



UPO UNIVERSITÀ DEL PIEMONTE ORIENTALE

Doctoral Thesis

**International Doctoral Program in Global Health, Humanitarian
Aid and Disaster Medicine**

Università degli Studi del Piemonte Orientale “Amedeo Avogadro”

Dipartimento di Medicina Traslazionale

Corso di Dottorato di Ricerca in Global Health, humanitarian Aid, and
Disaster Medicine.

Ciclo XXXVII

Titolo tesi “Intersection between Maternal, Newborn, and Child Health
(MNCH) and Complex Emergencies Among Population Affected by
Conflicts in Low- and Middle-income Countries”

SSD (Settore Scientifico Disciplinare) DIMET

della tesi MEDS-23/A (sigla)

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List of abbreviations

ANC	Antenatal Care
BWH	Brigham and Women's Hospital
CETE	Centre of Excellence for Trauma and Emergencies
COVID-19	Coronavirus Disease 2019
CRIMEDIM	Centre for Training and Research in Emergency and Disaster Medicine
CRVS	Civil Registration and Vital Statistics
DRMKC	Disaster Risk Management Knowledge Centre
FGD	Focus Group Discussion
FHCI	Free Health Care Initiative
FP	Family Planning
Health-EDRM	Health Emergency and Disaster Risk Management
HHI	Harvard Humanitarian Initiative
HICs	High-Income Countries
IASC	Inter-Agency Standing Committee
ICD-10	International Classification of Diseases, 10th Revision
IDIs	In-Depth Interviews
IDPs	Internally Displaced Persons
INGOs	International Non-Governmental Organizations
IPC	Intrapartum Care
LMICs	Low- and Middle-Income Countries
MDSR	Maternal Death Surveillance and Response
MMR	Maternal Mortality Ratio
MNCH	Maternal, Neonatal, and Child Health
MOHS	Ministry of Health and Sanitation
MWRA	Married Women of Reproductive Age
NEMS	National Emergency Medical Services
NGOs	Non-Governmental Organizations
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OR	Odds Ratios
PHC	Primary Health Care
PNC	Postnatal Care
RMNCAH	Reproductive, Maternal, Neonatal, Child, and Adolescent Health

SDGs	Sustainable Development Goals
SHRUC	Super High-Risk Union Councils
UC	Union Council
UHC	Universal Health Coverage
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
VA	Verbal Autopsy
WHO	World Health Organization

Acknowledgments

This thesis is a journey shaped by many remarkable individuals and institutions' support, guidance, and encouragement. I am deeply grateful to all who have contributed to this work, each playing a pivotal role in completing this PhD.

First and foremost, I would like to express my profound gratitude to the Center for Research and Training in Disaster Medicine, Humanitarian Aid and Global Health (CRIMEDIM) at the University of Eastern Piedmont, Italy. The academic and research environment at CRIMEDIM has been an incredible foundation for my studies in global health, humanitarian aid, and disaster medicine. The resources and opportunities provided by CRIMEDIM have been instrumental in developing and completing this research.

An exceptional note of thanks goes to Ameer Muhammad, my outstanding mentee, whose constant support has been a cornerstone of this journey. Ameer's constant encouragement, insightful feedback, and tireless efforts have been more than just academic support; they have been a trustworthy source of strength and inspiration. Ameer, your belief in our shared goals and your dedication to assisting with the research have significantly contributed to the successful completion of this thesis. Your friendship and support have meant the world to me.

I would now like to honor the memory of my late father. Although he passed away while I was still in college, his hard work, determination, and unwavering commitment to our family have been the bedrock upon which my journey has been built. His legacy of perseverance and strength has been a guiding light throughout my life and academic career. Dad, this achievement is as much yours as it is mine, and I carry your lessons with me every day.

To my beloved mother and all my family members, your steady support and encouragement have been the pillars of my strength. Your belief in me has been a constant source of motivation, and I am forever grateful for your love and sacrifices.

I am also profoundly thankful to the Aga Khan University in Pakistan, notably the Centre of Excellence for Trauma and Emergencies (CETE). The mentorship and support I received from my colleagues at CETE have been instrumental and deeply inspiring, helping to shape my work's direction and focus.

My heartfelt thanks extend to Brigham and Women's Hospital in the United States, where I worked with mentors and colleagues who are leaders in newborn medicine. Their expertise and unwavering commitment to advancing maternal and child health have enriched my research immensely.

My time at Harvard University, especially within the Harvard Humanitarian Initiative at the T.H. Chan School of Public Health, was a transformative experience. The intellectual stimulation and collaborative spirit fostered by the faculty and fellow researchers expanded my perspective on humanitarian response and health system resilience, playing a crucial role in this thesis.

To my advisors, mentors, and peers across these institutions, your guidance, encouragement, and constructive feedback have been invaluable. Your collective wisdom and support have contributed significantly to completing this work.

Thank you all for participating in this journey, your contributions, and your belief in me.

This thesis explored the critical intersection of Maternal, Neonatal, and Child Health (MNCH) with global health emergencies in conflict-affected regions. The research addressed one of the most pressing issues in global health: the challenge of providing continuous, high-quality MNCH services in settings where health systems are severely compromised by conflict and pandemics such as Ebola and COVID-19.

Globally, women and children in conflict zones face disproportionate risks to their health and well-being. The compounding effects of armed conflicts and health emergencies exacerbated existing vulnerabilities, leading to significant disruptions in essential healthcare services. These disruptions manifested as reduced access to antenatal care, increased maternal and neonatal mortality, and a widening gap in health outcomes between stable and fragile regions. The research conducted under the umbrella of this PhD has a broader goal to understand these challenges and identify pathways to strengthen health systems, ensuring that even in the most adverse conditions, the health needs of the most vulnerable populations are met.

The research was structured around four interconnected studies:

Analysis of maternal mortality in Sierra Leone: This study provided a detailed examination of maternal deaths in Sierra Leone, the country with the highest maternal mortality rates globally. By analysing data from the Maternal Death Surveillance and Response (MDSR) system, it identified the leading causes of maternal mortality. It highlighted the systemic weaknesses in healthcare delivery that contributed to these outcomes.

Impact of Ebola and COVID-19 on MNCH in population affected by conflict: A scoping review of existing literature explored how global pandemics like Ebola and COVID-19 disrupted MNCH services in conflict-affected regions. The study identified the direct impacts of these pandemics on healthcare delivery and the broader societal effects that further complicated access to care for women and children.

Access to antenatal and intrapartum care among Afghan refugee women: Focusing on Afghan refugee women in Pakistan, this study investigated the barriers to accessing antenatal and intrapartum care during the COVID-19 pandemic. A cross-sectional survey revealed the challenges displaced populations face in accessing essential health services and highlighting refugees' specific needs during crises.

Resilience of MNCH Services through health-EDRM: This study explored the potential of integrating the Health Emergency and Disaster Risk Management (health-EDRM) framework into primary healthcare systems to enhance the resilience of MNCH services. The research proposed practical recommendations for strengthening health systems in conflict-affected regions, ensuring they can stand and adapt to the pressures of health crises.

The findings from these studies were synthesized to provide a comprehensive understanding of the barriers and facilitators to seeking MNCH care in conflict-affected areas during global health emergencies. A central theme throughout the thesis was the need for resilient health systems to maintain continuity of care even in the most challenging situations. The research emphasized the importance of integrating emergency preparedness into health strategies, building systems to survive crises, and ensuring that vulnerable populations—particularly women and children in conflict zones—are not left behind.

This thesis made a significant contribution to the field of global health by offering evidence-based insights and policy recommendations to improve MNCH outcomes under complex emergencies. It called for a coordinated effort to address the unique challenges posed by these emergencies, advocating for a more resilient and equitable global health system.

Chapter 1: Introduction

MNCH in humanitarian contexts: Challenges and disparities

Maternal, Neonatal, and Child Health (MNCH) is a critical area of focus in global health, as millions of mothers and children continue to face life-threatening risks, particularly in low- and middle-income countries (LMICs) and conflict-affected regions.¹ While substantial progress has been made globally, many countries lag far behind, especially those affected by prolonged conflict, political instability, and fragile health systems.² Significant challenges and disparities in MNCH are evident, particularly in conflict-affected areas where poor infrastructure, socioeconomic barriers, and the exacerbating effects of the COVID-19 pandemic have compounded baseline vulnerabilities.³

Despite global efforts to reduce maternal and child mortality, glaring disparities remain, particularly between high-income and low- and middle-income countries.⁴ According to the World Health Organization (WHO), the global maternal mortality ratio (MMR) is approximately 212 deaths per 100,000 live births in 2020.^{5,6} However, in LMICs, the MMR ranged from 300 to more than 1000 deaths per 100,000 live births.^{4,5} The disparity is even more prominent in conflict-affected regions, where maternal mortality rates can exceed 600 deaths per 100,000 live births, such as in South Sudan, Afghanistan, Somalia, and Chad.^{5,6}

Similarly, neonatal mortality remains alarmingly high in LMICs, where the average neonatal mortality rate ranges between 18 to 39 deaths per 1,000 live births, compared to less than five in high-income countries.⁷ Conflict zones, including Afghanistan, South Sudan, Somalia, and the Democratic Republic of Congo (DRC), report neonatal mortality rates far above the global average.⁸ They are contributing disproportionately to the 2.5 million neonatal deaths globally each year.⁹

Impact of conflict on MNCH

Conflict is one of the most significant factors contributing to poor MNCH outcomes in certain regions.¹⁰ Armed conflict creates a multifaceted crisis, directly and indirectly affecting maternal and child health.¹¹ Prolonged conflict results in the collapse of healthcare systems, displacement of

populations, malnutrition, and insecurity, all of which contribute to heightened risks for mothers and children.¹² The breakdown of health systems in conflict settings leads to reduced access to essential services, including skilled birth attendance, emergency obstetric care, vaccinations, and nutrition interventions, exacerbating maternal and child mortality.^{13–15}

In conflict zones like South Sudan, Yemen, and Syria, health infrastructure is often deliberately targeted, or it collapses under the strain of violence.^{2,8,14–16} Hospitals and clinics are destroyed, medical supplies run out, and healthcare workers are either displaced or killed.^{8,17,14} For instance, in Yemen, only 51% of healthcare facilities are fully functional, severely limiting access to maternal and neonatal care.^{18,19} In South Sudan, where over 60% of the population lives in conflict zones, pregnant women often have to walk for hours or days to reach the nearest healthcare facility. This journey is dangerous and, in many cases, impossible due to insecurity.^{15,20}

Moreover, conflict-induced displacement also exacerbates MNCH challenges. Displaced populations, including refugees and internally displaced persons (IDPs), face extreme difficulties in accessing healthcare services.^{21,22} Overcrowded and unsanitary conditions in refugee camps increase the risk of infections, malnutrition, and complications during childbirth.²³ In Syria, over 6.8 million people have been internally displaced, many of whom lack access to essential health services.²⁴ Pregnant women in these settings face heightened risks of complications such as hemorrhage, sepsis, and obstructed labor, all of which require timely and skilled medical intervention—resources that are often scarce in humanitarian settings.^{8,10,13,15,20}

Socioeconomic and cultural barriers

Beyond the immediate impacts of conflict, socioeconomic and cultural factors contribute significantly to the inequalities in MNCH outcomes in LMICs and conflict-affected regions.⁸ Poverty, low levels of education, and entrenched gender inequalities create substantial barriers to accessing maternal and child health services.^{8,11,12} In many LMICs, maternal and neonatal care is often unaffordable, leaving millions of women without access to the necessary care during pregnancy and childbirth.²⁵

In countries where poverty levels are high, many women give birth at home without skilled attendance, increasing the risk of complications and death.²⁶ Only about 50% of births in LMICs are attended by skilled health personnel, compared to 99% in high-income countries.²⁷ Economic hardships, exacerbated by conflict, force many families to prioritize basic needs like food and shelter over healthcare expenses, further perpetuating poor MNCH outcomes.²⁷

Cultural practices and societal norms also play a critical role in shaping maternal and child health outcomes.²⁷ In many conflict-affected regions, traditional gender roles and patriarchal systems limit women's autonomy in making decisions about their health.²⁸ Early marriage and pregnancy are common in many of these countries, which significantly increases the risks of maternal mortality.^{29,30} Adolescents who become pregnant are more likely to experience complications such as preterm labor, obstructed labor, and hemorrhage, which require skilled medical intervention.³¹

In some regions, particularly in Sub-Saharan Africa and South Asia, cultural beliefs around childbirth discourage women from seeking formal healthcare services, opting instead for traditional birth attendants.³² While these traditional health providers may provide valuable support, they often lack the skills and resources to manage complications, leading to higher maternal and neonatal mortality rates.³² The stigma associated with certain conditions, such as obstetric fistula, also deters women from seeking timely care, further compounding the challenges they face.³³

Breakdown of health systems and infrastructure

In many conflict-affected regions, the healthcare systems are either severely under-resourced or have collapsed entirely, which significantly hampers the provision of essential maternal and child health services.³⁴ Weak health infrastructure, a shortage of skilled healthcare workers, and inadequate medical supplies create an environment where preventable maternal and child deaths continue to occur at alarming rates.³⁴ In DRC, for example, decades of conflict have led to a near-total collapse of the healthcare system.¹⁵ As a result, only 35% of women in the country give birth in a health facility, and even fewer receive postpartum care.¹⁵ Similarly, in conflict-affected areas of Nigeria where conflict

have affected the local health services, maternal and neonatal mortality rates remain among the highest in the world.³⁵ The lack of skilled birth attendants is a critical factor contributing to the high maternal mortality rates in these regions.³⁶ In Sub-Saharan Africa, the WHO reports only 2.3 skilled healthcare workforce per 1,000 people, far below the recommended ratio of 4.45.³⁷

Health systems in these countries are often overwhelmed by the scale of humanitarian needs, with insufficient resources to meet the demands of the local population and displaced individuals.³⁸ Limited access to clean water, sanitation, and electricity in healthcare facilities further exacerbates the risks for mothers and newborns, particularly when emergency care is required.³⁸ Moreover, the inability to stock essential drugs and equipment, such as antibiotics, and neonatal resuscitation devices, contributes to preventable deaths.³⁹

Impact of COVID-19 on MNCH in humanitarian settings

The COVID-19 pandemic has further magnified the challenges for MNCH in conflict-affected and low-resource settings.⁴⁰ The pandemic has disrupted essential health services worldwide, but its impact has been particularly severe in LMICs and regions grappling with fragile health systems.⁴¹ The disruptions caused by COVID-19 led to an alarming rise in child malnutrition and maternal health issues. An estimated 9.3 million more children could suffer from wasting, while 2.6 million could experience stunting. Additionally, the crisis may result in 168,000 more child deaths, 2.1 million cases of maternal anemia, and 2.1 million children being born to mothers with a low body mass index (BMI).⁴²

The pandemic has diverted scarce resources from maternal and child health services to the COVID-19 response in many conflict-affected regions.⁴³ Health facilities have been repurposed to treat COVID-19 patients, leaving pregnant women and children without access to essential care.⁴⁴ Lockdowns and movement restrictions have further limited access to health facilities, with many women unable to attend antenatal appointments or deliver in hospitals.⁴⁵ In regions like Sub-Saharan Africa and South Asia, this has led to an increase in home births, often without the presence of skilled birth attendants, further elevating the risk of maternal and neonatal mortality.⁴³

The economic fallout from the pandemic has also worsened food insecurity, particularly in conflict-affected regions, leading to increased rates of malnutrition among pregnant women and children.⁴³ Malnutrition is a crucial driver of maternal and child mortality, as it weakens the immune system and increases susceptibility to infections and complications during childbirth. The combination of malnutrition disrupted health services, and the direct impacts of COVID-19 have created a perfect storm for MNCH in conflict-affected regions.⁴³

Research rationale

The intersection of MNCH, conflict, and pandemics, particularly COVID-19, presents a compounded public health crisis that demands urgent attention. In conflict zones, where health systems are already fragile or collapsed, the pandemic has exacerbated pre-existing disparities in access to essential MNCH services, leaving millions of mothers and children at heightened risk. Conflict-induced disruptions such as displacement, infrastructure damage, and insecurity severely limit healthcare access, while pandemics further strain these fragile systems by diverting resources and impeding mobility. The socioeconomic fallout, including malnutrition and lack of skilled birth attendants, magnifies the risks of maternal and child mortality. Understanding and addressing these overlapping challenges is crucial to preventing further preventable deaths and worsening health outcomes in vulnerable populations. This study addresses these urgent gaps, focusing on improving MNCH outcomes in these high-risk settings. The four major research papers that form the basis of this thesis each contribute to a comprehensive understanding of these challenges from different perspectives and regions.

- The first paper focused on Sierra Leone – a country with the highest maternal mortality and affected by conflict in the past – and examined the longitudinal trends of causes of maternal deaths
- The second paper explored the broader impact of pandemics on MNCH services globally, focusing on the compounded effects for conflict-affected populations.
- The third paper investigated the barriers faced by Afghan refugee women in accessing MNCH services in Pakistan, particularly during the COVID-19 pandemic.

- The fourth paper assessed the integration of the health-EDRM framework within the primary health care system to enhance the resilience of MNCH services during crises for Afghan refugees in Pakistan.

Research questions

Aligned with the content and findings of the four research papers, this thesis seeks to answer the following research questions:

1. What are the patterns and district-level differences in the causes of maternal deaths reported in Sierra Leone's Maternal Death Surveillance and Response (MDSR) system between 2016 and 2019?
2. How do global pandemics disrupt MNCH service delivery, and what are the compounded effects of these disruptions in conflict-affected regions or populations?
3. What are the systemic and community-level barriers that Afghan refugee women face in accessing MNCH services in Pakistan, particularly during the COVID-19 pandemic?
4. How can integrating the health-EDRM framework within the health system address the barriers to accessing MNCH care for vulnerable populations, particularly during health crises like the COVID-19 pandemic?

Objectives

The primary objective of this thesis was to critically evaluate the impact of significant health crises, such as pandemics and conflicts, on MNCH services among vulnerable populations. Specifically, the overarching aims were to:

1. Comprehensively analyze the burden and distribution of different causes of maternal deaths at the district level in Sierra Leone using data from the MDSR system from 2016 to 2019, providing insights for improving maternal health outcomes in high-mortality settings.
2. Investigate the disruptions caused by global pandemics like Ebola and COVID-19 on MNCH service delivery, focusing on the compounded effects in conflict-prone populations.

3. Identify the systemic and community-level barriers faced by Afghan refugee women in accessing MNCH services in Pakistan, particularly during the COVID-19 pandemic.
4. This study aimed to gain an in-depth understanding of the barriers faced by the refugee community and healthcare workers in accessing MNCH care, particularly during the COVID-19 pandemic. It also explored potential pathways to strengthen the health system by integrating the health-EDRM framework with existing structures to achieve Universal Health Coverage (UHC) for vulnerable populations.

Chapter 2: Summary Methodology

Overall approach and design

The methodology adopted in this project was designed to systematically explore the research questions, with each study tailored to its specific context and objectives. The research design is strategically diversified across four core studies, each contributing to the overall thesis by applying particular methodologies.

First study

The first study implemented a secondary data analysis of the MDSR system, focusing on data from Sierra Leone. The analysis quantifies and categorizes the direct and indirect causes of maternal deaths across different districts, employing the International Classification of Diseases (ICD-10) framework for systematic classification.

Second study

A scoping review methodology was adopted to synthesize the impact of Ebola and COVID-19 on MNCH services in conflict-affected regions. This review systematically identifies and appraises existing literature, using a thematic synthesis approach to elucidate supply-side and demand-side challenges and strategies in delivering MNCH care.

Third study

The third study employed a cross-sectional survey design to assess the utilization of antenatal and intrapartum care among Afghan refugee women during the COVID-19 pandemic. Data were collected through structured interviews, focusing on crucial service coverage indicators and barriers to access to care within a humanitarian crisis context.

Fourth study

The final study performs qualitative key informant interviews to evaluate the implementation and effectiveness of health-EDRM frameworks in strengthening MNCH services during emergencies.

Data Collection

Data collection methods were meticulously chosen to suit the specific requirements of each study.

First study

Access to the MDSR system database enabled a detailed extraction of maternal death records from Sierra Leone. The data were cleaned, coded, and prepared for analysis according to ICD-10 standards.

Second study

An extensive literature search was conducted on PubMed, Scopus, and Web of Science databases, covering relevant publications over several decades. Studies were selected based on rigorous inclusion and exclusion criteria, and data were extracted and synthesized into predefined thematic areas.

Third study

A structured questionnaire was administered to a representative sample of Afghan refugee women in Pakistan. The survey captured quantitative data on antenatal and intrapartum care experiences during the pandemic, with the sample size determined using statistical modeling.

Fourth study

Qualitative data was obtained through in-depth interviews with the community, healthcare providers, and stakeholders to understand the barriers and pathways to building a resilient health system for refugees. This combination allowed for a comprehensive analysis of MNCH service resilience.

Data analysis

Data analysis was conducted using advanced statistical and qualitative techniques appropriate for each study.

Quantitative analysis (first and third studies)

Statistical analyses were performed using Stata 17 software, StataCorp. 2021 (Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC), focusing on descriptive and inferential statistics. Proportions, confidence intervals, and regression models were used to identify critical factors associated with maternal mortality and healthcare utilization.

Thematic synthesis (second and fourth studies)

The scoping review and mixed-methods study employed a thematic synthesis approach to categorize findings and identify patterns related to barriers, strategies, and health system resilience.⁴⁶

Ethical considerations

Ethical rigor was maintained throughout the research process. For studies involving primary data collection, ethical approval was obtained from the National Bioethics Committee (NBC) of Pakistan and Comitato Etico Territoriale Interaziendale AOU Maggiore della Carità di Novara, and informed consent was secured from all participants. Secondary data analysis was conducted with appropriate permission from the Ministry of Health, ensuring compliance with ethical standards for using health data. Confidentiality and anonymity were upheld in all phases of research.

Operational definition of critical terms

Terms	Definition
MNCH	Services or care during pregnancy and childbirth at any level (community outreach, primary, secondary, and tertiary), postnatal care, newborn and under-five care, childhood immunization, nutrition, and family planning services, including access to contraceptives.
Conflict	The conflict was employed as an umbrella term to encompass armed conflict, civil war, persecution, and ethnic violence.
Refugee	The term refugee refers to a person who is outside their country of origin for reasons of feared persecution, conflict, or generalized violence that seriously disturbs public order and requires international protection.
IDPs	IDP, in the context of this thesis, refers to those who had been internally (within their own country) forced to displace or flee their homes or places of habitual residence, in particular, because of or to avoid the effects of armed conflict or situations of generalized violence.

Vulnerable women and children or populations	Pregnant women or lactating mothers and their children under five years of age living in conflict-affected settings or displaced because of hostilities who became refugees or IDPs. Furthermore, this term also encompasses non-pregnant and non-lactating women with children under the age of five who require MNCH services.
Global health emergencies	Large-scale, urgent health crises pose significant risks to public health across countries or regions and require immediate, coordinated international intervention. These emergencies can result from infectious disease outbreaks, natural disasters, or other health-related threats like Ebola or COVID-19.

Chapter 3: Abstracts of PhD studies

Study 1: Causes of Maternal Deaths in Sierra Leone from 2016 to 2019: Analysis of Districts Maternal Death Surveillance and Response Data

Authors: Yasir Shafiq, Marta Caviglia, Zainab Juheh Bah, Francesca Tognon, Michele Orsi, Abibatu K Kamara, Caracciolo Claudia, Francis Moses, Fabio Manenti, Francesco Barone-Adesi, Tom Sessay

Introduction

Sierra Leone is among the top countries with the highest maternal mortality rates. Although progress has been made in reducing maternal mortality, challenges remain, including limited access to skilled care and regional disparities in accessing quality care. This paper presents the first comprehensive analysis of the burden of different causes of maternal deaths reported in the Maternal Death Surveillance and Response (MDSR) system at the district level from 2016 to 2019.

Methods

The MDSR data are accessed from the Ministry of Health and Sanitation, and the secondary data analysis was done to determine the causes of maternal death in Sierra Leone. The proportions of each leading cause of maternal deaths were estimated by districts. A subgroup analysis of the selected causes of death was also performed.

Results

Overall, obstetric haemorrhage was the leading cause of maternal death (39.4%), followed by hypertensive disorders (15.8%) and pregnancy-related infections (10.1%). Within obstetric haemorrhage, postpartum haemorrhage was the leading cause in each district. The burden of death due to obstetric haemorrhage slightly increased over the study period, while hypertensive disorders showed a slightly decreasing trend. Disparities were found among districts for all causes of maternal death, but no clear geographical pattern emerged. Non-obstetric complications were reported in 11.5% of cases.

Conclusion

The MDSR database provides an opportunity for shared learning and can improve the quality of maternal health services. To improve the accuracy and availability of data, under-reporting must be addressed, and frontline community staff must be trained to capture and report death events accurately.

Keywords: Maternal medicine; Public health; Reproductive medicine.

Disclaimer: This chapter is derived from the publication: “Shafiq Y, Caviglia M, Juheh Bah Z, Tognon F, Orsi M, K Kamara A, Claudia C, Moses F, Manenti F, Barone-Adesi F, Sessay T. Causes of maternal deaths in Sierra Leone from 2016 to 2019: analysis of districts’ maternal death surveillance and response data. BMJ Open. 2024 Jan 12;14(1):e076256. Doi: 10.1136/bmjopen-2023-076256. PMID: 38216175; PMCID: PMC10806740.”

Study 2: Impact of Ebola and COVID-19 on Maternal, Neonatal, and Child Health Care Among Populations Affected by Conflicts: A Scoping Review Exploring Demand and Supply-Side Barriers and Solutions.

Authors: Yasir Shafiq, Elena Rubini 6, Zoha Zahid Fazal, Muhammad Murtaza Bukhari, Maheen Zakaria, Noor Ul Huda Zeeshan, Ameer Muhammad, Luca Ragazzoni, Francesco Barone-Adesi, Martina Valente

Introduction

Armed conflicts have a severe impact on the health of women and children. Global health emergencies such as pandemics and disease outbreaks further exacerbate the challenges faced by vulnerable populations in accessing maternal, neonatal, and child healthcare (MNCH). There is a lack of evidence that summarizes the challenges faced by conflict-affected pregnant women, mothers, and children in accessing MNCH services during global health emergencies, mainly the Ebola and COVID-19 pandemics. This scoping review aimed to analyze studies evaluating and addressing barriers to accessing comprehensive MNCH services during Ebola and COVID-19 emergencies in populations affected by conflict.

Methods

The search was conducted on PubMed, Scopus, and Web of Science databases using terms related to Ebola and COVID-19, conflicts, and MNCH. Original studies published between 1990 and 2022 were retrieved. Articles addressing the challenges in accessing MNCH-related services during pandemics in conflict-affected settings were included. Thematic analysis was performed to categorize the findings and identify barriers and solutions.

Results

Twenty-nine studies met the inclusion criteria. Challenges were identified in various MNCH domains, including antenatal care, intrapartum care, postnatal care, vaccination, family planning, and the management of childhood illnesses. Ebola-related supply-side challenges mainly concerned accessibility issues, health workforce constraints, and the adoption of stringent protocols. COVID-19 has resulted in barriers related to access to care, challenges pertaining to the health workforce, and new service adoption.

On the demand-side, Ebola- and COVID-19-related risks and apprehensions were the leading barriers in accessing MNCH care. Community constraints on utilizing services during Ebola were caused by a lack of trust and awareness. Demand-side challenges of COVID-19 included fear of disease, language barriers, and communication difficulties. Strategies such as partnerships, strengthening of health systems, service innovation, and community-based initiatives have been employed to overcome these barriers.

Conclusion

Global health emergencies amplify the barriers to accessing MNCH services faced by conflict-affected populations. Cultural, linguistic, and supply-side factors are key challenges affecting various MNCH domains. Community-sensitive initiatives enhancing primary health care (PHC), mobile clinics, or outreach programs, and the integration of MNCH into PHC delivery should be implemented. Efforts should prioritize the well-being and empowerment of vulnerable populations. Addressing these barriers is crucial for achieving universal health coverage and the Sustainable Development Goals.

Keywords: COVID-19; Ebola; Maternal; Neonatal and child health; Primary health care.

Disclaimer: This chapter is derived from the publication: “Shafiq, Y., Rubini, E., Fazal, Z.Z. et al. Impact of Ebola and COVID-19 on maternal, neonatal, and child health care among populations affected by conflicts: a scoping review exploring demand and supply-side barriers and solutions. Confl Health 18, 12 (2024). <https://doi.org/10.1186/s13031-024-00572-x>.”

Study 3: Navigating Challenges in Access to Antenatal and Intrapartum Care: Afghan Refugee Women's Experiences Amidst the COVID-19 Pandemic in Pakistan

Authors: Yasir Shafiq, Ameer Muhammad, Zamir Hussain Suhag, Rehman Tahir, Abdullah Jan, Huba Atiq, Shayan Khakwani, Muhammad Ahmed, Dua Eva, Luca Ragazzoni, Francesco Barone-Adesi, Martina Valente

Introduction

Balochistan, the most economically and health system-deprived province in Pakistan, hosts a significant portion of the Afghan refugee population. The region's already fragile healthcare infrastructure faces additional strains due to the presence of refugees. This study aims to investigate maternal, neonatal, and child health (MNCH) care-seeking behaviors among Afghan refugee women in Balochistan during the COVID-19 pandemic and assess the multifaceted influences on healthcare access.

Methods

A cross-sectional survey was conducted in a settlement of Quetta city in the Balochistan province in Pakistan, where Afghan refugees are settled. The survey focused on antenatal and childbirth care-seeking behaviors among married women of reproductive age (MWRA) with at least one child aged 12-23 months born during the first four waves of COVID-19 in Pakistan.

Results

Among 480 MWRA, only 36.9% sought antenatal care (ANC) during pregnancy during the COVID-19 pandemic; only 13.1% received at least 4 ANC visits. Further, only 38.8% of MWRA had skilled birth attendance. Only 32.9% of MWRA received at least one ANC and had skilled birth attendance (i.e., comprehensive care). Accessing comprehensive care was associated with maternal age less than 25 years (Adjusted OR: 0.40; 95% CI: 0.21, 0.78), Tajik ethnicity (Adjusted OR: 0.40; 95% CI: 0.23, 0.70), and large family size (Adjusted OR: 0.58; 95% CI: 0.37, 0.93). Predictors of poor access were concerns related to the documentation of the refugee women (Adjusted OR: 1.52; 95% CI: 1.00, 2.34), women with no one at their household available to accompany them at the health facility (Adjusted OR: 1.75; 95% CI: 1.13, 2.70), myths and misconceptions related to available care (Adjusted OR: 1.89; 95% CI:

1.18, 3.02), and the transport unavailability (Adjusted OR: 1.76; 95% CI; 1.12, 2.77). Concerns related to COVID-19 had no association with the outcome.

Conclusion

The study highlights the multifaceted barriers to MNCH service utilization among Afghan refugee women in Balochistan, underscoring the need for targeted interventions that address the unique challenges faced by this population. Tailoring healthcare services to consider age, ethnicity, family dynamics, and logistical constraints is crucial for improving access and ensuring that vulnerable populations are included in pursuing universal healthcare coverage (UHC).

Disclaimer: Manuscript under review as, “PGPH-D-24-00961R1 - Navigating Challenges in Access to Antenatal and Intrapartum Care: Afghan Refugee Women's Experiences Amidst the COVID-19 Pandemic in Pakistan”

Study 4: Pathways to Develop Resilient Maternal, Neonatal and Child Health Care: A Qualitative Study Involving Afghan Refugee Women in Pakistan

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Introduction

Afghan refugees in Pakistan, particularly in Quetta, Balochistan, encounter several barriers in accessing maternal, newborn, and child health (MNCH) services. These challenges have been intensified by the COVID-19 pandemic and entrenched systemic health inequities. The study aimed to assess the obstacles within health systems and community environments that hinder access to MNCH services among Afghan refugees.

