eritrean Defence Forces (EDF).

Table 11.1 shows the number of operational health facilities reported at different points in time. Throughout the 2 years, the reported number of functional health facilities remained around 10%, with a spike in August 2021 when it was reported that 36% of health facilities were operational. The number of operational hospitals was generally higher, although it was reported on less frequently.

Table 11.1. Status of healthcare system in Tigray 2021–2022

Status of healthcare system	Date	SR No.
5 out of the 40 hospitals were physically accessible	11/01/2021	52
17 out of 224 health facilities (7.59%) were operational	09/02/2021	80
5-10% of health facilities were operational	23/02/2021	90
13% of health facilities were functioning normally	16/03/2021	104
55 out of 153 health facilities (35.95%) and 8 out of 17 hospitals (47.06%) were operational	16/08/2021	200
9.7% of health centres, 43.8% of general hospitals, and 21.7% of primary hospitals were fully functional.	31/05/2022	213
3.3% of health facilities in Western, 3.3% in South Eastern, 6.5 in North Western, 8% in Central, 14.6% in Southern, 16% in Eastern, and 78.6% in Mekelle were fully functional.	31/05/2022	213
9% of health facilities were functioning.	28/10/2022	300

The strain on the health system was caused by several factors. One of the common ways in which the healthcare system was undermined, was through the looting of medical supplies by armed forces and the destruction of health facilities and hospitals (EEPA, 2021, SR 48; EEPA, 2021, SR 62; EEPA, 2021, SR 72; EEPA, 2021, SR 103; EEPA, 2021, SR 105, 109; EEPA, 2021, SR 150). Armed troops also inhibited medical supplies from reaching facilities by blocking roads

and stopping envoys (EEPA, 2021, SR 76; EEPA, 2021, SR 132; EEPA, 2021, SR 183; EEPA, 2022, SR 208). Transport issues and seizing of ambulances led to patients not being able to access health facilities (EEPA, 2021, SR 76; EEPA, 2021, SR 104; EEPA, 2021, SR 173). In addition, hospitals were occupied by troops, restricting access to the general population (EEPA, 2021, SR 89; EEPA, 2021, SR 104; EEPA, 2021, SR 109). Humanitarian aid into the region was limited, with supplies being blocked and humanitarian workers killed (EEPA, 2021, SR 144; EEPA, 2021, SR 158; EEPA, 2021, SR 174; EEPA, 2021, SR 175; EEPA, 2021, SR 183; EEPA, 2022, SR 208; EEPA, 2022, SR 218). This led to the Médecins sans Frontières (MSF) suspending its activities in Adi-Abi, Adigrat, and Aksum (EEPA, 2021, SR 183). Finally, fuel shortage and the Internet blockade further restricted the accessibility of healthcare (EEPA, 2022, SR 209; EEPA, 2022, SR 225).

An increase in the prevalence of diseases was observed. An important factor in this was the decrease in vaccination levels in the region, falling to 10% towards the end of 2022 compared with pre-war vaccination levels being above 90% (EEPA, 2022, SR 272). On 30 June 2022, it was said that "the extremely limited availability of humanitarian aid and medical services caused epidemic-like diseases in the camps, including loss of lives" (EEPA, 2022, SR 231). On 17 October 2022, the Tigray Health Bureau stated concern for the increasing cases of malaria and insufficient health infrastructure to prevent needless deaths (EEPA, 2022, SR 291).

Several significant events took place during the war that further influenced the health system in Tigray. These are outlined in Table 11.2.

Table 11.2. Significant events in the Tigray war

#	Event	Date	Relevant zones	Description of event
0	Start of the law enforcement operation by the allied Federal Ethiopian forces	3–4 Nov 2020	All zones	Forces invade the Tigray region from the West, South, and North, and access to neighbouring countries and regions is blocked
1	Start of Operation Alula Abanega	18 Jun 2021	Central, South Eastern, and Southern	Recapturing of Mekelle (and several other towns) and unilateral cease-fire.
2	Mekelle is recaptured by the Tigray Defence Forces (TDF)	28 Jun 2021	Mekelle	The end of the *Alula Abanega* operation.
3	Start of Operation Tigrayan Mothers	12 Jul 2021	Southern	Recapturing of several towns in the Southern and South-Western fronts. Fighting expands beyond Tigray. The operation ends on 27 July with the TDF confirming the dismantling of some ENDF forces outside of Tigray.

4	ENDF and allies recapture several towns	23 Aug 2021	Eastern and Western	ENDF and Eritrean troops managed to recapture several towns and advance on Tigray.
5	The new chief of the interim administration	5 Oct 2021	All	Abiy is sworn into office for a second term, the cabinet is reorganised and a new chief of the Tigray interim administration is appointed.
6	The new offensive launched by the ENDF	15 Oct 2021	Inside and outside Tigray	Major offensives are launched across all important fronts in the Tigray, Amhara, and Afar regions. TDF launches a counter-offensive in the Amhara region.
7	The ENDF bombards the Tigray region	18 Oct 2021	Outside Tigray	Bombing focuses on dismantling telecommunication stations and other important infrastructure. Residential areas are also hit by airstrikes.
8	A formal agreement is signed between the TDF and	5 Nov 2021	Outside Tigray	A formal agreement is signed to work together towards a transitional

	Oromo Liberation Army (OLA)			government to replace Prime Minister Abiy. The TDF makes rapid advancements on the war front.
9	Announcement of the withdrawal of TDF troops from regions outside Tigray	20 Dec 2021	Outside Tigray	By 30 November, ENDF had recaptured significant towns in the Afar region, and progress is also made in the Amhara front. In December, the withdrawal of TDF troops outside of Tigray is announced to prioritise peace and humanitarian aid to the region.
9	A series of aerial strikes, also hitting residential areas	20 Dec 2021	All	The withdrawal of TDF troops is met with aerial bomb strikes in December and throughout January.
10	A ceasefire is announced	24 Mar 2022	*All*	A truce is agreed upon between the TPLF and the Federal Government. However, Eritrean troops remain active in the region. The ceasefire holds until June.

11	Humanitarian aid flows into Tigray	2 Apr 2022	*All*	The first humanitarian aid trucks enter the region, although it is by far not enough to cater to the needs of the Tigrayans.
12	Eritrean troops launch attack on North Western Tigray	24 May 2022	North Western	Despite the ceasefire, the EDF launched attacks in North Western Tigray, which was successfully retaliated by the TDF, upon which the EDF shelled Sheraro.
13	Fighting between the ENDF and TDF restarted along the southern border	24 Aug 2022	Southern	Increased movement of ENDF and allies is observed leading up to 24 August. A new front opens in Eritrea.
13	Multiple offensives are launched in Northern Tigray	24 Aug 2022	Northern	The ENDF and EDF launched multiple offensives in Northern Tigray.
13	Fierce battles take place in the Western Zone	24 Aug 2022	Western	The EDF is fighting the TDF on multiple fronts, and intense fighting over Dedebit town takes place lasting 70 days.

13	Airstrikes hit Mekelle	24 Aug 2022	Mekelle	ENDF carries out numerous aerial strikes on Tigray, focusing on Mekelle. Ayder Hospital in Mekelle gets an overwhelming influx of patients. The attacks slow down the delivery of humanitarian aid.
14	The ENDF & allies launch a largescale offensive on the North Western Zone	10 Oct 2022	North Western	The ENDF and EDF attack Zalambesa, Rama, Tserona and Adigrat. By 18 October, ENDF had captured Shire.
15	The Cessation of Hostilities Agreement is signed	2 Nov 2022	*All*	Negotiations for peace mediated by the African Union start on 25 October, with an agreement on cessation of hostilities signed in Pretoria on 2 November between the federal Ethiopian government and TPLF.

Note: Combat (underlined), administration (black), *aid and ceasefire* (italicised).

These events are important markers affecting the conditions related to the health of the Tigrayan population, as well as the capacity of the healthcare system to deal with changes in the health of the population.

The events were categorised as relating to combat (underlined), administration (black), and aid and ceasefire (*italicised*).

Fisher information results

The Fisher information trendline depicted below gives information on the stability of the system between 2021 and 2022. In general, increases in Fisher information signify that the order in the system is rising. In contrast, a decreasing Fisher information shows a decline in order. Steep declines in Fisher information indicate a critical transition. In the results calculated from the health data in Tigray, we can see that there is general stability in the system, with the steepest decline takes place at the start of 2021.

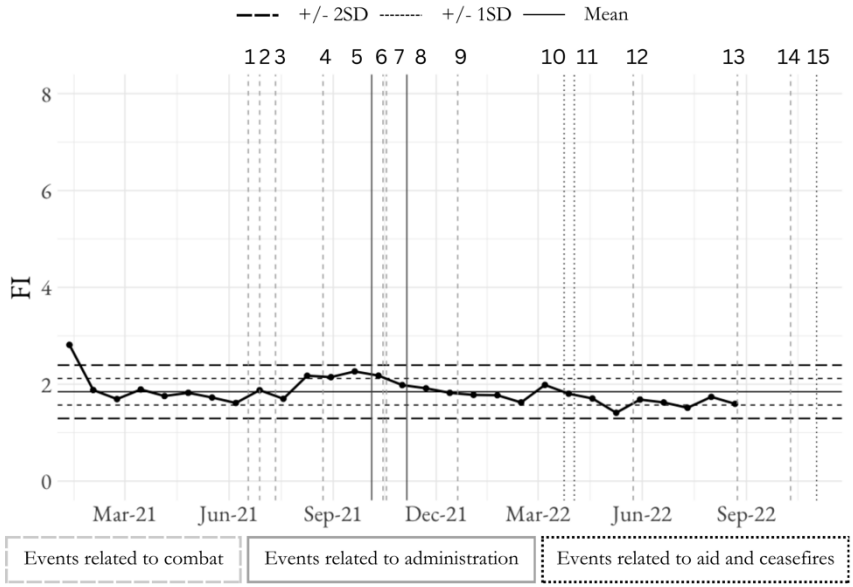

Figure 11.3. Fisher information for all zones

A slow and more gradual decline can be seen at the end of 2021 and start of 2022. The increase in Fisher information, indicating an increase in order, matches the recapturing of Mekelle by the TDF and subsequent operations that largely took place outside of Tigray. By September 2021 large-scale offensives are launched in Tigray by the ENDF and allies, which matches with the decrease in Fisher information, marking increasing instability. Interestingly, a short increase in Fisher information is seen around March 2022, which is

when a ceasefire was announced, and humanitarian aid was able to pour into the region. However, the increase in Fisher information takes place before this, followed by a decrease again reaching an all-time low around May 2022.

The results per zone show widely divergent stories in the different regions.

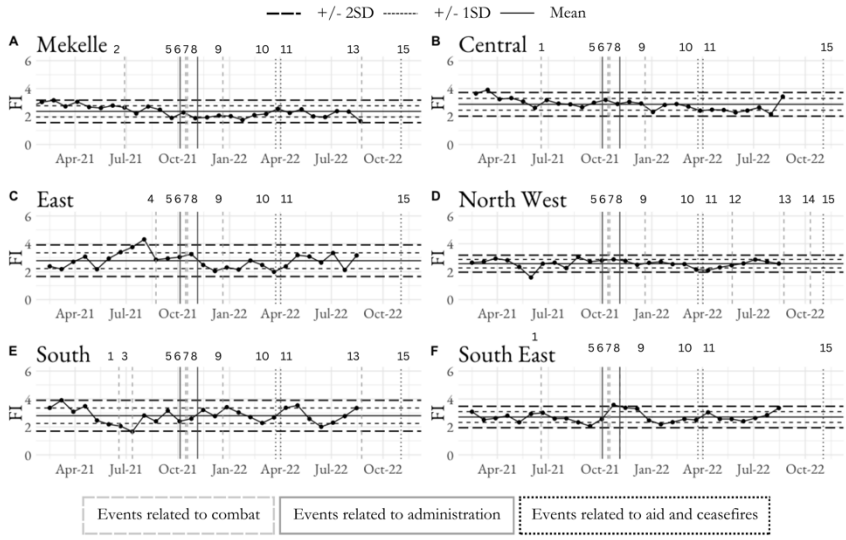

Figure 11.4. Fisher information per zone

Mekelle starts with a high Fisher information, which decreases upon the recapturing of Mekelle in June 2021. After this, it remains relatively stable at a low Fisher information, increasing now and then to reach the mean before going down again. The last point, in August 2022, is the lowest. The ceasefire and humanitarian aid in March and April 2022 match with an increase in Fisher information and a more stable trend.

The Central Zone also starts high, decreasing at the start of 2021 after which it remains relatively stable, around the mean until April 2022 when there is a slight decrease leading to the lowest point in August 2022. This point is followed by a steep increase in system order.

The Eastern Zone is among the least stable zones, with big fluctuations, especially in 2021. It is to be noted that this zone had a number of missing data points which were interpolated. This may

contribute to the large fluctuations. For instance, the significant peak around August 2021 matches with several missing data points. The interpolation thereof would have led to a semblance of stability, Fisher information interprets as an increase in system order. However, there are some notable points from the results. The Fisher information trendline matches well with the events that take place, with an increase in order after the recapturing of Mekelle and the start of the TDF operations outside of Tigray. The rebuttal from the ENDF and allies is also clearly visible in the drop that is observed, which remains until the ceasefire is announced and humanitarian aid is allowed to enter the region. This is followed by an increase in Fisher information.

The North Western Zone is largely stable, outside of a significant drop around May and June 2021, which is followed by a return to the mean. Like other zones, the Fisher information decreases as the ENDF and allies launch new offensives, and the TDF withdraws out of the regions outside of Tigray. The decline continues until the ceasefire, after which there is an increase in Fisher information. Interestingly, the increase in Fisher information continues despite an offensive from Eritrean troops in the zone.

The Southern Zone shows a lot of fluctuations. Here too there were several missing data points, especially between June and August 2021. Contrary to the effect of the missing point on the Eastern Zone, here the Fisher information incurs a significant drop followed by an increase. The big fluctuations continue throughout the period, with the second lowest point in June 2022, followed by an increase.

Like in other zones, the South Eastern Zone starts high with a gradual decrease until August 2021, where it rapidly rises before falling again to below the mean, coinciding with the retreat of TDF troops outside of Tigray. A gradual increase is visible until April 2022, matching the ceasefire, with relative stability around the mean after that.

Comparison of the results per zone

A Kruskal-Wallis test was performed to compare the Fisher information results of the zones with each other and with the results for all the zones together, with a significant difference found (chi-

squared = 59.154, p-value = 6.686e-11). To better see what the differences were, a Dunn test using the Bonferroni method was conducted. The results of this test are shown in Table 11.3.