Methods

This qualitative study was conducted from February to April 2023. It involved 20 key informants through in-depth interviews and focus group discussions, including Afghan refugee women, community elders, health workers, and representatives from non-governmental organizations and government agencies. The research focused on experiences during the initial four waves of the COVID-19 pandemic (2020-2021), utilizing a conceptual framework that integrates health-EDRM into primary health care.

Results

The study identified significant systemic barriers to accessing MNCH services, such as insufficient funding, inadequate health infrastructure, and discriminatory practices within the healthcare workforce. Additionally, community-level obstacles were prominent, including cultural and language differences, geographical isolation, and economic constraints. The integration of health-EDRM into local health systems was minimal, with many stakeholders either unaware of or unengaged with the framework.

Conclusion

The findings highlight a critical need for comprehensive policy reforms, infrastructure enhancement, and community-centered approaches to address the health needs of Afghan refugees effectively. Strengthening

the integration of health-EDRM into health systems is crucial for enhancing resilience and ensuring continuous care during health emergencies. The study calls for concerted efforts to implement culturally sensitive health interventions that include disaster risk management components to improve MNCH outcomes among Afghan refugees in crisis-affected settings. By addressing both systemic and community-level barriers, it is possible to create a more resilient and equitable health system for vulnerable populations.

Disclaimer: Manuscript under review as, “PGPH-D-24-01307: Pathways to Develop Resilient Maternal, Neonatal and child Health Care: A Qualitative Study Involving Afghan Refugee Women in Pakistan”

Chapter 4: Study of Causes of Maternal Deaths in Sierra Leone

Disclaimer: This chapter is derived from the publication: “Shafiq Y, Caviglia M, Juheh Bah Z, Tognon F, Orsi M, K Kamara A, Claudia C, Moses F, Manenti F, Barone-Adesi F, Sessay T. Causes of maternal deaths in Sierra Leone from 2016 to 2019: analysis of districts' maternal death surveillance and response data. BMJ Open. 2024 Jan 12;14(1):e076256. doi: 10.1136/bmjopen-2023-076256. PMID: 38216175; PMCID: PMC10806740.”

The United Nations estimates suggests that life expectancy at birth in Sierra Leone is 60 years.⁴⁷ It remains among the top countries having highest maternal mortality rate and lifetime risk of maternal death is 1 in 52.⁴⁸ The 2019 national survey data of Sierra Leone reported the maternal mortality ratio (MMR) of 717 per 100,000 live births and pregnancy-related mortality ratio was 796 per 100,000 live births.⁴⁹ However, the global data on trends of MMR showed that in Sierra Leone from 2000 to 2020 anticipated the decreasing trend MMR decreasing trends (443 per 100,000 live births in 2020 compared to 2480 per 100,000 live births in 2000).⁴⁸

Sierra Leone has made strides in improving maternal health as part of its commitment to the Sustainable Development Goals, notably through enhancing healthcare access and community education.⁵⁰ However, challenges such as limited resources and cultural barriers continue to impede further progress in this critical area.^{50,51} In previous years, the government of Sierra Leone, with the support of international partners, has implemented various initiatives to improve maternal health, including strengthening the health system and increasing access to maternal care.^{50,52,53} Free Health Care Initiative (FHCI) and the national reproductive, maternal, neonatal, child⁵⁴ and adolescent health (RMNCAH) strategy are the key programs which aimed to improve access to quality care.⁵³ In terms of major health indicators, the trends of facility births in the country have made significant progress, from 25% of deliveries took place in health facilities in 2008 to 83% in 2019.^{49,51,53} This trend varies by district, for instance, in Port Loko, 61% of births occur in health facilities, while in Kenema and Pujehun, the rate is as high as 97% in 2019.⁴⁹ However, access to skilled care on the continuum of maternal care during pregnancy, intrapartum, and postnatal period remains limited, and many women in rural geographies have inequalities in accessing essential obstetric services.⁵⁴ Further confirmation of this gap is indicated by the differences in caesarean section rates among Sierra Leonean districts, which remain below the safety threshold of 10% at the population level indicated by the World Health Organization (WHO).⁵⁵ These regional disparities in accessing essential quality care are grossly linked to maternal death.⁵⁶

In 2015-16, the Maternal Death Surveillance and Response (MDSR) system in Sierra Leone was launched.⁵⁷ The aim of identifying the causes of maternal deaths and informing targeted interventions.^{57,58} MDSR assigns primary death causes to maternal deaths based on clinical/medical records from hospital/facility in most of the cases, or through verbal autopsy (VA) data in a case where clinical or medical record are not available. The data on the cause of death are then coded according to WHO classification.⁵⁹ Indeed, in many low- and middle-income countries (LMICs), VA is often the only available method to produce mortality statistics, as deaths often occur at home.⁶⁰ Moreover, many of these countries do not have a structured and reliable system of reporting death data.⁶¹

The first annual report on MDSR was published by the Ministry of Health and Sanitation (MOHS) of Sierra Leone, Reproductive and Child Health Directorate, and partners in 2016.⁵⁷ Although this data is part of routine reporting and dissemination at MOHS to assess the trend and cumulative causes of maternal death,^{57,62} so far analysis has not investigated the differences and patterns between districts for the different causes of death. Therefore, this paper presents the first comprehensive analysis of the burden of different causes of maternal deaths reported in the MDSR system at the district level from 2016 to 2019. In a country with the highest maternal mortality and lowest life expectancy, a detailed presentation of the data by each participating district in MDSR is crucial for global health leadership. This paper is a joint effort of work on data analysis and synthesis in partnership with the Centre for Research and Training in Disaster Medicine, Humanitarian Aid, and Global Health (CRIMEDIM) at Università del Piemonte Orientale and Doctors with Africa CUAMM. These three are partners in one of the projects to evaluate the countrywide impact of National Emergency Medical Services (NEMS) on maternal health services.⁶³ The MDSR dataset is a key component of the impact evaluation of the NEMS project, and the scope of this paper falls under the umbrella of this work.

Methods

This is the secondary data analysis of MDSR data. The access to the dataset was given by MOHS.

MDSR system

In Sierra Leone, the MDSR is implemented through a multi-stakeholder approach involving the MOHS, healthcare providers, and both national and international non-governmental organizations. The key steps involved are: 1) the identification of maternal deaths through various sources; 2) notification to key program officials and clinicians; 3) verification and investigation of each maternal death, including periodical health facility-based death audits; and 4) review and clinical determination of the cause of death.

In the context of maternal mortality surveillance, the MOHS role in the identification and reporting of maternal deaths is pivotal.⁵⁷ Recognizing maternal death as a notifiable event, the MOHS implemented a surveillance and reporting system, integrating the Civil Registration and Vital Statistics (CRVS), the call system as well as community engagement, to capture maternal deaths irrespective of location.⁵⁷ This system is integral to the MDSR model, a comprehensive mechanism tracking maternal deaths and identifying underlying factors for targeted intervention.⁵⁷ The MOHS has endeavored to strengthen this system, addressing challenges such as underreporting and coordination limitations.⁵⁷ They have developed national technical guidelines to fortify the MDSR, incorporating a multifaceted approach that includes training clinicians for accurate death classification, supporting midwife investigators, and ensuring continuous data validation.⁵⁷ This systematic approach aims to improve the quality of care and response strategies at both facility and community levels, reflecting a committed effort to reduce maternal mortality through enhanced surveillance and response initiatives.⁵⁷

The process of assigning cause of death for maternal fatalities adheres to a structured and methodical approach.⁵⁹ The International Statistical Classification of Diseases and Related Health Problems - 10 (ICD-10) is used to assign causes.^{57,59} The investigation into suspected maternal deaths is triggered by reports to the Reproductive and Child Health unit, leading to a systematic inquiry by a multidisciplinary team comprising District Surveillance Officers, District Health Supervisors, and Midwife Investigators.⁵⁷ This team is tasked with confirming the nature of the death and elucidating the contributory factors.⁵⁷ The WHO ICD-10 definition of maternal death is employed, which encompasses deaths occurring during pregnancy or within 42 days of termination of pregnancy, attributable to pregnancy-related causes or its

management, excluding incidental causes.^{57,59} Maternal deaths are categorized into direct, indirect, incidental, and unclassifiable types, facilitating a better understanding of each case.^{57,59}

Nearly 90% of deaths recorded in the MDSR system occurred at health facilities; therefore, the cause of death is determined during review meetings by clinicians based on clinical symptoms, examination findings, and diagnosis in the case notes.⁵⁷ VA only applies to only 10% deaths occurring and reported at the community level. At the facility level, periodic MDSR meetings allow incident reviews by the same multidisciplinary team. A district representative is usually invited to strengthen the collaboration between peripheral, basic, and comprehensive healthcare facilities. Clinical/medical records or VA is used to determine the causes, and each cause was coded for the purpose of analysis.

Analysis

The data is cleaned, coded, and assessed for missingness and outliers. In case of discrepancies, MOHS is contacted to resolve these. After consulting the MOHS, the dataset for analysis was locked, and the main analysis was conducted using StataSE 17. The proportion of each leading cause of maternal death with their 95% Confidence Intervals (95%CI) was estimated by district for the period 2016-2019. CIs were calculated using the exact binomial method, chosen for its precision in estimating intervals for proportion data. This ensures robust and reliable statistical inference and provides an understanding of the variability and potential range of the observed proportions across different districts

The direct and indirect causes are analyzed and reported according to ICD guidelines, cumulative as well as by districts. Furthermore, a subgroup analysis of selected causes of death, such as obstetric hemorrhage and other direct and indirect obstetric complications, was performed as well. The denominator represented the total number of deaths reported in each district.

Patient and Public Involvement

Specific for MDSR system MOHS and stakeholders engaged with community to report the death events in the community. However, for this paper and analysis, there was no direct involvement of the patient and the public.

Results

Direct causes of maternal death

Overall, 2428 maternal deaths were recorded and coded in the MDSR system from to 2016-2019 in all 13 districts of Sierra Leone (Table 1).

Table 1 | Yearly distribution of maternal deaths reported in MDSR Sierra Leone^s

Districts	Year				Total
	2016 N=706	2017 N=551	2018 N=590	2019 N=581	
Western Area	183 (33.3%)	109 (19.8%)	133 (24.2%)	125 (22.7%)	550
Bo	76 (31.4%)	51 (21.1%)	55 (22.7%)	60 (24.8%)	242
Bombali	57 (33.5%)	42 (24.7%)	24 (14.1%)	47 (27.6%)	170
Bonthe	28 (37.8%)	14 (18.9%)	15 (20.3%)	17 (23.0%)	74
Kailahun	31 (38.8%)	18 (22.5%)	13 (16.3%)	18 (22.5%)	80
Kambia	37 (23.9%)	33 (21.3%)	49 (31.6%)	36 (23.2%)	155
Kenema	60 (26.7%)	60 (26.7%)	53 (23.6%)	52 (23.1%)	225
Koinadugu	33 (23.9%)	28 (20.3%)	41 (29.7%)	36 (26.1%)	138
Kono	53 (30.5%)	47 (27.0%)	39 (22.4%)	35 (20.1%)	174
Moyamba	29 (22.8%)	31 (24.4%)	35 (27.6%)	32 (25.2%)	127
Port loko	44 (23.5%)	52 (27.8%)	50 (26.7%)	41 (21.9%)	187
Pujehun	31 (26.7%)	23 (19.8%)	31 (26.7%)	31 (26.7%)	116
Tonkolili	44 (23.2%)	43 (22.6%)	52 (27.4%)	51 (26.8%)	190

Obstetric hemorrhage was the leading cause of maternal death in Sierra Leone over the study period (N=956, 39.4%, 95% CI: 37.4, 41.3), followed by hypertensive disorders in pregnancy, childbirth, and puerperium (N=384, 15.8%, 95% CI:14.4, 17.3), pregnancy-related infections (N=244, 10.1%, 95% CI: 8.9, 11.3), other obstetric complications (N=200, 8.2%, 95% CI: 7.1, 9.4), and pregnancy with abortive outcomes (N=71, 2.9%, 95% CI: 2.2, 3.3) (Table 2).

Table 2 | Proportion of maternal deaths in Sierra Leone due to different causes

Districts	Causes ^{db}														
	Pregnancy with abortive outcome		Hypertensive disorders in pregnancy, childbirth, and the puerperium		Obstetric hemorrhage		Pregnancy-related infections		Other obstetric complications		Unanticipated complications of management		Non-obstetric complications		Total
	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N
Western Area	16	2.9 (1.7,4.7)	110	20.0 (16.7,23.5)	220	40.0 (35.9,44.2)	35	6.4 (4.5,8.7)	34	6.2 (4.3,8.5)	0	-	74	13.5 (10.7,15.6)	550
Bo	7	2.9 (1.2,5.9)	37	15.3 (11.1,20.5)	102	42.2 (35.9,48.6)	24	9.9 (6.5,14.4)	19	7.9 (4.8,12.9)	2	0.8 (0.1,2.9)	30	12.4 (8.5,17.2)	242
Bombali	7	4.1 (1.7,8.2)	26	15.3 (10.2,21.6)	55	32.4 (25.4,39.9)	22	12.9 (8.2,18.9)	15	8.8 (5.0,14.1)	1	0.6 (0.01,3.2)	27	15.9 (10.7,22.2)	170
Bonthe	0	-	11	14.9 (7.7,25.0)	36	48.7 (36.8,60.5)	7	9.5 (3.9,18.5)	6	8.1 (3.0,16.8)	1	1.4 (0.03,7.3)	2	2.7 (0.3,9.4)	74
Kailahun	4	5.0 (1.3,12.3)	2	2.5 (0.3,8.7)	48	60.0 (48.4,70.7)	7	8.8 (3.6,17.2)	5	6.3 (2.0,13.9)	0	-	10	12.5 (6.2,21.8)	80
Kambia	1	0.7 (0.01,3.5)	22	14.2 (9.1,20.7)	51	32.9 (25.6,40.9)	10	6.5 (3.1,11.5)	19	12.3 (7.5,18.4)	1	0.7 (0.01,3.5)	26	16.8 (11.2,23.6)	155
Kenema	15	6.7 (3.8,10.7)	34	15.1 (10.7,20.4)	73	32.4 (26.3,38.9)	21	9.3 (5.9,13.9)	22	9.8 (6.2,14.4)	2	0.9 (0.1,3.1)	36	16.0 (11.4,21.4)	225
Koinadugu	2	1.5 (0.1,5.1)	19	13.8 (8.4,20.6)	57	41.3 (32.9,49.9)	20	14.5 (9.0,21.5)	12	8.7 (4.5,14.6)	2	1.5 1.5 (0.1,5.1)	16	11.6 (6.7,18.1)	138
Kono	6	3.5 (1.2,7.3)	25	14.4 (9.5,20.4)	49	28.2 (21.6,35.4)	31	17.8(12.4,24.3)	20	11.5 (7.1,17.1)	0	-	26	14.9 (9.9,21.1)	174
Moyamba	0	-	28	22.1 (15.1,30.2)	54	42.5 (33.7,51.6)	10	7.9 (3.8,14.0)	10	7.9 (3.8,14.0)	0	-	7	5.5 (2.2,11.0)	127
Port loko	2	1.1 (0.1,3.8)	34	18.2 (12.9,24.4)	88	47.1 (39.7,54.4)	19	10.2 (6.2,15.4)	11	5.9 (2.9,10.2)	0	-	7	3.7 (1.5,7.5)	187
Pujehun	7	6.0 (2.4,12.0)	19	16.4 (10.1,24.3)	39	33.6 (25.1,42.9)	13	11.2 (6.1,18.4)	12	10.3 (5.4,17.3)	1	0.9 (0.2,4.7)	8	6.9 (3.0,13.1)	116
Tonkolili	4	2.1 (0.5,5.3)	17	9.0 (5.2,13.9)	84	44.2 (37.0,51.5)	25	13.2 (8.6,18.8)	15	7.9 (4.4,12.6)	1	0.5 (0.01,2.8)	9	4.7 (2.1,8.8)	190
Countrywide	71	2.9 (2.2,3.6)	384	15.8 (14.3,17.3)	956	39.4 (37.4,41.3)	244	10.1 (8.8,11.3)	200	8.2 (7.1,9.4)	11	0.5 (0.2,0.8)	278	11.5 (10.2,12.7)	2428
^s Data shown is proportion of cause of death (%) with 95% confidence interval (95% CI) for each district in the MDSR data															
^{db} Data on ‘Coincidental causes (N=1, 0.04%)’ and ‘Unknown/ undetermined causes (N=283, 11.7%)’ is not included in the table and reported in supplementary table 4															

Within the different subgroups of obstetric hemorrhages, postpartum hemorrhage was the leading cause (N=740, 30.5%, 95% CI: 28.6, 32.3) in each district, followed by antepartum hemorrhage (N=205, 8.4%, 95% CI: 7.3, 9.6) (Table 3).

Table 3 | Subgroup analysis of obstetric hemorrhage

Districts	Causes							
	Postpartum hemorrhage		Antepartum hemorrhage		Intrapartum hemorrhage		Obstetric hemorrhage	
	N	% (95%CI)	N	N	N	% (95%CI)	N	% (95%CI)
Western Area	166	30.2 (26.6,34.2)	53	9.6 (7.3,12.4)	1	0.2 (0.004,1.0)	220	40.0 (35.9,44.2)
Bo	84	34.7 (28.7,41.0)	17	7.0 (4.1,11.0)	1	0.4 (0.01,2.2)	102	42.2 (35.9,48.6)
Bombali	45	26.5 (20.0,33.7)	9	5.3 (2.4,9.8)	1	0.6 (0.01,3.3)	55	32.4 (25.4,39.9)
Bonthe	27	36.5 (25.5,48.4)	9	12.2 (5.7,21.8)	0	-	36	48.7 (36.8,60.5)
Kailahun	40	50.0 (38.6,61.3)	8	10.0 (4.4,18.7)	0	-	48	60.0 (48.4,70.7)
Kambia	38	24.5 (17.9,32.0)	13	8.4 (4.5,13.9)	0	-	51	32.9 (25.6,40.9)
Kenema	62	27.6 (21.8,33.8)	11	4.9 (2.4,8.5)	0	-	73	32.4 (26.3,38.9)
Koinadugu	37	26.8 (19.6,35.0)	19	13.8 (8.4,20.6)	1	0.7 (0.01,3.9)	57	41.3 (32.9,49.9)
Kono	38	21.8 (15.9,28.7)	10	5.7 (2.7,10.3)	1	0.6 (0.1,3.1)	49	28.2 (21.6,35.4)
Moyamba	40	31.5 (23.5,40.3)	13	10.2 (5.5,16.8)	1	0.8 (0.1,4.3)	54	42.5 (33.7,51.6)
Port loko	73	39.0 (32.0,46.4)	14	7.5 (4.1,12.2)	1	0.5 (0.1,2.9)	88	47.1 (39.7,54.4)
Pujehun	32	27.6 (19.6,36.6)	6	5.2 (1.9,10.9)	1	0.9 (0.02,4.7)	39	33.6 (25.1,42.9)
Tonkolili	58	30.5 (24.0,37.6)	23	12.1 (7.8,17.6)	3	1.6 (0.3,4.5)	84	44.2 (37.0,51.5)
Countrywide	740	30.5 (28.6,32.3)	205	8.4 (7.3,9.6)	11	0.5 (0.2,0.8)	956	39.4 (35.9,44.2)
<i>Data shown are the proportion of cause of death (%) with 95% confidence interval (95% CI) for each district</i>								

Furthermore, the burden of death due to obstetric hemorrhage slightly increased over the study period, from 36.6% to 41.1% (Figure 1). Hypertensive disorders showed a slightly decreasing trend from 17.6% to 14.6% (Figure 1).

On the other hand, there was substantial variation in the proportion of obstetric hemorrhage over the total number of deaths among the different districts, ranging between 28.2% (Kono) and 60.0% (Kailahun), even if no clear geographic pattern emerged (Figure 2).

Figure 1 | Yearly trends of proportions of leading causes of maternal deaths in Sierra Leone

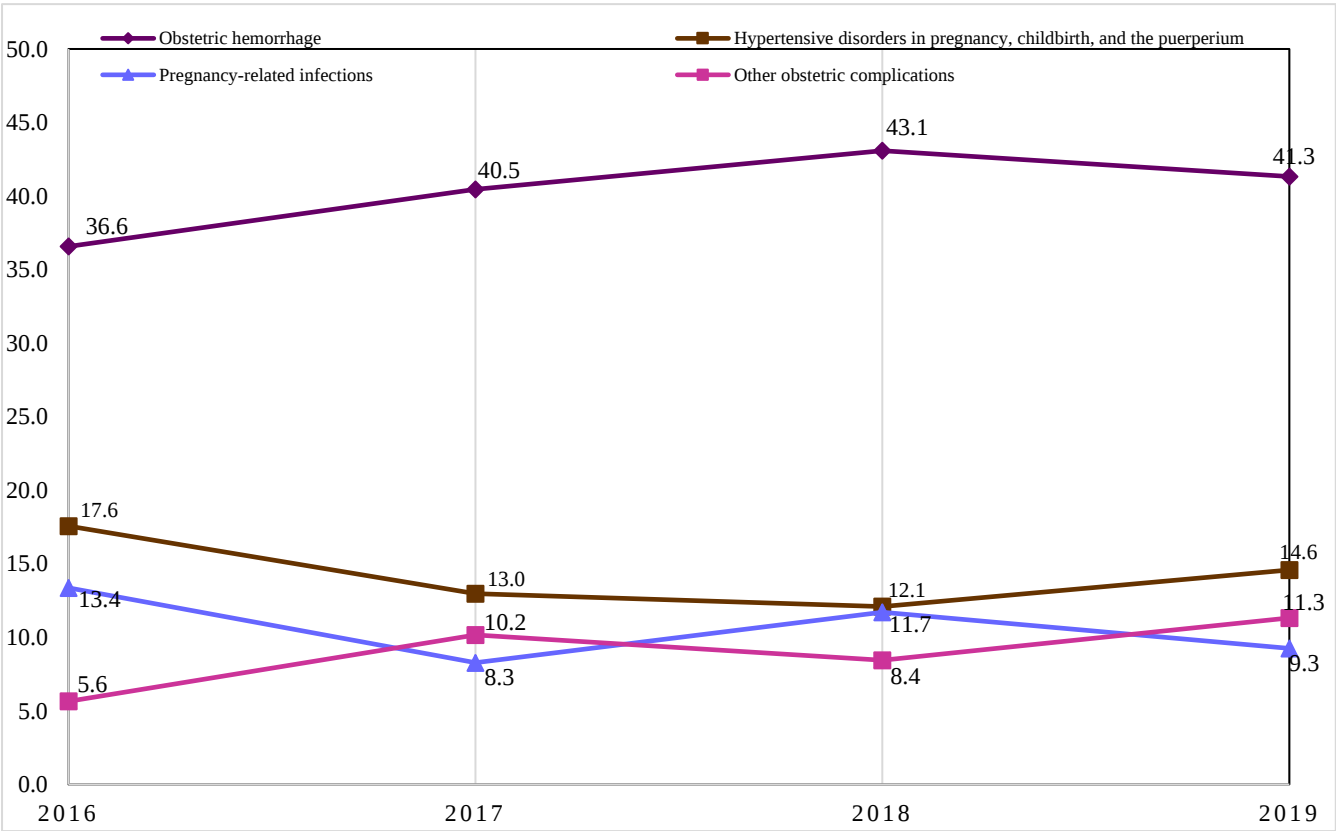
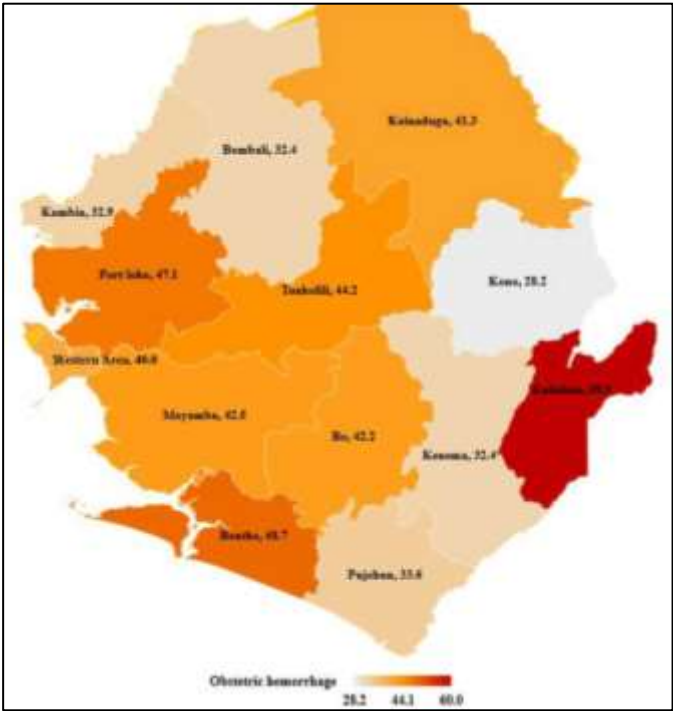
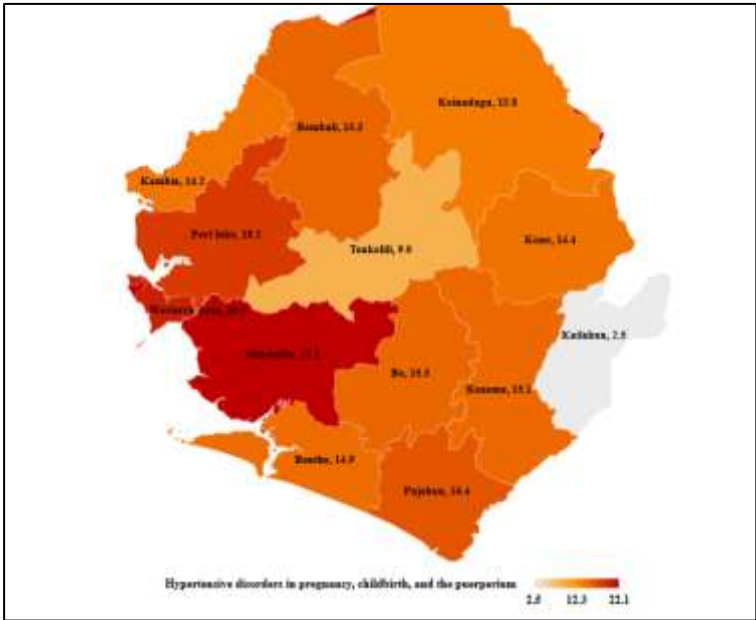


Figure 2 | Map of proportions of maternal deaths due to obstetric hemorrhage in each district



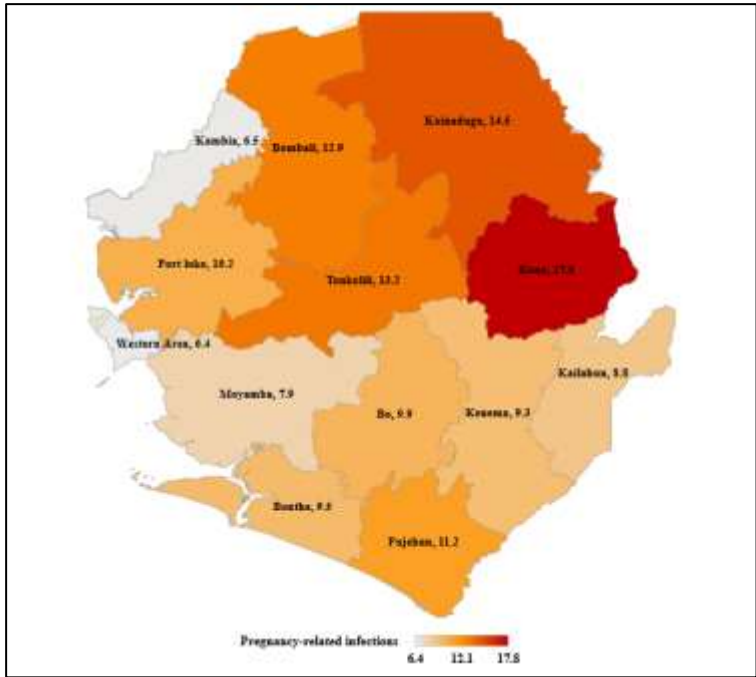
Even in this case, there was a large heterogeneity among districts, with figures ranging between 2.5% (Kailahun) and 22.1% (Moyamba), without a discernible spatial arrangement (Figure 3).

Figure 3 | Map of proportions of maternal deaths due to hypertensive disorders



The yearly trend for pregnancy-related infections decreased slightly from 13.4% to 9.3% (Figure 1). These infections also showed disparities among the districts, with proportions of 6.4% (western area) to 17.8% (Kono), with no distinct geographical arrangement observed (Figure 4).

Figure 4 | Map of proportions of maternal deaths due to pregnancy-related infections in each district



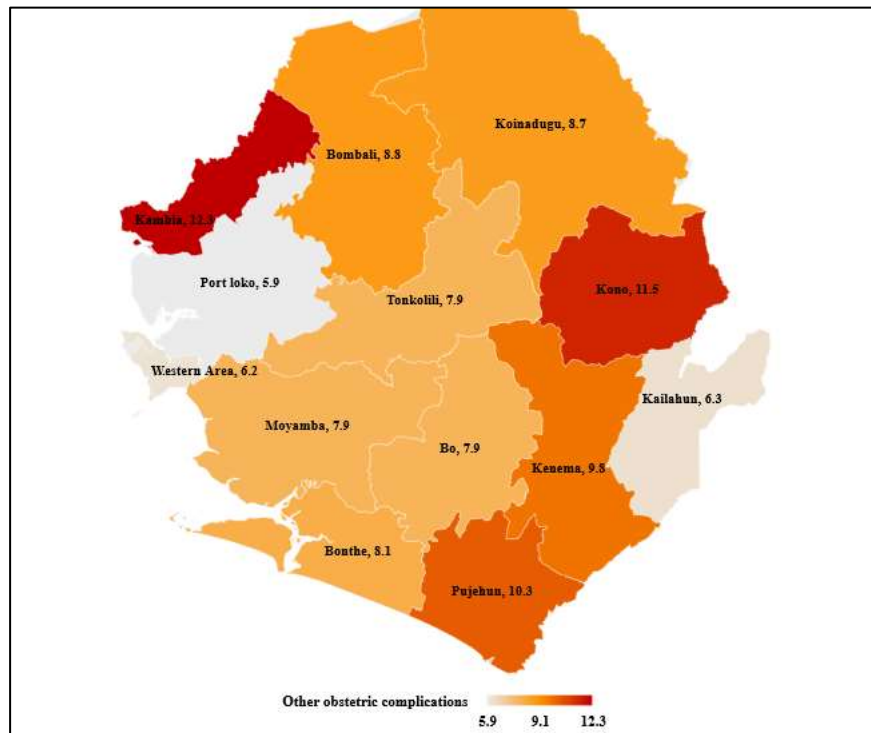
Finally, among the group labelled as other obstetric complications ruptured uterus (N=89, 3.7%, 95% CI: 2.9, 3.4) and obstructed labor (N=87, 3.6%, 95% CI: 2.8, 4.4) were the leading causes (Table 4).

Table 4 | Subgroup analysis of other obstetric complications

	Causes									
	Obstructed labour		Ruptured uterus		Pulmonary embolism		Intoxication		Other obstetric complications	
Districts	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)
Western Area	8	1.5 (0.6,2.8)	17	3.1 (1.8,4.9)	9	1.6 (0.7,3.0)	0	-	34	6.2 (4.3,8.5)
Bo	10	4.1 (1.9,7.4)	6	2.5 (0.9,5.3)	3	1.2 (0.2,3.5)	0	-	19	7.9 (4.8,12.9)
Bombali	8	4.7 (2.0,9.0)	7	4.1 (1.6,8.2)	0	-	0	-	15	8.8 (5.0,14.1)
Bonthe	2	2.7 (0.3,9.4)	4	5.4 (1.4,13.2)	0	-	0	-	6	8.1 (3.0,16.8)
Kailahun	0	-	5	6.3 (2.0,13.9)	0	-	0	-	5	6.3 (2.0,13.9)
Kambia	6	3.9 (1.4,8.2)	10	6.5 (3.1,11.5)	1	0.6 (0.01,3.5)	2	1.3 (0.1,4.5)	19	12.3 (7.5,18.4)
Kenema	15	6.7 (3.7,10.7)	7	3.1 (1.2,6.3)	0	-	0	-	22	9.8 (6.2,14.4)
Koinadugu	5	3.6 (0.1,5.1)	7	5.1 (2.0,10.1)	0	-	0	-	12	8.7 (4.5,14.6)
Kono	10	5.7 (2.7,10.3)	8	4.6 (2.0,8.8)	2	1.1 (0.1,4.0)	0	-	20	11.5 (7.1,17.1)
Moyamba	9	7.1 (3.2,13.0)	1	0.8 (0.1,4.3)	0	-	0	-	10	7.9 (3.8,14.0)
Port loko	7	3.7 (1.5,7.5)	3	1.6 (0.3,4.6)	1	0.5 (0.1,2.9)	0	-	11	5.9 (2.9,10.2)
Pujehun	4	3.4 (0.9,8.5)	4	3.4 (0.9,8.5)	4	3.4 (0.9,8.5)	0	-	12	10.3 (5.4,17.3)
Tonkolili	3	1.6 (0.3,4.5)	10	5.3 (2.5,9.4)	2	1.1 (0.1,3.7)	0	-	15	7.9 (4.4,12.6)
Country-wide	87	3.6 (2.8,4.4)	89	3.7 (2.9,4.4)	22	0.9 (0.5,1.3)	2	0.1 (0.01,0.5)	200	8.2 (7.1,9.4)
<i>Data shown are the estimated proportion of cause of death (%) with 95% confidence interval (95% CI) for each district</i>										

The trends almost doubled from 5.6% to 11.3% for all other obstetric complications (Figure 1); the range of variability was also visible among districts, from 5.9% (Port loko) to 12.3% (Kambia). No spatial pattern was observed (Figure 5).

Figure 5 | Map of proportions of maternal deaths due to other obstetric complications in each district



Indirect causes of maternal death

The results indicated that non-obstetric complications were reported in 11.5% of the cases (N=278, 95% CI:10.2, 12.7) as shown in Table 3. The most significant contributors to these complications included severe anemia (N=111, 4.6%, 95% CI: 3.7, 5.4), malaria (N=55, 2.3%, 95% CI: 1.7, 2.9), HIV/AIDS (N=33, 1.4%, 95%CI: 0.9, 1.9), and heart failure, cardiomyopathy, or stroke (N=34, 1.4%, 95% CI: 0.9, 1.9). For further analysis, a subgroup of non-obstetric complications by district is presented in Table 5.

Table 5 | Subgroup analysis of non-obstetric complications

Districts	Causes																	
	Heart failure / cardiomyopathy / Stroke		HIV/AIDS		Tuberculosis		Malaria		Respiratory Distress		Severe anemia		Sickle cell disease		Cervical cancer		Non-obstetric complications	
	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)
Western Area	8	1.5 (0.6,2.8)	11	2.0 (1.0,3.5)	5	0.9 (0.2,2.1)	20	3.6 (2.2,5.5)	0	-	20	3.6 (2.2,5.5)	9	1.6 (0.7,3.0)	1	0.2 (0.04,1.0)	74	13.5 (10.7,15.6)
Bo	2	0.8 (0.1,2.9)	3	1.2 (0.2,3.5)	0	-	4	1.7 (0.4,4.1)	2	0.8 (0.1,2.9)	18	7.4 (4.4,11.5)	1	0.4 (0.01,2.2)	0	-	30	12.4 (8.5,17.2)
Bombali	4	2.4 (0.6,5.9)	4	2.4 (0.6,5.9)	2	1.2 (0.1,4.1)	5	2.9 (0.9,6.7)	0	-	11	6.5 (3.2,11.2)	1	0.6 (0.01,3.3)	0	-	27	15.9 (10.7,22.2)
Bonthe	0	-	1	1.4 (0.03,7.3)	0	-	0	-	0	-	0	-	1	1.4 (0.03,7.3)	0	-	2	2.7 (0.3,9.4)
Kailahun	0	-	0	-	0	-	3	3.8 (0.7,10.5)	0	-	7	8.8 (3.5,17.2)	0	-	0	-	10	12.5 (6.2,21.8)
Kambia	3	1.9 (0.4,5.5)	1	0.6 (0.01,3.5)	0	-	1	0.6 (0.01,3.5)	0	-	16	10.3 (6.0,16.2)	5	3.2 (1.0,7.3)	0	-	26	16.8 (11.2,23.6)
Kenema	5	2.2 (0.7,5.1)	7	3.1 (1.2,6.3)	2	0.9 (0.1,3.1)	7	3.1 (1.2,6.3)	0	-	13	5.8 (3.1,9.6)	2	0.9 (0.1,3.1)	0	-	36	16.0 (11.4,21.4)
Koinadugu	2	1.4 (0.1,5.1)	0	-	1	0.7 (0.01,3.9)	2	1.4 (0.1,5.1)	0	-	9	6.5 (3.0,12.0)	2	1.4 (0.1,5.1)	0	-	16	11.6 (6.7,18.1)
Kono	4	2.3 (0.6,5.7)	3	1.7 (0.3,4.9)	2	1.1 (0.1,4.0)	7	4.0 (1.6,8.1)	0	-	5	2.9 (0.9,6.5)	5	2.9 (0.9,6.5)	0	-	26	14.9 (9.9,21.1)
Moyamba	0	-	0	-	0	-	4	3.1 (0.8,7.8)	0	-	3	2.4 (0.4,6.7)	0	-	0	-	7	5.5 (2.2,11.0)
Port loko	0	-	1	0.5 (0.1,2.9)	1	0.5 (0.1,2.9)	1	0.5 (0.1,2.9)	0	-	4	2.1 (0.5,5.3)	0	-	0	-	7	3.7 (1.5,7.5)
Pujehun	4	3.4 (0.9,8.5)	0	-	0	-	1	0.9 (0.02,4.7)	0	-	3	2.6 (0.5,3.7)	0	-	0	-	8	6.9 (3.0,13.1)
Tonkolili	2	1.1 (0.1,3.7)	2	1.1 (0.1,3.7)	2	1.1 (0.1,3.7)	0	-	0	-	2	1.1 (0.1,3.7)	1	0.5 (0.01,2.8)	0	-	9	4.7 (2.1,8.8)
Country-wide	34	1.4 (0.9,1.9)	33	1.4 (0.9,1.9)	15	0.6 (0.3,1.0)	55	2.3 (1.7,2.9)	2	0.1 (0.01,0.5)	111	4.6 (3.7,5.4)	27	1.1 (0.7,1.6)	1	0.04 (0.001,0.2)	278	11.5 (10.2,12.7)
Data shown are the estimated proportion of cause of death (%) with 95% confidence interval (95% CI) for each district																		

Discussion

Findings based on the MDSR platform between 2016 and 2019 suggest that more than half of the maternal deaths in Sierra Leone are attributable to hemorrhage, hypertensive disorders, and sepsis. These results are consistent with those from a recent nationally representative mortality study which used Sierra Leone Sample Registration System (SL-SRS) of births and deaths.⁶⁴ This study also reported hemorrhage as the leading cause of maternal deaths (25.0% compared to 39.4% from MDSR), followed by infections and sepsis (15.0% vs 10.1% in MDSR) and hypertensive causes (9.0% vs 15.8% in MDSR).⁶⁴ Moreover, comparing our findings with reports from the Sierra Leone National Reproductive, Maternal, Newborn, Child, and Adolescent Health Strategy 2017–2021, the leading causes of maternal death reported in that report were obstetric hemorrhage (46.0%), hypertension (22.0%), obstructed labor (21.0%), and sepsis (11.0%).⁶⁵ Regional comparison of our finding suggests that in the West African countries obstetric hemorrhage is also the leading cause of deaths (31.4%), followed by hypertension (22.7%), non-obstetric causes (14.1%), and infections (10.3%) were the leading causes of maternal death in West African countries.⁶⁶ Likewise, data from sub-Saharan Africa on maternal deaths suggest a similar pattern. A WHO systematic analysis revealed obstetric hemorrhage (24.5%), hypertension (16.0%), obstructed labor (2.1%), and sepsis (10.3%).⁵

Time-trend analysis of the major causes of maternal death failed to reveal any major patterns. A potential explanation could be that the observation period was relatively short to detect a temporal trend in maternal mortality at the population level.⁶⁷ The extent of the changes to be measured depends on numerous factors, such as the frequency with which the data are collected, accuracy of the data, and magnitude of the changes to be measured.⁶⁷ Data spanning at least five years is recommended to detect trends in maternal mortality.⁶⁸ Even in high-mortality settings, maternal mortality is a relatively rare event; therefore, data accuracy is particularly relevant.⁶⁸ Thus, in addition to the quantity of data, it is crucial to ensure data quality, and consider any changes in data collection methods or definitions that occur during

the observation period. Additionally, despite the heterogeneity in the burden of the specific causes of death, no clear geographical pattern emerged. The reason for this may be associated with the fact that the total number of deaths reported in MDSR may vary from district to district, and the validity of how the MDSR team assigns the cause of death in each district could differ due to the field-related challenges. This study presented comprehensive findings on causes of maternal deaths using the national dataset of MDSR Sierra Leone are presented segregated by districts. This is crucial for policymakers, decision-makers, and program implementers to understand the targeted interventions. However, it should be noted that the MDSR platform has the major constraint of underreporting deaths in the system. Approximately 76% of deaths were not recorded by this system in 2016 and 2017 due to several challenges in reporting [10]. This is a well-known limitation of systems like MDRS, which have been documented to have underreporting rates ranging between 58 and 76 in other settings.^{69–71} Nonetheless, such systems remain integral in developing countries to evaluate the performance of health systems and population-level issues. Similar evaluation the cause as well as in-depth analysis of these maternal death by districts could help the policy maker and program implementers to track the maternal health indicators [26].

The introduction of monitoring and evaluation (M&E) mechanisms, together with efforts to tackle reporting challenges within the community, limited organizational capacity and motivation, and difficulties in implementing the program in the field, can substantially improve the performance of the MDSR.^{72,73} Moreover, a differential underreporting rate among the specific causes of deaths seems unlikely. Thus, an analysis based on relative numbers (proportions over the total number of deaths) rather than absolute numbers should be less sensitive to this limitation.

Finally, the quality of assigning the CoD using clinical/medical records as well as verbal autopsy data may have affected the results in specific districts. However, the percentage of VA are low because of lack of data on maternal death from community. Therefore, MDSR system in Sierra Leone has great opportunity to strengthening the community reporting system within MDSR.

Conclusion

To reduce maternal mortality in Sierra Leone, there is a pressing need for more robust strategies in districts with a high burden of top preventable causes. There is an enormous opportunity for shared learning from the MDSR database, which can be utilized by different stakeholders to provide better-quality services to high-risk women. Although this platform and data have limitations, they can still be used to advance health policies, programs, and innovations aimed at reducing maternal deaths. This can be accomplished by applying the knowledge obtained from these findings. The issue of underreporting must be addressed to improve the availability and quality of data on maternal deaths and their causes. Capacity building and motivating frontline staff to capture the death event across different scenarios are crucial for improving mortality estimation at the district level. Effective monitoring and evaluation within the MDSR system will be ensured by strengthening the synergy between the national, district, facility, and community levels to improve the reporting system and assess the impact of the improvement strategies. Further, longitudinal data on maternal deaths and causes will ensure time-trend analysis of the causes of maternal mortality and design targeted interventions in different districts.

Chapter 5: Study on Impact of Ebola and COVID-19 on MNCH care among Populations Affected by Conflicts

Disclaimer: This chapter is derived from the publication: “Shafiq, Y., Rubini, E., Fazal, Z.Z. et al. Impact of Ebola and COVID-19 on maternal, neonatal, and child health care among populations affected by conflicts: a scoping review exploring demand and supply-side barriers and solutions. Confl Health 18, 12 (2024). <https://doi.org/10.1186/s13031-024-00572-x>.”

Armed conflicts and persecutions have devastating consequences on the overall health and well-being of women and children, directly through violence as well as indirectly through various health effects, such as an increased risk of morbidity and mortality as well as the burden of undernutrition and infectious diseases.⁷⁴ Globally, more than 114 million people were displaced as a consequence of armed conflicts at the end of September 2023.⁷⁵ More than 600 million women and girls are now living in countries affected by conflict⁷⁶, nearly 50% more than what was recorded in 2017.^{74 76} Women of reproductive age living in high-intensity conflict zones face a mortality risk that is three times higher than that of women living in peaceful settings.^{77 78} Further, 468 million children are forced to live in areas affected by armed conflict,⁷⁹ these figures reaching the estimate of 36.5 million children displaced as a consequence of conflicts by the end of 2022.⁸⁰

Global health emergencies, such as Ebola and COVID-19, amplify the strain on health systems, which, in turn, affects the overall health of populations.⁸¹ Both Ebola and COVID-19 have starkly demonstrated this challenge.^{82 83} In the context of COVID-19, 90% of countries experienced disruptions to at least one essential health service, risking a rollback of nearly a decade of progress towards the United Nations 2030 Sustainable Development Goal (SDG) number 3 – Good Health and Well Being.^{84 85} Previously, during the Ebola epidemic, affected countries, primarily in Africa, witnessed a significant strain on their health systems, with many health facilities becoming overwhelmed or shutting down entirely.⁸⁶ In both low- and middle-income countries (LMICs) and high-income countries (HICs), such outbreaks often lead to the disruption or suspension of essential health services, resulting in reduced access to care.^{85 87 88} This impact notably extends to MNCH services, especially at the primary health care (PHC) level, due to organizational and logistical challenges, such as staff and equipment shortages as well as broad public health restrictions⁸⁷. Both epidemics saw many countries reporting a decline in antenatal care (ANC) consultations, decreased reliance on skilled birth attendance, and suboptimal vaccination rates.^{84 89} A recent study highlighted that while some critical health interventions like ANC and immunization are

prioritized during conflicts, other essential MNCH services are not adequately provided in these settings.

⁹⁰ The study also noted that the delivery and effectiveness of these interventions in conflict zones are largely influenced by international donors and highly dependent on the specific context of each conflict, with innovative solutions being developed to address these challenges. ⁹⁰

The additional burden of pandemics and epidemics on MNCH services is usually difficult to quantify in conflict-affected countries due to huge constraints in accessing data and security challenges ⁹¹. Therefore, the intersection of the MNCH, armed conflict, and pandemics is a critical area of study that deserves attention for several reasons. Conflict-affected populations, particularly women and children, already face numerous challenges in accessing healthcare due to displacement, economic instability, and disrupted health systems ^{92 93}. Pandemics, such as Ebola and COVID-19, pose unique challenges to nearly all age groups ^{94 95 96} compared to endemic diseases (e.g., limited time and space) such as cholera, measles, malaria, or polio. ^{89 97} Outbreaks induced by Ebola and COVID-19 viruses often suspend or disrupt essential health services, including MNCH. Beyond direct health consequences, these pandemics have broader societal impacts, ^{96 97} disrupting economies, social structures, and resource allocation, ^{96 97} with cascading effects on MNCH services. A previous review investigated interventions addressing infectious diseases affecting women and children in conflict-affected regions. ⁹⁸ However, the authors focused solely on broader infectious diseases (e.g., malaria, polio, and tuberculosis) in conflict settings.

⁹⁸ Another review delved into MNCH interventions within conflicts, thoroughly analyzing methodologies, barriers, and outcomes, without focusing on Ebola or COVID-19. ⁹⁹ A broader review examined MNCH interventions during pandemics and epidemics such as Zika, Ebola, and COVID-19 without including populations affected by conflict. ⁸⁹ None of these reviews holistically assessed the intersection between MNCH, conflict, and global health emergencies, specifically pertaining to Ebola and COVID-19. The emergence of the Ebola and the COVID-19 pandemics has shown that many health systems face challenges in maintaining routine MNCH care because of the diversion of resources and staff to pandemic response efforts. ^{89 100} Taken together, the intersection of vulnerabilities connected to different identities and statuses (e.g., being a refugee or internally displaced, a pregnant woman or a

mother, or being a child mothered by them) may cause unique challenges to these populations in accessing MNCH services.^{101 102 103} Data is needed to bridge the gaps towards continuity of MNCH care during pandemics among women and children affected by armed conflict.^{104 105}

This scoping review aimed to thematically analyze original studies evaluating and addressing barriers to accessing MNCH services during Ebola and COVID-19 among conflict-affected pregnant women, mothers, and children under-five years of age. This will contribute to the assessment of barriers and potential solutions implemented or recommended in the published scientific literature. The findings aim to provide valuable insights for developing long-term strategies to enhance the quality of MNCH services for populations affected by conflict and with the additional burden of pandemics or epidemics.

Methods

Approach

A scoping review methodology was selected for its ability to map the breadth of research on MNCH in conflicts intersecting with Ebola and COVID-19 pandemics. This approach allows for the flexible incorporation of diverse studies, facilitating a comprehensive synthesis of the available evidence and the identification of significant research gaps. The scoping review's inherent adaptability makes it ideal for exploring complex, multifaceted public health challenges, where conventional systematic review protocols may be overly restrictive or inapplicable.

Research Question

This scoping review is centered around the research question: "What is the impact of Ebola and COVID-19 on MNCH care among populations affected by conflicts?" This question led to an exploration and synthesis of the available literature on the challenges, adaptations, and outcomes related to MNCH care in the context of these dual health emergencies in conflict-affected populations.

Search strategy and identification of relevant studies

A systematic search of original articles published from January 1, 1990, to August 7, 2023, was performed using three databases (PubMed, Scopus, and Web of Science). A manual search was

conducted to identify other relevant studies. The timeframe was chosen because we aimed to retrieve evidence connected to Ebola and COVID-19, and existing or past conflicts (e.g., Afghan War, Iraq War, Syrian War, conflict in countries such as Ethiopia, Yemen, Sudan, Nigeria, Uganda, Sierra Leone, Guinea, and the Democratic Republic of Congo). Three concepts were used to develop the search syntax, encompassing: (a) Ebola and COVID-19, (b) conflict, and (c) MNCH. To broaden the search, the terms pandemic, epidemic, and disease outbreaks were also included. Irrelevant articles were excluded during screening. (Table 1).

Supplementary table 1 | Search strategy

Concept 1: Disease Outbreaks "Hemorrhagic Fever, Ebola"[Mesh] OR "Coronavirus Infections"[Mesh] OR "COVID-19"[Mesh] OR "SARS-CoV-2"[Mesh] OR "COVID-19 epidemiology"[Tiab] OR "COVID-19 outbreak"[Tiab] OR "COVID-19 pandemic"[Tiab] OR "SARS-CoV-2 pandemic"[Tiab] OR "EBV"[Tiab] OR Ebola[Tiab] OR [Tiab]
"Disease Outbreaks"[Mesh] OR "Pandemics"[Mesh] OR "Epidemics"[Mesh]
Concept 2: Conflicts "Armed Conflicts"[Mesh] OR "Ethnic Violence"[Mesh] OR "Genocide"[Mesh] OR "Disasters"[Mesh] OR "Relief Work"[Mesh] OR "Emergencies"[Mesh] OR "Chemical Terrorism"[Mesh] OR "Terrorism"[Mesh] OR "Bioterrorism"[Mesh] OR "Civil Disorders"[Mesh] OR "War Exposure"[Mesh] OR humanitarian*[tiab] OR "Protracted armed conflict" [tiab] OR Conflict*[tiab] OR "conflict-affected settings"[tiab] OR Civil unrest [tiab] OR war [tiab] OR "conflict zone*" [tiab] OR "Conflict area*" [tiab] OR Persecution* [tiab] OR Hostilit* [tiab] OR Violence [tiab] OR War zone* [tiab] OR "Conflict-related"[tiab] OR "Civil unrest" [tiab] OR "War-torn region*" [tiab] OR post-conflict [tiab] OR "armed conflict"[tiab]
"Democratic Republic of the Congo"[Mesh] OR "Congo"[Mesh] OR "Guinea"[Mesh] OR "Liberia"[Mesh] OR "Afghan Campaign 2001"[Mesh] OR "Iraq War, 2003-2011"[Mesh] OR

"Syria"[Mesh] OR Sierra Leone[Mesh] OR Mali[Mesh] OR South Sudan[Mesh] OR Sudan[Mesh] OR Uganda[Mesh] OR "Yemen"[MESH] OR "Somalia"[MESH] OR "Myanmar"[MESH] OR DRC[tiab] OR Rohingya[tiab] OR "Syrian refugee"[tiab]

"Refugee Camps"[MeSH] OR "Refugees"[MeSH] OR "Transients and Migrants"[MeSH] OR "migrant women"[tiab] OR "displacement*"[tiab] OR "internally displaced"[tiab] OR "internal displacement*"[tiab] OR "idp"[tiab] OR "refugee women"[tiab] OR "conflict affected"[tiab] OR "conflict-affected population*"[tiab] OR "displaced famil*"[tiab] OR "crisis-affected"[tiab] OR "displaced mother*"[tiab] OR "refugee child*"[tiab] OR "Displaced famil*"[tiab] OR "conflict-induced displacement"[tiab] OR "refugee settlement*"[tiab] OR "conflict setting*"[tiab] OR resettled[tiab] OR "refugee camp"[tiab] OR FCAS[tiab]

Concept 3: Maternal, Neonatal and Child Health

"Maternal-Child Health Centers"[Mesh] OR "Pregnant Women"[Mesh] OR "Perinatal Care"[Mesh] OR "Prenatal Care"[Mesh] OR "Maternal Health*"[Mesh] OR "Maternal Health Services"[Mesh] OR "Child Health"[Mesh] OR "Child Health Services"[Mesh] OR "Infant Health"[Mesh] OR "Reproductive Health"[Mesh] OR "Reproductive Health Services"[Mesh] OR "Maternal-Child Health Services"[Mesh] OR "Vaccination"[Mesh] OR "Vaccination Coverage"[Mesh] OR "Immunization"[Mesh] OR "Maternal Mortality"[Mesh] OR "Child Mortality"[Mesh] OR "Infant Mortality"[Mesh] OR "Perinatal Mortality"[Mesh] OR "Perinatal Death"[Mesh] OR "Maternal Death"[Mesh] OR "Infant Death"[Mesh] OR "Pregnancy"[Mesh] OR "Family Planning Services"[Mesh] OR "Health Services Accessibility"[Mesh] OR "Newborn health"[tiab] OR "Health service"[tiab] OR "obstetric and newborn care"[tiab] OR "preventive measures"[tiab] OR fertility[tiab] OR mothering[tiab] OR "maternal, newborn, child health"[tiab] OR postnatal[tiab] OR "access to healthcare"[tiab] OR "utilisation"[tiab] OR "utilization"[tiab] OR nutrition[tiab] OR "cesarean section*"[Mesh] OR mothering[tiab] OR "obstetric service*"[tiab] OR "routine immunization"[tiab] OR "service utilization"[tiab] OR "Community-based"[tiab] OR "emergency

obstetric"[tiab] OR "child"[Mesh] OR "referral*"[tiab] OR delay*[tiab] OR MNCH[tiab] OR MNCHN[tiab] OR "nutritional counseling"[tiab] OR "follow-up care"[tiab] OR "vaccination coverage"[tiab] OR "postnatal healthcare"[tiab] OR birth[tiab] ANC[tiab] OR "ante-natal care"[tiab] OR IPC[tiab] OR intrapartum[tiab] OR childbirth[tiab] OR "family planning"[tiab] OR "post-natal care"[tiab] OR "postnatal care"[tiab] OR RMNCH[tiab] OR "home deliver*"[tiab] OR antenatal[tiab]

Operational definitions

For operational purposes, the term “MNCH services” refers to services or care during pregnancy and childbirth at any level (community outreach, primary, secondary, and tertiary), postnatal care, newborn and under-five care, childhood immunization, nutrition, and family planning services including access to contraceptives. “Conflict” was employed as an umbrella term to encompass armed conflict, civil war, persecution, or ethnic violence.¹⁰⁶ In this paper the expressions “refugee women and children” and “women and children” refer to pregnant women or lactating mothers and their children under-five years of age living in conflict-affected settings or displaced because of hostilities who became refugees or internally displaced persons (IDP). Furthermore, this term also encompasses non-pregnant and non-lactating women with children under the age of five who require MNCH services. The term refugee is defined as a person who is outside their country of origin for reasons of feared persecution, conflict, or generalized violence that seriously disturbed public order and require international protection.¹⁰⁷ Similarly, IDP in the context of this review refers to those who had been forced to flee their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict or situations of generalized violence.¹⁰⁸ This review also encompasses countries that have experienced prolonged civil war or conflict, leading to economic and healthcare system fragility. The inclusion criteria for studies from these countries were established based on a window period of 15 years between the conflict and the period when data collection was reported. In this review, the terms “global health emergencies”, “pandemic”, “epidemic”, and “infectious disease outbreak” are employed interchangeably for Ebola and COVID-19, while the expression “barriers to access to care” will be used as an umbrella

term to encompass the different elements presented in the conceptualization of Levesque et al.¹⁰⁹ We excluded the countries considered as “fragile” described in World Bank definition as “countries with high levels of institutional and social fragility, identified based on indicators that measure the quality of policy and institutions, and manifestations of fragility,” for example Venezuela, Zimbabwe etc.¹¹⁰

Study selection

Original studies focusing on MNCH services, assessing or reporting the challenges or barriers faced by the target population in accessing care, and describing interventions or strategies ensuring continuity of care were eligible for inclusion. Regarding global health emergencies, we only included articles addressing the effects of Ebola and COVID-19 viruses because these have emerged as health security threats globally or at least regionally and caused heightened disruption of health systems.¹⁰⁰ We included studies addressing the challenges affecting MNCH services in conflict-affected settings as per the operational definitions. Studies that targeted only health professionals or key informants involved in MNCH services were eligible for inclusion.

Articles that reported data from countries classified as “fragile” because of their high levels of institutional and social fragility were excluded. Emergencies related to climate-led or natural disasters were also excluded. Furthermore, studies targeting mental health and other PHC services that did not directly focus on MNCH were also excluded. Outbreaks related to measles, malaria, cholera, or polio were not eligible for inclusion since they did not have adverse consequences on health systems comparable to those induced by Ebola or COVID-19.⁹⁶ Articles related to the Zika virus were excluded because most of the infections were in countries not affected by conflict.¹¹¹ Studies related to the Human Immunodeficiency Virus (HIV) pandemic were also excluded because the challenges faced by people infected by this etiological agent are distinct and protracted over a longer time span. As many refugees are resettled in HICs, no exclusion criteria were connected to research conducted in countries based on their income level.¹¹² The PRISMA guidelines were followed to report inclusion and exclusion criteria.

¹¹³ (Table 2: Eligibility criteria)

Table 2 | Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
1. Language	English	All other languages
2. Timeframe of publications	1990 and after Rationale: Most trends at UNCHR on refugees are available from 1990	Before 1990
3. Type of studies	Qualitative Quantitative Mixed methods Case study Field implementation reports	Policy brief Perspective Reviews Letter to editor Book reviews Grey literature
4. Region	All	-
5. Target population	Women of reproductive age Children under-five years Neonates Health providers	All other population groups
6. Context	Conflicts: war, armed conflicts, persecution, ethnic violence, refugee camps, internal displacement, cross border conflicts Countries labeled as fragile due to long civil war in the past (WB/OCHA/UNHCR)	Natural disasters Climate change
7. Pandemic	COVID-19 Ebola	All other epidemics or pandemics like Zika, Swine flu

		Vaccine preventable diseases or small disease outbreaks like Measles, Malaria, Cholera, Polio
8. Type of health services	All or any domain of MNCH-related Primary health care services	Non-MNCH related PHC services Focused only secondary care or Tertiary care

Extraction and charting data

All identified indexed records were uploaded into Microsoft Excel version 2301 and duplicates were removed. Unique records from the databases were merged for screening. Four reviewers independently screened the titles and abstracts for relevance and any discrepancies were resolved through discussion or by a fifth reviewer. After the initial screening process, two reviewers assessed the full-text eligibility for inclusion. A comprehensive data extraction sheet was created to extract information for the thematic analysis. The data collection process included general information, variables such as setting and population characteristics, study design, objectives, and key findings. The results were categorized according to MNCH service domains. Furthermore, pertinent information was gathered if a study provided recommendations or described implemented strategies related to the continuity of care. To ensure accuracy, two reviewers entered the data, and any discrepancies or inconsistencies were resolved through discussion or with the assistance of a third reviewer. Data extracted from the studies were organized into a matrix that captured key information such as study location, methodology, population studied, main findings, and implications for MNCH care. This allowed for the systematic and thematic organization of the data, facilitating easier synthesis and analysis.

Data analysis, collating, summarizing, and reporting results

The findings from the selected studies were collated and summarized to provide a comprehensive overview of the impact of Ebola and COVID-19 on MNCH care to conflict-affected populations. We

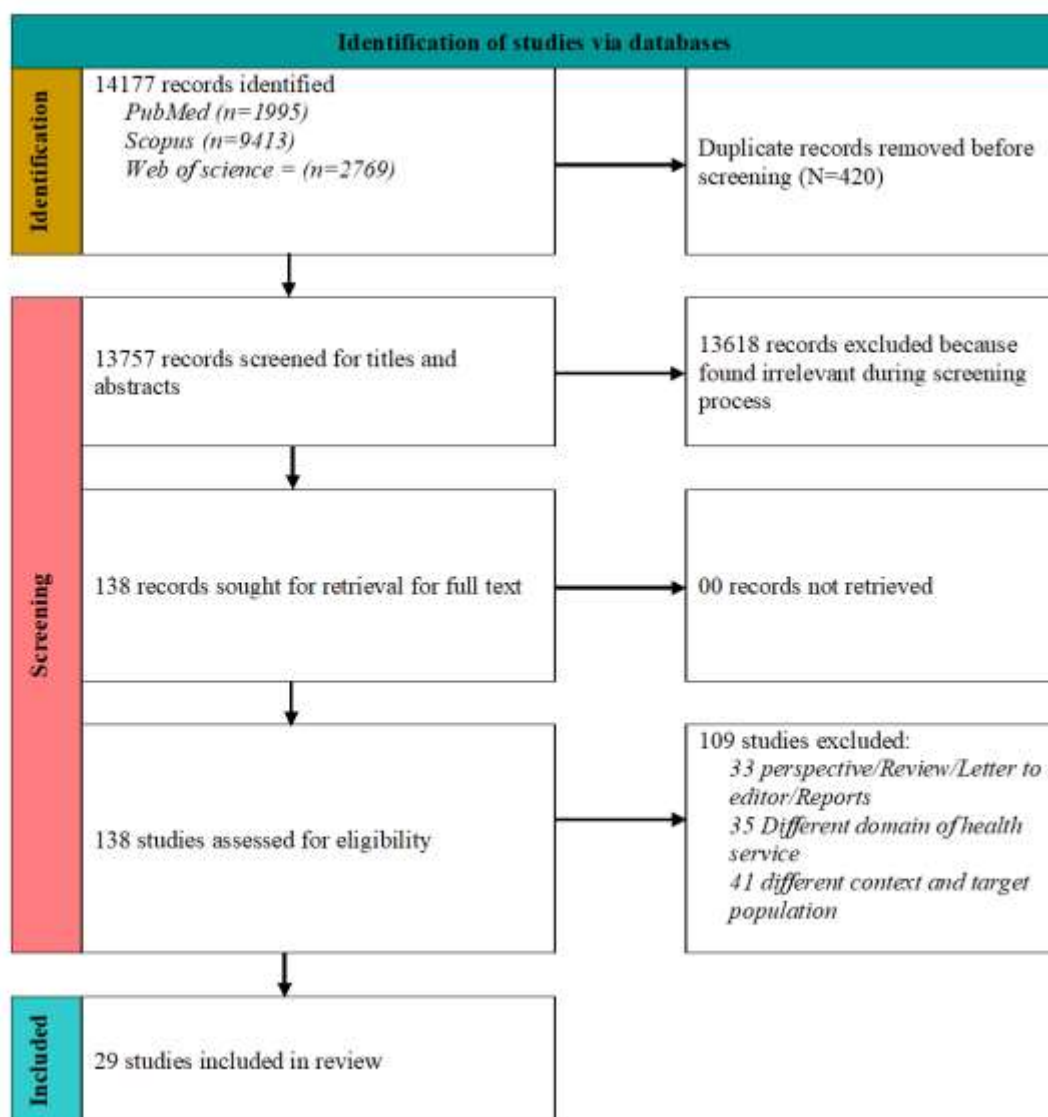
employed a narrative synthesis approach that enabled us to integrate the findings from diverse methodological backgrounds and draw broader conclusions about the overall trends and key issues identified in the literature. Descriptive statistics of the studies were performed to summarize the key characteristics, including geographic region, study type, type of conflict, displacement status of the population, and service characteristics (e.g., target population, MNCH service domain, and strategy applied). The MNCH domains or areas were categorized as community outreach, ANC, IPC, PNC, management of childhood illnesses, FP, vaccination, and nutrition. To report the findings, ANC and IPC were broadly defined as “Care during pregnancy and childbirth”, while PNC and under-five care, including vaccination and nutrition, were catalogued as “Preventive and curative newborn and childcare” and “FP.” A thematic analysis was conducted to report the impact of Ebola and COVID-19 on the continuity of care in MNCH services, and the strategies implemented or recommended in the studies. To facilitate the presentation of the findings related to health systems, the barriers and potential solutions were classified under the categories of “supply-side” and “demand-side” for all key domains of MNCH. The term “supply-side” is conceptualized as the various components related to the health system (e.g., service providers, service provision, supplies), ¹¹⁴ while “demand-side” encompasses individual behaviors, needs, and perceptions regarding services. ¹¹⁴

Results

Characteristics of the included studies

The search retrieved N=13757 studies, of which 29 met the eligibility criteria. The screening of sources and selection processes are shown in the PRISMA flow diagram (Figure 1). A total of 13618 records were excluded during screening because they were irrelevant and did not cover the scope. Of the 138 studies screened for full text, articles were excluded when they were non-original (N=33), focused on a different domain of health services (N=35), or when the context or target population did not match the inclusion criteria (N=41).