Table 11.3. Results of Dunn post-hoc test using Bonferroni method

Comparison	Z	P.unadj	P.adj
All – Central	-63,246,835	2.54E-10	**5.33E-09**
All – Eastern	-53,899,763	7.05E-08	**1.48E-06**
Central – Eastern	0.9184501	3.58E-01	1.00
All – Mekelle	-25,575,610	1.05E-02	2.21E-01
Central – Mekelle	38,132,084	1.37E-04	**2.88E-03**
Eastern – Mekelle	28,785,013	4.00E-03	8.39E-02
All – North Western	-43,560,960	1.32E-05	**2.78E-04**
Central – North Western	19,343,485	5.31E-02	1.00
Eastern – North Western	10,158,984	3.10E-01	1.00
Mekelle – North Western	-18,446,210	6.51E-02	1.00
All – Southern	-56,031,986	2.10E-08	**4.42E-07**
Central – Southern	0.7089363	4.78E-01	1.00
Eastern – Southern	-0.2095138	8.34E-01	1.00
Mekelle – Southern	-30,917,236	1.99E-03	**4.18E-02**
North Western - Southern	-12,254,122	2.20E-01	1.00
All – South Eastern	-50,651,842	4.08E-07	**8.57E-06**
Central – South Eastern	12,375,933	2.16E-01	1.00
Eastern – South Eastern	0.3191431	7.50E-01	1.00
Mekelle – South Eastern	-25,537,091	1.07E-02	2.24E-01
North Western – South Eastern	-0.6967553	4.86E-01	1.00
Southern – South Eastern	0.5286570	2.54E-10	**5.33E-09**

Significant differences were found between each zone and all the zones together, except Mekelle Zone. The results from Mekelle also significantly differed from the Central and the Southern Zone. The Southern and South Eastern zones also had significant differing results. Thus, from all the zones, Mekelle was the closest to the results of the entire region, which is probably due to most of the data in the dataset coming from the Mekelle Zone. Mekelle diverged from the Central Zone the most, despite both zones having relatively stable Fisher information trends. The results show that the various zones had more in common with each other than with the entire region together.

Influence of variables on Fisher information results

To identify the influence of each variable on the results, the Fisher information for each zone was calculated, leaving out one variable each time. All the Fisher information results were then compared using a simple Pearson correlation test. The results can be found in Table 11.4.

Table 11.4. Correlation between Fisher information values with all the variables together and Fisher information values, where the named variable was removed from the dataset

	All	**Central**	**Eastern**	**Mekelle**	**North Western**	**Southern**	**South Eastern**
All	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Malaria	0,89	0,76	**0,54**	0,91	0,97	0,95	**0,49**
Microscope /Rapid Diagnostic Test	0,89	0,92	0,92	0,82	0,77	0,98	0,75
Pulmonary fibrosis	0,90	0,82	**0,68**	0,91	0,81	0,97	**0,57**

	All	Central	Eastern	Mekelle	North Western	Southern	South Eastern
polycythaemia vera (PV)	0,89	0,89	**0,52**	0,87	0,99	0,97	**0,59**
Meningitis	0,87	0,91	0,79	0,93	**0,58**	0,75	0,84
Meningitis death	0,91	1,00	0,92	0,95	0,90	0,98	0,98
Dysentery	0,89	0,92	0,99	0,79	**0,58**	0,96	0,87
Typhoid fever	0,89	1,00	0,81	0,89	0,23	1,00	0,70
Rheumatic fever	0,86	0,99	1,00	0,93	0,70	0,86	0,97
Typhus	0,91	0,94	0,93	0,84	0,88	0,85	1,00
SAM	0,89	0,90	0,89	0,83	**0,63**	0,86	0,90
SAM deaths	0,82	0,96	0,72	0,95	0,71	0,85	0,98
Acute flaccid paralysis	0,88	1,00	1,00	0,92	0,95	0,99	1,00
Measles	0,89	0,99	0,93	0,91	0,73	0,83	0,91
Anthrax	0,88	0,75	0,85	0,97	0,99	0,93	**0,62**
Anthrax deaths	0,89	0,98	0,97	0,96	0,98	0,96	1,00

	All	Central	Eastern	Mekelle	North Western	Southern	South Eastern
Number needed to treat deaths	0,86	1,00	0,85	0,96	1,00	1,00	1,00
Acute water diarrhoea	0,89	1,00	0,99	0,96	0,79	1,00	1,00
Rabies	0,89	0,82	1,00	0,91	0,98	0,81	0,80
Rabies deaths	0,86	0,99	1,00	0,96	0,76	1,00	1,00
Maternal deaths	0,88	0,99	0,92	0,94	0,99	0,79	1,00
Pre-natal deaths	0,86	0,84	0,88	0,91	0,95	0,86	0,86
HVOD	0,87	0,93	1,00	0,96	**0,39**	0,94	1,00
HVOD deaths	0,90	1,00	0,98	0,95	0,79	0,99	0,99
Scabies	0,89	**0,53**	0,93	0,89	0,25	1,00	0,95
ARTI	0,90	0,82	0,99	0,80	0,30	0,88	0,80

The results indicate that all Fisher information values were significantly correlated, aside from typhoid fever (p-value = 0,239), scabies (p-value = 0,214) and ARTI (p-value = 0,135) in the North Western Zone. The correlations were especially strong in Mekelle and all the zones together. This would indicate that all variables had similar impacts on the final Fisher information values, indicating robustness in the results.

Discussion

Fisher information reduces a number of variables to a one-dimensional reading of a situation. In this case, it looks specifically at how information changes over time, thereby providing information on stability and resilience. Thus, increases and decreases in Fisher information would be related to the patterns in the data – if there is a lot of change in a lot of variables at once, this will be visible.

The two hypotheses that were formulated for this study were that (1) significant events in the war would be noticeable through an increase or decrease in Fisher information, and (2) the collapse of the health system in Tigray would be visible in a gradual, but significant, decrease in Fisher information. The first hypothesis is accepted in all the zones together, and in most zones separately, although they are not always strongly visible, and the causality is not clear. For instance, whilst in some zones it is very clear that system order increased after the ceasefire, in some it was already happening by the time the ceasefire was implemented. The second hypothesis is only true for all zones together, and the Mekelle and Central zones separately.

There are several reasons why this could be the case. The first is that the data starts a few months into the war, when the conditions were already bad. The steep decrease would have been expected at the end of 2020, although the steep declines that can be seen at the start of 2021 for the Central and Southern zones, could be indicating that this indeed took place and continued up to the first quarter of 2021. Another point of consideration is that it was not always clear where humanitarian aid was being delivered and where (I)NGOs were active. Thus, increases in Fisher information in some areas may be related to this.

An additional aspect to contemplate is whether the variables are good indicators of the health system as a whole. There have been several publications on the collapse of the health system in Tigray (Gesesew *et al.*, 2021; Medhanyie *et al.*, 2024), discussing the closing of health facilities, lack of supplies, and difficult working conditions for health practitioners, etc.; the variables included in this study do not look at these parameters. Instead, several cases and deaths related to dozens

of diseases were used, as it was expected that a less robust care healthcare system would be translated in an increase in cases and mortality. While on one hand it could be said that these are not reliable indicators, it is more likely that the effect on the number of cases and deaths is not straightforward.

An interesting study with which to compare the findings is one conducted by Odhiambo *et al.* (2020), who investigated the health system resilience in conflict, focusing on South Sudan. They found that it is difficult to apply the concept of resilience in fragile settings, where indicators are very low and the situation cannot deteriorate much further. They argue that in these situations, resilience can be demonstrated through the maintenance of coverage at low levels or the improvement thereof.

Because the data used in this study starts a few months after the onset of the war, the situation is similar to the one described above, with a health system that has already been severely weakened: in January only 5 out of the 40 hospitals in the region were physically accessible (EEPA, 2021, SR 52), and in February only 7.59% of health facilities were operational (EEPA, 2021, SR). Thus, at this stage resilience indicates the ability to maintain what is left operational. The relative stability that we can see in the Mekelle and Central zones can, thus, be attributed to this. Repeating this study with data starting before the onset of the war and continuing until after the signing of the Pretoria Agreement would provide a different insight into how and when critical transitions occur related to conflict.

Odhiambo *et al.* (2020) also found that the areas with a higher number of internally displaced people (IDPs) demonstrate higher resilience, possibly due to more relief efforts in those states combined with more local leadership capacity. In Tigray, the highest number of IDPs were received in Shire (North Western Zone) and Mekelle. These regions both have the lowest standard deviations, meaning that there was less variety in Fisher information over time, indicating stability. This could be related to the number of IDPs. The North Western Zone also shows a clear increase in Fisher information after the ceasefire and humanitarian aid entered Tigray, it is feasible to assume that a large

amount of the aid was directed to places where there was a large number of IDPs.

Trustworthiness of Fisher information for the indication of system stability

The results of the analysis seem to align to some extent with what is known about the situation in Tigray at the time. Especially for the entire region together, the trendline matches the timeline of events well.

The analysis indicated that critical transitions occurred at different times in each region, as presented in Table 11.5.

Table 11.5. Overview of critical transitions

Critical transition	Zones	Timeline	Remarks
1	All	February 2021	The trendline starts higher of two standard deviations away from the mean.
2	Eastern	August 2021	Fisher information briefly shoots upwards in August.
3	Central	March 2021	Fisher information starts very high, briefly exceeding two standard deviations from the mean.
4	North Western	June 2021	Fisher information suddenly drops significantly and immediately returns to values close to the mean.
5	South Eastern	October 2021	Fisher information climbs around October, and stays high until the end of the year, before decreasing again.

This can be interpreted in two ways. Either a critical transition took place across all regions in the first months of the war (for which we do not have data) and the critical transitions displayed here are smaller fluctuations in the state – worsening still or improving as the events of the war shifted the conditions. These fluctuations would be on a smaller scale than the original expected transition which brought the Tigray health system to an alternative state, a state similar to that described by Garry and Checchi (2020). This alternative state would continue possibly until years after the cessation of hostilities. If this is the case, the analysis conducted in this study is all-encompassed within the alternative state.

A second interpretation would be that the transition into an alternative state had not yet taken place by 2021. In this case, the transition to the alternative state overall would be at the start of the year, with differences across regions, with the South Eastern Zone only transitioning in October 2021.

From the perspective of the capacity of the healthcare, the former is more likely, as the healthcare system had already been largely destroyed by the start of 2021. However, there is a lag in the emergence of diseases and epidemics. For instance, the number of cases of infectious diseases would have significantly increased months or years into the war. Similarly, the effects on patients of non-communicable diseases would take time. This would create a delay in the occurrence of a critical transition, making the second interpretation more likely.

Quantitative analyses in data black holes

The data that was used in this study contained limitations. Since the data was produced in real time by the health facilities during the war, there were missing data points, and the number of reporting health facilities were not consistent. The extent of missing data was such that one zone had to be excluded from the study. An important limitation that has also been highlighted by Moreno-Serra *et al.* (2022) is the lack of continuous data from before, during, and after the conflict. The data that we found for this study, was similarly limited in its timespan, only covering the middle part of the war. Analysing the system's

stability as it shifted into a war situation and out of it again after the Pretoria Cessation of Hostilities Agreement, would have provided a lot of useful information on system dynamics.

When data is not available from during the war, researchers adapt by collecting data after the conflict, which may lead to recall bias (Moreno-Serra *et al.*, 2022). In this study, parts of the analyses were performed by researchers who had been present on the ground. However, there too, recall bias is a possibility.

These issues are to be expected when using data from conflict areas. The conditions of the health system that we described are also a good indication of how difficult it was to collect data at that time. Travelling was complicated, especially long distances, which means that many places were unreachable. On top of that, there was a communication blackout and no Internet in the entire region. Essentially, Tigray was in a digital black hole: there was very little information coming in or out of the region.

Amare *et al.* (2024) outline the importance of decentralised health data repositing to avoid issues such as these in the future, where relying on data at the central government level resulted in data no longer being available when the region was invaded by the central government. This study shows the relevance of being able to access reliable and complete data to conduct important analyses and assessments to better understand the dynamics of and responses to the conflict.

Conclusion

This study used Fisher information to analyse the stability of the health system in Tigray. Data from EEPA Situation Reports were used to compare the events of the war with the findings. The trends emerging from the analysis matched to some extent with the events of the war, especially when all the zones were analysed together. The lack of (reliable) data was an important issue and continues to be an issue in areas suffering from conflict and war.

Thus, the results indicate that the most stable regions were the Mekelle and North Western zones, with the least stable regions being

the Eastern, Southern, and South Eastern zones. The latter had the most missing data points, which is also a sign that the regions were less stable, inhibiting data collection. The Central Zone showed a gradual decline in Fisher information, this was also noticeable in the Mekelle Zone and all zones together. A gradual decline in system order would be expected as the war takes an increasing toll on the population of Tigray.

Some events were correlated with a clear increase in Fisher information, demonstrating the resilience of the system being able to recover temporarily when conditions were better. This is interesting, as it could indicate a minimal hysteresis effect – improved conditions lead to a rapid bounce back. However, whether this is the case on a large or small scale is important, and unfortunately cannot be deduced from this limited dataset. If the critical transition had already occurred prior to 2021, relatively small increases in Fisher information would not be indicative of a return to the previous state. On the other hand, if the critical transition had not yet occurred, these increases in Fisher information would have been more significant.

This study demonstrated that Fisher information is a useful method for analysing the stability of a system. However, it did not allow a conclusion to be drawn about the bouncing back effect after the war. Understanding the dynamics prior to, during and after the war would help to identify the long-term effects of the war on the health system of Tigray, and how to build it back better.

Acknowledgements

The production of this chapter relied on the collection of data during the Tigray war, under difficult and sometimes life-threatening circumstances. When the idea for this chapter was born, we were very unsure whether any data would be available for such an analysis. After looking for some time, we were able to get this data from the Tigray Health Bureau, which felt like a gold mine. We would, therefore, like to extend our gratitude to the Tigray Health Bureau and all its partners who participated in the production of data in times of war. We would also like to thank B. G. Kahsay who offered advice and preliminary data that were used as pilot for the testing of the model. We also thank the double-blind peer reviewers for their comments.

Authors' contributions

The first author designed the study and the models used for this study. She also performed the modelling analysis and the statistical analysis. The second author supported the identification and acquisition of the data, and he advised on the implementation of the research and reviewed the chapter.

Ethical considerations

The data was obtained from the Tigray Health Bureau through a formal request (Reference number: CHS/MARCH/ 196/ 24, dated 14/03/2024). There were no personal identifiers or individual patients' names in the dataset obtained from the bureau.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 12

War-related Destruction of the Digital Health Data Infrastructure:

Discovering Features for a Resilient Digital Health Information System

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May a biased judge and a wounded cargo animal be perished.

Abstract

The consequences of the 2020–2022 war necessitate a transition to digital health systems in Tigray. Before the war, digital health transformation had already begun, spearheaded by the Tigray Regional Health Bureau. Significant investments had been made in improving not only digital information systems, but also paper-based health data systems to produce high-quality data for knowledge-based decision-making in health. During the war in Tigray the health data recording and reporting systems were destroyed. The collapse of the digital health system caused a critical transition, making a return to the original state unlikely without significant new conditions met. Hysteresis suggests that higher levels of support would be required for recovery. Therefore, instead of rebuilding the old system, it is recommended to develop new a digital health architecture suited to the current situation, incorporating lessons from past failures. This forward-thinking approach should focus on resilience, creating a robust digital health ecosystem that can withstand future disruptions, with a roadmap that includes local data management, local data ownership, and compliance with local regulations.