Fig 1. Prisma flow diagram. Providing details regarding the review screening and selection process.



Overall, the included studies were conducted in sub-Saharan and West Africa, South Asia, Middle East, and North America. The eligible studies adopted the following methodologies: mixed methods (N=11, 37.9%), qualitative (N=4, 13.7%), and quantitative (i.e., cross-sectional, or ecological survey and cohort studies (N=14, 48.4%) (Table 2). The study participants were refugees (N=9, 50%), population affected by a long civil war (14%), and population living in conflict or IDPs (N=6, 10%). (Table 2)

Table 1 | Description of the studies

Authors	Title	Study design	Methods	Objectives	Study setting, study population status and status of conflict						Target population	MNCH service domain	Conclusions
					Setting where the study was conducted	Type of conflict [‡]	Year of conflict [‡]	Duration from conflict to study of pandemic/ epidemic of interest (years) [‡]	Study population status	Type of pandemic or epidemic			
Altare C. et.al. (2022)	COVID-19 epidemiology and changes in health service utilization in Uganda's refugee settlements during the first year of the pandemic	Secondary data analysis	Descriptive statistics, testing rates, incidence rates of COVID-19 cases, adjusted odds ratios for selected outcomes and applied interrupted time series analysis.	To analyze the epidemiology of COVID-19 cases in Uganda's refugee settlement, and evaluation of how health service utilization changed during the first year of the pandemic.	Settlements in West Nile, South and Center regions of Uganda	Displaced population from multiple countries affected by conflicts: South Sudan, DR Congo, Somalia, Burundi, Rwanda	Conflict in multiple countries resulted in displacement	Not determined as study population is displaced	Refugees	COVID-19	Children	Postnatal care (PNC)	Routine and preventative health services appear to have been little affected by the COVID-19 pandemic, while immediate reductions were reported mostly for infectious disease consultations. The situation may have been very different in the second and third years of the pandemic, with more contagious variants.
Barua M. et.al. (2022)	Community-based referral transportation system for accessing emergency obstetric services in the Rohingya refugee camp during the COVID-19 pandemic in Bangladesh: facilitators and barriers through beneficiaries' and providers' lens using a mixed-method design.	Mixed methods	Survey among 100 women, the qualitative in-depth interviews with mothers and key informant interviews with providers.	To present a community-based referral transportation system and explore its facilitators and barriers to improve the utilization of emergency obstetric services during the pandemic.	Cox's Bazar, Bangladesh	Persecution in Myanmar	2017	3	Refugees	COVID-19	Mothers	Intrapartum care (IPC)	Alliances and connections help reaching out to women who need emergency transport services and ensure access to the facility when needed.
Rodo M. et.al. (2022)	A mixed methods study to assess the impact of COVID-19 on maternal, newborn, child health and nutrition in fragile and conflict-affected settings.	Mixed methods	Key informant interviews	To investigate the collateral impacts of COVID-19 on funding, services and MNCHN outcomes in fragile and conflict affected setting (FCAs), as well as adaptations used in the field to continue activities.	Afghanistan, DRC, Iraq, Somalia, Cameroon, South Sudan, Syria, Yemen, and Bangladesh	Fragile and conflict affected states, population in Conflict, and fragile settings. We only take findings which are collected from countries which are affected by conflict or hosting refugees because of conflict.	Conflict in multiple countries resulted in displacement	Not determined	Refugees and internally displaced people (IDPs), Population affected by long civil war	COVID-19	Mothers and Children	General MNCH, IPC, Antenatal care (ANC), Family planning (FP), PNC	Humanitarian actors have made several adaptations to continue providing MNCHN services during the pandemic; these strategies have often been implemented unevenly within and across settings, and not been evaluated.
Njoh A. et.al. (2022)	Impact of periodic intensification of routine immunization within an armed conflict setting and COVID-19 outbreak in Cameroon in 2020.	Cross-sectional	Survey	To assess the impact of periodic intensification of routine immunization (PIRI) on vaccination coverage and disease surveillance in the region.	Southwest Region (SW) of Cameroon	Anglophone Crisis	2017	2	Population living in conflict or IDPs	COVID- 1	Children	PNC	PIRI improved the performance of routine vaccination coverage and disease surveillance of vendor drug programs (VPDs) in the SW of Cameroon in the context of insecurity and COVID-19. PIRI also helped to rapidly stimulate the uptake of newly introduced vaccines like the ones covering measles and rubella (MR-2) and human papilloma virus (HPV).
Hirani S.A.S. et.al. (2022)	Impact of COVID-19 on women who are refugees and mothering: a critical ethnographic study.	Qualitative	Critical ethnographic study. Field observations, review of media reports, and in-depth, semi-structured interviews with study participants.	To explore the impact of COVID-19 on women who are refugees and mothering young children aged 2 and under in Saskatchewan, Canada, as well as to explore major barriers (sociocultural, environmental, and economic) and determinants causing stress and adding to the vulnerability of women during the COVID-9 pandemic.	Saskatchewan community, Canada	Displaced population from multiple countries affected by conflicts: Middle East and Africa	Conflict in multiple countries resulted in displacement	Not determined	Refugees	COVID-19	Mothers and Children	ANC, IPC, PNC	Refugee women with young children are at risk of experiencing reduced physical, mental, and emotional well-being. During COVID-19, women who are refugees and mothering are at high risk of experiencing add on stressors due to limited social support, difficulty accessing health care, and other COVID-19-related restrictions put in place in their social environment. Fear of getting sick, limited socialization, lack of social support, economic difficulties, limited follow-up community-based care, inability to access health-care settings, and restrictions on their ability to stay with their sick hospitalized child due to COVID-19 restrictions caused negative effects on mothering refugees' mental health.
Barua M. et.al. (2022)	Implementation of a community-based referral project to improve access to emergency obstetric and newborn care in Rohingya population during COVID-19 pandemic in Bangladesh.	Mixed methods	Secondary data of routine utilization of the 12 referral hubs through key informant interviews and a community survey conducted with 100 pregnant women.	To describe the implementation process of the Referral Hub (RH) and present clients' utilization and perception of the service.	Refugee camps. Bangladesh	Persecution in Myanmar	2017	5	Refugees	COVID-19	Mothers	ANC	The RH is a timely innovation to increase access to emergency obstetric care in the Rohingya population even during the COVID-19 pandemic. Moreover, it is a boon to the Rohingya community that otherwise lacks proper and easy access to transport facilities, especially during an emergency. The success is evident from the increasing utilization and recommendations from clients.
Stirling C. et.al (2021)	"COVID affected us all:" the birth and postnatal health experiences of resettled Syrian refugee women during COVID-19 in Canada.	Qualitative	Individual, semi-structured interviews.	To understand the experiences of resettled Syrian refugee women accessing PNC and social support.	Nova Scotia, Canada.	Syrian war	2011	8	Refugees	COVID-19	Mothers and Children	IPC, PNC, FP	Equity-oriented approach must be taken to reduce reproductive health disparities for resettled refugee women.
Lusambili A.M. et. al. (2020).	"We have a lot of home deliveries" A qualitative study on the impact of COVID-19 on access to and utilization of	Qualitative	In-depth interviews	To improve understanding of the impact of COVID-19 on women refugees' access to and utilization of antenatal care, delivery and PNC in	Eastleigh, Kenya.	Displaced population from multiple countries affected by conflicts: Somalia,	Conflict in multiple countries	Not determined	Refugees	COVID-19	Mothers and Children	ANC, IPC, PNC	Findings identify gaps in existing national policies and call for urgent consideration for refugee women who have no access to

	reproductive, maternal, newborn and child health care among refugee women in urban Eastleigh, Kenya.			Eastleigh, Kenya in order to identify existing gaps and inform potential interventions that could improve uptake of services during the COVID-19 pandemic.		Ethiopia, Tanzania, Uganda, Eritrea, and South Sudan. Most of the refugees are of Somali	resulted in displacement						facility-based skilled care during a pandemic. Findings show that refugees delayed uptake of RMNCH care, and facilities reported low attendance. This was often a result of refugees' fear of contracting COVID-19 together with poverty, which meant that they could not afford masks or the cost of private maternity services.
Altare C. et.al. (2022)	COVID-19 epidemiology and changes in health service utilization in Azraq and Zaatari refugee camps in Jordan: A retrospective cohort study.	Observational	Secondary data analysis	To describe the epidemiology of COVID-19 in Azraq and Zaatari refugee camps in Jordan and evaluate changes in routine health services during the COVID-19 pandemic.	Azraq and Zaatari refugee camps, Jordan	Syrian war	2011	9	Refugees	COVID-19	Mothers and Children	ANC, FP, PNC	The pandemic has both exacerbated existing inequalities and demonstrated that until all populations are included in national response plans, the world remains vulnerable to the current and the next pandemic.
Hossain M.R. et.al. (2023)	Exploring healthcare-seeking behavior of most vulnerable groups amid the COVID-19 pandemic in the humanitarian context in Cox's Bazar, Bangladesh: Findings from an exploratory qualitative study.	Mixed-method research	In-depth interviews	To understand the factors influencing healthcare-seeking behavior of the most vulnerable groups during COVID-19 pandemic.	Ukhiya sub-district of Cox's Bazar, Bangladesh	Persecution in Myanmar	2017	3	Refugees	COVID-19	Pregnant and lactating women as well as other population	ANC and IPC	The healthcare-seeking behavior of MVGs amid the COVID-19 pandemic in the context of Rohingya and the host communities of Cox's Bazar was influenced by several factors ranging from socioeconomic, demographic, individual, health belief-related, and institutional factors. However, these factors are not linear rather they are intertwined, and their intersectionality represents diverse nuances of the lived realities of these most vulnerable groups during the COVID-19 pandemic.
Galle A. et.al (2023)	Utilization of services along the continuum of maternal healthcare during the COVID-19 pandemic in Lubumbashi, DRC: findings from a cross-sectional household survey of women	Cross-sectional	Survey	The continuum of maternal care along antenatal (ANC), intrapartum and postnatal care (PNC) is fundamental for protecting women's and newborns' health. The COVID-19 pandemic interrupted the provision and use of these essential services globally. This study examines maternal healthcare utilisation along the continuum during the COVID-19 pandemic in the Democratic Republic of the Congo (DRC).	Lubumbashi, DRC,	Armed conflict	2020 and later	1	Population living in conflict or IDPs	COVID-19	Pregnant women	ANC, intrapartum, and PNC	During the COVID-19 pandemic, maternal healthcare seeking behaviors were shaped by vaccine hesitancy and care unaffordability in Lubumbashi. Addressing the high cost of maternal healthcare and vaccine hesitancy appear essential to improve access to maternal healthcare.
Nomhwange T. et.al (2022)	Measles outbreak response immunization during the COVID-19 pandemic: lessons from Borno State, Nigeria	Retrospective	review assessment of the WHO framework, epidemiological reports and vaccination response data.	documents the implementation of an outbreak response immunization (ORI) during the COVID-19 pandemic and the implementation of global guidelines for mass vaccination.	Borno state across six local government areas (LGAs)	Armed conflict	2019	2	Population living in conflict or IDPs	COVID-19	Children	Vaccination	the WHO decision-making framework for implementing mass vaccinations in the context of the COVID-19 Pandemic was utilized for the outbreak response immunization in Borno State, Nigeria with 181,634 children aged 9 Months-9 years vaccinated with the measles vaccine. The use of the WHO decision-making framework to assess risk benefits of initiating mass vaccination campaigns remains a very important practical tool. These types of responses in Nigeria and other low- and middle-income countries (LMICs), with hitherto suboptimal immunization coverage and weak health systems and other settings, affected by humanitarian emergencies is essential in the achievement of the regional measles elimination targets.
Gizelis, T.I. et.al (2017)	Maternal Health Care in the Time of Ebola: A Mixed-Method Exploration of the Impact of the Epidemic on Delivery Services in Monrovia	Mixed methods	Multinomial logit model with in-depth semi-structured interviews	data on the utilization of maternal health care services from two representative surveys	Liberian DHS and urban Monrovia	Civil war	Ended in 2003	12	Population affected by long civil war	Ebola	Women	MNCH and Delivery services	Our findings indicate that resources to shore up healthcare institutions should be directed toward interventions that support private facilities and health personnel working privately in communities during times of crisis so that these facilities are safe alternatives for women during crisis.
Elston J.W.T. et.al (2020)	Maternal health after Ebola: unmet needs and barriers to healthcare in rural Sierra Leone	Mixed methods	Household survey targeting women who had given birth since onset of the Ebola outbreak; structured interviews at rural sites investigating maternal deaths and reporting; and in-depth interviews (IDIs) targeting mothers, community leaders and health workers.	described health outcomes and health-seeking behavior amongst pregnant women to inform health policy.	urban and rural areas of Tonkolili District of Seirra Leone	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	Postpartum mothers, community leaders and health workers	health-seeking behaviors, barriers to healthcare, and childbirth outcomes	Pregnant women faced important barriers to care, particularly in rural areas, leading to high preventable mortality and morbidity. Women wanted to access healthcare, but services available were often costly, unreachable and poor quality. We recommend urgent interventions, including health promotion, free healthcare access and strengthening rural services to address barriers to maternal healthcare.
Delamou A. et.al. (2017)	Maternal and Child Health Services in the Context of the Ebola Virus Disease: Health Care Workers' Knowledge, Attitudes and Practices in Rural Guinea	Cross-sectional	standardized self-administered questionnaire	to document maternal and child health care workers' knowledge, attitudes and practices on service delivery before, during and after the 2014 EVD outbreak	ten health districts in rural Guinea.	Armed conflict	Ended in 2001	14	Population affected by long civil war	Ebola	maternal and child health care workers	MNCH service delivery	Infection prevention and control measures established during the EVD outbreak have substantially improved self-reported provider practices for maternal and child health services in rural Guinea. However, more efforts are needed to maintain and sustain the gain achieved.
Elston J.W.T. et.al (2016)	Impact of the Ebola outbreak on health systems and population health in Sierra Leone	Mixed methods	interviews, focus groups, and interrogation and analysis of data from health facilities, district health records and burial teams.	identify and quantify the impact of the Ebola outbreak on population health and health systems.	Two districts of Sierra Leone	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	key local stakeholders, Ebola response team members; civil and traditional authority figures,	General MNCH service utilization	The findings indicate a public health emergency as a legacy of the Ebola outbreak. Sustained commitment of the international community is required to support health system re-building.

											HCWs, community workers, social mobilizers, patients, and NGO members		
Kotiso M. et.al. (2022)	Impact of the COVID-19 pandemic on the utilization of health services at public hospitals in Yemen: a retrospective comparative study	Retrospective	routinely hospital services data and medical records by using the DHIS2 system and by phone	Delivery of health services is investigated both before and during the outbreak of the COVID-19 pandemic at public hospitals in Yemen to assess the impact of COVID-19 on the utilization of health services.	127 hospitals in Yemen	War in Yemen	2014	5	Population living in conflict or IDPs	COVID-19	General hospitals, maternal and children's hospitals, psychiatric hospitals and district hospitals.	continuity of MNCH services delivery	The impact of COVID-19 on continuity of health services delivery in Yemen has been distinct and profound, where the study revealed that the number of the consultations, surgeries and number of vaccinated children have been declined during the COVID-19 pandemic, likely due to the partially lockdown measures taken and fear of being infected. However, the deliveries and C-section services remained nearly in the same level and did not affect by the COVID-19 pandemic.
Hategeka C. et.al. (2021)	Impact of the COVID-19 pandemic and response on the utilization of health services in public facilities during the first wave in Kinshasa, the Democratic Republic of the Congo	Observational	Monthly time series data from the DRC Health Management Information System (January 2018 to December 2020) and interrupted time series with mixed effects segmented Poisson regression models	Evaluated the impact of the pandemic on the use of essential health services (outpatient visits, maternal health, vaccinations, visits for common infectious diseases and non-communicable diseases) during the first wave of the pandemic in Kinshasa.	Gombe commune of Kinshasa, city in Africa	Armed conflict	2020 and later	1	Population living in conflict or IDPs	COVID-19	health facilities (i.e., health centers and hospitals)	Health service use (outpatient visits, maternal health, vaccinations, visits for common infectious diseases and non-communicable diseases)	The COVID-19 pandemic resulted in important reductions in health service utilization in Kinshasa, particularly Gombe. Lifting of lockdown led to a rebound in the level of health service use but it remained lower than prepandemic levels.
Quaglio G. et.al. (2019)	Impact of Ebola outbreak on reproductive health services in a rural district of Sierra Leone: a prospective observational study	Prospective Observational	MCH services uptake using routinely collected health services data	To assess the trends concerning utilization of maternal and child health (MCH) services before, during and after the Ebola outbreak, quantifying the contribution of a reorganized referral system (RS).	Pujehun district in Sierra Leone, 77 community health facilities and 1 hospital from 2012 to 2017	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	77 community health facilities and 1 hospital	Utilization of maternal and child health (MCH) services, institutional deliveries, Cesarean-sections, pediatric and maternity admissions and deaths, and major direct obstetric complications (MDOCs), at hospital level; (2) antenatal care (ANC) 1 and 4, institutional delivery and family planning, at community level.	A stronger health system compared with other districts in Sierra Leone and a strengthened RS enabled health facilities in Pujehun to maintain service provision and uptake during and after the Ebola epidemic.
McKay G. et.al. (2022)	Family Planning in the Sierra Leone Ebola Outbreak: Women's Proximal and Distal Reasoning	Qualitative	In-depth interviews	to explore women's perspectives on delaying pregnancy during the Ebola outbreak using family planning methods	Kambia District of West Africa	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	Women who were either family planning users or nonusers	FP use during outbreak	Using the lens of family planning to consider how women choose to access health care in an outbreak gives us a unique perspective into how all health care interactions are impacted by a generalized outbreak of Ebola, and how outbreak responses struggle to ensure such services remain a priority.
Jones S. et. al. (2017)	'Even when you are afraid, you stay': Provision of maternity care during the Ebola virus epidemic: A qualitative study	A hermeneutic phenomenological approach	Face to face interviews	To explore nurse-midwives understanding of their role in and ability to continue to provide routine and emergency maternity services during the time of the Ebola virus disease epidemic in Sierra Leone.	14 districts of Sierra Leone	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	Nurses, midwives, medical staff and managers providing maternal and newborn care during the Ebola epidemic in facilities designated to provide basic or emergency obstetric care	Overall MNCH	Nurse-midwives faced increased risks of catching Ebola compared to other health workers but continued to provide essential maternity care.
Siekman K. et.al. (2017)	Community-based health care is an essential component of a resilient health system: evidence from Ebola outbreak in Liberia	Mixed methods	collect data from CHWs (structured survey, n = 60; focus group discussions, n = 16), government health facility workers and project staff. Monthly data on child diarrhea and pneumonia treatment were gathered from CHW case registers and local health facility records.	to examine the value of a community-based health system in ensuring continued treatment of child illnesses during the outbreak and the role that CHWs had in Ebola prevention activities	Bomi County, Montserrado County, Gbarpolu County	Civil war	Ended in 2003	12	Population affected by long civil war	Ebola	CHWs, government health facility workers and project staff	community-based treatment of child diarrhea and pneumonia	Investments in community-based health service delivery contributed to continued access to lifesaving treatment for child pneumonia and diarrhea during the Ebola outbreak, making communities more resilient when facility-based health services were impacted by the crisis. To maximize the effectiveness of these interventions during a crisis, proactive training of CHWs in infection prevention and "no touch" iCCM guidelines, strengthening drug supply chain management and finding alternative ways to provide supportive supervision when movements are restricted are recommended.
Jones S.A. et.al (2016)	'Women and babies are dying but not of Ebola': The effect of the Ebola virus epidemic on the availability, uptake and outcomes of maternal and newborn health services in Sierra Leone	Mixed methods	The number of antenatal and postnatal visits, institutional births, availability of emergency obstetric care (EmOC), maternal deaths and stillbirths were assessed by month, by districts and by level of healthcare for 10 months during, and 12 months prior to, the Ebola virus disease (EVD) epidemic.	to determine the impact of the Ebola virus epidemic on the availability, uptake and outcome of routine maternity services in Sierra Leone.	All healthcare facilities designated to provide comprehensive (n=13) or basic (n=67) EmOC across the 13 districts of Sierra Leone were included.	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	Healthcare facilities designated to provide comprehensive (n=13) or basic (n=67) EmOC	Number of antenatal and postnatal visits, institutional births, availability of emergency obstetric care (EmOC), maternal deaths and stillbirths	During the EVD epidemic, fewer pregnant women accessed healthcare. For those who did, an increase in maternal mortality and stillbirth was observed. In the post-Ebola phase, 'readiness' (or not) of the global partners for large-scale epidemics has been the focus of debate. The level of functioning of the health system with regard to ability to continue to provide high-quality effective routine care needs more attention.

Evens E. et.al. (2023)	"Africans, we know how to adapt indeed": Adaptations to family planning and reproductive health services in humanitarian settings in Nigeria during the COVID-19 pandemic	Mixed methods	quantitative analysis of data from routine programmatic activities, qualitative data from in-depth interviews (IDIs) with project staff and process documentation of programmatic activities and modifications	1) identify modifications in FP/RH services due to COVID-19, 2) understand staff perception of their utility and impact, and 3) gauge trends in key FP/RH in-service delivery indicators to assess changes prior to and after the March 2020 lockdown	Borno State and Cross River State, in Nigeria	Armed conflict	2019	2	Population living in conflict or IDPs	COVID-19	data from routine programmatic activities, project staff and process documentation of programmatic activities and modifications	Family Planning/Reproductive Health (FP/RH) services	Lessons learned included the need to better sensitize and educate communities, maintain FP commodities and increase support provided to health workers. Deliberate adaptations in IHANN II and UNHCR-SS-HNIR projects turned challenges to opportunities, ensuring continuity of services to the most vulnerable populations.
Tesfai A. (2023)	Human Rights Violations and Mistrust among Refugees in South Africa: Implications for Public Health during the COVID Pandemic	Qualitative	In-depth interviews	about refugees' access to healthcare in South Africa during the COVID-19 pandemic and the consequences of inconsistent access and discrimination on their trust of public healthcare initiatives	South Africa	Armed conflict	Conflict in multiple countries resulted in displacement	Not determined as study population is displaced	Refugees	COVID-19	11 key stakeholders from the refugee community, 7 community leaders, and 4 NGO staff members who served refugee communities	refugees' access to healthcare in South Africa during the COVID-19 pandemic and the consequences of inconsistent access and discrimination on their trust of public healthcare initiatives.	The results suggest that refugees' access to public healthcare services were perceived as exclusionary and discriminatory. Furthermore, the growing mistrust in institutions and authorities, particularly the healthcare system, and misperceptions of COVID-19 compromised refugees' trust and adherence to public health initiatives. This ultimately exacerbates the vulnerability of the refugee community, as well as the wellbeing of the overall population.
Camara b.s. et. al. (2017)	Effect of the 2014/2015 Ebola outbreak on reproductive health services in a rural district of Guinea: an ecological study	Ecological study	routine service data	compared trends in family planning, antenatal care, and institutional deliveries over the period before, during and after the outbreak	Macenta district of Guinea	Armed conflict	2001	14	Population affected by long civil war	Ebola	all the health facilities data in Macenta district.	trends in family planning, antenatal care, and institutional deliveries	All services assessed were affected by Ebola. Family planning recovered post-Ebola; however, shortfalls were observed in recovery of antenatal care and institutional deliveries. We call for stronger political will, international support and generous funding to change the current state of affairs.
Shannon, II F. Q. et. al. (2017)	Effects of the 2014 Ebola outbreak on antenatal care and delivery outcomes in Liberia: a nationwide analysis	Cross-sectional	Routinely reported program data	To determine access to antenatal care (ANC), deliveries and their outcomes before, during and after the 2014–2015 Ebola outbreak.	All health facilities, public and private, in Liberia, West Africa.	Civil war	Ended in 2003	12	Population affected by long civil war	Ebola	Women seeking ANC at health facilities, all institutional and community deliveries and all newborns	antenatal care (ANC) and deliveries	The Liberian health system was considerably weakened during the Ebola outbreak and had difficulties providing basic maternal health services. In the light of the major reporting gaps during the Ebola period, and the reduced use of health facilities for maternal care, these findings highlight the need for measures to avoid such disruptions during future outbreaks.
Quaglio GL et. al. (2017)	Maintaining maternal and child health services during the Ebola outbreak: experience from Pujehun, Sierra Leone	Mixed methods	Hospital registers and contact tracing form data with healthcare workers and local population interviews, the transmission chain was reconstructed. Data on the utilization of maternal and neonatal health services were collected from the local district's Health Management Information System.	to provide information on understanding of how Ebola impacted maternal and child health services in Sierra Leone	Pujehun district, in Sierra Leone	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	Hospital registers and contact tracing form data with healthcare workers and local population	Women seeking ANC at health facilities, all institutional and community deliveries and all newborns	The Ebola outbreak reduced the number of patients at hospital level in Pujehun district. However, the activities undertaken to manage Ebola reduced the spread of infection and the impact of the disease in mothers and children. A number of reasons which may explain these results are presented and discussed.
Caulker V. M. L. et. al. (2017)	Life goes on: the resilience of maternal primary care during the Ebola outbreak in rural Sierra Leone	Cross-sectional	secondary program data.	To compare trends in antenatal care (the first and fourth visit [ANC1 and ANC4]), delivery, and postnatal care (PNC1) service utilization before, during and after the Ebola outbreak (2014–2016).	All 100 health facilities providing maternal services in Moyamba, Sierra Leone, a rural district that experienced a smaller Ebola outbreak than other areas.	Civil war	Ended in 2002	12	Population affected by long civil war	Ebola	100 health facilities secondary program data	antenatal care (the first and fourth visit [ANC1 and ANC4]), delivery, and postnatal care (PNC1) service utilization	In a rural district less affected by Ebola transmission than other areas, utilization of maternal primary care remained robust, despite the outbreak.
^a Authors of this scoping review derived this information from UNHCR, WORLD Bank data and other online information available from countries specific data as well as information provided in the articles. Sources: https://data2.unhcr.org/en/situations ; https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations ; https://www.cfr.org/global-conflict-tracker/conflict/violence-democratic-republic-congo ;													

Challenges and strategies

Our review examined the factors that affect continuity of care in MNCH services and explored potential strategies for addressing them. In this section, the supply- and demand-side challenges, and strategies to overcome them are described and analyzed.

Challenges affecting continuity of care at supply-side

Accessibility barriers

‘Preventive and curative newborn and child care’ was highly impacted by ‘accessibility’ issues during the Ebola and COVID-19.^{43 115 116 117 118} In LMICs, geographical inaccessibility, disruption of services, lack of services or supplies, or suspension of services were common and resulted in limited access to these essential health services.^{43 119 115} Furthermore, some level of discrimination was also reported during the COVID-19 pandemic among refugee women, as mentioned by a social worker: *“Refugees have been experiencing the discrimination from many years in all departments They be afraid always triggered by their past experiences... which means there is no good experience someone is expecting [from] healthcare services.”* [61]

In some cases, the authors reported that suspension of routine vaccination services and diversion of human resources due to COVID-19 resulted in an outbreak of vaccine-preventable diseases, such as measles, among children under-five.¹²⁰ Borno State in Nigeria documented 1176 suspected measles cases, with 509 confirmed cases, in 2020.¹²⁰ However, the authors did not report a drop in immunization coverage.

Health workforce constraints

‘Care during pregnancy and childbirth’ i.e., ANC and IPC were the domains in which most of the studies reported greater barriers.^{43 119 115 121} The most frequently described challenges faced by women were associated with health workforce constraints for both Ebola,^{122 123} and COVID-19.^{43 119 115 121} These constraints were mostly related to limited staffing, overburdened health services, or insensitive behavior of staff, which at times led women to prefer unskilled birth attendants.^{43 122 119 124 125} In some settings the health system showed resilience despite huge financial and human resource constraints.¹²⁶ Issues

also emerged around childhood-related nutritional interventions when the dedicated health workforce was diverted to other areas of COVID-19 care,⁴³ as expressed by a multilateral organization worker: *“When the COVID-19 started... I would say nutrition really suffered, because... they are reassigning... all the nutrition staff to work on COVID-19 related activities. So, we noted that... all the upstream work that we do with policy guidelines... things were not moving, everything had to come to a standstill for like five months”*.⁴³ In LMICs, a number of women chose traditional birthing practices owing to service disruption.^{43 127} Similarly, routine immunization programs were significantly impacted during Ebola, primarily due to widespread disengagement of the population with healthcare services, but also due to a reduction in the outreach services provided by healthcare workers in the community.¹²⁸ The behavior of health workers was also a crucial element impacting continuity of care, as shared by one health worker from Liberia: *“We were told not to touch, so during Ebola, I did not treat. When someone brought a child, I did not know if they had Ebola or not, so I referred.”*¹²⁵

Funding limitations

Redirection of financial resources (e.g., hiring of new staff, equipment and medical supplies) to cover Ebola or COVID-19 needs is a challenge⁴³ [52] [44] [53] One of the staff members of an NGO mentioned: *“Before the pandemic for certain activities did not materialize and planned programs didn’t open. In Yemen we scaled back antenatal and delivery care in an area in the knowledge that another actor had received funding and would start delivering these services; however, in the end this actor was not able to open the expected services, citing funding issues...”*⁴³

Security

The security threat to the healthcare workforce in areas affected by conflict is concerning. Pandemics and epidemics have imposed a double burden to this risk, as explained by health staff: *“It will also be good to increase remuneration. Yes, for healthcare workers who have been at the forefront of this...fight, because for one in a humanitarian crisis setting, the major challenge is their insecurity and security threats. In addition, we have COVID-19 to contend with. So, it’s double trouble for each and everyone us.”*¹²⁹

Gender sensitivity

Issues surrounding cultural sensitivity (e.g., limited access to female staff) have emerged as important challenges to care seeking.^{130 117} With regards to ‘community outreach’ programs, accessibility issues related to their suspension,^{43 124} and to limited female workforce available to perform outreach visits because of the diversion of staff to cover pandemic-related care were reported.^{116 117} The suspension of FP services or delays in providing contraceptives has also been documented in the studies.^{43 117}

New mode of service delivery

Among refugees in HICs, new service delivery modes connected to the COVID-19 outbreak, such as mask restrictions, new policies on isolation protocols, and virtual appointments for antenatal and postnatal care, were the most frequently documented obstacles^{116 117}. Similarly, COVID-19 related restrictions in host HICs imposed harsh experiences at facilities, as shared by one woman: *“The hospital rules are strict during COVID. Visits are forbidden, friends can’t come, and they could not be there to help me.”*¹¹⁷ The experiences of pregnant women during Ebola were even worse, and challenges were even more complex, especially because of the high case fatality rate in many West African countries.¹²³
^{131 132 133} In HICs, the new guidelines imposed at health facilities after the start of the COVID-19 pandemic led to severe concerns among refugee women in need of PNC.^{116 117} One refugee woman called attention to her experience: *“When the COVID-19 pandemic hit, they [healthcare providers] gave us a certain time for visits, 2 hours in the morning to see the baby [sick and hospitalized child] and to meet the doctor and 2 hours in the night, and I was the only one allowed to visit”*¹¹⁶. Furthermore, services connected to PNC and child illnesses other than nutrition were also affected, and access to care was hampered as a consequence of the new modalities of service delivery and disruption of care provoked by the pandemic.^{115 116} Visitor restriction policies during childbirth negatively affected the mental state of many pregnant women, as reported by one study participant: *“No one could accompany me to the hospital because of COVID. I was alone. My husband drove me to the hospital, but I was all by myself during delivery. My husband helped me carry my things with me to the hospital, but other than that I was all by myself”*.¹¹⁷

(Fig 2. Common barriers impacting continuity of care. Thematic analysis of the findings of the included studies).