Keywords: Tigray way, health information system, digital health, Ethiopia, hysteresis, health resilience

Introduction

The destruction of health data is a major concern, alongside other damage to the digital health system, caused by and resulting from war and armed conflict. Armed conflict severely impacts the health system of countries, leading to the significant loss of health data (Debarre, 2018). Conflict disrupts the entire health sector, including the destruction of health infrastructure, which poses a challenge to accessing data from health facilities (Devkota & Van Teijlingen, 2010; Iqbal, 2019; Medhanyie *et al.*, 2024; Niguse *et al.*, 2024). Facility closures also interrupt record-keeping at health facilities (Gaffey *et al.*, 2020; Stocker & Medhanyie, 2024). Conflict can deteriorate the quality and completeness of health data, making it difficult to monitor disease outbreaks, track health trends, and develop effective healthcare policies (WHO, 2020). The trend of the crises in war-torn countries has similarities where the warring parties deliberately damage health facilities (Ekzayez *et al.*, 2021).

War undermines routines for health data collection, management, analysis, and dissemination in health information systems (HIS) (Dureab *et al.*, 2021). Many health institutions have been assaulted in conflict-affected nations over the last three decades, resulting in the destruction of hospitals and clinics as well as major losses of health data. Carolyn Briody *et al.* examined the facilities attacked during conflicts in Yemen (2015-Present), Syria (2011-Present), Iraq (2003-2011), Chechnya (1999-2000), Kosovo (1998-1999), and Bosnia and Herzegovina (1992-1995), focusing on the impact of violence on health data. A lack of health data could impede progress toward Sustainable Development Goal (SDG) 3 on health and well-being (Asi & Williams, 2018).

The use of health management information systems (HMIS) in Ethiopia has become central to the digital data revolution, transforming how health data are collected, analysed, and disseminated for decision-making (Health Sector Transformation Plan, 2015–2020). This progress extended to Tigray before the war, with significant improvements in electronic health systems (Advancing Partners & Communities, 2019). Tigray was at the forefront of implementing HIS, with substantial investments made by

the Tigray Regional Health Bureau since the reformed HMIS inception in 2015. The Bureau, guided by the Ethiopian Ministry of Health, structured the health information system, built capacity, and deployed digital systems over many years (FMOH, 2021a). However, this digital foundation of the health sector collapsed due to the war.

The war in Tigray started on 3 November 2020, and left health facilities deliberately looted, vandalized, and systematically destroyed (Fisaha, 2021, Niguse *et al.*, 2024; Medhanyie *et al.*, 2024, Stocker & Medhanyie, 2024). Medical equipment and computers were destroyed, patient files were damaged and scattered on floors and set on fire, and facilities were shelled. In addition, numerous healthcare workers were killed or forced to escape. The international medical humanitarian organisation Doctors Without Borders/Médecins Sans Frontières (MSF) shared the findings of an assessment by their team on 15 March 2021, exposing the deliberate and widespread destruction of health facilities across the Tigray region (MSF, 2021b). Stocker & Medhanyie (2024) listed a series of events in which the health system was negatively affected in the Tigray war and concluded that digital data on the health situation were missing. Stocker & Medhanyie (2024) also concluded that this health data was important for understanding the situation of health needs and prioritises needs for building back.

Hence, the research question is: *What were the cause of the destruction of the digital health system in the Tigray war, what features undermined the resilience of the system, and what are the requirements for rebuilding a resilient digital health data system?*

Methodology

The study was conducted as explorative participatory research with a case study in Adwa Hospital. It uses a deductive research approach.

Study area

This case study was conducted in Tigray, in northern Ethiopia. A case study was carried out in Adwa Hospital, which is in the central part of Tigray, about 240 km from Mekelle. Adwa is located in central Tigray and was on the front line for much of the war period. The

hospital suffered significant damage multiple times during the war and was subsequently converted into a military camp. As a result, it was unable to provide services for 8 months from November 2020 to June 2021.

Before the war, the facility had a daily turnout of 300 to 350 outpatients and a monthly turnout of 700 to 800 inpatients. The HIS implementation in Adwa Hospital was progressing well, and a large amount of health data had been recorded.

Study period and timeline

The study was conducted during 2020-2023. The war started on 3 November 2020 and a Cessation of Hostilities Agreement was signed on 2 November 2022 (ICHREE, 2023; Africa Union 2022). The following periods can be distinguished;

- Up to 3 November 2020 (pre-war): Tigray was administered by the regional government elected in Tigray.
- From 4 November 2020 to June 2021: Tigray was under the administration of an interim government appointed by the federal government.
- June 2021 to November 2022: The administration was appointed by the Tigray People's Liberation Front (TPLF).
- From November 2022 to March 2023 (post-war): Under Pretoria Cessation of Hostilities Agreement, Tigray was administered by the TPLF.

During the period 2020–2022 the Tigray region was under siege, which included the blocking of all electronic communication systems (Gebreslassie *et al.*, 2024). It was also under siege for other essential areas, such as banking and trade, which meant that digital equipment could not be obtained. The salaries of health workers, paid by the federal government of Ethiopia, were stopped during this period.

The research was conducted in the following periods:

- January-April 2022: preparations for the research and site visits
- May-June 2022: interviews and focus group discussions (FGD)

- July-September 2022: data analysis
- January 2023: Situation Report analysis

Some areas of Tigray continued to be under occupation during the period of research. Even after the Cessation of Hostilities Agreement was signed not all areas could be visited. The findings of this study pertain to the areas that were under the control of the regional administration, and which could be visited during the research period. This concerns primarily the central area of Tigray.

Data collection

The data collected for the study is qualitative data, with the following origin:

- Document analysis: The researcher conducted a mapping of the HIS in place in Tigray before the war.
- Literature review: A literature review was conducted to inventory the causes of health information disruption during the war.
- Analysis of Situation Report: A review based on the entries logged in the daily Situation Reports from December 2020 to June 2022 covering the situation in Tigray, prepared by Europe External Programme with Africa (EEPA) was carried out. A report of MSF on destruction of health facilities was also included.
- Observations: The researcher conducted observations during the period 2020–2022 and visited sites of health facilities.
- Key informant interviews with experts on HIS in Tigray: The study involved conducting interviews with three key informants at different positions in Adwa Hospital, including the Hospital Administrator (CEO), HMIS Administrator, and Health Information Technician.
- Focus group discussion on data production: a focus group discussion with one Health Information Administrator and 5 HMIS experts in the regional health bureau was conducted.

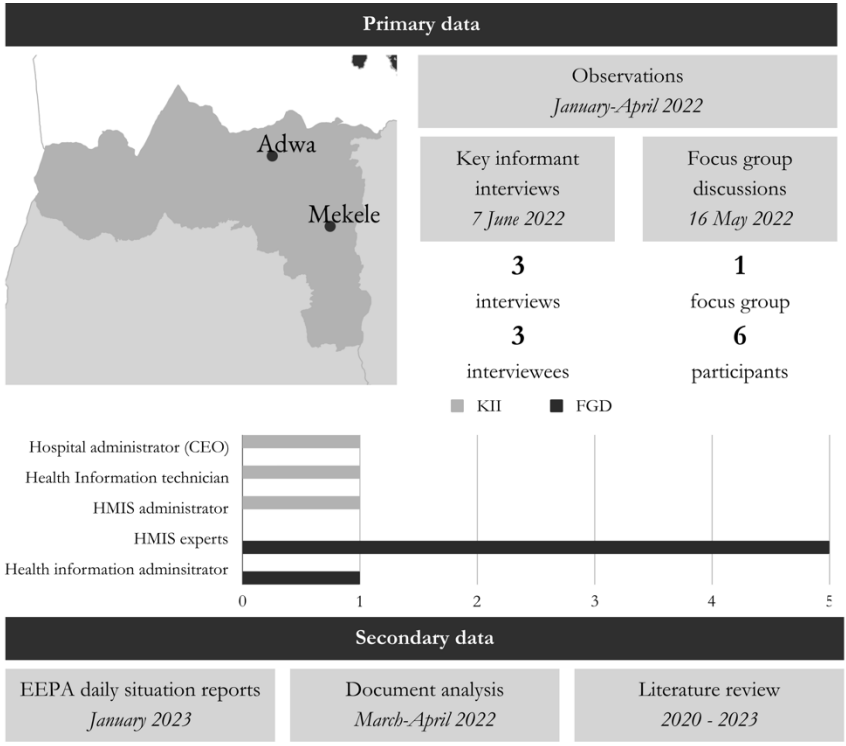

Figure 12.1. Overview of data collected and used in this study

The steps undertaken to conduct the research are listed below.

- Document analysis: The purpose was to obtain a baseline of the situation in Tigray before the war relating to (digital) health data information flows. An analysis of available policy tools and work formats in health data collection was conducted to identify good insight into the information flows and the different tools that were employed before the war.
- Literature review: The purpose was to investigate the causes for the loss of health information because of the war. Literature was reviewed based on the information contained on causes of information flow loss in the health sector during the war in Tigray.
- Analysis of Situation Reports: The purpose of the analysis of the entries in the Situation Reports was to obtain an objective verification of the findings obtained from the field visits with regard to the context of health facilities functioning during

the war. Documents were reviewed to substantiate the study and to better understand the situation before and during the war. A systematic review of the daily Situation Reports on the war in Tigray by Europe External Programme with Africa were included to support the study.

- Observations: The purpose of the site visits was to explore the situation on the ground. The researcher's observations during the period were written down in a research diary. On field visits notes and pictures were taken. Also, informal discussions were held with the health workers in the location. In this way, a detailed understanding of the situation in the field was obtained. Field visits were conducted in teams. The observations of the field visits were shared and discussed with other members of the team. The observations were also shared with the Regional Health Bureau which administered the situation of health services in the region and provided regular updates.
- Focus group discussions: The purpose of the focus group discussion was to verify critical points that had emerged from the observations during site visits. One semi-structured interview guide was developed for the focus group Discussion. The focus group discussion was conducted face-to-face. The focus group discussion was conducted in a physical meeting in the working room at Tigray Regional Health Bureau HMIS on 16 May 2022. A semi-structured interview guide was prepared with open-ended questions in English and the questions were translated into the local language Tigrinya. The discussion was conducted in the local language, Tigrinya. The discussion lasted for 2 hours and was audio-taped with a digital recorder.
- Interviews with resource persons: The purpose of the interviews was to receive an in-depth understanding of the salient issues that emerged from the field visits and to explore specific points which needed further understanding to complete the study. The selection of the participants was based on their proximity to the data production,

management, analysis, and reporting processes. The interviewees were experts at Adwa Hospital in the city of Adwa, which was a front city during the war. The investigator conducted face-to-face in-depth interviews individually in their private office at Adwa Hospital. The researcher received oral consent from all participants. A narrative approach with the guidelines of a topic list was used for in-depth interviews with resource persons with open-ended questions in English and translated into the local language Tigrinya. The interviews were carried out on the same day, on 7 June 2022, in a sequential order. The in-depth interviews were conducted for a duration of 30 minutes. The interviews were audio-taped with a digital recorder. Table 12.1. Overview of Study Methods

All personal data was anonymised and prepared to avoid identification. The following steps were undertaken to process and analyse the data obtained.

- Document analysis: The documents were analysed to obtain a listing of the HIS's used prior to the war; their purpose and the underlying information flow. The result was a baseline for the study in the form of a mapping of the situation on available health data information flows in Tigray that were in place prior to the outbreak of war.
- Literature review: A purposeful literature review was conducted from which an inventory of causes of the disruption of health information flows during war, was obtained.
- Situation Report analysis: The daily entries of the Situation Reports were included in an Excel sheet, relevant entries on health facilities were manually selected and through a coding-labelling qualities of the situation were manually logged, the entries were subsequently compared and analysed by the researcher. The analysis was conducted after the Cessation of Hostilities Agreement had been signed and access to all the Situation Reports could be obtained. The situation report analysis provided an independent source of information, in

addition to the fieldwork observations to triangulate the data obtained with regards to the status of the health facilities during the war.

- Observations: The observations on the use of the health system information systems during the war were logged in a research diary and discussed in the field visit teams, shared with other researchers upon return, and shared with the Regional Health Bureau for further verification and handling of information for the administration. The notes were consulted during the data analysis and provided important input in the topic list and questionnaire developed for interviews and the focus group meeting.
- Focus group: The focus group discussion was transcribed, translated and analysed using Microsoft Word 2019. Themes were identified by highlighting as many patterns as possible for each participant. The data were thematically analysed using back and forth review of the transcripts. The qualitative data analysis process has followed an inductive approach. The data were inductively coded against the employed conceptual framework focusing on the secondary consequences and the impacts on health data and HMIS.
- Interviews: An identical method was used as described in the preceding section. The data were coded against the themes identified in the focus group discussion. Where new themes emerged, these were marked and analysed.

Table 12.1. Overview of the research methodologies

Topic	Method	Time	Findings
Baseline on HIS	Document Analysis	March-April 2022	Inventory
Damage to health infrastructure	Literature review, site visits and Situation Report analysis	2020-2023	Hypotheses of causes, observations, verification and triangulation
Loss of healthcare workers and services at facilities, a decline in the quality and quantity of health data collected and interrupted experiences of using digital health systems	Site visits, focus group discussion, interviews, and Situation Report analysis	2022-2023	Observations, verification and triangulations
A lack of functioning of HIS	Focus group discussion and interviews	May-June 2022	Transcripts, coding labelling, identifying themes

Findings

The results of the study are presented in two parts. In the first part the results of the document analysis, literature review and the analysis of Situation Reports on the war in Tigray are presented. In the second part the experience by the users of the digital health systems is presented. These results are based on the focus group meeting and the interviews. The presentation of the experiences is also split in reported experiences from before the war, during the war and after the war.

Description of digital health systems before, during and after the war

Health data flows in Ethiopia

The data recording mechanism in most health facilities in Ethiopia is still manual, utilising papers and logbooks (Adane *et al.*, 2021). Health facilities would allocate large storage areas to keep records, which may complicate the management of patient records. Thus, the quality and safe storage of patient records determines the quality of healthcare service and delivery (Bisrat *et al.*, 2021). When record-keeping fails, medical errors occur, and this may hurt the services delivered to patients. Proper patient data recording and storage is the backbone of communication between healthcare providers. When patient data is lost or damaged, communication between healthcare providers breaks down, medical errors occur, and patients are put at risk (Taye, *et al.,* 2021).

The administration in the health sector of patient data is organised by the Ministry of Health at federal level in Ethiopia and the Regional Health Bureau. Ethiopia has a federal administrative structure with a certain devolved autonomy at the regional state level. The Regional Health Bureaus function horizontally under the regional government administration and report vertically to the Ministry of Health. In Tigray the Regional Health Bureau is part of the Tigray regional administration. During the war, a transitional government was put in place in Mekelle after the war broke out on 4 November 2020. The transitional regional government was later replaced by an administration that was put in place by the majority party in the region which lasted until 2023, when a new regional government was inaugurated, functioning under the Cessation of Hostilities Agreement, which was signed on 2 November 2022 (Africa Union, 2022).

The Ethiopian Ministry of Health, Regional Health Bureaux and other stakeholders were committed to realising the four transformation agendas of the first Health Sector Transformation Plans between 2015 and 2020 (FMOH, 2015). The Health Sector Transformation Plan is a five-year strategic plan detailing strategic

objectives and initiatives to ensure the health system provides excellence in health service delivery, quality improvement and assurance, leadership and governance, and health system capacity.

Table 12.2. Principle administrative units in the health sector

Ministry of Health	MoH	The Ministry of Health is a federal government ministry of Ethiopia, responsible for public health concerns.
Tigray Regional Health Bureau/ Regional Health Bureau	TRHB /RHB	is responsible for public health concerns at regional level.

The information revolution is an important element of the Health Sector Transformation Agenda. The information revolution aims at transforming the methodologies and mechanisms of capturing, storing, analysing, and disseminating patient health information (FMOH, 2016). As a result, some health facilities have started producing reliable and timely health data since the introduction of the information revolution roadmap guided by regional health bureaus administration at different levels of the health sector. This data production involves the standardization of data production processes, medical records, registries, tally sheets, and reporting formats (FMOH, 2021b). Following the period covering the first five years, a second Health Sector Transformation Plan was put in place, in 2020.

Digital health data programmes in Ethiopia

An inventory was made of software programmes utilised in the digital health information flows. The software systems are part of the digitization process going on under the leadership of the Ministry of Health and active engagement of national and international actors. These systems are designed to manage health data in the Ethiopian health sector (Lowenberg, 2020). This shows that a range of digital programmes are used in the sector for various purposes.

The systems in use in Ethiopia are:

- Electronic Community Health Information System (eCHIS)
- Electronic Medical Record (EMR)
- Health Management Information System (HMIS)
- District Health Information System2 (DHIS2)
- SmartCare
- Human Resource Information System
- Supply chain system
- Logistics Management Information Systems

An inventory set out in Table 12.3 shows different digital software systems that are relevant for the information flows in Ethiopia.

Table 12.3. Digital systems for production of health data in Ethiopia

Term	Definition
Electronic Community Health Information System	A mobile platform that assists in the management of health extension programmes through the collection and use of demographic data, health services delivery information and service utilisation.
Electronic Health Record	A digital version of a paper chart or register created and managed by health services providers at a health organisation to capture and store patient health information. Example is SmartCare which is fully functional at Ayder Hospital.
Health Management Information System	Collects, stores, analyses, and evaluates health-related data from health facility to district, regional and national administrative levels.
District Health Information System2	A system for HMIS aggregate data collection, analysis and reporting.

Term	Definition
SmartCare	(Electronic) Patient Records
Human Resource Information System	A software solution that maintains, manages, and processes detailed employee information and human resources-related policies and procedures.
Supply chain system	Interoperable systems for managing health system supply chain information in support of the Information Revolution (IR) agenda. There are different applications to support the supply chain system such as Dagu and mBrana.
Logistics Management Information Systems	The system of physical- and technology-based records and reports that supply chain workers and managers use to collect, organise, present and use logistics data gathered across all levels of the system.

With regards to data collection, the following categories of health support workers should be acknowledged within the digital health sector:

- Health extension workers: Staff of the Health Extension Program
- Health information technicians: A professional who is responsible for handling all technical aspects regarding managing patient health information.
- Members of the performance monitoring team (PMT): A multidisciplinary team which is primarily responsible for improving data quality and using information on a regular basis to evaluate the progress and to enhance healthcare delivery, is the main platform for routine data use in the health sector.

Digital health data information in Tigray (pre-war)

Before the war in Tigray, there were efforts to make a radical shift from traditional data use to systematic information use by the Tigray Regional Health Bureau. These efforts included initiatives such as the introduction of the HMIS, which involves a core set of indicators, standardized registers, patient cards, and reporting forms. The two platforms that were implemented to increase the utilisation of health data in Ethiopia are:

- DHIS2 at facility level
- eCHIS at community level

To avoid fragmentation, improve data quality, strengthen data analysis and use across all levels of the health sector, a web-based HMIS DHIS2 has been implemented since 2016. Ethiopia is one of the countries that adopted DHIS2 as its nationwide health information system platform (WHO, 2022). Almost all health facilities in Tigray were using DHIS2 when the war in Tigray began, and the facilities would send monthly, quarterly, bi-annual, and annual aggregate data to the district, Tigray Regional Health Bureau, and the Ministry of Health.

The Community Health Information System (CHIS) was implemented mainly using a unified data collection tool called the family folder. The family folder assists the management functions of health programmes, including the collection of data on basic demographic statistics, health service delivery, and utilisation based on the health extension package in health posts (Lowenberg, 2020). The eCHIS is a mobile platform implementation of CHIS, which was in the piloting phase just before the war started. The eCHIS was designed to collect health data at the community level within the Health Extension Programme (Ethiopia-Data Use Partnership, 2021). The Health Extension Programme is a national-level programme to create health equity by generating demand for essential health services through the provision of health information at the household level and access to services through referrals to health facilities.

The data collected using eCHIS would support health extension workers in their activities and empower decision-makers with high-quality data for improving the health system in implementing regions, one of which was Tigray.

Table 12.4. Inventory of paper-based and digital health data systems in Tigray before the war

System	Objective	Status in Nov 2020
DHIS2	Aggregate data produced in health facility and sent to Ministry of Health in Addis Abeba	Operational in most health facilities in Tigray
CHIS	Collection of data on basic demographic statistics, health service delivery, and utilisation based on the health extension package in health posts	Operational in most health facilities in Tigray
eCHIS	Digital mobile platform for CHIS	Pilot
Health Extension Programme	to create health equity by generating demand for essential health services through the provision of health information at the household level and access to services through referrals to health facilities.	Envisaged

System	Objective	Status in Nov 2020
Electronic Medical Record (EMR)	(Electronic) Patient Information Record System	Operational in Ayder Hospital in Tigray (e.g., SmartCare)

Disruption of digital health data flows due to Tigray war

The destruction of digital health data in Tigray caused by the war and its impact has not been given much emphasis during the preliminary damage assessments conducted by governmental and non-governmental organisations. A literature review was conducted to identify causes of disruption of information flows of health data within the situation of war.

In Tigray, the effects of the war on the health system resulted from the destruction through direct violence, forced displacement, other social crises, and the destruction and disruption of the health system (WHO, 2023). The war created a nearly total collapse of the healthcare system (Godefay, 2022).

The war disrupted both the operation of DHIS2, piloting of eCHIS, and all other digital health systems. The disruptions were caused by:

- Deliberate communication shutdowns during the siege implemented as part of the war (Yilma, 2021; Anthonio & Tackett, 2023)
- Power interruptions due to the destruction of infrastructure (Gebreslassie & Bahta, 2023)
- Computer damages due to destruction in the war (and lack of repair capability due to the siege)
- Displacement of healthcare professionals caused by the federal government (Gesesew *et al.*, 2021)

Increasing evidence pointed to most health facilities in Tigray being destroyed in the war. Table 12.5 shows information reported regarding the destruction of facilities in Tigray during the 2020-2022

war in the Situation Report of EEPA and by MSF. The reports are based on real-time observations during the war.

Table 12.5. Destruction of health facilities

Date	Facility	Location	Status	Reported by
26.12.2020	Hospitals	Wukro and Adigrat	Completely looted	EEPA, 2020, SR 37
31.12.2020	Health centres	Wukro, Negash, Idagahamus and Adigrat	Pictures show that medical equipment and pharmacies were completely destroyed and looted	EEPA, 2020, SR 42
07.01.2021	Hospital	Adwa	Looted	EEPA, 2021, SR 48
11.01.2021	Hospitals	Outside the capital city, Mekelle	Looted and many reportedly destroyed	EEPA, 2021, SR 52
29.01.2021	Health facilities	Between Mekelle and Aksum	Around 80% or 90% of the health centres that we visited between Mekelle and Aksum were not functional	MSF (2021a)
02.05.2021	Health facilities	Tigray Region	Of 106 health facilities visited by MSF teams between mid-December and early March, nearly 70%	MSF (2021b)

Date	Facility	Location	Status	Reported by
			had been looted and more than 30% had been damaged; just 13% were functioning normally.	

The experience with digital health systems in Tigray

The analysis of the interviews and focus group discussions present insight in the expectations of participants regarding the digital health data system in Tigray. Five themes emerged from the data:

- The experience of using digital systems before the war
- The destruction of the systems during the war
- The capacity building before the war
- The capacity building after the war
- The priorities in rebuilding the digital HISs after the war

The experience of using digital systems before the war

All respondents agreed that in their experience the use of electronic systems for data aggregation, analyses and reporting had a robust foundation in Tigray, but data recording was still mostly paper based. The regional health bureau was committed to realising the information revolution that was directed by the federal ministry of health. One of the goals of the information revolution was to introduce a computer-based reporting system in all health facilities in Tigray. The HMIS administrator of the regional health bureau explained his experience as follows:

> *When we say information revolution, it implies the introduction of computer-based reporting in all health facilities. Without exaggeration, almost all health centres and hospitals were able to send monthly and quarterly reports either by email or other reporting systems - electronically.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

The HMIS administrator of the regional health bureau explained that DHIS was used for data aggregation, analyses, reporting, feedback, and other activities altogether.

> *In July 2019, we started to report using the DHIS system. In the beginning there were some issues, Interestingly, by resolving the issues one by one progressively, we were able to improve the usability of DHIS*. (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

The HMIS administrator of Adwa Hospital also added his satisfaction with the introduction of electronic patient data reporting through DHIS2:

> *We were able to report directly to the district health bureau, regional health bureau, and MOH [Ministry of Health] using DHIS2. … We were using DHIS2 to record aggregate data, do analyses, and send reports based on several indicators. We were also using these for our performance monitoring team (PMT) consumption to track our hospital's progress.* (ADWA-P1, HMIS Administrator, face-to-face interview, 07-06-2022, Adwa Hospital)

The HMIS Administrator of the regional health bureau explained that the Health Extension Programme was implemented in health posts to create health equity at the household level and access to services through referrals to health facilities. This was managed using the CHIS to record health data at the community level to empower health extension workers. Later a mobile application of the CHIS, electronic CHIS (eCHIS) was deployed and piloting was undergone.

> *The bureau decided to commence the piloting of the eCHIS and it was progressing well; however, initiating it in all health posts at the same phase caused issues such as a shortage of tablets. There was a lack of resources to conduct trainings on eCHIS.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

HMIS experts in the regional health bureau explained that an Electronic Medical Recording system known as SmartCare was introduced in almost all health facilities. At least, the facilities implemented SmartCare in card rooms. Patients were registered in

SmartCare and provided service immediately without requiring patient cards.

> *Before the war, SmartCare was introduced in almost all health facilities in Tigray. Maybe except 10 facilities with no electricity, all health centres and hospitals had EMR [electronic medical record] (SmartCare). It was possible to register most patients in SmartCare to receive registration number. We were almost reaching the stage patients not required to bring patient cards.* (TRHB-P2, Health Informatician, face-to-face, 16-05-2022, FGD, TRHB)

The HMIS expert of the regional health bureau also added:

> *Introducing SmartCare in facilities would enable capturing individual patient data and improve continuum of care.* (TRHB-P3, HMIS expert, face-to-face, 16-05-2022, FGD, TRHB)

A participant of focus group discussion added that there was also a logistics management information system functioning in Tigray. The LMISs such as Dagu and mBrana were used to manage pharmacy stores and vaccines, respectively:

> *We had branch hubs in Mekelle and Shire which were used in their respective coverage areas. At each coverage area there was a Dagu system in each pharmacy store. For vaccine management, Embrana mobile application was in piloting in selected 7 health facilities in Hintalo Wojerat.* (TRHB-P4, logistics management information system expert, face-to-face, 16-05-2022, FGD, TRHB)

Focus group respondents highlighted that a system to support human resource information was also one of the systems functional at *woreda* (district) level before the war. The Human Resource Information System was used to store data about the workforce under the regional health bureau. This enabled the bureau and partners to manage their workforce and to do analyses every 3 months:

> *Every 3 months, the human resource data were analysed and the regional health bureau was able to know the turnout of the workforce at woreda level.* (TRHB-P5, Human Resource Information System expert, face-to-face, 16-05-2022, FGD, TRHB)

The technician of health information of Adwa Hospital reported that patient data were mostly recorded by hand on standard paper forms

at the point of service. Every department has a particular register and patient data should be produced daily. These data were compiled into a tally sheet which contain the aggregated data:

> *Our patient data recording at the point of service and each department such as OPD, IPD, and Emergency uses paper-based registration books and tally sheets. Then we collect the tally sheets and put the aggregated data into DHIS2. Our department (HMIS) used the electronic system DHIS2 system to do analyses and compile reports to the next level.* (ADWA-P2, health information technician, face-to-face interview, 07-06-2022, Adwa Hospital)

Before the war, data were compiled for reporting to be sent in aggregate form to the next administrative level. Aggregated data were prepared in each health facility digitally, using DHIS2, which were prepared for reporting electronically to the regional health bureau. The HMIS administrator of Adwa hospital explained their experience of recording aggregated data to DHIS2 at Adwa hospital:

> *We had a relatively robust system. Though the computers were not enough for the activities we carried out in our hospital, we were able to record electronic data consistently.* (ADWA-P1, HMIS Administrator, face-to-face interview, 07-06-2022, Adwa Hospital)

The analyses results which were produced from DHIS2 was used for health programme planning and reporting by the PMT which monitored the performance of a facility and team at the next level of administration such as district, regional and national health administrations. Feedback was also provided as soon as the report checked by the corresponding authority in the next level:

> *The reports were prepared based on the analyses done using specified indicators in the DHIS2. We use the result form the analyses to present to our PMT team in our hospital and send it to next level as well. We were receiving feedback on the specific reports we submitted.* (ADWA-P1, HMIS Administrator, face-to-face interview, 07-06-2022, Adwa Hospital)

Prior to the war, Tigray had set up a robust infrastructure of electronic health data systems that included DHIS2 for reporting to the Ministry of Health, SmartCare for electronic patient records, and electronic systems to track the logistics in health facilities and the availability and changes in human resources in the facilities. The findings suggest that

there was a relatively high degree of satisfaction with these systems which were generally running well.