Continuum of Maternal, Neonatal and Childcare array												
Supply-side	Barrier		Service domains									
	Themes	Categories	Community outreach		Care during pregnancy and childbirth		Preventive and curative newborn and childcare		Family planning services		Overall MNCH	
			Ebola	COVID-19	Ebola	COVID-19	Ebola	COVID-19	Ebola	COVID-19	Ebola	COVID-19
Demand-side	Accessibility barriers	Poor physical access										
		Disruption of services or lack of services/supplies										
		Limited quality of care										
		Lack of accuracy in data										
		Suspension of services										
	Health workforce constraints	Limited human resources/Paucity of healthcare personnel										
		Behaviour of providers										
		Extra workload										
	Funding limitations	Lack of funding										
		Inadequate infrastructures, lack of supplies as well as PPE										
		Diverging/redirecting/redistribution of resources										
	Security	Lack of security										
	Gender inequalities	Male dominating services										
	Ebola or COVID-19 led service adaptations	New guidelines/rigorous or strict Ebola or COVID-19 protocol/Lockdown										
		Fear among health workers										
		New mode or modified service delivery										
	Socio-economic constraints	Lack of social or other kinds of community support										
		Financial barriers/Limited financial resources										
	Communication barriers	Language barriers										
Lack of communication medium												
Community constraints	Poor care seeking or utilization of services or delayed care seeking, or number of visits reduced											
	Lack of awareness											
	Lack of trust on health services or health workforce											
Ebola or COVID-19 related barriers	Lockdown-led mobility challenges											
	Apprehension or fear due to misinformation of being exposed to Ebola or COVID-19											
	Perceived risk of death due to Ebola - information on high case fatality											
	Misconception that health workers are spreading infection											
		Ebola or COVID-19 related restrictions at facilities										
Barriers reported 9 times for a particular service domain Barriers reported 8 times for a particular service domain Barriers reported 7 times for a particular service domain Barriers reported 6 times for a particular service domain Barriers reported 5 times for a particular service domain Barriers reported 4 times for a particular service domain Barriers reported 3 times for a particular service domain Barriers reported 2 times for a particular service domain Barriers reported 1 time for a particular service domain Barriers reported 0 times for a particular service domain			Barriers reported 9 times for a particular service domain Barriers reported 7 times for a particular service domain Barriers reported 6 times for a particular service domain Barriers reported 5 times for a particular service domain Barriers reported 4 times for a particular service domain Barriers reported 3 times for a particular service domain Barriers reported 2 times for a particular service domain Barriers reported 1 time for a particular service domain Barriers reported 0 times for a particular service domain									

Challenges affecting continuity of care at demand-side

Socio-economic constraints

In the context of conflicts, the challenges of poverty and inaccessible healthcare are further exacerbated. During periods of conflict, government-provided maternity services are often unavailable or severely limited.¹²⁴ This creates a vacuum in healthcare that is only partially filled by private facilities.^{124 134} However, these private facilities, while operational, are frequently too expensive for most of the population. The situation is compounded during emergencies such as the COVID-19 pandemic, when the demand for healthcare services, particularly maternity care, surges dramatically.⁴³ With government facilities being either non-functional or overwhelming, many expectant mothers are left with no choice but to seek services from private hospitals. This high demand for limited supply in private facilities not only inflates costs but may also lead to overcrowded conditions, further diminishing the quality of care.⁴³ Moreover, in conflict zones, the physical and logistical challenges of reaching healthcare facilities become even more daunting.¹¹⁹ The risks of traveling, combined with the disruption of usual transportation services, often result in many deliveries occurring at home, without professional medical assistance.¹²⁴

Communication hurdles

“Communication hurdles” emerged as the main challenge for many refugee women living in HICs, who were concerned of suspension or modification of interpreter services^{116 117} and of the language barriers that they could encounter while seeking PNC and childcare in both HICs and LMICs.^{116 117 124} With regards to community awareness, there was misinformation that led to disease spread, as shared by one health professional during Ebola: *“We were not prepared, by that time, we had no training and were not knowledgeable. The message that was around was that when you eat bats and mangoes, you will be infected. We believe that we will get infected through that. It is only during the intense phase [of the epidemic] that we came to know it was transmitted through body contact, sweat saliva, and things like that”*¹³⁵. Linguistic barriers were one of the most frequently reported challenges identified in the domain of pregnancy care: *“Sometimes they explained things to me by using signs and I understand a little*

English, but it's hard to understand medical terms and they didn't use an interpreter for this — a refugee women". ¹¹⁷ One woman reported: *"If you cannot speak like in isiZulu here in KZN, they will just go on with their languages until you feel like you can go crazy. And then you start to answer things you do not even know. You are not expected to say I don't understand isiZulu".* ¹³⁶

Community constraints

Some were also concerned about being discriminated against by health providers due to past experiences connected to ethnic discrimination, mistreatment, and refusal of care, as highlighted by a health provider: *"They [Rohingyas] fear being tortured at hospitals, or the doctors will not treat them correctly. They have this belief. This situation has worsened during the pandemic. We encountered many cases in which they refused to go to hospitals. They think they will be maltreated even more because of COVID [if suspected or diagnosed with it] ...They believe that the doctors would not care for them as Rohingyas."*

¹¹⁹ Mistrust of the existing health system in LMICs led refugee women to avoid care seeking, as shared by a community worker: *"It seemed like a lot of our clients would make sure they are very, very sick before they go to hospitals.... They completely avoid going. They say until I feel like I am about to die I won't go, because I don't want to face that system"* ¹³⁶. Additionally, care across MNCH domains was affected by constraints (e.g., poor care seeking behaviors, lack of awareness of health conditions, and lack of trust). ^{43 119 124 129 135 137}. Low utilization of services was provoked by refugee women's health status, lack of awareness of available services, and limited knowledge of facility guidelines during the pandemic. ^{119 127 137} Most women experienced these challenges while in need of neonatal and childcare services, ANC, and IPC. ^{123 117}. Misconceptions related to the spread of the disease and fear affected care seeking behaviors among women. [69] FP was also affected, as explained by one of the women who stopped using contraceptives during Ebola: *"Because during that time we were afraid, we felt they were giving Ebola [injections] or if you go to seek prevention, you might not know the person who is treating you, they might give you another injection that is not prevention, so that was why we were afraid during that time."* [70]

Ebola or COVID-19 related barriers

On demand-side, ‘Care during pregnancy and childbirth’ carried the greatest impact.^{138 43 119 116 117 127}

^{124 139} During the pandemic, the lockdown was perceived with great fear, negatively influencing women’s care-seeking behaviors for ANC and IPC. During Ebola in Guinea, ANC attendance, PNC visits, and facility-based births decreased by 18 %, 22%, and 11%, respectively. This decline led to a 34% increase in facility maternal mortality ratio and a 24% increase in stillbirths.¹⁴⁰ A woman shared the experience during Ebola: *“I decided to give birth at home during Ebola because they made the thing so fearful; that when you went [to the clinic] they will put you into a vehicle and then go and kill you”*.¹²³ Avoidance of access to care due to lockdown-related restrictions and due to fear of contracting Ebola and COVID-19 at facilities was also common in LMICs,¹²⁴ as shared by a health professional: *“Before the outbreak of Corona, they were coming to the hospital in large numbers. They used to come, many of them, but now the numbers have reduced drastically because they fear coming to the facility.”*¹²⁴ Many pregnant women and mothers were hesitant to seek essential healthcare services, fearing being exposed to Ebola, especially given the close physical contact required during maternity care and the possibility of becoming infected in healthcare settings.¹³⁵ The high fatality rate led to an atmosphere of fear and panic, which deterred individuals from visiting health facilities, even when they needed critical medical care. This apprehension severely affected the utilization rates of MNCH services, leading to potentially preventable maternal and neonatal complications and deaths. A health professional working during Ebola shared his experience : *“During that time initially the community people feared to come to the health facility thinking that sometimes if they come, they will be infected with Ebola.”*¹³⁵ Moreover, women also perceived use of PPE during Ebola as one of the barriers to access care, as explain by one of the community women: *“That is why some are afraid to go to the center because of the PPE...because when they wear the PPE is like a ghost, even if you know someone, when they wear the PPE, you will not recognize the person.”*¹⁴¹ Similarly, fear of contracting COVID-19 caused avoidance of care-seeking behaviors in LMICs, as explained by one health staff: *“Yes. We have a lot of home deliveries. In fact, we were discussing yesterday that home deliveries have gone up, and it has gone to an extent that even those mothers feared coming to the hospital”* [51]. Another refugee woman explained: *“I think COVID-19,*

*changed life itself, especially during the lockdown times. We are not able to see doctors as easily because of [a] fear of going to the hospital”.*¹¹⁶ (Fig 2. Common barriers impacting continuity of care. Thematic analysis of the findings of the included studies).

Strategies to overcome supply-side challenges

Nine strategies were reported on the supply side. ‘Partnerships between different stakeholders’ were the most frequently mentioned ones across key MNCH domains.^{43 119 117 127 124 136} The studies highlighted that collaboration between government and humanitarian actors as well as communities was integral to the delivery of MNCH services. This is even more crucial in the context of LMICs, where countries are more strained by the dual impact.^{43 127 124} Equity-oriented approaches aiming to keep refugees in the center of decision-making were identified as strategies that could potentially address the challenges faced by populations affected by conflict while seeking ANC and childbirth care in HICs.^{116 117} ‘Strengthening health system’ by improving referrals system and improving access to transport system could be used to improve access to care, as reported in one study conducted in Bangladesh for Rohingya refugees in Cox Bazar, where this was employed to support refugee women in accessing emergency obstetric care.^{119 127} Strategies that strengthen the role of midwives were also described as crucial in delivering better services.^{43 119 125} Similarly, ‘innovation in service delivery,’ for example use of technology and mobile health application tailored according to the needs of the population accessing MNCH services, was also highlighted as a pathway for improving access to care.^{43 117 142} The ‘intensification of services’ by rapid outreach for vaccination at community level during COVID-19 was identified as a key measure that could avert the loss in gains in service indicators due to pandemic-induced disruptions.^{120 142}

(Fig 3. Strategies implemented or recommended in articles to ensure continuity of care. Driven by a thematic analysis of the content of the studies)

Continuum of Maternal, Neonatal and Childcare array							
Thematic area		Strategies and recommendations	Service domains				
			Community outreach	Care during pregnancy and childbirth	Preventive and curative newborn and childcare	Family planning	Overall MNCH
Supply-side	Strengthening Health System	Role of community midwives and community outreach					
		Positive behavior of staff					
		Referral links					
		Financial subsidies					
		Capacity development and training support and empowering health workforce					
		Resource availability for essential health services and supplies					
		Enhance rural health services					
		Availability of transport for women in labor and postnatal visits					
	Innovative Service Delivery Models	Use of technology					
		Establishment of mobile clinics					
		Strengthening local health network and oversight of formal and informal private health providers					
		Periodic reclassification of services or initiating mass vaccination campaigns					
	Partnership	Equity-oriented approach					
		NGOs and government collaboration					
Collaborative Efforts							
Preparedness	Maternity Crisis Preparedness						
Demand-side	Community-oriented initiatives	Community engagement, sensitization, and rebuilding trust					
		Refugee-centered approach					
	Strengthening communication	Community messaging - awareness, assurance of safety measures					
		Support person at facilities					
	Innovation	Virtual family-centered care					
	Barriers reported in 9 times for a particular service domain Barriers reported in 6 times for a particular service domain Barriers reported in 3 times for a particular service domain Barriers reported in 4 times for a particular service domain Barriers reported in 1 times for a particular service domain Barriers reported in 2 times for a particular service domain Barriers reported in 0 times for a particular service domain						

Strategies to overcome demand-side challenges

Community-centered initiatives, such as community engagement and refugee-centered approaches, have been emphasized as leading ways to improve access across the continuum of care.^{117 129 143 135} Furthermore, ‘strengthening communication’ with women through community messaging and community support systems has been described as a key solution to achieving the optimal utilization of services.^{128 118 144} and continuity of care^{130 141}. This pathway has been reinforced in several studies, especially for the care of pregnant women, preventive and curative care of newborns, and childcare.⁴³
116 117 124

(Fig 3. Strategies implemented or recommended in articles to ensure continuity of care. Driven by a thematic analysis of the content of the studies) and Table 3 with detail thematic analysis

Table 2 | Barriers to access to care in MNCH service domains by income level of the country and adopted solutions.

Demand-side		MNCH domain	Supply-side	
Solutions	Barriers		Barriers	Solutions
- Community engagement.[Ⓒ] - Messaging system.[Ⓓ]	Diminished trust.^{Ⓛ Ⓓ}	Community outreach	- Disruption of services.^{Ⓛ Ⓓ} - Inadequate/limited personnel.^{Ⓛ Ⓓ} - Financial restrictions.^{Ⓛ Ⓓ} - Redirection of resources.^{Ⓛ Ⓓ} - Community uninvolved.^{Ⓛ Ⓒ} - Limited access to community support.^{Ⓛ Ⓒ} - Measures to deter gathering.^{Ⓛ Ⓒ} - Limited information on vaccination and ANC awareness.^{Ⓛ Ⓒ}	- Empowerment community midwives.[Ⓓ] - Encouraging care-seeking behaviors.[Ⓓ] - Early recognition of danger signs.[Ⓒ] - Use of technology.[Ⓒ] - Mobile clinics.[Ⓒ] - Partnership and collaborations.[Ⓓ] - Community outreach to strengthen via midwives.[Ⓓ]
- Refugee-centered care.[Ⓒ] - Support groups.[Ⓒ] - Flexibility in guidelines.[Ⓒ] - Guidelines in different languages.[Ⓒ] - Community outreach.[Ⓓ]	- Perception of new Ebola or COVID-19 guidelines.^{Ⓛ Ⓓ} - Mobility restrictions.^{§ Ⓒ} - Communication media.^{§ Ⓒ} - No translator/community support.^{Ⓛ Ⓒ} - New attendance policies restricted access.^{Ⓛ Ⓒ}	Antenatal care	- Paucity of healthcare personnel.^{Ⓛ Ⓓ} - Insufficient resources.^{Ⓛ Ⓓ} - Redistribution of resources.[Ⓛ] - Rigorous Ebola or COVID-19 protocols.^{Ⓛ Ⓓ} - Culturally attuned care missing – limited availability of female staff.^{Ⓛ Ⓒ} - Missed recommended antenatal visits.^{Ⓛ Ⓓ} - Paucity of healthcare personnel.[Ⓓ] - Inadequate infrastructure, lack of supplies as well as PPE.[Ⓓ] - Lack of data accuracy.[Ⓔ]	- Use of technology.[Ⓒ] - Mobile phone applications.[Ⓒ] - Strengthening partnerships.[Ⓓ] - Community outreach.[Ⓓ] - Capacity development and training support and empowering health workforce.[Ⓔ] - Enhance rural health services.[Ⓔ]
- Refugee-centered care.[Ⓒ] - Encouraging facility delivery.[Ⓓ] - Community messaging.[Ⓓ] - Virtual family interactions.[Ⓒ] - Community outreach.[Ⓓ]	- Birth at home preferred/more trust on traditional practices at the time of pandemic.^{Ⓛ Ⓓ} - Lack of information on comprehensive services.^{§ Ⓓ} - Interaction with healthcare providers.^{§ Ⓓ} - Apprehension of contracting Ebola or COVID-19 or Fear of potential COVID-19 exposure.^{Ⓛ Ⓓ} - Limited financial resources.^{§ Ⓓ} - Perceived risk of death due to Ebola - information on high case fatality.[Ⓔ]	Intrapartum care	- Traditional birth attendants available.^{Ⓛ Ⓓ} - New/modified service delivery model.^{Ⓛ Ⓒ} - Service disruptions.^{Ⓛ Ⓓ} - Government lockdown measures.^{§ Ⓓ} - Culturally attuned care missing – limited availability of female staff.^{Ⓛ Ⓒ} - Paucity of healthcare personnel.[Ⓓ] - Inadequate infrastructure, lack of supplies as well as PPE.[Ⓓ] - Lack of data accuracy.[Ⓔ]	- An efficient transport system with 24/7 availability.[Ⓒ] - Limiting delays in accessing emergency obstetric care.[Ⓓ] - Increasing trust in health workforce.[Ⓓ] - Community outreach.[Ⓓ] - Enhance rural health services.[Ⓔ]
- Refugee-centered approach.[Ⓒ] - Mother-physician messaging.[Ⓒ] - Virtual family meetings.[Ⓒ] - Community support persons.[Ⓒ] - Community outreach[Ⓓ]	- Perception of new Ebola or COVID-19 guidelines.[Ⓓ] - Suspended language support.[§] - Restrictive visitor policies.[§] - Forcible mother-child separation.^{§ Ⓒ} - Home-delivered newborns rejected for hospital care.^{Ⓛ Ⓒ} - Perceived risk of death due to Ebola - information on high case fatality.[Ⓔ]	Postnatal care	- Restricted family or community support.^{§ Ⓒ Ⓒ} - Hospital-imposed restrictions on visitors.^{Ⓛ Ⓒ} - Early discharge of postpartum women.^{Ⓛ Ⓒ} - Lack of assistance from trained healthcare professionals.^{Ⓛ Ⓒ} - Inadequate infrastructure, lack of supplies as well as PPE.[Ⓓ] - Lack of data accuracy.[Ⓔ]	- Strong partnership of health care providers and other MNCH stakeholders.[Ⓓ] - Equity-based approach for displaced populations.[Ⓒ] - Enhance rural health services.[Ⓔ]
	Suspension of community outreach programs and campaigns.[Ⓛ]	Vaccination	- Limited childhood vaccination services.^{Ⓛ Ⓓ} - Added burden on routine staff.^{Ⓛ Ⓒ} - Suspension of services.^{Ⓛ Ⓓ} - Surge of vaccine-preventable diseases.^{Ⓛ Ⓓ}	- Improvement in vaccination uptake.[Ⓓ] - Rollout of new vaccines.[Ⓒ]
Interventions tailored to the needs of displaced populations.[Ⓒ]	- Ebola and COVID-19 related restrictions.^{§ Ⓓ} - Low utilization of services.^{Ⓛ Ⓓ}	Childhood illnesses	- Decrease in consultation visits.^{Ⓛ Ⓒ} - Virtual appointments decreased motivation.[Ⓒ]	
Interventions tailored to the needs of displaced populations.[Ⓒ]	- Restrictions at facility.^{Ⓛ Ⓓ} - Low service utilization.^{Ⓛ Ⓓ} - Lack of trust in health services or health workforce.[Ⓔ] - Perceived risk of death due to Ebola - information on high case fatality.[Ⓔ]	Family planning	- Modified service delivery methods.^{Ⓛ Ⓒ} - Transition to virtual provision.^{Ⓛ Ⓒ} - Limited availability of long-term postpartum contraceptives.^{Ⓛ Ⓒ} - Limited information for informed decisions.^{Ⓛ Ⓒ} - Suspension of services.[Ⓔ] - Supplies shortage.[Ⓔ] - Lack of trust in health services or health workforce.[Ⓔ]	
- Virtual communication. - Refugee-centered approaches.[Ⓒ]	Lack of communication medium and support.^{Ⓛ Ⓒ}	Nutrition	- Restricted access to screening.^{Ⓛ Ⓒ} - Nutrition staff were reassigned.^{Ⓛ Ⓒ} - Reduced enrollment in feeding programs.^{Ⓛ Ⓒ}	Mobile activity to identify children.[Ⓒ]
- Community engagement, sensitization, and rebuilding trust.[Ⓔ] - Sensitization, and rebuilding trust.[Ⓔ]	- Lack of trust in health services or health workforce.[Ⓔ] - Perceived risk of death due to Ebola - information on high case fatality.[Ⓔ]	Overall MNCH	- Paucity of healthcare personnel.[Ⓔ] - Shortage of essential supplies.[Ⓔ] - Inadequate infrastructure, lack of supplies as well as PPE.[Ⓔ] - Lack of data accuracy.[Ⓔ]	- Holistic Crisis Preparedness.[Ⓔ] - Capacity development and training support and empowering health workforce.[Ⓔ] - Resource availability for essential health services and supplies.[Ⓔ] - Enhance rural health services.[Ⓔ]

[Ⓛ] Emerged from the themes of studies conducted in LMICs or LICs. In of Ebola, all the studies reported here are conducted in LMICs or LICs

[Ⓛ] Emerged from the themes of studies conducted in HICs, mostly in case of studies conducted on refugees during COVID-19 pandemic

[§] Emerged from the themes of studies conducted in both LMICs or LICs and HICs

[Ⓒ] Reported in the studies conducted in the context of COVID-19

[Ⓓ] Reported in the studies conducted in the context of Ebola

[Ⓓ] Reported in the studies conducted in the context of Ebola as well as COVID-19

Discussion

Among MNCH service domains, supply-side factors have been reported in more studies compared to demand-side factors.^{43 116 117 124 136 125 137 144} Care during pregnancy and childbirth, specifically IPC, had the highest number of reported challenges,^{140 43 116 117 124 127 138 142 120}, while nutrition had the lowest.

43

The limited number of included studies confirms the data gap existing in research focusing on populations affected by armed conflicts and with the additional burden of pandemics or epidemics. These findings suggest that Ebola and COVID-19 led to a change in service provision both at supply-side (e.g., new guidelines or strict Ebola and COVID-19 protocols, restrictions, and new or modified service delivery mechanisms) and on the demand-side (e.g., restriction-led mobility challenges, apprehension, or fear of being exposed to Ebola or COVID-19).

In HICs, refugee women and children encountered challenges in accessing MNCH services due to cultural and linguistic barriers, lack of tailored healthcare services, and limited awareness of available resources.^{103 145 146 147} The findings of this review highlight that after the start of the pandemic many social and linguistic services previously available for refugee women in HICs were either suspended or postponed, hindering care seeking patterns in ANC, IPC, and PNC.^{116 117} These challenges were amplified after the implementation of the new guidelines, and restrictions affected the general lives of women and children, as well as their access to facilities. Refugees from LMICs sometimes have difficulties understanding the care provision in HICs and might also face financial constraints.¹⁰³ Therefore, displacement to a new location can compromise their ability to receive adequate care,^{103 148} and this effect may be exacerbated by pandemics or epidemics. In LMICs, women and children, whether refugees or internally displaced or living in countries affected by conflict, face different challenges in accessing MNCH services.^{145 149} Limited healthcare infrastructure, personnel, and essential supplies hamper the ability of under-resourced healthcare systems to provide adequate MNCH care.¹⁵⁰ The

findings of this review show that during Ebola and COVID-19, the response of health systems was not optimal to fill these gaps in LMICs. This was provoked by pre-existing inadequate funding for healthcare services, geographical inaccessibility, and higher disease burden that further impedes access to PHC for the general population,^{151 152 153} and creates huge constraints for displaced women and children in accessing MNCH care.⁴³ Other key aspects that were highlighted in the included studies, which are also essential for ensuring continuity of MNCH care for our target population, are cultural beliefs related to gender preferences for health workers, which influence healthcare-seeking behaviors among refugee populations in LMICs.^{119 127 151 152}

Differences in the impact of Ebola and COVID-19 on MNCH services in conflict settings are profound. While both pandemics severely disrupted health systems globally, their regional and temporal focuses were distinct. Ebola, with its higher mortality rate and more immediate, visible impacts, has typically garnered significant attention and fear in these settings.¹⁵⁴ The visibility of Ebola's effects, coupled with its rapid transmission within communities, necessitated urgent healthcare interventions.¹⁵⁵ In contrast, COVID-19, despite its global significance, often did not receive the same level of immediate concern in conflict-affected regions.¹⁵⁶ This difference in perception can be largely attributed to the lower mortality rate of COVID-19, coupled with a lack of testing infrastructures leading to a high proportion of undetected asymptomatic cases.¹⁵⁷ As a result, in many conflict-stricken areas, the response to COVID-19 was subdued or delayed, overshadowed by more pressing health emergencies and the direct impacts of ongoing conflict.¹⁵⁸ Further, Ebola predominantly affected West African nations, where health systems were already strained due to prolonged conflicts and limited resources.⁸⁶ The challenges during the Ebola outbreak were intensified by community mistrust, limited health infrastructure, and the virulence of the disease itself, which at times caused healthcare providers to abandon health facilities. On the other hand, the COVID-19 pandemic, being a global crisis, stretched even well-resourced health systems in HICs,¹⁵⁹ leading to wider service disruptions, including of MNCH services. The rapid spread of COVID-19 necessitated stringent restrictions and modifications in service provision guidelines, inadvertently widening the gap of healthcare access for vulnerable groups, especially in conflict zones.

The contrast in regional concentration and global reach between the two pandemics has further highlighted the disparities and gaps in health systems' preparedness and response, particularly in conflict settings.

Moreover, the strategies employed to address these health crises in conflict settings have varied significantly. The response to Ebola, for instance, often involved intensive community engagement and education, given the disease's high transmission rate and visibility.^{90 160} For COVID-19, the strategies were more complex, owing to its asymptomatic spread and the global challenge in managing the pandemic. However, there remains a gap in the literature regarding a comprehensive analysis of these strategies and their effectiveness in different conflict-affected settings. An in-depth discussion on how these strategies have been implemented, their successes, and limitations could provide valuable insights for health service providers in similar contexts. Such an analysis could focus on factors like resource allocation, community engagement, and the adaptation of public health measures under the constraints imposed by conflict. Understanding these strategies and their outcomes is essential for guiding future responses to health crises in similar challenging environments.

Recommendations

The findings of this review strongly suggest that, it is pivotal that MNCH services remain culturally sensitive, with specific initiatives targeting these populations to grant continuity of care for women and children affected by conflict and facing the burden of global health emergencies.¹⁶¹ We recommend that enhancing PHC is crucial to achieve universal health coverage (UHC) and for tracking progress towards achieving the SDGs, as it involves investing in accessible, well-equipped facilities and continued care.^{162 163 164} One essential step in enhancing the availability and quality of MNCH services is to train healthcare workers on the specific needs of vulnerable pregnant women, mothers, and children under five and integrate essential MNCH services into PHC delivery.^{163 165} Moreover, to overcome geographical barriers and ensure that MNCH services reach refugees and IDPs living in conflict-affected countries in their settlements or homes, the implementation of mobile clinics or outreach services is vital.¹⁶⁶ To further strengthen these solutions, it is important to connect them with the WHO's health-EDRM

framework.¹⁶⁷ This involves developing contingency plans and protocols specifically tailored to address the needs of vulnerable women and children affected by conflicts during global health emergencies.¹⁶⁷ This should also include equipping PHC facilities with necessary resources, establishing communication channels, and providing emergency response training for healthcare providers.^{167 168} Efforts to ensure continuity of care during and after emergencies should focus on providing access to essential services and medications, facilitating interpreter services, and coordinating with humanitarian organizations and communities.¹⁶⁸ This comprehensive approach is essential for providing better preparedness and response to the population affected by conflicts,¹⁶³ and facing a double burden, such as vulnerable women and children. By addressing these barriers, countries can progress towards achieving UHC, which encompasses essential services for vulnerable populations affected by conflict, including refugees and IDPs.¹⁶² Furthermore, prioritizing the well-being and empowerment of populations affected by conflict, refugee and IDP women, as well as of those who are living in conflict through access to maternal healthcare, including FP services and safe childbirth will help reducing gender disparities in health.^{169 99} Lastly, it is imperative to emphasize the role of a Disaster Risk Reduction for Resilience (DRR) approach in strengthening health systems in conflict-affected areas.¹⁷¹ DRR, which focuses on pre-emptively building the resilience of communities and healthcare systems to withstand and recover from disasters, is particularly relevant in regions where ongoing conflict exacerbates the vulnerability to health emergencies.¹⁷¹ Integrating DRR strategies involves not only preparing for immediate health crises but also building long-term resilience.¹⁷² By embedding resilience-building measures into the healthcare system, such as reinforcing supply chains, diversifying healthcare delivery models (e.g., mobile clinics, telemedicine), and fostering community engagement in health planning and response, healthcare systems can be more responsive and sustainable in the face of both conflict and health emergencies.¹⁶⁷

Strengths and limitations

The major strength of this review is that to our knowledge it is the first to analyze the existing literature on MNCH-related services for pregnant women, mothers, and children affected by conflict and facing a dual burden of to Ebola and Covid-19. Moreover, it is the first to summarize the barriers faced by these

populations accessing MNCH and possible solutions on the demand- and supply- side. The limitations of the present review are connected to the small number of included studies the limited number of databases employed, as well as to the lack of inclusion of gray literature.

Conclusion

In conclusion, the Ebola and COVID-19 emergencies have exacerbated the existing challenges in accessing MNCH services faced by people living in conflict, including refugees and IDP women and children coming from conflict-affected settings. Policymakers and stakeholders should acknowledge these issues and could take into consideration the potential solutions discussed in this study. By developing targeted interventions, policymakers can enhance the accessibility and quality of MNCH services for women and children living in conflict, refugees, and IDP women and children in diverse host countries. By addressing these issues, we can contribute to the realization of SGDs and create a more equitable and inclusive healthcare system for all.

Chapter 6: Study on Challenges in Access to Antenatal and Intrapartum Care among Afghan Refugee Women's Experiences Amidst the COVID-19 in Pakistan

Disclaimer: Manuscript under review as, “PGPH-D-24-00961R1 - Navigating Challenges in Access to Antenatal and Intrapartum Care: Afghan Refugee Women's Experiences Amidst the COVID-19 Pandemic in Pakistan”

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Pakistan is home to nearly 1.4 million Afghan immigrants, representing 34% of the total displaced population from Afghanistan.^{173,174} Considering that many Afghans are undocumented, it is likely that these numbers underestimate the phenomenon.¹⁷⁵ For the vulnerable Afghan refugee population, especially women and children, healthcare access is paramount. In their own country, around 90% of Afghan women, newborns, and children under five do not have access to quality essential health services.¹⁷⁶ In 2020, Afghanistan had a maternal mortality rate of 638 per 100,000 births.¹⁷⁷ Along with neonatal and under-five mortality of 34 and 55.7 per 1,000 births.¹⁷⁸ Moreover, the data from Afghanistan showed that more than 85% of pregnant women in the country do not have optimal four or more antenatal care (ANC) visits, as recommended by the World Health Organization (WHO), and skilled health providers attend less than 50% of births in Afghanistan.¹⁷⁹ With the baseline vulnerability of being refugees from Afghanistan with suboptimal MNCH indicators, the overall health status of these women and children under five in Pakistan is even more crucial.