Destruction of patient data and digital health systems during the war

Most in-depth interviews and focus group participants expressed that the war had caused a significant amount of damage. Respondents from Adwa Hospital were first-hand witnesses that the facility was closed for 8 months from November to June 2021. The HMIS Administrator of Adwa Hospital reported the following:

> *The war hurt our health facilities. Adwa Hospital stopped providing service for 8 months from November 2020 to June 2021, it was used as a military camp. This means all activities of the hospital stopped: no service delivery, no digital systems, and nothing - everything halted. Before the war started, the hospital had around 300 to 350 patient turnouts daily.* (ADWA-P1, HMIS Administrator, face-to-face interview, 07-06-2022, Adwa Hospital)

The HMIS Administrator of the regional health bureau, who participated in the focus group discussion, observed:

> *All computers were either damaged or stolen, thus it is obvious that the health data and the system that produced health data would be lost along with the computers.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

One HMIS expert stressed that loss of patient data is a critical problem for care to be delivered and continued without interruption. The destruction of patient data, caused by the war, is enormous, he finds, and it is one factor leading to the collapse of basic healthcare delivery in Tigray:

> *The extent of the data destruction due to the war is huge. Doctors require patient history to carry successful diagnosis out. These put the lives of millions at stake. Patient data is significant for the continuum of healthcare service. If patient data is lost, lives will be lost. Especially, chronic patients missed their clinical follow-ups (Gesesew et al., 2021).* (TRHB-P3, HMIS expert, face-to-face, 16-05-2022, FGD, TRHB)

The HMIS administrator of the regional health bureau expressed his resentment over the destruction that the war caused with critical

damage to the processing of data in the health sector. All the activities that were carried out using electronics, such as recording, aggregation, analysis, and reporting, were no longer functioning:

> *Every activity in our department (HMIS) that requires an Information System has been stopped. The war destroyed everything. They took or destroyed every equipment that would enable us to use the systems we built for decades.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

A respondent, who is the CEO of Adwa Hospital, added:

> *After the soldiers camped in our hospital, we were not able to come to work for 8 months. Afterward, all equipment in the hospital was looted; all computers were taken. Thus, we could not record patient data electronically.* (ADWA-P3, CEO, face-to-face interview, 07-06-2022, Adwa Hospital)

All participants responded that by the time the interview was held the activities had partially resumed. Ever since the Tigray-based regional government regained control over most of Tigray by 28 June 2021, the regional health bureau started some activities to assess and reopen healthcare facilities. The HMIS department of the regional health bureau was mandated to collect data for aggregation, analyses, and reporting using a special form compiled as a temporary solution.

> *Patient data recording has been resumed using available registers and tally sheets. However, the reporting has altered. The regional health bureau prepared a special reporting form which has few datasets, not more than two pages.* (ADWA-P2, health information technician, face-to-face interview, 07-06-2022, Adwa Hospital)

Although the regional health bureau tried to resume the health service in the region, the reality on the ground was beyond the capacity of the bureau. The extent of the damage to the infrastructure such as communication, electricity, and transportation were bottlenecks for resuming health service immediately. The regional health bureau collaborating with NGOs tried to collect aggregated data on special indicators from facilities using a two-page form. These put the facilities in a difficult situation to find a way to send the form back to the regional health bureau. The regional health bureau was also unable to send feedback to the facilities. To improve the interaction, the regional health bureau was discussing with stakeholders on how to

set up a landline phone for reporting and feedback. The HMIS administrator of Adwa Hospital added:

> *Though we have tried to resume the activities partially, sending a report to the regional health bureau has become very difficult. This is because of a lack of communication, electricity, transportation, and other infrastructure. We have not received any feedback from any authority until recently. There is a rumour that they (TRHB) will start using the landline phone for reporting and feedback.* (ADWA-P1, HMIS Administrator, face-to-face interview, 07-06-2022, Adwa Hospital)

The amount of the registries and tally sheets in facilities was limited. As the health service opened for patients, facilities would not have registries and tally sheets to record data. The CEO of Adwa Hospital said:

> *Even the registration books and tally sheets are going to be finished soon. That means we will stop recording patient data altogether. You can imagine what will happen to the continuum of care going forward without patient data, laboratory equipment, and other essential medical equipment.* (ADWA-P3, CEO, face-to-face interview, 07-06-2022, Adwa Hospital)

The war created significant disruptions on health data recording, aggregation and reporting in the Tigray region with varying impacts on facilities in different location. Adwa hospital, for instance, suffered extensive looting and destruction during the military occupation by Ethiopian and Eritrean defence forces. Facilities were used as camps for soldiers. The soldiers were using wooden racks, papers, plastic materials, and other flammable materials to cook their food. Thus, registration books and tally sheets burnt.

The lack of communication-means such as mobile, Internet connectivity compounded the difficulties. The siege that was imposed on the region further exacerbated the situation, as essential supplies, including food, were scarce. Despite a complete communication and Internet blockade, the regional health bureau and other involved stakeholders sought to resume the recording, aggregation and reporting of health data from accessible health facilities. The determination by healthcare professionals, health facility administrators, and HMIS experts served as the foundation for persisting through dire circumstances. This showed the resilience and

untiring commitment of the healthcare community to resume capturing vital health data, regardless of the challenges brought about by war.

Capacity building of human resources before the war

The introduction of the digital systems in the health sector required the development of new skilled human resources trained in the previous few years. This capacity-building effort brought huge investment from partners and funding organisations. The mission was to employ at least one health information technician at each facility. To succeed in this, continuous training and capacity-building programmes were provided by the Ministry of Health and partners. The HMIS administrator of the regional health bureau explained this as follows:

> *Digitalisation of systems in the health sector should be backed up with health information technicians. If there is at least one health information technician in each facility, the HMIS activities will be carried out without much difficulty. Hence, in Tigray the digitalisation was successful because of the few trained human resources who worked day and night to fulfil the information revolution plan.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

The HMIS administrator of the regional health bureau added:

> *Information use and data quality were the two most important things that required continuous improvement. Therefore, we had several capacity-building programmes and workshops to bring about continuous improvement not only to our HMIS staff but also to our community in the health facilities.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

Before the war, the regional health bureau and collaborating partners spearheaded continuous training and capacity-building programmes to ensure the success of the health sector transformation plan. A concerted effort was made, highlighting the collective commitment to fortifying the healthcare workforce with the essential skills required for navigating and optimising the digital landscape in healthcare. The dedication to this capacity-building mission underscores a collaborative and forward-looking approach, which was laying the

foundation for an increasingly resilient and technologically skilled health sector.

Capacity building of human resources during the war

Unfortunately, the onset of the war set everything back to square one. The war commenced when the regional health bureau and involved parties were on the verge of transforming the health sector to the new frontier of digital health:

> … *continuous capacity-buildings were sure to transform the health sector. Digital health requires continuous capacity improvements on the culture of data use and data quality.* (TRHB-P3, HMIS expert, face-to-face, 16-05-2022, FGD, TRHB)

A CEO of Adwa hospital indicated the current status of training:

> … *related to the capacity building, now we have not received any support. Any training for capacity-building needs finances not only for per diem but also for training items. Except for ordinary meetings, we have not started conducting trainings yet.* (ADWA-P3, CEO, face-to-face interview, 07-06-2022, Adwa Hospital)

The war impacted every implementation and investment that was showcasing the transformation of the health sector in the region. Numerous facilities stopped providing services, and healthcare professionals were forcibly displaced from their workplace. Means of communication were disrupted and transportation became impossible. The extensive efforts invested for many years to establish continuous training and capacity-building programmes were interrupted, leading to the collapse of the health system.

Rebuilding of a resilient health data infrastructure after the war

A participant said so far, the effort to rebuild the HMIS is not satisfactory. The regional health bureau started mobilising computers to support the HMIS activities in facilities:

> *The regional health bureau provided us two computers; however, we will not use them for data aggregation, reporting, and activities that need connectivity except for data recording and analyses for the hospital's consumption.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

A respondent from Adwa Hospital replied that the first step for the rebuilding should be to make DHIS functional where one can report and receive feedback directly to and from the regional health bureau.

> *I expect that the Internet service and other digital equipment will be put in place in few months or a year so that we quickly resume the HMIS activities such as using DHIS2 in our hospital.* (ADWA-P1, HMIS Administrator, face-to-face interview, 07-06-2022, Adwa Hospital)

The participants in the focus group discussion suggested that a comprehensive approach is needed to rebuild HISs, including the use of technology, capacity building for healthcare workers, and collaboration between different stakeholders.

> *The health professionals will have a lion's share in rebuilding the health system. The health sector without the professionals is nothing. Therefore, involving the health providers working with all stakeholders is inevitably crucial in stimulating activities such as capacity building, technology use, and rebuilding HIS.* (TRHB-P1, HMIS Administrator, face-to-face interview, 16-05-2022, FGD, TRHB)

All participants agreed on the need for community involvement in the rebuilding process. They said it is crucial to involve local communities in rebuilding HISs and ensuring that their needs are met.

Discussion: Factors in the resilience of a digital health system

To explain the total collapse of the digital health system in Tigray, it is essential to understand how the resilience of this system was undermined during the conflict. The concept of resilience has evolved over time, traversing various spatial and disciplinary boundaries (Stocker, 2024). The conceptual framework on health resilience proposed by Guha-Sapir and Van Panhuis (2002) provides insight into the significant impact that armed conflict can have on health outcomes. As illustrated in Figure 12.2, the framework identifies three interrelated consequences: primary impact, secondary impact, and the impact on health data and the use of digital systems.

Armed conflict primarily disrupts health systems by causing extensive damage to infrastructure, a consequence recognised as the primary impact. This disruption leads to secondary impacts, including reduced access to healthcare due to the loss of healthcare workers and

facilities, a decline in the quality and quantity of health data collected through health management information systems (HMIS), and interrupted digital health system operations due to the destruction of patient data and the HMIS. The culmination of these primary and secondary impacts is the further degradation of health services, particularly due to the absence of reliable HMIS and patient data.

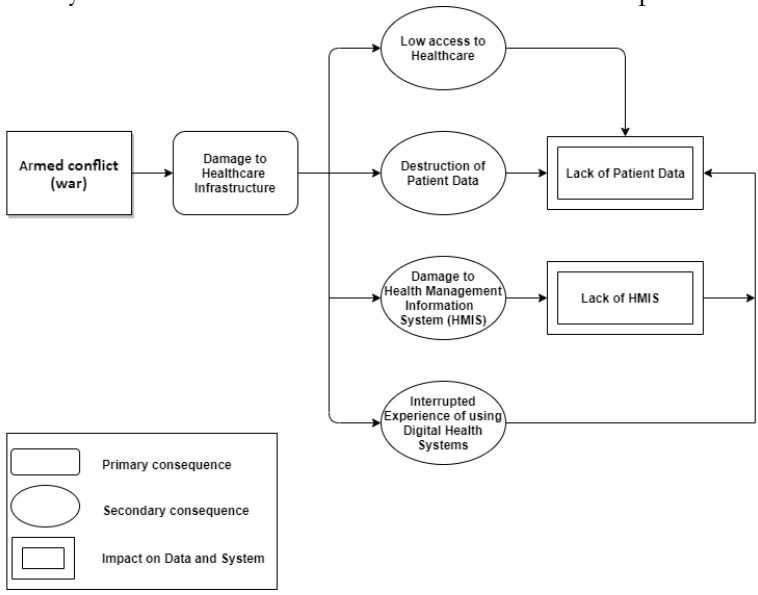

Figure 12.2. Conceptual framework for the impact of armed conflict on health data and HMIS Source: Adopted with modification from Guha-Sapir & Van Panhuis (2002)

The study corroborates the framework established by Guha-Sapir and Van Panhuis (2002), demonstrating how the war adversely affected the health system at multiple levels, leading to the destruction of digital health systems and undermining their overall performance. This framework aligns with broader concepts of health resilience, which are intrinsically connected to the notion of resilience. Resilience is defined as the capacity of systems to plan and prepare for disruptions, endure changes while mitigating their adverse effects, recover swiftly, and enhance performance by learning from experiences (OECD, 2019). Systemic disruption can lead to a critical transformation, resulting in the establishment of a new regime that replaces the original state (Stocker, 2024; Scheffer *et al.*, 2012).

Resilience, therefore, embodies the system's ability to remain within a stable ecosystem state or to rebound once that state has been altered.

Stocker (2024) explains the usefulness of the conceptual framework of resilience in showing that it may lead the system to bounce back or to move into a new regime that is triggered by the disruption. A shift causes a situation to move from an original state called 'regime 1' into a new situation called 'regime 2'. This change is referred to as a critical transition. The hysteresis is the conditions required to create a shift back to the original state of regime 1.

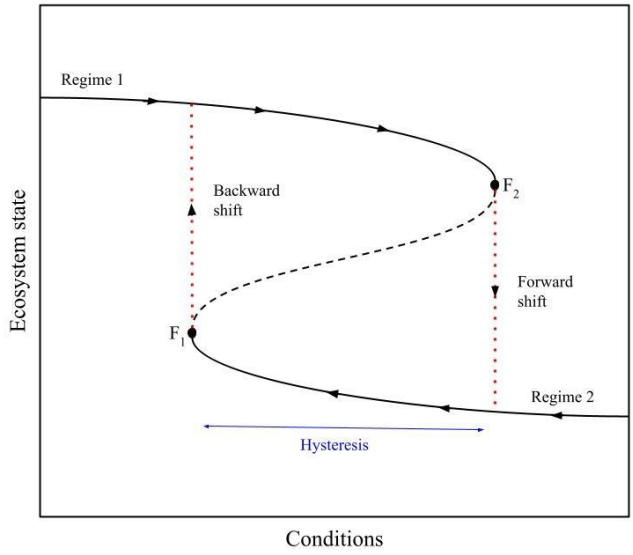

Figure 12.3. A shift between two different regimes

Source: Adapted from Scheffer *et al.* (2012) by J. Stocker (2024)

This conceptual framework can help a reflection on what the outcome of the study means for understanding the factors that determine resilience of a digital health system.

Prior to the conflict, the regional health bureau, along with other stakeholders, initiated digital health transformation activities, establishing digital health as an increasingly important feature within the system (FMOH, 2016). The subsequent collapse of the health

system and digital health infrastructure resulted in a critical transition, leading to a new situation from which returning to the original state would require conditions that are currently unattainable. According to the concept of hysteresis, restoring the system to its original state necessitates meeting certain conditions at significantly higher levels. Consequently, the prospect of rebuilding the digital health support in Tigray to its former state appears unrealistic. It is therefore recommended to consider how digital health systems can be reconstructed within the new context that has emerged, incorporating lessons learned from the failure of system resilience during the war.

In light of this, the post-disruption environment calls for a forward-thinking approach, emphasising the development of a resilience strategy (Rockström *et al.*, 2023). A new system should focus on addressing the identified weaknesses to build a more robust framework capable of withstanding the challenges of future conflicts. This should involve the creation of a comprehensive roadmap for the digital health ecosystem, ensuring a seamless transition from the conventional health system. The capacity of health workers to manage digital health systems remains intact and is a key factor in establishing a resilient digital health landscape. However, the system's reliance on central backbones located outside the region, along with dependencies on Internet connectivity and electricity, critically undermined its stability. Additionally, the inability of health facilities to securely store patient data locally emerged as a significant concern.

A future-oriented roadmap should prioritise the design of a digital health data architecture that ensures safe and secure local data storage, clear ownership of patient data, independence from external backbones, autonomy from Internet and electricity availability, technology-agnostic interoperability, and alignment with local regulations. These elements are essential for constructing a resilient digital health data system (Van Reisen *et al.*, 2023).

Conclusions

This study investigated the destruction of the digital health system in the Tigray war. The study looked at the impacts of war on the digital health data systems of the health sector in Tigray, shedding light on

the challenges and vulnerabilities that emerged during the conflict. It looks for features for rebuilding a resilient digital health data system in the context of the disruptions caused by the war. The findings show three elements:

- The disruption of digital health systems due to damage to the digital health data infrastructure
- A decline in the quality and quantity of health data collected, and interruptions to digital health systems, the destruction of patient data, and loss of healthcare workers and services at health facilities
- A lack of functioning of HISs in the context of the war, siege and Internet and communication blockade

The adoption of HMIS in Ethiopia has become pivotal to the digital data revolution, revolutionising the collection, analysis, and dissemination of health data for decision-making. Before the war, this progress was evident in Tigray, which saw significant advancements in electronic health systems. Leading the charge in implementing HISs, the Tigray Regional Health Bureau invested heavily since the reformed HMIS began in 2015. With guidance from the Ministry of Health, the Tigray Regional Health Bureau developed a structured health information system, enhanced capacity, and deployed digital systems over several years. However, this foundation of digital health collapsed due to the war, which shows that it lacked resilience.

The conclusion is that the health data and health information system in Tigray encountered a devastating shock due to the war. The respondents shared their experience of the use of digital health systems, data management activities, and capacity-building activities in health facilities before and after the onset of the war. They affirmed the destruction of health facility infrastructure, including the HMIS and other health data systems dependent on central backbone systems, and that this destruction was deliberate and systematic. Neither hard copy nor soft copy patient data are now available in most facilities. It has become difficult to manage activities such as recording, aggregation, analyses, and reporting. This has resulted in a health sector that struggles to produce data about health service provision and population health status.

The collapse of the health system and digital health environment in Tigray led to a critical transition, making a return to the original state unlikely under current conditions. Hysteresis suggests that restoring the system would require much higher levels of support for conditions to be met to return to the level of digital health systems in use before the war. More importantly, for the rebuilding of the system, the lessons learnt on what undermined the resilience of the system should be integrated in a future looking resilient digital health architecture.

Instead of aiming to rebuild the original digital health system in Tigray, it is advisable to develop new a digital health system suited to the current situation, incorporating lessons from the failures observed during the war. The experiences of the war should be considered in defining what constitutes a resilient system, as the systems in place were not able to withstand the targeted and systematic destruction of the health system imposed by the war. The issues of concern are the lack of availability of data when links with the central system are disconnected; the lack of control over data at the local level when there is a systematic attack targeting the destruction of the data; and the reliance on a central backbone and on centrally available connectivity, in general, all of which was blocked during the siege. Reliance on one central system undermines resilience. Instead, in a future system it is proposed that the patient data is stored locally, that sources of connectivity are diversified, and that backbones are built on distributed systems. The rebuilding must prioritise the resilience of the digital health system.

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Authors' contributions

The research presented in this chapter was carried out by Maleda Taye, a PhD student at Tilburg University. He wrote the first version of the chapter and attended to all subsequent revisions. He is the first author of this chapter. Araya Abrha Medhanyie advised on the implementation of the research, provided input on the research tools that were used and commented on earlier versions of the chapter. Mirjam Van Reisen edited the chapter at the different stages of production, and she added considerations on the conceptual framework of the chapter.

Ethical considerations

This study obtained ethical clearance from the Institution Review Board (IRB) of the College of Health Science at Mekelle University, MU-IRB 1982/2022 This research was carried out under ethical clearance obtained from Tilburg University Identification code: REDC #2020n13 on "Social Dynamics of Digital Innovation in remote non-Western Communities"

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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Chapter 13

Data Visiting in Digital Black Holes: FAIR Based Digital Health Innovation during War

S. Y. Amare, Araya Abrha Medhanyie & Mirjam Van Reisen

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They pour it out in a hurry and sit down and harvest it.

Abstract

The crisis in Tigray hindered data findability and accessibility, creating a 'digital black hole' due to the Internet blockade. A need arose, due to shortages and service interruptions. To address this, a data architecture for patient data was piloted in Tigray's health facilities, focusing on findability, accessibility, interoperability, and reusability (FAIR). The possibility and opportunity arose to deploy a resilient system independent of external sources. The pilot confirmed that data visiting, where algorithms access in-residence data, can overcome accessibility challenges. These junctures shaped the development and deployment of a new approach to developing a digital health system with principles of FAIR-with Ownership Localisation and Regulatory (OLR) compliance. The success shows this system has the potential to drive change to a new global standard for resilient digital health architectures. This approach would help health systems remain effective and operational even in challenging or crisis situations.

Keywords: Tigray war, digital health, resilient health system, critical junctures, FAIR-principles, FAIR-OLR standard, Ethiopia

Introduction

In response to crises, including war, many countries have developed or adopted digital health technologies, which can be a matter of life and death. Digitalisation is a priority for humanitarian organisations such as the International Committee of the Red Cross (ICRC), as it is rapidly transforming how humanitarian operations and assistance activities are conducted, thereby influencing the effectiveness of the humanitarian sector in serving affected populations (Rejali & Heiniger, 2020). During outbreaks of Ebola and severe acute respiratory syndrome (SARS), digital health technologies demonstrated their potential in detecting and combating global epidemics (Alwashmi, 2020). However, these crises also revealed that data often became inaccessible once interventions concluded (Van Reisen *et al.*, 2021). The deployment of eHealth technologies in conflict settings requires further clarification on global norms to ensure their effective use (Bowsher *et al.*, 2021).

The COVID-19 pandemic has further exposed existing weaknesses and gaps in health systems, particularly in developing countries. These nations have faced severe challenges due to under-resourced health facilities, poor data and information coordination, and generally weak health systems, which hindered efforts to mitigate the impact of COVID-19 and other health issues (Van Reisen *et al.*, 2021). The lack of data from marginalised communities significantly impacts the generalizability of data and contributes to data poverty—a situation where machine learning algorithms lack the ability to generalize due to the underrepresentation of marginalised populations (Ibrahim *et al.*, 2021). Addressing these challenges necessitates a holistic approach that recognises health systems as complex and adaptive entities, functioning at multiple interconnected levels with diverse stakeholders (Ajadi, 2020).

On 3 November 2020, the outbreak of a full-scale war in Tigray led to a total siege and communication blackout, inflicting severe damage on the region's health system (ICHREE, 2023; Gesesew *et al.*, 2021; Hagos, 2021). The war caused significant destruction to health infrastructure (Gesesew *et al.*, 2021; Niguse *et al.*, 2024), making access to information nearly impossible and hindering the ability to respond

to crises and treat patients. With electronic health information systems out of service and shortages of basic materials such as pen and paper, recording patient data during the two-year siege became nearly impossible. This situation prompted researchers to explore alternative, more resilient data architectures (Gebreslassie *et al.*, 2024). Consequently, a new paradigm for digital health architecture was developed and tested during the war (Gebreslassie *et al.*, 2024).

This study investigates the development and assesses the relevance of a digital innovation designed to address the challenges posed by war in the collection and distribution of health information in Tigray. The design was developed and tested during the COVID-19 pandemic and the Tigray war, which provided the overall context for this innovation. The study aims to evaluate the implementation of a digital health solution that enhances the resilience of the health system during a time of war and siege, focusing on the critical junctures in the design and implementation process.

Multiple crises during an internet black-out

From 2020 onwards, Tigray faced a convergence of multiple crises, including the desert locust infestation, the COVID-19 pandemic, an Internet and communications blackout, a siege, a severe economic downturn, famine, and a widespread humanitarian crisis (Annys *et al.*, 2021). By 2021, Tigray had an estimated 2 million Internally Displaced Persons (IDPs) (Annys *et al.*, 2021). The Tigray war is considered one of the least documented conflicts, as access to information was deliberately obstructed (Hagos, 2021). Effective crisis response necessitates timely access to information, yet paradoxically, data availability was severely limited in this context.

Addressing the information system needs of Tigray's health sector during an ongoing war and pandemic required innovative approaches. The region's Health Management Information System (HMIS) relied on the District Health Information System 2 (DHIS2), which was managed by the federal government. However, the DHIS2 backbone, including the system and data repository, was under the control of the federal government, which was the principal adversary in the Tigray war (Taye *et al.*, 2024). The conflict also involved deliberate and

systematic destruction of health facilities and records. The situation in Tigray was unique in that the conflict occurred between the region and the national government hosting it. Consequently, the federal government, upon which the regional health sector was dependent, rendered it nearly impossible for the regional health system to function effectively (Gebreslassie *et al.*, 2024; Taye *et al.*, 2024).

Investigating change in digital architectures

This study looked at the redesign of a digital architecture in the context of a new situation in a fundamentally altered digital ecosystem. This can be referred to as a critical transition, which is the change resulting from new conditions that create a critical threshold into the alternative regime. This new situation is defined by new needs, new opportunities, and new possibilities, in which alternative architectures can emerge. The design of an alternative architecture passes through critical junctures that define the outcome. In the context of this research, the design was influenced by the exposure of the designers to a new paradigm for data architecture. This is discussed below.

Hysteresis and alternative regimes of digital architectures

Architectural design decisions play a crucial role in software architecture; hence they need to be an explicit part of software architecture (Jansen & Bosch, 2005). If the security of the system is compromised and authorised users have no access to the system, it cannot continue. If the system has been designed to work with Internet connectivity and when there is a sudden communication blackout, then the system cannot function beyond this situation unless it is re-designed whenever possible to run with the new scenario. Whenever there is a distraction of necessary software, hardware, and data, the system, no matter how well it was designed, does not function as expected. Hysteresis refers to the delay in response observed in a system when reacting to changes in the conditions that moved it to a new state (Stocker, 2024). Therefore, the software system may become dysfunctional.

The blockade rendering the system dysfunctional, may cause a tipping point to occur, a transition to an alternative regime, that corresponds

to the new situation (Hardy, 2008). Bourdieu (1990) explained such a change for social ecosystems, but this may equally apply to technologies that are functioning in a social context and an extension of that social context (Van Stam, 2017). A resilient technical system is a system that can respond to provide the outcome it was designed to release, when the social circumstances change. A transition in software architecture is the point in time when changes in the social system require the software system to respond. If the software is no longer functioning or providing the output it was designed for, it will be amenable to change. Such moments are critical transitions.

Critical junctures in software architecture

If the architecture is amenable to change, some decisions leading to change during a process shape the outcome of it, and these are termed critical junctures. Decisions made in such critical moments, alter outcomes. The criticality of such events can be seen in how these shape divergence from the past through causal logic (Soifer, 2012). The critical junctures are the points of decision-making that have a causal effect on the design as it progresses to respond to the critical transition.

When a critical juncture occurs, it is important to carefully consider the implications of any technology change to the entire software architecture and how it relates to the social environment in which it should function. These changes can have a significant impact on the future of the software system, so it is important to make sure that they are well-thought-out and implemented in a way that minimises risk. Architectural design decisions play a crucial role in software architecture; hence they need to be an explicit part of software architecture (Jansen & Bosch, 2005).

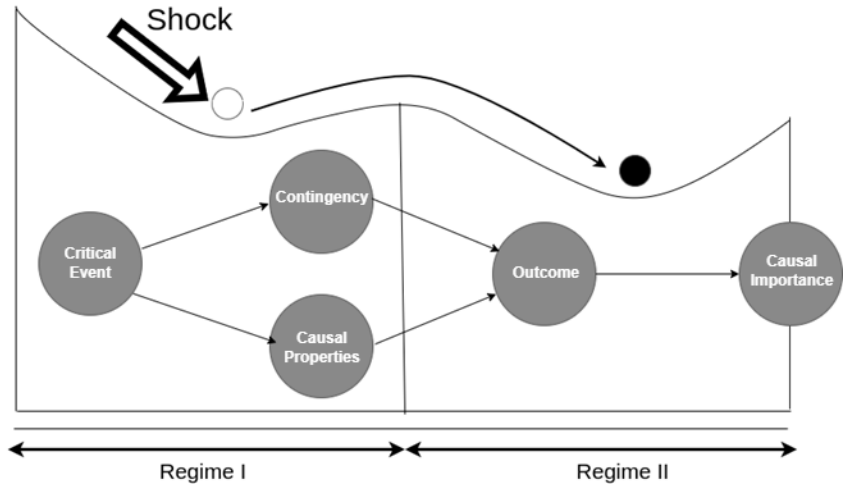

Figure 13.1. Critical junctures in adapted framework

Source: Based on concepts drawn from Hardy (2008)

Critical junctures present two causal conditions: permissive condition and productive condition. The critical junctures are spaces in time where political agency can be exercised, and choices can be made to play a decisive causal role in setting a certain path of development that persists over a long period. The critical junctures are marked by events that are well-bounded episodes in the history of a case. They are marked by a particular occurrence or specific pattern of activity (Soifer, 2012). The permissive condition refers to the easing of constraints leading to an ease of structures that make change a possibility (Soifer, 2012). The productive condition on the other hand presents us with the outcome or range of outcomes that are then reproduced after the permissive conditions disappear and the juncture ends (Soifer, 2012).

The framework was used as a lens to identify the critical events during the design and implementation of the alternative new software system. The contingency refers to what has happened in the context of what could have happened because of the event. The causal property shows the resulting causality leading to a certain outcome that has causal importance allowing an agency or contingency to shape divergence from the past. A regime shift which entails a shift from the current system state to an alternative regime, represented

here by the ball, because of a shock from critical events leading to an important outcome. The ability to respond to situations in a stable state is referred to as resilience; a resilient system is a system that can absorb external shocks.

New requirements: FAIR Guiding Principles

Digital health enables the management of healthcare by leveraging digital tools and services to transform care delivery, thereby empowering individuals and populations (Alwashmi, 2020). Central to digital health is the production and reliance on digital data. The processes governing how, where, by whom, and for what purposes data is stored and utilised determine the underlying structures of benefit, control, and power.

This design research is framed within a set of data stewardship principles known as FAIR, which emphasise that digital data should be Findable, Accessible under specific conditions, Interoperable, and Reusable by both humans and machines (Wilkinson, 2016). Additionally, FAIR encompasses Federated AI-ready data, positioning itself as a paradigm that enhances or complements the concept of Open Data by integrating considerations of privacy, data ownership, sovereignty, regulatory compliance, data quality, and the explicit articulation of digital data's value (Jati *et al.*, 2022).

The FAIR principles support data federation and ensure data remains in its original location by enabling the accurate tracking of data provenance. This research employs the FAIR principles as the theoretical foundation for evaluating crisis response solutions. Consequently, the FAIR Ownership, Localization, and Regulatory (FAIR-OLR) Framework has been proposed for implementation (Van Reisen *et al.*, 2023).