Refugee health is a global issue; they face significant barriers worldwide in accessing healthcare due to legal, economic, and social challenges.¹⁸⁰ Studies on Syrian refugees show that they experience substantial barriers to healthcare, including fear of deportation, high out-of-pocket costs, and limited service availability.^{181,182} During the COVID-19 pandemic, these issues have been exacerbated.¹⁸⁰ In Bangladesh, Rohingya refugees faced dire healthcare conditions worsened by the pandemic, with limited access to essential maternal, neonatal, and child health (MNCH) services.^{183,184} In sub-Saharan Africa, during public health emergencies like the Ebola outbreak, there was a marked decline in MNCH services, highlighting how conflict and crisis exacerbate health vulnerabilities.¹⁸⁵ A study in Turkey demonstrated that inclusive policies and coordination between international organizations and local health systems can mitigate adverse impacts on refugee health.¹⁸⁶ The pandemic has underscored the need to integrate refugee health into national health systems to ensure universal health coverage (UHC).^{180,187,188}

Pakistan needs to catch up in achieving the Sustainable Development Goals (SDGs) targets, so improving refugee health is of great importance both in policy and practice.¹⁸⁹ Balochistan is the most economically fragile and health system-deprived province in Pakistan, hosting nearly 0.32 million Afghan refugees.¹⁹⁰ The provincial capital, Quetta, has the most significant refugee settlements.¹⁹¹ Geographic location and economic conditions greatly influence the healthcare experiences of both residents or the host community and the refugee population.¹⁹² Compared to other regions, considerable gaps in the healthcare infrastructure of Balochistan are noted.^{175,192} Better facilities are found in urban areas like Quetta. In contrast, healthcare inaccessibility in the rural parts of the province is often reported, mainly due to vast distances, lack of infrastructure, and a shortage of medical professionals.^{193–196} Consequently, the province relies on outreach programs for primary healthcare.¹⁹⁷ Furthermore, MNCH indicators in the province are also lagging, with a maternal mortality rate of 298 per 100,000 births recorded in 2019.¹⁹⁸ The neonatal and under-five mortalities are 34 and 78 per 1,000 live births, respectively.¹⁹⁹ Furthermore, 44.6% of pregnant women do not seek care from any qualified health provider in the antenatal period, and 65.1% of women deliver at home.¹⁹⁹ The compounding effect of Balochistan's infrastructural fragility and MNCH challenges, combined with the humanitarian needs of the Afghan refugee population, makes this a critical setting.^{200,201}

For this reason, primary healthcare (PHC), vaccinations, and maternal care are provided in the host province to registered Afghan refugees through the United Nations High Commissioner for Refugees (UNHCR) and its partner organizations, though not always in coordination with local establishments for specialized care.¹⁸⁹ On the other hand, undocumented refugees often end up seeking care at private entities with high out-of-pocket expenditures.^{201,202} Moreover, concerns about potential deportation or legal implications are believed to hinder healthcare-seeking behavior.²⁰³ UHC is a considerable challenge in such a context under these circumstances.^{201,203} Moreover, the recent COVID-19 pandemic has brought unparalleled challenges to healthcare systems globally, especially at the PHC level.^{180,204} These challenges are marked by resource diversion and a decline in healthcare utilization, especially in low-and middle-income countries (LMICs).²⁰⁵ Furthermore, it is known that recent pandemics and public health

emergencies like Ebola have impacted access to MNCH care among populations affected by conflict, including refugee women.^{187,206} Pakistan is among the countries where the COVID-19 pandemic has left strains on the overall economy and health system, especially in terms of the overall delivery of PHC services.²⁰⁷

Despite the increasing evidence on the impacts of the COVID-19 pandemic on populations, the question remains whether this same impact holds true for regions already deprived of optimal health infrastructure, such as Balochistan. The paucity of evidence from such areas stresses the significance of this research. This study aimed to understand the MNCH care tendencies of Afghan refugee women in Balochistan during the pandemic and to document the multifaceted influences that shape healthcare-seeking behaviors in a province disreputable for its challenges.

Methods

Study design

This study employed a cross-sectional survey approach to document the coverage indicators across the continuum of care related to MNCH and assess factors potentially associated with poor utilization of MNCH services. This study is part of a broader project in which comprehensive data on MNCH domains, such as antenatal care (ANC), childbirth, postnatal and childcare, childhood immunization, nutrition, family planning, and finally, knowledge, attitudes, and practices related to COVID-19 were collected. This paper only reports on the components of antenatal and childbirth care seeking.

Study setting

The study was conducted in one of the union councils (UCs) of Quetta city, Kharotabad-1, one of the Super High-Risk UCs (SHRUC) in Pakistan for polio cases and positive environmental samples. The UC has a population of 67,782. UC Kharotabad1 has no single government health facility; only private health facilities are available.

Sample size

The sample size was calculated based on the modeling done by Robertson T et al. to present the impact of COVID-19 on the coverage of crucial MNCH service domains.²⁰⁸ The authors' primary assumption is that, in addition to the disruptions in the health system, the government-led movement restrictions, forcing families and nonessential workers to stay home, may have contributed to the coverage reduction of different MNCH domains, like family planning, antenatal care, postnatal care, early child curative care, etc., by 39.3% to 51.2%.²⁰⁸ Based on these assumptions, the estimated sample size for this study was 384 married women of reproductive age (MWRA) with at least one child aged 12-23 months. Further, adjusting for the 20% non-respondent rate, the final sample size for the survey was 480 MWRA.

Population, sampling technique, and eligibility

The local partner, Trust for Vaccine and Immunization (TVI), has longstanding experience in the target community by providing MNCH care in several remote areas of Pakistan. TVI has a line listing of households with MWRA and under-five children. Leveraging on this, the female social scientists paired with female local community health workers to collect the data between the 1st of December 2022 and the 10th of January 2023. A list of random households was generated from the line listing. MWRAs were approached by their families and screened for eligibility using available line listings from the existing MNCH services in the community. MWRA aged 18–49 years, with the status of Afghan refugees who were residents in the catchment area, with at least one child aged 12-23 months, and who provided written consent to participate, were enrolled in the study. Eligibility criteria were explicitly formulated to capture participants' maternity experience during the different waves of the COVID-19 pandemic in Pakistan.²⁰⁹ For this study, the first four COVID-19 waves—from April 3, 2020, to November 29, 2021—were taken into account.²⁰⁹

Data collection tools

A questionnaire was developed under the 'Levesque's Conceptual framework' guiding principles to cover the themes and dimensions of access to services like approachability, acceptability, availability, accommodation, affordability, and appropriateness of MNCH-related PHC services.²¹⁰ The tool also considered the socioeconomic determinants corresponding to the abilities to perceive, seek, reach, pay,

and engage in accessing basic PHC care, including challenges during COVID-19 and hurdles due to refugee status. Further, satisfaction with the available services was assessed using the Likert scale.^{211–213} The questionnaire was designed on the Kobo toolbox, and each research staff had a unique user ID and password to access the data collection application. Research staff interviewed the MWRAs and collected their responses to the application. The data was only accessible to PI and senior research staff for quality assurance and analysis.

Potential biases and mitigation

Several potential biases and strategies were implemented to mitigate their impacts. Firstly, selection bias of the participants, for which a randomized sampling method was used, rigorous criteria for participant inclusion was applied, and diverse representation across demographic variables was ensured. Secondly, there was a risk of response bias, where participants might provide socially desirable responses. To minimize this, a study questionnaire based on a literature search was devised, pilot testing of the study instrument was done, and interviews were conducted in a culturally sensitive manner to foster openness and authenticity in responses. Furthermore, standardized protocols and data collection training helped mitigate the risk of inconsistencies in the data.

Data analysis

Data analysis was conducted using Stata version 18. Descriptive analyses were performed for primary demographic covariates, presented as frequencies and percentages. Four outcomes were assessed and presented sequentially in this paper: 1) “optimal ANC care,” defined as at least 4 ANC received during pregnancy by any formal health provider, which could be at either public or private hospital or PHC;¹⁹⁹ 2) “skilled birth attendance or skilled facility,” defined as childbirth by a formal health provider or with a skilled birth attendant who could be either in a public or private hospital, PHC clinic or at home;¹⁹⁹ 3) “comprehensive care,” defined based on whether women received at least 1 ANC visits plus had a skilled birth attendance; and 4) “satisfaction with comprehensive care” during the antenatal and childbirth periods. Satisfaction data was collected on a Likert scale as: “very satisfied,” “satisfied,” “neutral,” “dissatisfied,” and “very dissatisfied.” However, for the final analysis, the responses under very satisfied

plus satisfied were re-coded as satisfied, very satisfied, very unsatisfied, unsatisfied, or neutral. Further, the factors “COVID-19 related concerns/hurdles” were compositely created by merging several other variables: fear of getting COVID-19 vaccine, fear of being exposed to the COVID-19 screening test, mask-related restriction at facility for the patients who are visiting, fear of being exposed to the COVID-19 infection, infected with COVID-19 recently, lack of ability to pay since COVID-19, services fees’ increase since COVID-19 and closure or rejection of services since COVID-19. For the primary statistical analysis, unadjusted/crude odds ratios (ORs) of poor care seeking across different MNCH domains with 95% confidence intervals (CIs) were calculated in the univariable analysis. Variables with a p-value less than 0.25 in the univariable analysis were entered into the stepwise multivariable logistic regression analysis, and adjusted ORs for poor care seeking across different MNCH domains were calculated. Further, ordinal logistic regression was used to understand the association of factors with varying satisfaction levels. The model was adjusted for priori variables: maternal age, gravidity, ethnicity, maternal education, household size, ethnicity, and perceived low income. In case of missing data, the team reached out to the participants within 24 hours of the first attempt of the interview, and where missingness was high, the team approached the next random participant in the list. No further imputation method was performed in case of missingness.

Ethics considerations

Ethical approval was obtained from the Segreteria Tecnico-Scientifica Comitato Etico Interaziendale di Novara (reference number: CE214/2022) and the National Bioethics Committee of Pakistan (Ref: No.4-87/NBC-843/22/559). Among the eligible participants, the research team obtained written informed consent in a local language to inform about the research, and the household decision makers, where available, or the other elderly, were also informed about the research to build rapport. The research team is supported by locally hired community health workers with the strong support of Trust of Vaccines and Immunization (TVI), a nongovernmental organization with a long-standing rapport working with the refugee community in Pakistan. Where applicable, the signatures of both participants and witnesses were taken; otherwise, thumb impressions were recorded. Every participant was given a unique study ID,

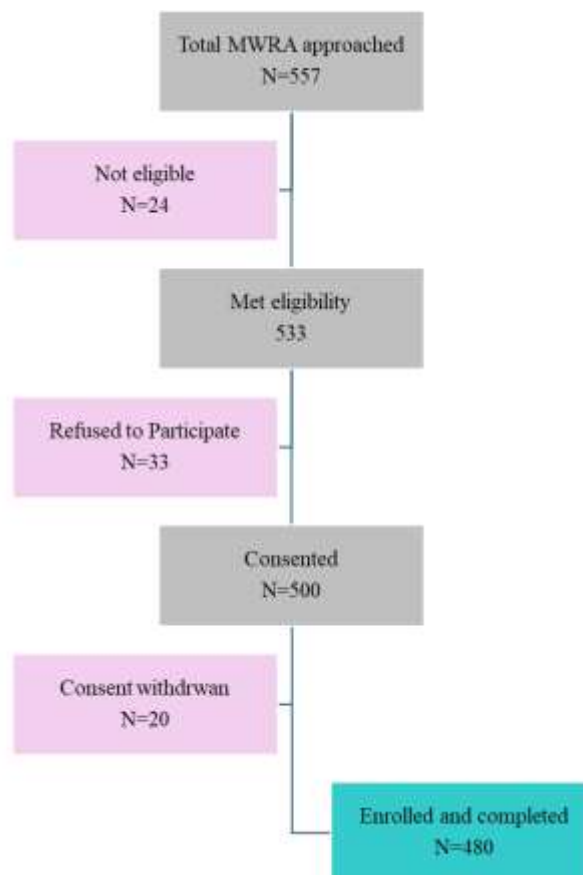
and anonymity was maintained. Data confidentiality was assured as all data was stored in a locker and only accessible to the study team.

Results

Population characteristics

From the 1st of December 2022 to the 10th of January 2023, 557 MWRA were approached, out of which 533 (94.5%) met the eligibility criteria; 33 (6.3%) eligible women refused to participate and did not agree to consent, and 20 (3.8%) consented to be withdrawn at a later stage of the interview. In the case of the refused household, the next one was approached to complete the sample size of 480 MWRAs.

Figure 1 | Study flow diagram



Among a total of 480 MWRA who participated, the mean maternal age was 32.5 ± 6.8 years. The average number of members per household across the sample of families was 8.6. The ethnic composition of the study population was predominantly Pashtun, accounting for 64.4% of the total. Tajiks and Uzbeks

followed, comprising 19.6% and 16.0%, respectively. Regarding maternal education, 71.9% had no formal education, and 21.5% had at least primary education. Among enrolled MWRA, the mean gravidity and parity were 4.8 ± 2.0 and 4.6 ± 1.9 , respectively (**Table 1**).

Table 1 | Baseline characteristics

Demographic factors – Mean $\pm$SD	
Maternal age	32.5 $\pm$ 6.8
Total Family members	8.6 $\pm$ 4.1
Male family members	4.6 $\pm$ 2.4
Female family members	3.7 $\pm$ 2.1
Ethnicity – n (%)	
Pashtuns	309 (64.4)
Tajiks	94 (19.6)
Uzbeks	77 (16.0)
Maternal education – n (%)	
Formal education	135 (28.1)
Primary	103 (21.5)
Secondary or above	32 (6.7)
No formal education	345 (71.9)
Obstetric history– Mean $\pm$SD	
Gravidity	4.8 $\pm$ 2.0
Parity	4.6 $\pm$ 1.9
Health seeking during pregnancy and childbirth	
Care seeking during the antenatal period – n (%)	
At least one ANC visit	177 (36.9)
At least 4 ANC visit	63 (13.1)
Childbirth – n (%)	
Skilled birth attendance	186 (38.8)
Women received at least one ANC plus skilled birth	158 (32.9)
Impact of COVID-19 on access to care during pregnancy and childbirth	
COVID-19 concerns during ANC ϕ – n (%)	
Fear of getting COVID-19 vaccine	98 (20.4)
Fear of being exposed to COVID-19 screening test	74 (15.4)
Mask-related restriction	5 (1.0)
Fear of being exposed to COVID-19 infection	54 (11.3)
Infected with COVID-19 recently	8 (1.6)
Lack of ability to pay since COVID-19	11 (2.3)
Services fees have increased since COVID-19	2 (0.4)
Closure or rejection of services since COVID-19	28 (5.8)
COVID-19 concerns during childbirth ϕ – n (%)	
Fear of getting COVID-19 vaccine	29 (6.0)
Fear of being exposed to COVID-19 screening test	15 (3.1)
Mask-related restriction	6 (1.3)
Fear of being exposed to COVID-19 infection	47 (10.0)
Infected with COVID-19 recently	3 (0.6)
Lack of ability to pay since COVID-19	39 (8.1)
Services fees have increased since COVID-19	23 (4.8)
Closure or rejection of services since COVID-19	17 (3.5)

ϕ Explained as one of the concerns of not seeking care

Health care seeking during pregnancy and childbirth

The health-seeking patterns showed that only 36.9% of the MWRA sought care during pregnancy during the COVID-19 pandemic, and only 13.1% received at least 4 ANC visits. Among those who did not seek care during ANC, 20.4% shared that fear of getting the COVID-19 vaccine was among the significant concerns. 15.4% of MWRA mentioned fear of being exposed to the COVID-19 screening test. Further, at the time of childbirth, 38.8% of MWRA had births at skilled facilities. Traditional birth attendants attended all the births at home. Among those who did not seek care during childbirth, 10.0% mentioned

that they had a fear of being exposed to the COVID-19 infection. MWRA who received at least one ANC plus had skilled birth attendance were only 32.9% (**Table 1**).

Predictors of not receiving optimal visits (at least four visits) in the antenatal period

Among different refugee ethnic groups, most Pashtuns (96.1% out of 309) did not receive at least 4 ANC visits. Comparatively, among Tajiks (78.7%; Adjusted OR: 0.24; 95% CI: 0.09, 0.52) and Uzbeks (62.3%, Adjusted OR: 0.07; 95% CI: 0.03, 0.16), the patterns showed better trends, although not optimal. Overall, 93.1% of MWRA residing in households with less than eight members did not have at least 4 ANC visits compared to those living in larger families (82.3%; Adjusted OR: 0.34; 95% CI: 0.15, 0.78). Many MWRA were concerned about their refugee status and experienced challenges in accessing care because of being refugees. Among them, 90.5% reported not receiving the optimal ANC due to their refugee status compared to 83.1% who did not experience the same challenges (Adjusted OR: 2.83; 95% CI: 1.12, 6.29). The majority of women (92.6%) facing challenges to go outside to seek care without an accompanying person were unable to seek care compared to those with no such constraints (Adjusted OR: 2.16; 95% CI: 1.01, 4.63). Preference of traditional care (mostly from traditional birth attendants) of ANC among refugee women resulted in poor care seeking among 91.4% of women, compared to those who did not have this preference (Adjusted OR: 2.56; 95% CI: 1.02, 6.41). Moreover, the lack of availability of ANC services nearby households was reported by 93.8% of women who did not receive at least 4 ANC compared to 82.8% who did not have issues with the availability of ANC services (Adjusted OR: 3.30; 95% CI: 1.44, 7.53). Among low-income refugee women, 93.2% did not receive at least 4 ANC visits compared to 81.5% in MWRA, who had no such financial barriers (Adjusted OR: 2.71; 95% CI: 1.27, 5.76). Among refugee women who perceived healthcare has high costs, 92.3% did not receive at least 4 ANC compared to 82.2% of those who perceived that cost was low (Adjusted OR: 2.52; 95% CI: 1.22, 5.19). Concerns related to COVID-19 did not appear as an associated factor (**Table 2**). **Predictors of unskilled births (home births)**

Table 2 | Factor explaining not receiving optimal visit (at least four visits) antenatal period

Factors	Categories	Sought antenatal care			Crude OR	p-value	95%CI		Adjusted OR*	p-value	95%CI		
		Yes N=63 n (%)	No N=417 n (%)	Total N=480									
Demographic factors													
Maternal age	Less than 25 years	12 (19.7)	49 (80.3)	61	0.50	0.086	0.23	1.10	0.62 Ref.	0.446	0.18	2.14	
	Between 25 to 34 years	19 (10.9)	155 (89.1)	174									
	Greater than 34 years	32 (13.1)	213 (86.9)	245									
Gravidity	Two or less	15 (22.7)	51 (77.3)	66	2.24	0.015	1.17	4.29	Ref. 1.49	0.223	0.28	1.35	
	Greater than 2	48 (11.6)	366 (88.4)	414									
Formal education	Yes	27 (20.0)	108 (80.0)	135	2.15	0.006	1.24	3.70	Ref. 2.06	0.048	1.01	4.21	
	No	36 (10.4)	309 (89.6)	345									
Ethnicity	Pashtuns	14 (4.5)	272 (96.1)	309	0.18	0.000	0.08	0.36	Ref. 0.22	0.001	0.09	0.52	
	Tajik	20 (21.3)	74 (78.7)	94									
	Uzbek	29 (37.7)	48 (62.3)	77									
Household size	Less than 8	13 (6.9)	176 (93.1)	189	0.08	0.000	0.04	0.16	Ref. 0.07	0.000	0.03	0.16	
	Eight or above	50 (17.2)	241 (82.8)	291									
	Refugee status												
Concerns or hurdles related to refugee status	No	40 (16.8)	198 (83.2)	242	1.92	0.019	1.11	3.33	Ref. 4.04	0.000	1.93	8.46	
	Yes	23 (9.5)	219 (90.5)	229									
Decision-making and household support													
Someone else had to decide to seek care	No	43 (13.7)	270 (86.3)	313	1.17	0.586	0.66	2.06	Ref.	Ref.	Ref.	Ref.	
	Yes	20 (12.0)	147 (88.0)	167									
Concerns that one available to accompany a woman	No	49 (16.8)	243 (83.2)	292	2.51	0.004	1.34	4.68	Ref. 2.16	0.047	1.01	4.63	
	Yes	14 (7.4)	174 (92.6)	188									
Preferred traditional care	No	53 (14.6)	311 (85.4)	364	1.81	0.103	0.89	3.68	Ref. 2.56	0.044	1.02	6.41	
	Yes	10 (8.6)	106 (91.4)	116									
Awareness													
Language barriers	No	54 (13.5)	347 (86.5)	401	1.21	0.618	0.57	2.56	Ref.	Ref.	Ref.	Ref.	
	Yes	9 (11.4)	70 (88.6)	79									
Myths and misconceptions related to care	No	47 (13.0)	315 (87.0)	362	0.95	0.872	0.52	1.75	Ref.	Ref.	Ref.	Ref.	
	Yes	16 (13.6)	102 (86.4)	118									
Aware that health-seeking is important	Yes	48 (15.2)	268 (84.8)	316	1.78	0.066	0.96	3.29	Ref. 2.38	0.053	0.99	5.71	
	No	15 (9.1)	149 (90.9)	164									
Availability and reach													
Availability of service nearby	Yes	52 (17.2)	251 (82.8)	303	3.13	0.001	1.58	6.17	Ref. 3.30	0.005	1.44	7.53	
	No	11 (6.2)	166 (93.8)	177									
Transportation available	Yes	51 (14.3)	306 (85.7)	357	1.54	0.202	0.79	3.00	Ref. 1.86	0.179	0.75	4.58	
	No	12 (9.8)	111 (90.2)	123									
Gender of health provider													
Fear of exposure to exposed to the male staff	No	40 (17.3)	191 (82.7)	231	2.06	0.010	1.19	3.56	Ref. 1.92	0.069	0.95	3.86	
	Yes	23 (9.2)	226 (90.8)	249									
Affordability													
Low income	No	48 (18.5)	212 (81.5)	260	3.09	0.000	1.68	5.70	Ref. 2.71	0.010	1.27	5.76	
	Yes	15 (6.8)	205 (93.2)	220									
Perceived high cost of healthcare	No	46 (17.7)	214 (82.3)	260	2.57	0.002	1.42	4.62	Ref. 2.52	0.012	1.22	5.19	
	Yes	17 (7.7)	203 (92.3)	220									
Pandemic impact													
COVID-19 related concerns/hurdles	No	52 (13.7)	327 (86.3)	379	1.30	0.455	0.65	2.60	Ref.	Ref.	Ref.	Ref.	
	Yes	11 (10.9)	90 (89.1)	101									
* Model adjusted for a priori variables: Maternal age, Gravidity, Ethnicity, Maternal education, Household size, Ethnicity, and perceived low-income													

Women aged less than 25 years had more home birth compared to those in the age range 25-34 years and older than 34 years (29.5%; Adjusted OR: 3.18; 95% CI: 1.22, 8.32). Among those of Pashtun ethnicity, 70.9% of women had home births compared to lesser proportions in Tajiks (48.9%; Adjusted OR: 0.48; 95% CI: 0.26, 0.87) and Uzbeks (37.7%; Adjusted OR: 0.31; 95% CI: 0.15, 0.64). Concerns for being a refugee remain highlighted as the significant explaining factor for no care seeking during childbirth since 86.9% of women with such concerns did not deliver at a formal health facility compared to 54.6% of those who did not experience challenges because of their refugee status (Adjusted OR: 2.83; 95% CI: 1.27, 6.29). Among those afraid of exposure to male staff, 87.2% did not have skilled birth attendance compared to 49.7% of those with no such fear (Adjusted OR: 3.36; 95% CI: 1.70, 6.66). Among MWRA who did not seek care during childbirth, 68.3% delivered at home compared to 14.3% of those who received ANC (Adjusted OR: 11.60; 95% CI: 4.78, 28.16). Concerns related to COVID-19 remained an insignificant factor (**Table 3**).

Table 3 | Factor explaining not attending skilled facility during childbirth

Factors	Categories	Skilled births			Crude OR	p-value	95 CI		Adjusted OR*	p-value	95 CI	
		Yes N=186 n (%)	No N=294 n (%)	Total N=480								
Demographic factors												
Maternal age	Less than 25 years	18 (29.5)	43 (70.5)	61	1.78	0.075	0.94	3.03	3.18	0.018	1.22	8.32
	Between 25 to 34 years	74 (42.5)	100 (57.5)	174					Ref.			
	Greater than 34 years	94 (38.4)	151 (61.6)	245	1.18	0.392	0.80	1.76	1.04	0.872	0.63	1.74
Gravidity	Two or less	26 (39.4)	40 (60.6)	66					Ref.			
	Greater than 2	160 (38.6)	254 (61.4)	414	1.03	0.908	0.61	1.76	0.93	0.865	0.41	1.04
Formal education	Yes	64 (47.4)	71 (52.6)	135					Ref.			
	No	122 (35.4)	223 (64.6)	345	1.65	0.015	1.10	2.47	1.52	0.107	0.91	2.54
Ethnicity	Pashtuns	90 (29.1)	219 (70.9)	309					Ref.			
	Tajik	48 (51.1)	46 (48.9)	94	0.39	0.000	0.25	0.63	0.48	0.015	0.26	0.87
	Uzbek	48 (62.3)	29 (37.7)	77	0.25	0.000	0.15	0.42	0.31	0.002	0.15	0.64
Household size	Less than 8	54 (28.6)	135 (71.4)	189					Ref.			
	Eight or above	132 (45.4)	159 (54.6)	291	0.48	0.000	0.33	0.71	0.68	0.120	0.41	1.11
Refugee status												
Concerns or hurdles related to refugee status	No	173 (45.4)	208 (54.6)	381					Ref.			
	Yes	13 (13.1)	86 (86.9)	99	5.50	0.000	2.97	10.20	2.83	0.011	1.27	6.29
Decision-making and household support												
Someone else had to decide to seek care	No	166 (46.0)	195 (54.0)	361					Ref.			
	Yes	20 (16.8)	99 (83.2)	119	4.21	0.000	2.50	7.11	1.97	0.147	0.79	4.89
Concerns that one available to accompany a woman	No	164 (45.8)	194 (54.2)	358					Ref.			
	Yes	22 (18.0)	100 (82.0)	122	3.84	0.000	2.32	6.37	1.91	0.174	0.75	4.86
Preferred traditional care	No	167 (41.1)	239 (58.9)	406					Ref.			
	Yes	19 (25.7)	55 (74.3)	74	2.02	0.013	1.16	3.53	1.60	0.209	0.77	3.36
Awareness												
Language barriers	No	172 (42.4)	234 (57.6)	406					Ref.			
	Yes	14 (18.9)	60 (81.1)	74	3.15	0.000	1.70	5.82	1.86	0.122	0.85	4.07
Myths and misconceptions related to care	No	168 (40.5)	247 (59.5)	415					Ref.			
	Yes	18 (27.7)	47 (72.3)	65	1.78	0.051	1.00	3.16	1.36	0.446	0.62	2.99
Aware that health-seeking is important	Yes	169 (40.7)	246 (59.3)	415					Ref.			
	No	17 (26.2)	48 (73.8)	65	1.94	0.027	1.08	3.49	1.08	0.854	0.49	2.39
Availability and reach												
Perceived availability of service	Available	179 (39.3)	277 (60.7)	456					Ref.			
	Not available	7 (29.2)	17 (70.8)	24	1.57	0.326	0.64	3.86	1.34	0.454	0.63	2.88
Transportation available	Yes	166 (40.2)	247 (59.8)	413					Ref.			
	No	20 (29.9)	47 (70.1)	67	1.58	0.109	0.90	2.76	0.93	0.847	0.43	2.00
Gender of health provider												
Fear of exposure to exposed to the male staff	No	167 (50.3)	165 (49.7)	332					Ref.			
	Yes	19 (12.8)	129 (87.2)	148	6.87	0.000	4.05	11.65	3.36	0.001	1.70	6.66
Affordability												
Low income	No	170 (41.9)	236 (58.1)	406					Ref.			
	Yes	16 (21.6)	58 (78.4)	74	2.61	0.001	1.45	4.70	1.18	0.689	0.53	2.63
Perceived high cost of healthcare	No	168 (42.4)	228 (57.6)	396	Ref.							
	Yes	18 (21.4)	66 (78.6)	84	2.70	0.000	1.55	4.72	1.71	0.152	0.82	3.57
Pandemic impact												
COVID-19 related concerns/hurdles	No	167 (40.0)	251 (60.0)	418					Ref.			
	Yes	19 (30.6)	43 (69.4)	62	1.51	0.162	0.85	2.67	0.86	0.712	0.39	1.91
Experienced with antenatal services												
Sought antenatal care during the same pregnancy	Yes	54 (85.7)	9 (14.3)	63					Ref.			
	No	132 (31.7)	285 (68.3)	417	12.95	0.000	6.21	27.02	11.60	0	4.78	28.16
* Model adjusted for a priori variables: Maternal age, Gravidity, Ethnicity, Maternal education, Household size, Ethnicity, and perceived low-income												

Factor explaining no comprehensive care-seeking

Among refugee MWRA who did not seek any antenatal care or care during childbirth, women under 25 years of age had significantly lower care-seeking rates (82.0%) compared to those aged 25-34 years (63.2%) and those over 34 years (66.1%) (Adjusted OR: 4.32; 95% CI: 1.71, 10.93). Additionally, Pashtun women were less likely to receive comprehensive care (73.1%) compared to Tajik (53.2%, Adjusted OR: 0.37; 95% CI: 0.21, 0.65) and Uzbek women (59.7%, Adjusted OR: 0.59; 95% CI: 0.32, 1.07). Women in small family sizes had poor comprehensive care, i.e., 75.1% versus 61.9% in another group (Adjusted OR: 0.61; 95% CI: 0.39, 0.97). Of women concerned that no one was available at the household to accompany them to the health facility, 73.6% did not seek care compared to 58.8% who had no such issue (Adjusted OR: 1.78; 95% CI: 1.15, 2.76). If the MWRA had myths and misconceptions related to available care (related to quality, behavior of staff, and other characteristics of care), 72.9 % of them did not seek comprehensive care compared to 64.0% of those who had no such myths (Adjusted OR: 1.87; 95% CI: 1.17, 3.00). Transport availability was also a significant concern; 74.6% had not sought care about who had this concern compared to 62.9% who had access to transport (Adjusted OR: 1.79; 95% CI; 1.13, 2.82). Of women who were concerned about low income, 60.7% delivered at home compared to those with no such concerns (Adjusted OR: 1.62; 95% CI: 1.05, 2.50). Refugee concerns were significant but became insignificant for comprehensive care; 69.8% of MWRA who had concerns did not have comprehensive care compared to 62.7% among those who had no such concerns (Adjusted OR: 1.48; 95% CI: 0.96, 2.27). Concerns related to COVID-19 remained an insignificant factor for this (Table 4).

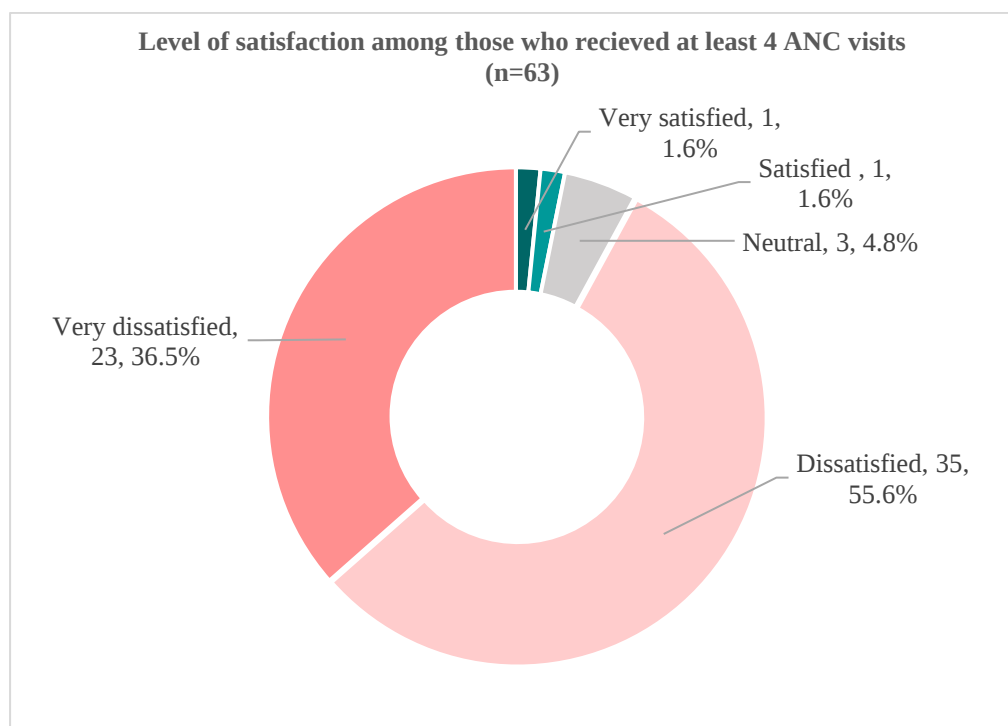
Table 4 | Factor explaining poor comprehensive care-seeking

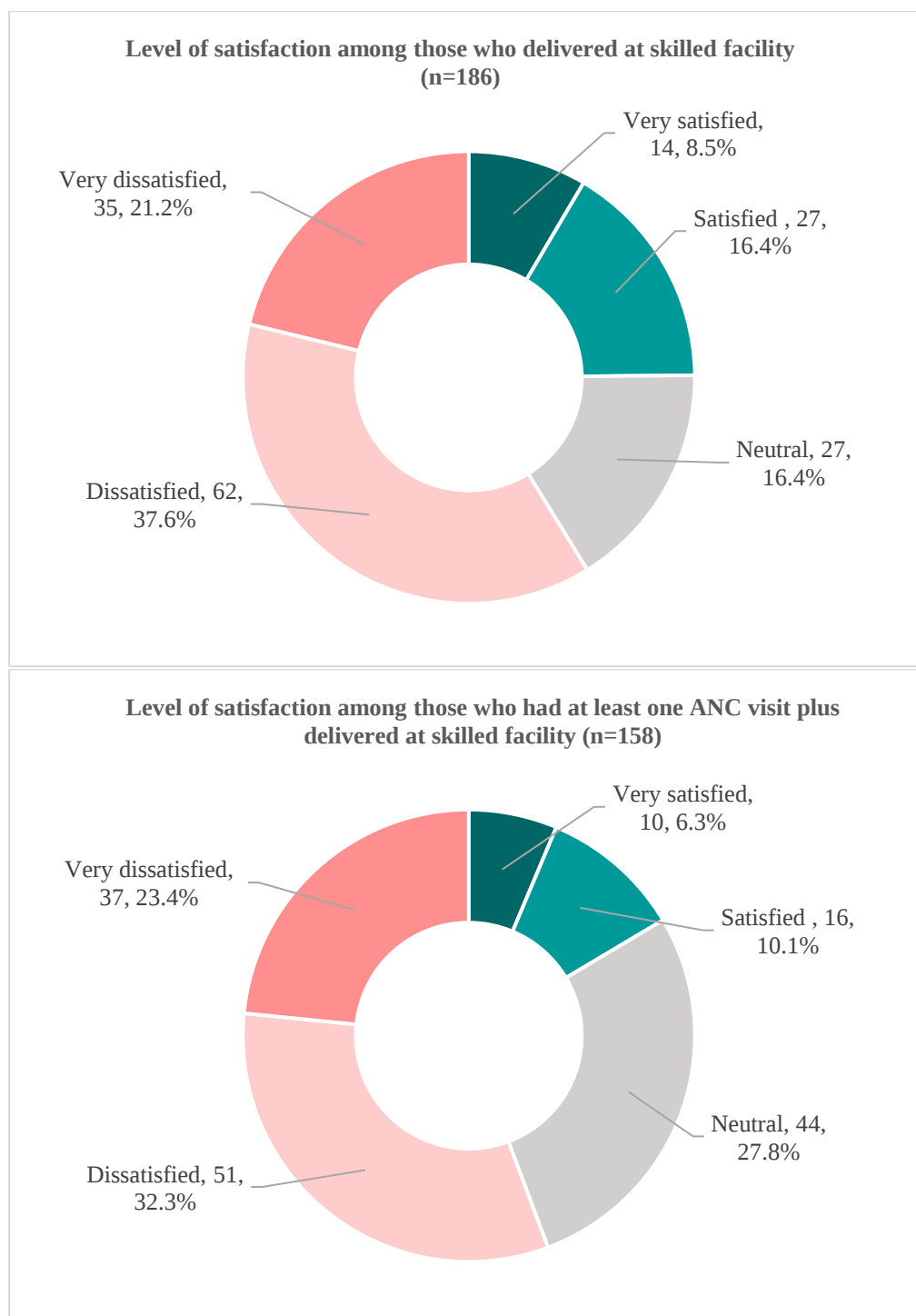
Factors	Category	At least 1 ANC visit plus skilled birth			Crude OR	p-value	95%CI		Adjusted OR*	p-value	95%CI		
		Yes N=158 n (%)	No N=322 n (%)	Total N=480 n									
Demographic factors													
Maternal age	Less than 25 years	11 (18.0)	50 (82.0)	61	2.64	0.008	1.28	5.44	4.32	0.002	1.71	10.93	
	Between 25 to 34 years	64 (36.8)	100 (63.2)	174					Ref.				
	Greater than 34 years	83 (33.9)	162 (66.1)	245	1.13	0.539	0.75	1.70	0.92	0.727	0.58	1.46	
Gravidity	Two or less	19 (28.8)	47 (71.2)	66					Ref.				
	Greater than 2	139 (33.6)	275 (66.4)	414	0.80	0.443	0.45	1.42	1.41	0.406	0.62	3.20	
Formal education	Yes	50 (37.0)	85 (63.0)	135					Ref.				
	No	108 (31.3)	237 (68.7)	345	1.29	0.230	0.85	1.96	1.28	0.306	0.80	2.03	
Ethnicity	Pashtuns	83 (26.9)	226 (73.1)	309					Ref.				
	Tajik	44 (46.8)	50 (53.2)	94	0.42	0.000	0.26	0.67	0.37	0.000	0.21	0.65	
	Uzbek	31 (40.3)	46 (59.7)	77	0.54	0.022	0.32	0.92	0.59	0.082	0.32	1.07	
Household size	Less than 8	47 (24.9)	142 (75.1)	189					Ref.				
	Eight or above	111 (38.1)	180 (61.9)	291	0.54	0.003	0.36	0.81	0.61	0.038	0.39	0.97	
Refugee status													
Concerns or hurdles related to refugee status	No	69 (37.3)	116 (62.7)	185					Ref.				
	Yes	89 (30.2)	206 (69.8)	295	1.38	0.106	0.93	2.03	1.48	0.073	0.96	2.27	
Decision-making and household support													
Someone else had to decide to seek care	No	88 (37.9)	144 (62.1)	232					Ref.				
	Yes	70 (28.2)	178 (71.8)	248	1.55	0.024	1.06	2.28	1.29	0.249	0.84	1.98	
Concerns that no one is available to accompany a woman	No	87 (41.2)	124 (58.8)	211					Ref.				
	Yes	71 (26.4)	198 (73.6)	269	1.96	0.001	1.33	2.88	1.78	0.010	1.15	2.76	
Preferred traditional care	No	101 (33.1)	204 (66.9)	305					Ref.				
	Yes	57 (32.6)	118 (67.4)	175	1.02	0.903	0.69	1.52					
Awareness													
Language barriers	No	120 (35.2)	221 (64.8)	341					Ref.				
	Yes	38 (27.3)	101 (72.7)	139	1.44	0.098	0.93	2.23	1.25	0.367	0.77	2.02	
Myths and misconceptions related to care	No	113 (36.0)	201 (64.0)	314					Ref.				
	Yes	45 (27.1)	121 (72.9)	166	1.51	0.050	1.00	2.28	1.87	0.009	1.17	3.00	
Aware that health-seeking is important	Yes	97 (35.7)	175 (64.3)	272					Ref.				
	No	61 (29.3)	147 (70.7)	208	1.34	0.144	0.91	1.97	1.42	0.126	0.91	2.22	
Availability and reach													
Perceived availability of service	Available	103 (36.0)	183 (64.0)	286					Ref.				
	Not available	55 (28.4)	139 (71.6)	194	1.42	0.080	0.96	2.11	1.35	0.181	0.87	2.09	
Transportation available	Yes	114 (37.1)	193 (62.9)	307					Ref.				
	No	44 (25.4)	129 (74.6)	173	1.73	0.009	1.15	2.62	1.79	0.012	1.13	2.82	
Gender of health provider													
Fear of exposure to the male staff	No	64 (40.5)	94 (59.5)	158					Ref.				
	Yes	94 (29.2)	228 (70.8)	322	1.65	0.014	1.11	2.46	1.45	0.100	0.93	2.27	
Affordability													
Low income	No	86 (39.3)	133 (60.7)	219					Ref.				
	Yes	72 (27.6)	189 (72.4)	261	1.70	0.007	1.16	2.49	1.62	0.029	1.05	2.50	
Perception of high cost of healthcare	No	81 (38.0)	132 (62.0)	213	Ref.								
	Yes	77 (28.8)	190 (71.2)	267	1.51	0.034	1.03	2.22	1.17	0.458	0.77	1.79	
Pandemic impact													
COVID-19 related concerns/hurdles	No	111 (33.6)	219 (66.4)	330					Ref.				
	Yes	47 (31.3)	103 (68.7)	150	1.11	0.619	0.73	1.68					
* Model adjusted for a priori variables: Maternal age, Gravidity, Ethnicity, Maternal education, Household size, Ethnicity, and perceived low-income													

Level of satisfaction with available care

The study examined satisfaction levels for healthcare services among three different groups. The first group comprises MWRA, receiving at least 4 ANC visits. Only 1.6% reported being very satisfied or felt satisfied, and 4.8% of respondents remained neutral. The largest group, i.e., 55.6% and 36.5%, were dissatisfied and very dissatisfied. Considering the level of satisfaction among the second group who delivered at a health facility, 8.5% were very satisfied, 16.4% felt satisfied, and 16.4% remained neutral. Among this group, 37.6% were dissatisfied with the healthcare services, and 21.2% were very dissatisfied. Lastly, among the group who sought comprehensive care, 6.3% were very satisfied, and 10.1% were satisfied. 27.8% were neutral, 32.3% dissatisfied, and 23.4% very dissatisfied with the overall care.

Figure 2 | Level of satisfaction with service during pregnancy and childbirth





Factors explaining dissatisfaction with comprehensive care

Among those who sought comprehensive care, 63.0% of the women older than 34 years were dissatisfied with the services compared to the rest of the groups (Adjusted OR: 2.13; 95% CI: 1.03, 4.42).

Perceived high cost of healthcare was the primary obstacle to satisfaction, which resulted in 66.0% of women being dissatisfied compared to 45.0% of those who perceived the cost as low (Adjusted OR:

2.30; 95% CI: 1.12, 4.72). Satisfaction with the behavior of the staff at facilities was an essential factor. Women who were not satisfied with the behaviors of the staff resulted in overall dissatisfaction (64.9%) compared to 31.8% of those satisfied with the staff (Adjusted OR: .25; 95% CI: 1.43, 7.16). Lastly, if the women were not satisfied with the number of female staff, this resulted in dissatisfaction among 64.3% compared to 31.0% if they were satisfied (Adjusted OR: 3.37; 95% CI: 1.52, 7.47). COVID-19-related concerns did not appear to be significant (**Table 5**).

Table 5 | Factors explaining dissatisfaction with comprehensive care

Factors	Categories	Level of satisfaction with care				Crude OR	p-value	95%CI		Adjusted OR*	p-value	95%CI					
		Satisfied N=26 n (%)	Neutral N=44 n (%)	Dissatisfied N=88 n (%)	Total N=158												
Demographic factors																	
Maternal age	Less than 25 years	3 (27.0)	2 (18.0)	6 (55.0)	11	1.09	0.884	0.31	3.87	Ref.	0.89	0.881	0.20	4.01			
	Between 25 to 34 years	13 (20.0)	21 (33.0)	30 (47.0)	64												
	Greater than 34 years	10 (12)	21 (25)	52 (63)	83	1.87	0.051	1.00	3.53		2.13	0.042	1.03	4.42			
Formal education	Yes	11 (22.0)	15 (30.0)	24 (48.0)	50	1.62	0.141	0.85	3.08	Ref.	1.56	0.230	0.75	3.24			
	No	15 (13.9)	29 (26.9)	64 (59.3)	108												
Ethnicity	Pashtuns	8 (10.0)	21 (25.0)	54 (65.0)	83	0.39	0.011	0.19	0.81	Ref.	0.46	0.071	0.20	1.07			
	Tajik	12 (27.0)	12 (27.0)	20 (45.0)	44												
	Uzbek	6 (19.0)	11 (35.0)	14 (45.0)	31						0.46	0.051	0.21	1.00	0.44	0.070	0.18
Refugee status																	
Concerns or hurdles related to refugee status	No	12 (17.0)	24 (35.0)	33 (48.0)	69	1.59	0.136	0.86	2.91	Ref.	1.20	0.613	0.59	2.43			
	Yes	14 (16.0)	20 (22.0)	55 (62.0)	89												
Awareness																	
Myths and misconceptions related to care	No	15 (13.3)	33 (29.2)	65 (57.5)	113	0.68	0.251	0.35	1.32	Ref.							
	Yes	11 (24.4)	11 (24.4)	23 (51.1)	45												
Transportation available	Yes	16 (14.0)	34 (29.8)	64 (56.1)	114	0.82	0.566	0.42	1.61	Ref.							
	No	10 (22.7)	10 (22.7)	24 (54.5)	44												
Affordability																	
Low income	No	11 (13.0)	26 (30.0)	49 (57.0)	86	0.80	0.473	0.44	1.47	Ref.	0.61	0.166	0.30	1.23			
	Yes	15 (21.0)	18 (25.0)	39 (54.0)	72												
Perceived high cost of healthcare	No	14 (18.0)	28 (37.0)	34 (45.0)	76	Ref.	0.02	1.13	3.85	1.92	0.077	0.93	3.95				
	Yes	12 (15.0)	16 (20.0)	54 (66.0)	82												
Satisfaction with health expenses	Satisfied	16 (18.0)	27 (30.0)	48 (53.0)	91	Ref.	0.401	0.70	2.41								
	Dissatisfied or neutral	10 (15.0)	17 (25.0)	40 (60.0)	67												
Type of services and features																	
Type of facility where care was sought	Hospital	19 (16.0)	37 (31.1)	63 (52.9)	119	1.40	0.367	0.67	2.92	Ref.	2.31	0.093	0.87	6.14			
	Primary Healthcare	7 (17.9)	7 (17.9)	25 (64.1)	39												
Cadre of health facility	Governmental	8 (12.0)	19 (30.0)	37 (58.0)	64	0.80	0.482	0.43	1.48	Ref.							
	Nongovernmental	18 (19.0)	25 (27.0)	51 (54.0)	94												
Satisfaction with distance to the facility	Satisfied	4 (22.2)	5 (27.8)	9 (50.0)	18	Ref.	0.523	0.53	3.46								
	Dissatisfied or neutral	22 (15.9)	38 (27.5)	78 (56.5)	138												
Satisfaction with travel time to the facility	Satisfied	9 (23.7)	16 (42.1)	13 (34.2)	38	Ref.	0.005	1.35	5.29	1.91	0.116	0.85	4.26				
	Dissatisfied or neutral	17 (14.4)	27 (22.9)	74 (62.7)	118												
Satisfaction with waiting time at a facility	Satisfied	9 (31.0)	9 (31.0)	11 (37.9)	29	2.61	0.014	1.21	5.61	Ref.	1.62	0.277	0.68	3.89			
	Dissatisfied or neutral	17 (13.4)	34 (26.8)	76 (59.8)	127												
Health workforce																	
Satisfaction with the behavior of facility staff	Satisfied	15 (34.1)	15 (34.1)	14 (31.8)	44	4.26	0	2.15	8.44	Ref.	3.25	0.003	1.48	7.16			
	Dissatisfied or neutral	11 (9.6)	29 (25.4)	74 (64.9)	114												
Satisfaction with the deployment of female staff	Satisfied	14 (33.3)	15 (35.7)	13 (31.0)	42	Ref.	0	2.04	8.13	3.37	0.003	1.52	7.47				
	Dissatisfied or neutral	12 (10.7)	28 (25.0)	72 (64.3)	112												
Pandemic impact																	
COVID-19 related concerns/hurdles	No	14 (12.6)	36 (32.4)	61 (55.0)	111	0.87	0.677	0.44	1.70	Ref.							
	Yes	12 (25.5)	8 (17.0)	27 (57.4)	47												
* Model adjusted for a priori variables: Maternal age, Gravidity, Ethnicity, Maternal education, Household size, Ethnicity, and perceived low-income																	

Discussion

This study investigated maternal care tendencies among Afghan refugee women in Balochistan, uncovering that only a small portion of MWRA engaged with ANC services during the COVID-19 pandemic, with only a fraction receiving the recommended four or more ANC visits. Further, the low proportion of skilled birth attendance highlights the limited alignment of MNCH among refugee women, reflecting deeply embedded barriers. The findings of this study are consistent with recent data from Afghanistan, which suggests that only 17.8% of women attended at least 4 ANC visits, and 53.6% utilized a skilled birth attendance.²¹⁴ Furthermore, trends of the past 15 years show that only 13.3% to 14.6% of Afghan women had received at least 4 ANC visits, 38.6% to 46.1% had access to skilled birth attendance, and facility births were around 38.7%.¹⁷⁹

Among different expected predictors, COVID-19-related concerns did not emerge as significant barriers to access to care in this study, suggesting that the pre-existing socio-economic and infrastructural deficits in Balochistan might have already set a low baseline for healthcare access, rendering the pandemic's additional apprehensions less visible in the study population.²⁰¹ Contrary to the initial assumption that the COVID-19 pandemic would significantly disrupt access to maternal healthcare.^{43,117,124} The findings suggest that the pandemic's impact could have been more pronounced in this setting. Literature from other LMICs anticipated and documented substantial disruptions in healthcare services due to COVID-19, especially among the population displaced as a result of conflicts.^{43,117,124} A study conducted in Uganda in a refugee settlement also found no significant change in health service utilization for maternal care services.¹¹⁸ Some qualitative studies (ref!) have highlighted some COVID-19-related barriers to accessing maternal care, such as fear of exposure, implementing guidelines to prevent the spread of the virus, and new service delivery modalities, such as telemedicine.

MNCH care disparities for refugee women in LMICs are substantial and multifaceted.¹⁸⁷ These disparities often stem from a complex interplay of socioeconomic, cultural, and systemic factors

exacerbating this population's vulnerabilities.^{188,206} Among these factors, access to MNCH care among women of Pashtun ethnicity in Pakistan and Afghanistan is significantly hindered by complex cultural and social norms.¹⁹⁷ The deeply embedded patriarchal values within these communities often limit women's autonomy, restricting their ability to seek healthcare independently.^{215–218} Decision-making about health services, including MNCH care, is predominantly controlled by male family members, which can delay or prevent timely access to necessary health care.^{219,220} Additionally, there is a notable shortage of female healthcare providers, which is crucial for Pashtun women, who are culturally and religiously inclined to seek care from female practitioners.²²¹ This scarcity not only exacerbates the challenge of accessing health services but also underscores the broader issue of gender disparities in healthcare provision within these communities.^{187,188,222} Moreover, refugee women in Balochistan face some significant barriers that are commonly reported in other LMICs, such as legal and policy restrictions, language and cultural differences, limited mobility, and lack of awareness about available services.²²³ Additionally, many refugee camps' overcrowded and resource-constrained settings further limit the availability and quality of healthcare services.²²⁴ For instance, the reluctance towards ANC visits and skilled birth attendance among the study population mirrors trends reported in other regions of Pakistan and LMICs, where limited healthcare infrastructure and socio-cultural resistance to formal health interventions persistently undermine maternal and neonatal health outcomes.^{214,225–229}

The findings on the satisfaction levels with maternal healthcare services among refugee women in Balochistan further illustrate the complex interplay between service availability and perceived quality of care. Despite some access to healthcare services, the pervasive dissatisfaction underscores a critical gap between service provision and refugee women's expectations or needs. This disagreement is not unique to Balochistan; literature from other refugee-hosting areas highlights similar issues, where the quality of interpersonal care, cultural sensitivity, and logistical barriers to accessing healthcare facilities significantly impact satisfaction levels.^{193,221,227,230–232} this implies that, beyond ensuring service availability, there is a pressing need to enhance the quality, culturally acceptable or appropriate, and accessibility of maternal healthcare services to meet the diverse needs of refugee populations effectively.

The underrepresentation of female staff in health facilities can lead to significant dissatisfaction among patients, particularly women.^{222,233–236} Refugee women often feel more comfortable and understood when receiving care from female health professionals, especially for gender-sensitive issues such as MNCH.²³⁷ The lack of female staff can deter women from seeking care, leading to delayed diagnoses and treatment.²³⁸ Female health professionals are often characterized by empathetic communication and patient-centered care approaches, critical for building trust and understanding patients.²³⁹ The scarcity of such perspectives can lead to a less inclusive healthcare environment, potentially overlooking the specific health needs and concerns of female patients. However, this appears to be in contrast with the recent report on access to care in Afghanistan, where the health staff's gender was not highlighted as a crucial factor influencing access to care.²⁴⁰

Perceptions regarding the cost and quality of primary healthcare facilities significantly influence patient satisfaction and healthcare-seeking behavior.^{187,219,220,227,240,240} High perceived costs can be a substantial barrier to healthcare services, particularly for individuals in low-income communities.²⁴¹ Even when services are free or subsidized, hidden costs such as transportation lost wages due to time off work, and incidental medical expenses can accumulate, making healthcare unaffordable for many.²⁴² Negative perceptions of these aspects can lead to dissatisfaction and a lack of trust in the healthcare system, discouraging patients from utilizing PHC services.²⁴³ This can result in increased reliance on emergency services and advanced stages of illness, which are more costly and challenging to manage.

Considering these findings, the imperative for targeted, culturally sensitive, and accessible healthcare interventions in Balochistan becomes even more critical. Strategies to improve maternal healthcare access must address the nuanced barriers identified, incorporating lessons from other LMICs that have successfully navigated similar challenges. For instance, community-based healthcare models and mobile clinics have shown promise in enhancing healthcare access in remote and underserved areas, offering a potential roadmap for Balochistan. Additionally, fostering partnerships between local health authorities, international organizations, and refugee communities could facilitate the development of more inclusive and responsive healthcare systems.

Strengths and limitations

This study has several strengths, including its focus on a highly vulnerable population of Afghan refugee women in Balochistan, a region often overlooked in academic research. Employing a cross-sectional survey approach enabled the collection of comprehensive data on maternal and neonatal healthcare access and utilization during a critical period, the COVID-19 pandemic, offering valuable insights into the healthcare-seeking behaviors of this population. Moreover, the study's rigorous sampling technique and the excellent response rate enhance the reliability of the findings. However, the study has limitations. Its cross-sectional design limits the ability to infer causality between identified factors and healthcare-seeking behaviors. This approach does not allow for the examination of changes or trends in behavior over time, nor does it provide insights into the causal relationships between variables. The cross-sectional design could be more comprehensive in understanding the dynamic nature of healthcare access and utilization, especially in a protracted crisis like forced displacement compounded by a global pandemic. Additionally, the reliance on self-reported data may introduce recall bias, particularly concerning past healthcare experiences and satisfaction levels. In this study, the criteria for comprehensive care were established as at least one antenatal care (ANC) visit coupled with skilled birth attendance, diverging from the conventional benchmark of a minimum of four ANC visits. The observation necessitated this adaptation that a minimal proportion of women achieved the optimal threshold of four or more ANC visits. Employing a more stringent criterion would have significantly reduced the sample size available for analysis, potentially skewing the study's findings and limiting the understanding of healthcare access among this population. The chosen definition thus reflects a pragmatic approach to capturing a broader spectrum of maternal healthcare engagement within the constraints of the study's context.

Recommendations

The study found that cultural norms and the shortage of female healthcare providers significantly hindered healthcare access. Strengthening the community health workers (CHW) program that trains and employs female health workers within the Afghan refugee communities could bridge the gap between refugees and the formal healthcare system. CHWs can provide culturally sensitive health education,

support during antenatal care, and assistance during childbirth. This approach is feasible and cost-effective, and it has shown success in other low-resource settings by improving health service delivery and building trust within the community.²⁴⁴

Geographic barriers and the lack of healthcare infrastructure in rural areas were significant obstacles identified in this study. Deploying mobile health clinics can address the inaccessibility of healthcare services by bringing essential MNCH services directly to the communities. These clinics can offer antenatal care, vaccination, and skilled birth attendance services. Mobile clinics have been effective in other LMICs, providing a practical solution to reach underserved populations.²⁴⁵

Strengthening existing healthcare facilities in urban areas like Quetta is necessary to ensure they can adequately serve both the local and refugee populations. Investments in healthcare infrastructure, including providing more female healthcare providers and culturally sensitive care, are essential. Local health authorities, with support from international organizations, should focus on enhancing the capacity and accessibility of these facilities.

Lastly, future research should consider longitudinal studies better to understand the evolution of healthcare-seeking behaviors among refugee populations. Longitudinal studies can track changes in healthcare access, utilization, and outcomes over extended periods, providing a more comprehensive picture of how these behaviors evolve in response to changing circumstances and interventions. Such studies could help identify long-term trends and the impact of various health policies and programs on refugee health outcomes.

Conclusion

In conclusion, the study contributes to a growing body of evidence highlighting the complex barriers to maternal healthcare access among refugee populations in LMICs, with Balochistan presenting a particularly challenging context. The findings underscore the need for a multifaceted approach to healthcare provision that transcends traditional service delivery models, advocating for interventions that are culturally compatible, accessible, and sensitive to the unique needs of refugee women. As the global

community continues to contend with the repercussions of the forcibly displaced population like refugees, the lessons from Balochistan offer valuable insights into strengthening healthcare systems hosting Afghan refugees, ensuring that the most vulnerable populations are not left behind in the quest for universal healthcare access.

Chapter 7: Study on Pathways to Develop Resilient MNCH Care

Disclaimer: Manuscript under review as, “PGPH-D-24-01307: Pathways to Develop Resilient Maternal, Neonatal and child Health Care: A Qualitative Study Involving Afghan Refugee Women in Pakistan”

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Globally, an estimated 108.4 million people, predominantly women and children, are forcibly displaced due to conflict and persecution.¹⁷³ This group faces high maternal, newborn, and child health (MNCH) care disparities. The health crisis magnified health access and outcomes inequalities, particularly among displaced populations in low- and middle-income countries (LMICs). These conditions disrupt the continuity of care and accessibility, further hindering progress towards universal health coverage (UHC) and equitable primary health care (PHC).^{246,247} These disparities, compounded by complex emergencies like the COVID-19 pandemic, strained global health systems, have heightened the urgency to address MNCH needs among vulnerable populations.^{248,249} The impact of the pandemic on the economy, infrastructure, and health systems has exposed vulnerabilities, including inadequate health systems and growing social protection gaps for refugees.²⁵⁰

Building resilient systems and adopting an equitable health system approach is crucial to addressing these issues.²⁵¹ The intersection of global health crises and refugee movements underscores the urgency of robust health systems capable of adapting to crises and maintaining primary health care services.^{252–254} An Effective health system is crucial for managing routine health needs and unexpected health emergencies that disproportionately impact vulnerable populations, including refugees.²⁵⁵ In response to emerging global health challenges, the WHO launched the health-EDRM (health Emergency and Disaster Risk Management) framework in 2019.²⁵⁶ This initiative promotes a community-centered, cooperative approach designed to enhance the resilience of health systems against emergencies.²⁵⁶ The framework for health is designed to guide countries in integrating health considerations into their disaster risk management plans. It emphasizes preparedness, response, recovery, and mitigation activities to enhance the resilience of health systems to emergencies and disasters, whether natural, biological, or human-made.²⁵⁶ Specifically, integrating the health-EDRM framework into PHC can bolster the infrastructure needed to support MNCH services in crisis-affected regions, enhancing overall community health resilience.²⁵¹ In many LMICs, the overall adoption of health-EDRM within the national and regional

plans needs a lot of commitment and political will.^{257,258} While some countries have made significant strides in aligning their public health systems with the health-EDRM framework, challenges persist. These include inadequate funding, lack of coordination among governmental and non-governmental entities, limited technical expertise, and insufficient health integration into broader disaster risk management policies.²⁵⁹ The COVID-19 pandemic exposed and exacerbated these challenges, highlighting the need for more vital health systems and better preparedness to handle such crises.²⁶⁰

Pakistan has long been affected by political instability and is vulnerable to natural disasters, including frequent earthquakes and floods. In addition, Pakistan is home to 1.4 million Afghan refugees who were displaced because of prolonged conflict and war in Afghanistan. Specifically, Balochistan, hosting 24% of the refugee population,¹⁷³ is the least populated province in Pakistan. The region is predominantly rural and underdeveloped, with a significant portion of its economy driven by agriculture and livestock. Geographically remote areas, a poor law and order situation, and limited local resources aggravate the challenges, complicating the delivery of consistent and effective health services.²⁶¹ Furthermore, it faces significant economic hardships and health system deficiencies that impair its ability to improve MNCH indicators.^{261,193}

After the devastating earthquake of 2005, the Pakistani government took significant steps towards improving disaster preparedness by introducing the National Disaster Management Ordinance.²⁶² This ordinance was later superseded in 2010 by the National Disaster Management Act.^{263–265} Furthermore, the 2017 National Action Plan for Disaster Risk Management elaborated on the disaster management framework, outlining Disaster Management Associations at national, provincial, and district levels.²⁶¹ However, the integration of the health-EDRM framework within the health system has not been reported so far in the literature or other reports. Furthermore, commitment to the overall health of refugees in Pakistan is also generally lacking, and the health system often leaves behind these vulnerable groups.²⁶⁶ These issues are rooted in the health system's lack of political will, multiple priorities, and financial limitations.²⁶⁴ Currently, no study has investigated the impact of COVID-19, if any, on the continuity of MNCH care among Afghan refugees in Pakistan with the lens of exploring potential pathways to build

a resilient health system through the integration of the health-EDRM framework within current health system and policies. This study aimed to gather an in-depth understanding from both the refugee community and health workforce on the barriers to accessing MNCH care in general as well as during the peak waves of the COVID-19 pandemic and enquired about the potential pathways to build a resilient health system through an integration of the health-EDRM framework with to existing health system to achieve UHC for vulnerable populations.