The implementation of FAIR principles in digital health data has been identified to address the challenges posed by data fragmentation and lack of integration, specifically tailored to different social contexts (Van Reisen *et al.*, 2021). The FAIR principles advocate for the development of new practices that:

- Ensure data serves the public interest and is governed by public policy,

- Expand collective knowledge through data-driven science,
- Promote science that addresses practical solutions and services, and
- Encourage public scrutiny and citizen involvement in knowledge discovery, thereby democratizing science and its application (Van Reisen *et al.*, 2021).

The Go FAIR methodology encompasses a transformative approach to data architecture, integrating three key processes: Go BUILD (the creation of new designs), Go CHANGE (adaptation of designs to fit specific contexts and circumstances), and Go TRAIN (training to establish common standards and advance shared objectives). The combined application of these processes is particularly relevant for design initiatives based on FAIR principles within an African context (Van Reisen *et al.*, 2020).

Methodology

The study followed an autoethnographic participatory case study design; the researchers used participatory observation while participating in the design process. Field notes, documents, design specifications, and design artifacts of the system were used to assess the main drivers. Formal and informal interviews and focus group discussions with health workers, business officials of the health bureau, technical teams, and health information technology professionals were conducted for the researcher to reflect and to uncover the critical junctures and key drivers during the implementation.

Autoethnography

Autoethnography draws on and analyses or interprets the lived experience of the author(s) (Rapp, 2018). This method connects insights of the researcher(s) which has specific relevance to Human Computer Interaction and refers to locating the research with awareness of self-identity, cultural rules and resources, communication practices, traditions, premises, symbols, rules, shared meanings, emotions, values, and larger social, cultural, and political issues. It is an autobiographical genre of academic writing which takes

the following six steps: selecting an approach; ensuring ethical responsibility; deciding theoretical underpinnings; assembling and gathering data; reflecting and analysing; and disseminating work with supporting drawings, photography, and other evocative formats (O'Hara, 2018).

Symbiotic autoethnography (Beattie, 2022) is a research approach that blends personal narrative with ethnographic study to explore and critically analyse the interplay between individual experiences and broader social, cultural, and political contexts. The purpose of symbiotic autoethnography, particularly when incorporating the seven features of a political transformative focus, evocative storytelling, temporality, reflectivity, interpretative analysis, researchers' omnipresence (in the situation), and polyvocality, is multifaceted:

1. Political transformative focus: This feature ensures that the research aims not only to understand but also to challenge and transform existing power structures and social inequalities. It emphasises the role of research in advocating for social justice and political change.

2. Evocative storytelling: By using narrative techniques that evoke emotions and resonate with readers, this approach seeks to create a deep connection between the audience and the lived experiences being studied, making the research more impactful and accessible.

3. Temporality: This aspect highlights the importance of time in understanding experiences. It considers how past events, present circumstances, and future possibilities interact to shape the subject's experiences and the research narrative.

4. Reflectivity: Reflectivity involves the researcher's continuous self-examination and critical reflection on their positionality, biases, and the research process itself. It ensures that the research is conducted with awareness and ethical sensitivity.

5. Interpretative analysis: This feature emphasises the interpretation of the data collected, going beyond mere description to uncover deeper meanings, patterns, and implications of the studied experiences within their broader context.

6. Researchers' omnipresence: By being omnipresent in the research situation, the researcher integrates their own experiences, emotions, and reflections into the study, acknowledging the inseparability of the researcher from the research context and subject matter.

7. Polyvocality: Polyvocality involves incorporating multiple voices, perspectives, and interpretations into the research. This inclusivity ensures that the research reflects a diversity of experiences and viewpoints, enhancing the depth and richness of the analysis.

Overall, symbiotic autoethnography, with these seven features, serves as a powerful tool for examining and transforming complex social realities. It aims to produce research that is not only scholarly but also personally and socially meaningful, contributing to both individual understanding and broader societal change (Beatty, 2022).

This research method was selected because the authors were not only researchers but also implementers of the intervention and residents of Tigray during the war and pandemic. Symbiotic autoethnography is particularly suited for this study as it allows for a deep exploration of the researchers' lived experiences, both as participants and observers. By drawing on the reporting of their own lived experiences, the researchers could engage in a reflective and interpretative analysis that acknowledges their omnipresence in the situation. This approach enables the identification of critical junctures caused by the crisis in Tigray and the impact these had on the software architecture. Through the use of evocative storytelling and the inclusion of multiple voices (polyvocality), the study provides a nuanced understanding of how the war and pandemic influenced the intervention, ultimately aiming for a political transformative focus that seeks to address the broader social implications of these events.

VODAN Africa

VODAN Africa served as the research initiative that provided the foundational context for this study. VODAN Africa is dedicated to identifying gaps and challenges associated with digital health data management. In early 2020, a technical team comprising software architects, programmers, and domain experts from nine African

countries, alongside a team of experts from Leiden University Medical Center (LUMC), was established to contribute to data collection efforts related to the COVID-19 pandemic. The researchers involved in this study were members of the VODAN Africa technical research team.

The VODAN Africa initiative encompassed the implementation of a FAIR-based system across Tigray and eight other countries. Mekelle University established a specialised team of technical experts responsible for the implementation in Tigray as part of the broader VODAN Africa project. The Tigray team actively engaged in developing solutions to ensure that COVID-19 and other clinical data, adhering to the FAIR principles. This effort involved studying and applying the guiding principles of FAIR data management to clinical and research data. The principles were implemented across 88 health facilities, facilitating the management of both clinical and research-related data.

Data collection

Ayder and Mekelle hospitals in Tigray were purposefully selected for the study. Ayder Hospital is the largest referral hospital in the region and Mekelle Hospital is a general hospital which at the time was a sole isolation and treatment centre for COVID-19.

During the research period, the Tigray VODAN project team was actively engaged with health workers in the health facilities. The researchers engaged in the development and deployment of the architecture, being concerned about how this could work during the siege causing a blockade of the Internet.

During the process, the researchers conducted formal interviews and focus group discussions. During the formal interviews and focus group discussions, a topic list was used. The structured interviews were conducted with individuals from the regional health bureau and health information directorate of the regional administration and with health workers, health management information technology professionals in health facilities, doctors, and nurses.

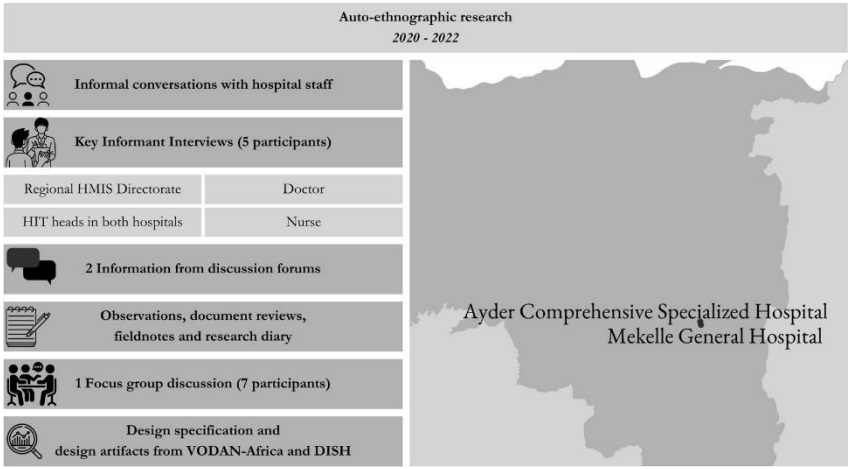

Figure 13.2. The data used and collected for this study

Work-related meetings with implementing health workers and management of health facilities were also recorded in the form of field notes and research diary. The researchers also recorded observations in a research diary.

Design thinking framework

Designing a digital health solution capable of functioning in extreme conditions such as war and siege, as experienced in Tigray, represents a wicked problem. Wicked problems are characterised by the presence of interdependent factors that render them exceptionally challenging to resolve, necessitating extensive deliberation and analysis (Matthews *et al.*, 2022). These problems are fundamentally conceptual, with solutions emerging from rigorous research or the reframing of the issues at hand (Matthews *et al.*, 2022). The design research framework must incorporate two intersecting dimensions, defined by the approach and mindset: one emerging from a research-led perspective and the other from a design-led perspective (Sanders, 2008). Design thinking offers a methodological framework for understanding the problem and provides insights into the approach taken to address it. According to design thinking principles, solutions are identified at the intersection of Need, Possibility, and Opportunity. The research aimed to incorporate the users of the system into the design process, adhering to a human-centred design approach for developing computational solutions.

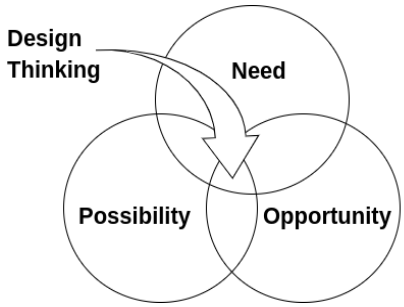

Figure 13.3. Design thinking: solutions are found at the intersection of need, possibility, and opportunity

Source: Carlgren *et al.* (2016)

A synthesis of multiple data sources, coupled with active engagement by the project team with health workers in the health facilities, provided a reflective mirror for the researcher, who had been personally involved in the development and deployment of the VODAN architecture. A topic list was employed to guide both group discussions and individual interviews. Additionally, work-related meetings with health workers and the management of health facilities were documented through field notes and a research diary. The data collected from these various sources were systematically analysed, considering the context, timing, and the composition of the research team, both individually and collectively. Supplementary materials that reflected the engineering process were also reviewed. The researcher thoroughly examined all these data to identify critical junctures that influenced the overall design.

Findings

The findings are organised to describe the new situation that was observed, and the needs, opportunities, and possibilities that emerged from this new alternative situation for the re-design of a health information system to serve a population under siege.

Changed needs: Impact of the war on health data registration

The health system in Tigray faced a critical need for a mechanism to record patient data. The registers traditionally used for this purpose were printed by the federal government. However, due to the siege and the accompanying digital blockade, once the available registers

were exhausted, they could not be replenished. Additionally, health facilities in the region began to run out of paper, making it impossible to produce the registers locally. Interviewees reported that, even with the support of international non-governmental organisations (INGOs), printing alternative registers took more than a year and incurred significant costs. Ironically, this situation highlighted the necessity of implementing digital health solutions, as the cost of printing registers became infeasible, particularly given the closure of banks and the difficulties in obtaining paper and toners for printing due to the siege.

This pressing need catalysed the development and implementation of a digital health solution by the research team. However, the creation of digital solutions was not straightforward, as the blockade included restricted Internet access. Furthermore, electricity posed a substantial challenge, mitigated only through the use of solar power and backup generators, which were difficult to sustain due to fuel shortages and high costs resulting from the siege.

The sudden communication blackout exacerbated the situation, leaving some health facilities without any backup systems, causing them to lose access to their own data. Moreover, the existing digital system ceased to function, as it was no longer supported by Internet connectivity, and the government's Health Information Technology staff were discontinued. This situation was explicitly noted in an interview with the head of the Health Management Information System (HMIS) at the Tigray Regional Health Bureau (TRHB):

> *Implementation of electronic medical record (EMR) and HMIS software such as DHIS2 were in a better position before the war when compared with other regions of the country. However, the HMIS data collection and management were centrally managed by the health ministry and almost all facilities in Tigray were working on the online version to ensure quality criteria such as timeliness and completeness.* (Interviewee 001, interview with TRHB HMIS head, face-to-face, June 2022)

The administrator was frustrated, in that Tigray had an advanced system but was not able to use this for the much-needed insights to

manage the health crisis as the health system needed to respond to the war, COVID-19, and other crises, all occurring simultaneously:

> *Our officials are being starved of data. We will follow with the data production as clinicians, academics, and researchers to make sure we benefit from the data system put in place. Data on patient charts were not being fully recorded previously and making the data production using digital health tools will enforce mandatory data to be collected properly hence we can get even quality data this time.* (Interviewee 002, interview with Medical Doctor, face-to-face, May 2022)

The problem was specifically identified as a dependency problem on the centralised setup of system, with the backbone controlled in Addis Ababa, from where the siege was initiated:

> *While data is more relevant to lower-level workers, it is ironically least accessible to them in the current centralised arrangement.* (Interviewee 003, interview with Health Information Technology Professional in Mekelle Hospital, face-to-face, May 2022)

Before the communication blackout, data quality was being checked using phone calls. Outpatient Department (OPD) waiting time was also being measured but without communication services operating it was hard to keep-up. The idea of what constituted quality data also changed during the war. It was observed that having access to individual patient data was more powerful than having aggregate reports to the central government.

Systems have breaking points when a change is inevitable. Crisis response requires creative thinking that can create resilient systems. The need for owned and localised data and systems and the need for local mechanisms in the region to ensure the quality of the data were observed in the health facilities:

> *The regional government is more physically close to the data source but it is practically more remote when it comes to having access to the data.* (Interviewee 004, interview with DHI member at Ayder, face-to-face, May 2022)

In addition to the Internet blockade and the software no longer working, other challenges were the lack of incentives as no salaries were paid during the war. The destruction of resources such as PCs,

and the destruction of the Woreda-net (wide area network of health facilities in the region) that stopped working has posed challenges.

As a result, alternative digital health systems were demanded to create a HMIS report that would function and be resilient to the changed situation.

New opportunity: Localisation

Following the FAIR framework, the research team has been working on the localisation of a system to low resource settings. The possibility to localise the FAIR based solution is subsequently discussed.

Design decisions

The solutions the research team tested was to deploy a virtual image to be hosted in each of the health facilities. The virtual image has all the tools for FAIRification and was hosted in local machines in clinics. The architecture broadly specifies the input data sources, meta/data stores, and the provision for its access in machine readable FAIR data formats and analytics of the data in the form of a dashboard for the health workers in the health facilities. The architecture ensures data production and data use in a federated modality without data losing its provenance and the data being held in residence. It also enables remote data-visiting and queries.

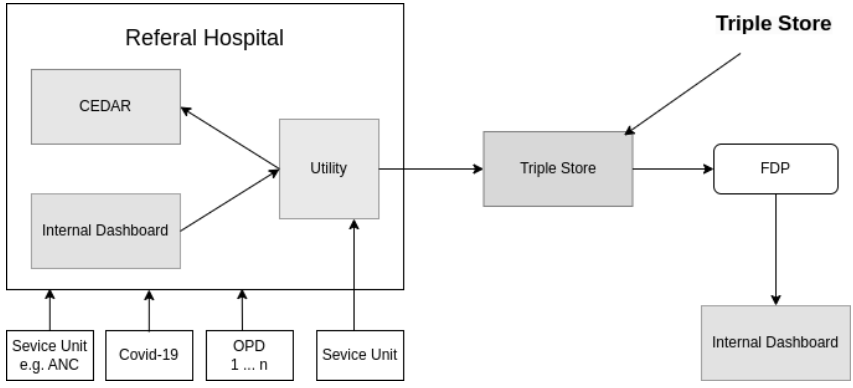

Figure 13.4. Adapted VODAN Africa architecture, created for the Tigray context from the original VODAN Africa architecture

Source: Van Reisen *et al.* (2020)

The picture is an adapted framework to implement the VODAN platform in the health facilities in Tigray. It shows the components of the architecture that have been developed.

Localisation of CEDAR

The CEDAR Workbench allows the creation of templates that can collect FAIR data and metadata. Based on the FAIR principles, the research team wanted to have full control over the deployment of the system in the hospitals but this was not possible due to the communication blackout. The Tigray team laid out two options: to install the system in the host machine or to make it ready in the form of a virtual image. The global team moved on with preparing the second option. It allowed ease of installation as the image would run similarly on all the sites. However, the team in Tigray could not implement this option as downloading an image the size of 30GB was not feasible due to the siege allowing it extremely limited connectivity.

The Tigray team decide to investigate an alternative solution. This was to repackage the Ubuntu operating system with the miniservices from CEDAR in a localised instance. This way, the installation of the system became easy as the users would seamlessly install the system. This required less skill and above all avoided the need for connectivity to install the system. Moreover, it allowed the use of all the resources in the host machine, unlike the image which only used the portion of the system allocated to the image. This had implications on the performance and ease of use and made the Tigray team's way of deployment comparably superior to other installations.

Another challenge was fulfilling the hardware requirements of the system. The computers that were available in the health facilities did not have the required amount of RAM. The other sites had bought the required hardware, but it was not possible in Tigray as there was no access to the funds and the required hardware was not available in the local markets due to the siege. Hence, the deployment architecture was changed to a client-server architecture as the hospital management allowed sharing their server. This enabled the use of any computer, tablet, or phone that could be connected to the local network and access the system through a web browser. This did not

depend on connectivity to the Internet and could function within the 'digital black hole'.

During data production, the system was reaching out to the controlled vocabularies that were hosted on the BioPortal, residing in Stanford in the United States. There was no connectivity for this available in the hospitals. The team then decided to download and host vocabularies with a script developed for it in such a way that they could be accessed without the need for Internet connectivity.

Data stewards were trained on how to create new templates, collect data through the template, and see reports using the internal dashboard which were all hosted locally and available offline. Through the limited connectivity, syncing aggregate and agreed-upon indicators happened to the external dashboard periodically.

To address the challenges the team was facing, and to enhance the features of the system, the team created a set of tools locally. Some of the tools included the bulk input tool that allows FAIRification of existing data (making data FAIR, i.e., convert them to a FAIR format). Analytics on the data provided in dashboards for local facilities was possible and it was also possible to send the analytics through despite the limited connectivity. This allowed aggregate statistics to the external dashboard to be available.

Beyond solving its own issues, the Tigray team started supporting other sites in other countries where low connectivity was an issue, using the model, that had been tested in Tigray. This model also worked in these low resource settings. In this instance, the team added remote query service provision to realising the initial architecture making data visiting through remote SPARQL query possible.

To enhance capacity building, the team participated in a data stewardship programme using the support of the international academic capacity building organisation Nuffic. A blended learning programme named Digital Innovation Skills Hub (DISH) was set up. The programme provides training to youth for three months on a range of topics including data science and FAIR data stewardship. A studio was built from locally available materials. Video in the local

language was created based on the English version initially done in collaboration with Kampala International University and other partnering institutions. All the above activities allowed the team to harness opportunities and localise systems through data held in residence. The result was the ability to demonstrate that the dependency on the central backbones could be overcome.

The strength of the architecture to be resilient despite the siege, gained the support from management of the Regional Health Bureau and from the Ayder Chief Executive Director (CED).

The possibility: Interest of health workers in the new system

Doctors and nurses who gave little attention to health data recording regretted the fact that they could not conduct proper research due to the quality and format of the data that was being kept. The health workers amid the harsh conditions would talk about data quality and enhancing the system so that they could serve their patients better.

> *This is not extra work; rather this is an extra commitment that we have to make to serve our patients.* (Interviewee 005, interview with Health Information Technology member at Mekelle Hospital, face-to-face, June 2022)

The health workforce worked under extreme conditions without getting paid for almost two years. The health workers were also receptive to the system VODAN Africa introduced. The implementation team worked with the health workers in the hardest of times without having access to the funds available to implement the programme, as banks were closed due to the siege. This created a strong capacity, an element that contributes in and of itself to the resilience of this home-grown solution that responded to local circumstances.

Critical junctures

Looking at the chronology of events, critical junctures shaped the design decision and technology choices made along the way of implementing the FAIR-based digital health solutions amid the ongoing war, siege, communication blackout, and pandemic. This situation was extreme. Table 13.1 summarises the critical junctures.

Table 13.1. Critical junctures

Critical event	Category	Contingency	Causal properties	Outcome	Causal importance
1. Moving from ViB to CEDAR	Technology	VODAN was meant to work on COVID-19 using WHO eCRF. A decision was made to move beyond COVID and led to challenges in new template creation	New technological and implementation choices were made to address the challenges, and this led to adoption of new architecture	Localisation of CEDAR and hence availability of an architecture that was not dependent on backbones	A FAIR based digital solution for digital patient data was developed and run locally: a key element for sustainability
2. Bulk upload tool developed	Requirement	Existing data that was collected in the meantime needed to be uploaded	This need led the team to create a new tool to address the challenge	Bulk Upload Software Developed	Made FAIR data production by increment a possibility
3. Request for interoperability with DHIS2	Policy	The architecture was designed to address patient recording and reporting needs. A	The need to make automatic reporting to reduce duplication of effort and making one time data entry	Interoperability between the VODAN-architecture and DHIS2 was imple-	Working with the existing system without breaking the workflow is helpful for proper implementa-

Critical event	Cate-gory	Contin-gency	Causal properties	Outcome	Causal importance
		request for interoperability with DHIS2 was demanded by many health facilities	and re-use of data possible, led to interoperability	mented	tion
4. War and destruction of health facilities and health records	Political	The war was unexpected and happened during the critical stage of project implementation and it not only affected Tigray but other sites too	New development teams, new design, creation of virtual images, and many more new implementation choices to fill the gap that was created.	Farther modification of the architecture and implementation mods	Implementation across many African countries has since been changed
5. Communication blackout	Technology	This was not expected and accounted for in the design and implementation process	Difficulty sharing, systems stop functioning, technical and financial support provisioning stopped	Light weight system for offline use developed	It has enabled creative solution provisioning but has also gravely affect the project
6. Siege and lack of materials	Economic	The siege in Tigray was unexpected	Created permissive conditions to	Permissive Conditions created	The resistance was unexpectedly

Critical event	Category	Contingency	Causal properties	Outcome	Causal importance
		and has resulted in lack of even pen and papers to record patients data	try out the architecture as the situation was complex	for implementing the VODAN-architecture	reduced in an effort to tackle shortage of pen and paper
7. Connected back-up using V-SAT: efforts of solidarity	Operational feasibility	Unexpectedly connected back through collaborative and creative effort and generous support of partners.	Connected back with VODAN global team and contributing again in design and implement what has been developed by both teams	Revised architecture and inclusion of triple store and remote query	The architecture was further enhanced taking lessons from Tigray and the global team and Ayder solidarity efforts showcased on the global podium.
8. Capacity building on data stewardship	Operational Feasibility	Participation in the DISH project and VODAN team	Created capacity in FAIR data stewardship and beyond	Demonstrated resilience	Showcased at the European Development Days – create interest in the Health Data Space

The following phases can be identified:

Phase 1. In the pre-war period, the critical junctures were mostly technical associated with technical requirements for:

- Flexibility
- Bulk upload
- Interoperability needs with DHIS2

Phase 2. The war, the effects of the situation were:

- Failure of the digital systems which depended in central backbones controlled by the adversary in the war
- Destruction of health facilities,
- Digital blockade and Internet blackout
- Siege

The challenges that emerged during the war, prompted a fundamental change in design and operation.

In this study related to the two phases, the following critical junctures emerged:

Critical juncture 1: Moving from provider to self-engineering

The need to have an easy way of template creation was the contingency that led to the adoption of a system that allowed engineers to create and adapt the templates and supporting elements.

Critical juncture 2: Bulk Upload Tool Developed

The newly adopted system did not have this feature which was being requested by end users and the complaint was that data upload was time intensive. This contingency led to an in-house development of a new software system that made this possible and created new possibilities.

Critical juncture 3: Interoperability with DHIS2

The system has been widely adopted and required by ministries to do HMIS reporting and was seen as a critical factor for any digital system, this created a contingency that led to the development of a script that allows the automatic creation of the report and making VODAN and DHIS2 interoperable. This showed that the data, which was entered only once in the system, and stored as semantic machine-actionable instances, could be used in parallel use-cases.

Critical juncture 4: War and destruction of health facilities and health records

This happened abruptly; it affected local and global implementation leading to the establishment of new teams and working modalities and approaches, providing confidence that the architecture is useable in remote and hard to reach areas.

Critical juncture 5: Communication blackout

The software system and the vocabularies it uses needed the Internet to work, and the whole implementation process was also disrupted. This led to the development of a new lightweight software system to be used in low resource and crisis settings. This gave confidence to the idea that the continental architecture could run on locally available services, without dependency on central backbones.

Critical juncture 6: Siege and lack of materials

The daily activities of routine recording and reporting were disrupted. A new and alternative approach was needed and an opportunity for innovation was created which otherwise would potentially have faced resistance to changing systems.

Critical juncture 7: V-Sat connection

A light-weight V-Sat connection was offered that allowed for the integration of what was done locally with what was done globally, without dependency on the connectivity backbone that was blocked by the federal government. It also created an opportunity to provide technical support globally.

Critical juncture 8: Capacity building on data stewardship

Capacity-building efforts by DISH resulted in a data stewardship programme that created data science skills for the youth during an ongoing war and siege. This created a sense of purpose and resilience.

Overall, the critical junctures have shaped the adoption of a new modus operandi on how to develop an architecture, based on FAIR principles. The need for ownership of systems and localisation of them was evident. Moreover, the need to comply with the regulatory framework was also key in implementation.

The critical junctures led to the establishment of principles for a FAIR-data architecture with Ownership of data in Locale under Regulatory compliance, or FAIR-OLR. This can be seen as a new paradigm for data architectures that are resilient to external shocks.

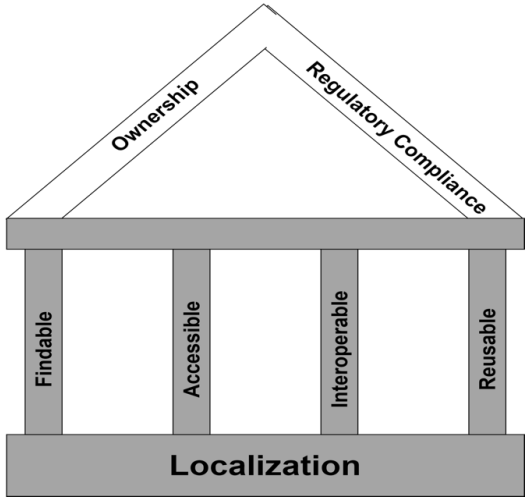

Figure 13.5. The FAIR-house completed with the foundation of localisation (federated data) and delivering a rooftop for data ownership and regulatory compliance of data handling

Source: Van Reisen *et al.* (2023)

Data needs to be owned and managed where it is produced in a federated manner keeping its provenance. The owners of the data can make all the arrangements to make it FAIR.

Systems used to produce FAIR data need to be installed in residence and localised and contextualised to the hosting environment. Being cognisant of the sensitivity of health data was important and all data access and system deployment needed to comply with the regulation, laws, and political landscape so that the intervention is acceptable.

Discussion

Crisis situations necessitate immediate access to reliable data to facilitate an appropriate response; however, the crisis in Tigray severely compromised data findability and accessibility. The region's Internet blockade exacerbated its dependency on a centralised digital infrastructure, controlled from Addis Ababa, where the siege

originated. This dependency effectively turned Tigray into a 'digital black hole', a zone from which the transmission and reception of information were significantly hindered, if not entirely obstructed. Overcoming such a digital black hole is intrinsically linked to improving the findability and accessibility of digital data – two essential components of the FAIR (Findability, Accessibility, Interoperability, and Reusability) architecture.

The research demonstrates that findability and accessibility challenges can be mitigated through the concept of data visiting. This process involves maintaining data in its original location (in residence) while sending algorithms to perform scientific computations on the data. Given the siege in Tigray, enabling data accessibility to the global community was critically important. The development of a localised system, which could be directly accessed externally with granted permission, and did not rely on a centralised backbone, emerged as a significant achievement.

This design illustrates a method by which information can bypass traditional gatekeeping mechanisms and escape the confines of the 'digital black hole'. Consequently, Tigray was able to provide real-time information on the health status of patients, facilitating external assistance during the crisis. Since its implementation, Ayder Hospital has become a vital source of information on the direct impacts of the Tigray war.

Analysing the critical junctures and the resultant design adaptations, it is evident that these events not only influenced implementation within Tigray but also shaped broader acceptance of the FAIR-data principles with OLR (Ownership, Localization, and Regulatory compliance). This shift has led to the emergence of a new digital state, wherein dependence on centralised backbone systems is replaced by localised distributed systems. Consistent with the concept of hysteresis, it can be hypothesised that a return to the pre-war digital health architecture may be unlikely and, perhaps, undesirable. Future-oriented digital health architectures that are independent of central backbones may offer enhanced resilience, making them a more favo**u**rable option moving forward.

Conclusion

The Tigray war presented significant challenges to the health system, particularly in relation to patient data recording, as traditional paper registers supplied by the federal government could not be replenished due to the siege and digital blockade. Local health facilities faced severe shortages, with even local printing of registers becoming impossible. Despite efforts by international NGOs, the printing of abstract registers was both time-consuming and costly, taking over a year to implement. The sudden communication blackout exacerbated these challenges, causing some health facilities to lose access to their data due to the absence of backup systems. The digital health infrastructure, reliant on Internet connectivity and centrally controlled by the adversary, was critically compromised, leading to a systemic crisis.

However, these challenges provided an opportunity to innovate and localise digital systems using data held in residence. The study identified critical junctures that defined the direction of the architecture, notably the reliance on central backbones and the disruption of Internet connectivity. In response, a lightweight system was developed for low-resource settings, demonstrating that local systems could function independently of central backbones while enabling local-global integration and technical support without dependency on connectivity. The capacity-building efforts on data stewardship fostered resilience among youth during the siege, inspiring them to explore alternative digital systems.

Overall, these junctures informed the development of a new approach to digital health systems, emphasising the principles of FAIR (Findability, Accessibility, Interoperability, and Reusability) with Ownership, Localization, and Regulatory (OLR) compliance. This approach has the potential to establish a new global standard for resilient digital health architectures, setting a benchmark for creating robust and adaptable digital health systems that can function effectively in challenging or crisis conditions.

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The first author is a PhD student at Leiden University Medical Center. He conceived the research and carried it out. The second author reviewed the different versions. The third author reviewed and restructured all of the versions and provided suggestions for the theoretical framework of the study.

Ethical considerations

This study obtained ethical clearance from the Institution Review Board (IRB) of the College of Health Science at Mekelle University, MU-IRB 1982/2022.

This chapter should be read in conjunction with the 'Note on Content and Editorial Decisions'.

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