Methods

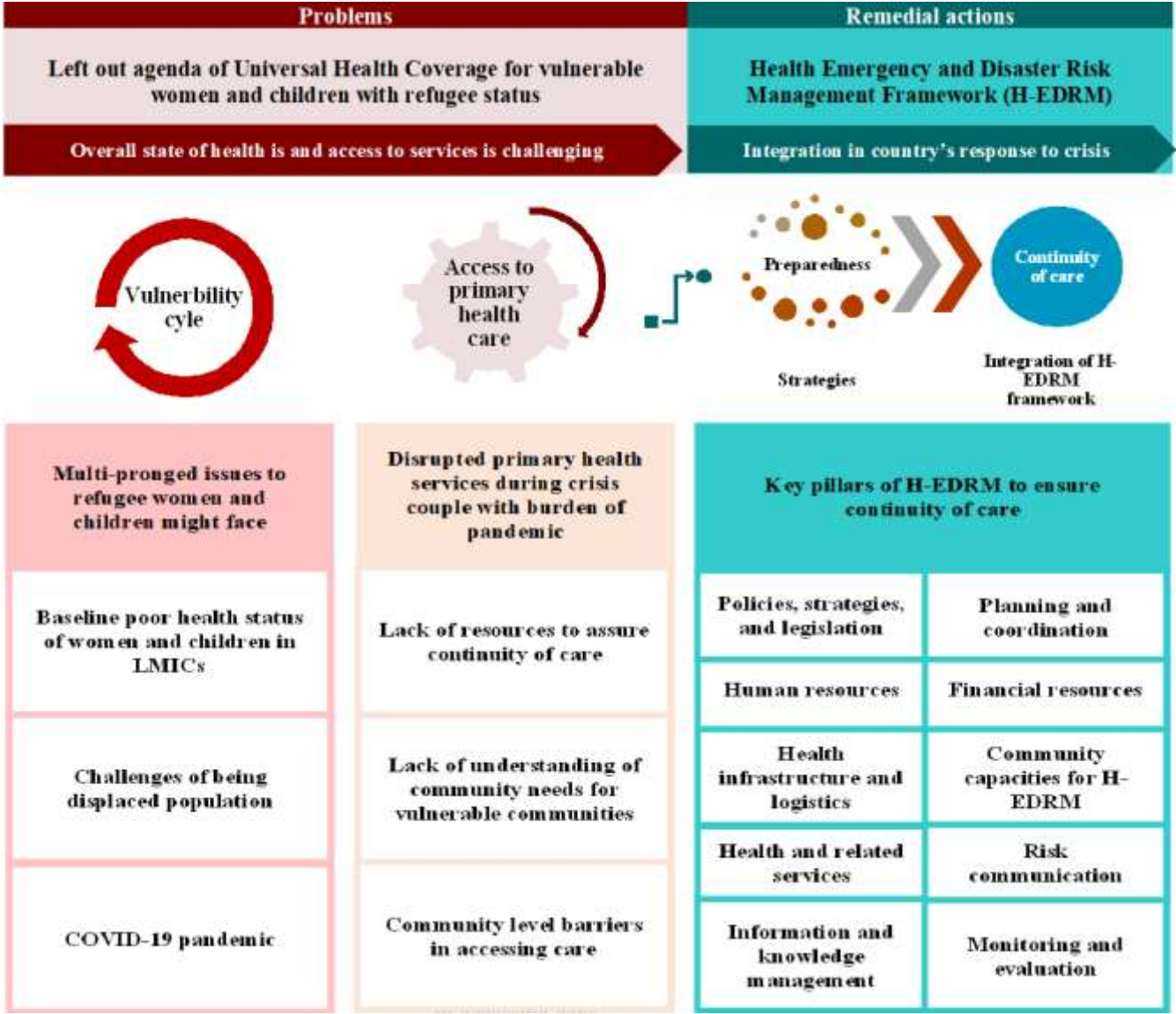
Research Design

A qualitative study was conducted using in-depth interviews (IDIs) and focus group discussions (FGDs) with Afghan refugee women, community elders, and the health workforce (key informants) in Quetta, Balochistan. Quetta hosts 0.3 million registered Afghan refugees who face significant challenges, including poor livelihoods, limited education and health services, and insecure social protection conditions. This environment provides a concentrated sample for detailed data collection, which is crucial for investigating how these factors impact MNCH alongside the effects of global health crises like the COVID-19 pandemic. Specific to MNCH care, we explore all domains, i.e., care during antenatal (ANC), intrapartum, and postnatal period, childhood illness, family planning, vaccination, and nutrition.

Conceptual framework

Based on the existing literature, a guiding conceptual framework was developed,^{246,255,261,267–273}, resulting in an IDI and FGD guide. This framework highlights the significant health challenges faced by vulnerable women and children with refugee status, particularly in LMICs. The core issue identified is their exclusion from the agenda of UHC, leading to a poor overall state of health and limited access to necessary services.^{247,252,274} This exclusion perpetuates a vulnerability cycle, where poor health status and restricted access to primary health care continuously reinforce each other. Key issues identified include the baseline poor health status of women and children in LMICs, challenges related to displacement, the impact of the COVID-19 pandemic, and various barriers to accessing care. The framework suggests

addressing these problems through the Health-EDRM, which integrates preparedness and continuity of care into a country’s crisis response.²⁵⁶ The health-EDRM framework emphasizes essential pillars such as policies, strategies, legislation, planning, coordination, human and financial resources, health infrastructure, risk communication, and monitoring and evaluation to ensure the continuity of care during emergencies.²⁵⁶ **Figure 1 | Conceptual framework of study**



Study setting

The study was conducted in one of the union councils (UCs) of Quetta city, Kharotabad-1. This UC has a population of 67,782 and is one of the Super High-Risk UCs (SHRUC) in Pakistan for polio cases and positive environmental samples for poliovirus. UC Kharotabad-1 has no government health facility; only private health facilities are available.

Participants and eligibility

The study collected data from two types of participants from the community: Afghan refugee married women of reproductive age (MWRA) and Afghan community elders or other stakeholders. MWRA aged 18–49 years with the status of Afghan refugees who had at least one child aged 12-23 months from 3 April 2020 to 29 November 2021 and who provided written consent to participate were enrolled in the study. The eligibility criteria were explicitly formulated to capture participants' maternity experience during the initial four waves of the COVID-19 pandemic in Pakistan. All those interviewed were residents of the same community since before the pandemic. As for key informants, stakeholders who played a crucial role in delivering health services to refugees, the population, and the host communities were invited. Key informants were actors working in the health sector (program staff, policymakers, and practitioners from local and international non-governmental organizations (NGOs) and United Nations (UN) agencies) engaged in MNCH care in Balochistan during the COVID-19 pandemic. Participants were purposively recruited from a contacts list combining information from the authors' networks.

Interview guide and data collection

We used an adapted version of the interview guide developed by Rodo et. al, ¹⁸⁸ with the inclusion of some components derived from the H-ERDM framework ²⁵⁶ and this study's conceptual framework. A separate guide was designed for Afghan refugee women and key informants to capture different angles. The interviews lasted approximately one hour. Interviews with Afghan refugee women were conducted in Pashto and Dari, while Urdu or English were used with key informants. We pilot-tested the guide in different communities in Karachi to improve the rigor of our questions and probes. Data was collected through semi-structured interviews, except for one FGD with a group of NGO representatives. FGDs facilitated gathering communal insights and shared experiences, whereas in-depth interviews allowed for a deeper exploration of individual viewpoints and experiences. The interviews were tape-recorded and later transcribed and translated into English languages independently by a third party.

Data analysis

Thematic analysis was performed on the interview transcripts, adopting Braun and Clarke's six phases.

²⁷⁵ The inductive analysis was performed independently by two researchers (YS and AM) manually using Microsoft Excel. The process began with familiarization with the data, wherein researchers immersed themselves thoroughly to understand its depth and breadth. This initial engagement helped identify meaningful chunks of data during the second phase, which was the development of initial codes, where data were organized into concise, meaningful groups. In the third phase, these codes were used to identify potential themes, which were broader patterns that emerged across the dataset. These themes were then reviewed and refined in the fourth phase, ensuring they accurately reflected the dataset and remained distinct yet cohesive. The fifth phase involved a deeper analysis, during which researchers clarified the specifics of each theme and refined their definitions and names, ensuring each theme was clearly articulated and supported by data. The final phase, interpreting the data, was where the significance of the themes of the research question was explored, and conclusions were drawn, providing a rich and detailed account of the data.²⁷⁵

Ethics considerations

Ethical approval was obtained from the Segreteria Tecnico-Scientifica Comitato Etico Interaziendale di Novara (reference number: CE214/2022) and the National Bioethics Committee of Pakistan (Ref: No.4-87/NBC-843/22/559). Among the eligible participants, the research team obtained written informed consent in a local language, and household decision-makers were also told to build rapport. Where applicable, the signatures of both participant and witness were taken. Otherwise, thumb impressions were recorded. Every participant was given a unique study ID, and anonymity was maintained. Data confidentiality was assured as all data was stored in a locker and only accessible to the study team. Among the eligible participants, the research team obtained written informed consent in a local language. Every participant was given a unique study ID, and anonymity was maintained. Data confidentiality was assured as all data was stored in a password-protected folder and was only accessible to the study team.

Results

General description

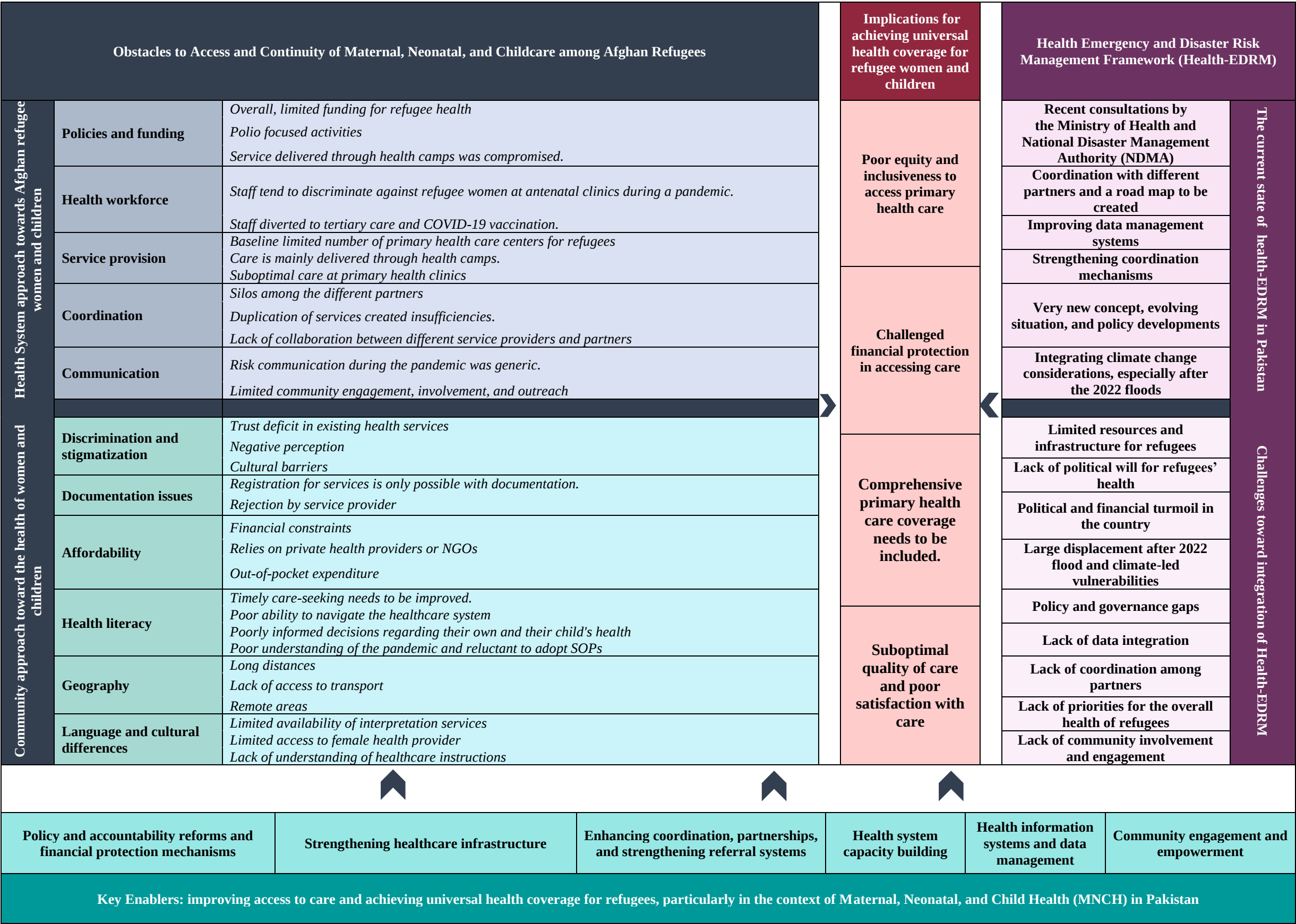
A total of 20 key informants were involved in the qualitative study; overall, 11 IDIs and one FGD were conducted from 25 February 2023 to 30 April 2023. Various respondents were MWRA, community elders, governmental staff, academics, INGOs representatives, and NGO staff. The gender distribution was nearly balanced, with a slight female predominance. The average age of participants ranged from 26 to 42 years, reflecting a diverse age group across the different respondent categories (Table 1).

The thematic analysis revealed two main themes: 1) Overall barriers to accessing MNCH care and 2) the current state of Health-EDRM.

Barriers to accessing MNCH care

The thematic analysis uncovered various challenges shaping Afghan refugee women's healthcare experiences in Balochistan. The barriers are further classified as health system and community-related barriers.

Figure 2 | Thematic analysis



Health system barriers resulted in poor utilization of care

Policies and funding issues

The ‘limited funding’ available severely affects the health system's capacity to address the specific needs of Afghan refugees. This financial constraint leads to inadequate service coverage and poor healthcare quality, significantly affecting MNCH care availability and accessibility.

“Because there weren’t enough funds given for refugee health care, Afghan refugees might not have had enough help or services when they had health problems; we have seen this during the COVID-19 pandemic.” (INGO staff)

Further, the emphasis ‘only on polio eradication activities’ during COVID-19 diverted resources and attention from other essential preventive services, leaving significant gaps in service provision for Afghan refugees.

“We are trying our best, but the truth is that we are only focused on polio. Polio, Polio, Polio! Everyone is just obsessed with it. Our main goal is to eliminate polio, and we are not considering other issues. This is what we all worried about during COVID.” (NGO staff)

In addition, the heavy reliance on ‘health camps for service delivery’ often compromised care continuity and quality. These temporary services/clinics are set up to provide healthcare services in areas where permanent health facilities are scarce or non-existent. These camps were not equipped to provide comprehensive MNCH services, leading to gaps in care and unmet health needs among the refugee population.

“Health camps might not have been able to give steady and full healthcare because they didn't have enough resources, people, or money. This made it hard to give Afghan refugees the care they needed. But we are doing everything we can to help them.” (INGO staff)

The health workforce is involved in service delivery.

The precautionary measures taken by healthcare staff during the pandemic were perceived as discriminatory by Afghan refugees, who already faced existing biases within the healthcare system. This perception intensified the challenges among the refugee population. The perceived discrimination

contributed to low coverage of ANC, particularly during the pandemic, and often limited access to essential prenatal services, leading to adverse maternal and neonatal health outcomes. The health measures aimed to safeguard public health; the implementation may have inadvertently mirrored or exacerbated existing prejudices against refugees, thus affecting their access to necessary healthcare services.

“During the COVID-19 pandemic, we went to a public hospital, but they wouldn't help me because I didn't have a mask and was coughing. They told us to take a COVID-19 test, but we said no. Then, we went to a private clinic where I had my baby. There, they treated me like I was the one who spread the disease.” (Afghan women)

The health worker mentioned:

“When we put restrictions during the pandemic like mask and social distancing at our facility, everyone, including refugees, thought that we were discriminating against them. Refugee women perceive that we are trying to avoid them and don't want to provide service to them, which is why we are asking for all these precautions. We tried to create awareness. (Government staff)

Further, the ‘redirection of health staff’ to tertiary care facilities and COVID-19 vaccination campaigns have decreased the number of healthcare providers available to address the MNCH needs of Afghan refugees. This diversion impacts the quality and accessibility of care, leaving refugees with even fewer healthcare options.

“During the pandemic, not just in Quetta or Pakistan but worldwide, everyone focused on just one illness. Other health issues were ignored, and we transferred most of our staff to hospitals. We weren't ready when the pandemic first hit. We didn't know how to test for it or how to handle it. At first, we didn't get any advice on what to do, but over time, we did start getting some directions.” (Health Department)

Service provision for refugees

The ‘baseline scarcity of primary healthcare’ centers dedicated to serving the refugee population directly limits access to essential MNCH services. This shortage challenges the health system's ability to provide accessible and equitable care to Afghan refugees, even more so during an emergency.

“They are refugees, and it seems like nobody cares about them, not even the government, which appears indifferent to its citizens. From Chaman to Pishin and Pishin to Quetta, healthcare services are lacking. There's also a lack of basic living infrastructure, even for us locals. Considering this, it's hard to imagine what the government could do for refugees.” (NGO staff)

Similarly, the care provided at the available primary health clinics is often suboptimal, lacking quality and scope. This inadequacy in service provision fails to meet the comprehensive health needs of Afghan refugee women and children, compromising their overall health outcomes.

“Many women go to public hospitals, private clinics, or private hospitals for healthcare. Basic Health Units (BHUs) aren't very good and offer only a few services. Often, they run out of medicine. Our refugee sisters especially look for places to get plenty of medicines.” (INGO staff)

“There isn't a specific plan just for Afghan refugees, but we do have initiatives in place, like the ones in Kharotabad you mentioned, aimed at tackling major health risks. There is no government facility there and given the large number of people moving around in these areas, our health department has suggested to our partners, such as WHO and UNICEF, that we run health camps and weekend shifts to address gaps in our regular health services. These camps and special efforts help ensure everyone gets the vaccinations they need, care for mothers and children, and support for any other health issues that might arise.” (Representative of academia)

Coordination among healthcare providers and NGOs

The health system's fragmented approach is characterized by sectors working in ‘silos and duplication’ of services among different partners, creating inefficiencies and resource wastage. The lack of streamlined coordination between service providers leads to suboptimal care and missed opportunities for comprehensive service delivery. This lack of coordinated service delivery has created gaps in care, with refugees often receiving overlapping services from different organizations without a cohesive healthcare plan.

“There's quite a bit of overlap in our efforts. For instance, if we focus on nutrition, you'll notice another organization doing the same. This seems a common practice among NGOs here; they tend to concentrate on areas with available funding.” (NGO staff)

‘Lack of collaboration’ between different healthcare providers and partners has further divided care for Afghan refugees, which hinders the development of integrated and effective healthcare strategies, limiting the potential for a unified response to the refugees' health needs.

“All the NGOs prefer to operate independently. Despite efforts to unite them on a single platform, achieving consensus is challenging. They choose to work solo rather than collaboratively.” (INGO staff)

Communication with refugees

During the pandemic, the ‘generic nature of risk communication’ failed to address the specific concerns and circumstances of the refugee population, resulting in inadequate preparedness and response within the refugee communities. The inconsistent and unreliable flow of health information within the system delayed effective communication and response strategies, hampered the timely dissemination of critical health information to refugees, and compromised the effectiveness of health interventions.

“There is a big problem: very little we do for their health awareness. We only do these things for vaccinations, especially polio. As a result, many other services lack proper information flow. COVID is a good example; our community and refugees have many myths and misconceptions about all the precautions we tried to impose. Because of this, we faced a lot of confusion and issues we faced at our facilities and camps” (NGO staff)

The health system's ‘limited efforts in engaging’ with the Afghan refugee community have stalled the establishment of trust and the effective delivery of health services. Community involvement is essential for understanding specific health needs and cultural sensitivities and designing well-received and effective interventions.

“We all understand the importance of communicating with the community and our partners on the ground, yet we often neglect to practice this. At times, we behave as if we are inexperienced, withholding information from our partners as if to say: “This is my project; why should I share?” This mindset makes

us forget that our primary objective is to effectively connect and engage with the community.” (INGO staff)

Community Barriers to Accessing Care

Discrimination and Stigmatization felt by refugees

‘Discrimination and stigmatization’ prevail against Afghan refugees. Negative perceptions and cultural barriers compound this.

“Doctor behavior with us is very rude. If they see us and hear us speaking (XYZ) language, they start yelling at us.” (Community woman)

The ‘negative perception of the healthcare system’ from Afghan women has led to a reluctance to seek medical help. Cultural differences between Afghan refugees and healthcare providers lead to misunderstandings and inadequate care. The lack of culturally sensitive approaches and communication barriers worsens these challenges, making it difficult for refugees to access and utilize healthcare services effectively.

“There are cultural differences. I am not saying that this is something new for us; our community also has similar issues, like they don't give much attention to pregnancy care. They only sought care if there was a problem. But refugees sometimes have more of these issues which are hard to address”. (NGO staff)

Documentation issues

The requirement for documentation to access health services presents a significant barrier for refugees, many of whom need more legal documents. This bureaucratic obstacle results in refugees being sent away from health services. Also, refugees often face rejection at healthcare facilities due to documentation requirements, i.e., registration or identification cards, capacity constraints, or discriminatory practices. This rejection denies them essential healthcare services and reinforces the perception of exclusion and marginalization within the healthcare system.

“Sometimes staff at health facilities ask for a registration card. If the woman has no document or in case the document is expired, this could block them from getting health care.” (Community Elder)

Affordability

The high reliance on private health providers puts a considerable ‘financial burden’ on refugee families.

This economic barrier makes it difficult for many to afford the healthcare services they urgently need.

“People here don't see primary health care as a good choice, and it's not just me saying this; it's the general belief. If they have the means, they opt for private hospitals, and if they know someone inside the system, they lean toward government hospitals. While we can offer guidance, we're aware of the poor state of health facilities.” (INGO staff)

The insufficient public healthcare infrastructure has forced Afghan refugees to rely on private NGOs or healthcare providers. This dependency has led to significant out-of-pocket expenditures, making healthcare access financially burdensome for the refugee population.

“I heard from someone that they don't have medicines or X-ray facilities available and were advised to see a private doctor for these services. I'm unsure about the details; my husband was talking to them. We end up spending a lot on our healthcare. We also attend health camps if they're close by.” (Community women)

Health literacy

A lack of ‘health literacy’ characterized by difficulties accessing the healthcare system and making informed health decisions delays refugees seeking timely and appropriate care. This gap in knowledge and understanding further marginalizes Afghan refugees within the health system.

“Awareness among the refugees is quite low. Firstly, they often have trouble understanding us, and secondly, they're not very open to listening to what we say. The issue is that the community is generally reluctant to engage.” (NGO staff)

Further, Afghan refugees ‘limited familiarity with the local healthcare system,’ not speaking the local language, and cultural differences lead to delayed or missed care.

“The lack of targeted health education and limited access to information among refugee women lead to suboptimal healthcare utilization.” (Representative of Academia)

“The general lack of clear, accessible information about the pandemic and associated safety protocols has resulted in a poor understanding and reluctance among Afghan refugees to adopt standard operating procedures (SOPs).” (Representative of health department)

This gap in knowledge and compliance posed significant public health risks, particularly in densely populated refugee settlements.

Geographical accessibility

The ‘geographical challenges’ of long distance to health facilities, lack of transportation, and the remote location of many refugee settlements pose significant challenges to accessing healthcare services, making it difficult for refugees to receive timely MNCH care.

“The area where we’ve settled is on the city’s outskirts, as you know. Families with many members or those with relatives in Pakistan are in a better situation. However, the situation is quite different for us here without such connections; we have very little.” (Community elder)

Moreover, transportation barriers significantly hinder Afghan refugees’ ability to access healthcare facilities, especially those living in remote areas or with limited financial means. This lack of access to transport intensifies the challenges of reaching timely and adequate healthcare services. The distance to healthcare facilities and the need for transportation and infrastructure limit the availability and continuity of care for refugees.

Language and cultural barriers

The limited availability of ‘language interpretation services’ and ‘culturally sensitive care,’ particularly the availability of female health providers, creates significant barriers to effective communication and understanding between healthcare providers and Afghan refugee women, further complicating their healthcare access and discouraging many women from seeking necessary medical attention.

“We face a problem: our language is different, and they don’t have anyone who speaks their same language. When I was in Karachi, this was also a huge problem. But we came back here, and it’s all the same; no one helps us understand.” (Community women)

Afghan refugees necessitate female health providers, particularly for maternal and reproductive health services.

“Having predominantly male staff is a significant issue, especially since we are working in a Pashtun community with strict traditions regarding gender roles. This challenge was even more pronounced during the COVID-19 pandemic when staffing issues were exacerbated.” (Representative of health department)

Current state and challenges in integrating health-EDRM

Many NGO respondents needed to be made aware of the health-EDRM framework. Those who were aware of such a framework highlighted several steps to progress in this direction and challenges that they perceived might hinder the integration of the health-EDRM framework in the local health system. A few respondents have mentioned attending meetings held by the Ministry of Health and the National Disaster and Management Authority (NDMA) to set the strategic direction for Health-EDRM. According to them, these meetings focus on identifying gaps in the current system, proposing solutions to enhance the resilience of health services, and ensuring that the specific needs of vulnerable populations like Afghan refugee women are addressed in MNCH care plans. Nevertheless, the level of integration of programs targeting the needs of refugees still needs to be determined.

“Indeed, it's pretty recent that the MoH and the NDMA organized a meeting with partners to discuss Health-EDRM. I participated in this discussion. They also brought in academics, which is a positive step. However, this initiative is still very new, so perhaps we'll learn more about its progress and impact in the coming months. (Representative of academia)

Key informants emphasized that this framework is essential for refugees as it ensures that health services are resilient and responsive to emergencies, providing continuous MNCH care even in crises.

“The WHO may be taking some action, but I'm not certain. After the experiences with COVID-19 and the floods, there's much talk about prioritizing disaster preparedness, yet I'm not convinced any substantial measures are being taken. The flood-affected regions, particularly in many parts of

Balochistan, remain in dire straits. This isn't just my observation; it's a widely acknowledged fact.”
(Representative of academia)

However, due to a lack of implementation, it was highlighted that effective coordination among government agencies, NGOs, INGOs, and community representatives is critical for a whole-of-health-system approach to health emergency management, which is missing. Developing a comprehensive road map involves aligning strategies, pooling resources, and setting clear roles and responsibilities for all stakeholders to improve MNCH care for Afghan refugees.

“We lack a proper emergency response system, as recent crises like the pandemic and floods show. Both private and public hospitals, including civil hospitals, were unprepared for emergencies, such as a measles outbreak. There's a general lack of preparedness at the provincial level. We're discussing establishing an emergency response mechanism with provincial governments to ensure we're ready for future emergencies, knowing our roles, communication channels, resource allocation, and action plans.”
(INGO staff)

They also mentioned the need for robust data management systems, which are foundational for effective health-EDRM, enabling real-time monitoring, rapid response to health emergencies, and informed decision-making. There has been a recent shift in implementing better databases to optimize data collection across the country.

“Enhancing data and reporting systems involves leveraging technology to collect, analyze, and share health data, mainly focusing on MNCH indicators; this can be implemented among Afghan refugee populations. (INGO staff)

Effective health-EDRM requires comprehensive data integration across various sectors and stakeholders. Integrated data systems are necessary to ensure informed decision-making and coordinated responses.

“This is a great limitation in an existing system where the health department is still struggling with digitalizing data. People here don't want to use it because you will be monitored and in trouble if you start using it. We have implemented it for immunization and other programs as well. Then they also need to maintain manual registers, so they lost the interest.” (NGO staff)

Importantly, the floods in Pakistan in 2022 were stated as a critical time, which created a huge demand for integrating climate change adaptation and mitigation strategies into health-EDRM.

“Assessing and addressing the specific vulnerabilities of Afghan refugees to climate-related health risks, ensuring that MNCH services are resilient to environmental changes and natural disasters.”

(Representative of academia)

Acute humanitarian needs, especially in flood-hit areas, highlighted the shortage of resources and infrastructure dedicated to refugee care, hindering effective emergency management. Pakistan's crisis response plans and the ongoing displacement from the 2022 floods underscore the broader context of political and financial instability that complicates health-EDRM efforts.

“The catastrophic floods significantly increased vulnerabilities, underscoring the need to integrate climate resilience into refugee health strategies. However, the scale of displacement and economic loss greatly impacted all the different sectors. We depend on more aid, which we all know is not sustainable.”

(Representative of academia)

“There are a lot of macro-level gaps in this area, and we know it's not easy. We see the performance of our political leaders and the health department's poor performance. Issues are everywhere, and with these issues, whatever you plan and do is just not practical. (NGO staff)

The competing national priorities and the complex socio-political landscape have led to refugees' health not being at the forefront of policy agendas. Still, it has emerged as one of the major issues.

“Refugees are not part of any agenda; leadership and politicians might not include them in such plans. That's the fact and part of the problem. However, in Balochistan, the issues are complex. Everyone knows how people are deprived here. They don't listen to their people. Haven't you seen it on social media? I don't want to say more...” (Community elder)

Engaging refugee communities in health-EDRM planning and implementation is crucial for successfully implementing an integration plan. This involvement ensures culturally sensitive and effective health interventions. The absence of such involvement may lead to uneven health services that do not fully meet the needs of the refugee population.

“I have been working for this community for many years and always try to address the problems that our community faces, but I know nothing will happen. We are refugees who will listen to our problems, no one, not the government here, they are very busy, but we will keep trying.” (Community elder)

The multiplicity of actors involved in refugee care necessitates improved coordination mechanisms. Without them, efforts are less cohesive, resulting in inefficiencies and gaps in service delivery.

“The key point is to coordinate with all partners for a long-term disaster plan. This is not an easy job. Government needs budget and policies according to that.” (INGO staff)

Discussion

This research highlighted the significant hurdles faced by Afghan refugee women in accessing essential MNCH care. The issue is mainly related to health systems and community environments, critically affecting the delivery and accessibility of essential health services to one of the most vulnerable cohorts within the refugee community. The core issue stems from limited funding, which restricts healthcare services' availability and quality, as highlighted in the findings. During the COVID-19 pandemic, the focus shifted almost entirely to polio vaccination or the COVID-19 infection, dismissing other crucial healthcare needs. Moreover, healthcare camps, often the only source of care in remote areas, need help providing continuous, quality care due to resource constraints. Discriminatory practices within the healthcare workforce further alienate refugee women, limiting their access to the care they need. Primary healthcare facilities are scarce, and those available often need more quality and breadth of services. The lack of coordination among healthcare providers leads to duplicated efforts and inefficiencies, while cultural and language barriers between healthcare providers and the refugee community complicate communication and service delivery. The geographical remoteness of refugee settlements and the financial burden of healthcare pose additional challenges to accessing timely and adequate care. Lastly, although not substantial, the redirection of healthcare staff to manage COVID-19 cases has weakened the system's ability to meet the broad healthcare needs of the refugee community.

These findings converge with existing literature, underscored by a global resonance in the challenges displaced populations face in accessing healthcare.²⁷⁶ Our study's financial constraints and resource limitations echo the broader discourse on healthcare provision for refugee women.²⁶⁷ Similarly, the theme of discrimination from the healthcare workforce aligns with the narrative presented by other authors, who revealed the detrimental impact of provider's biases on healthcare accessibility for marginalized groups.^{277–279} Furthermore, the suboptimal health system approach, the resulting duplications, and inefficiencies resulted in the need for integrated healthcare strategies in refugee settings.^{188,269} This also highlights the need for a concerted global effort to develop more inclusive and equitable healthcare policies and practices.²⁷⁰

The study findings show significant gaps in the journey toward UHC, especially for refugee populations. The immense challenges and barriers identified—ranging from health system limitations to community-level obstacles—underscore the critical unique needs of refugees.²⁸⁰ The overall impact on UHC is negative and pushing the agenda behind it. health-EDRM in such contexts becomes critical, emphasizing the need for resilient PHC systems to respond to complex emergencies. The integration of emergency preparedness into MNCH services emerges as a crucial element in advancing UHC in humanitarian crisis contexts,²⁷⁴ They are ensuring that vulnerable populations, such as Afghan refugees, have access to essential health services without financial hardship, even in times of crisis. The PHC system often falls short of comprehensive coverage, leaving critical services out of reach for this vulnerable population.²⁷¹ Financial protection is another critical concern: the high out-of-pocket costs of healthcare services deter many from seeking care, exacerbating the risk of untreated health conditions.²⁷² Moreover, the quality of available care could be better, marred by inadequate facilities and a scarcity of skilled healthcare professionals.^{194,272}

Addressing incorporating the health-EDRM framework and fortifying health system resilience necessitates a multifaceted approach, encompassing strategic policy interventions and robust operational guidelines²⁵⁷. Despite varying levels of awareness among respondents about the health-EDRM framework, its significance in bolstering health services' resilience, particularly for Afghan refugees, is

clear. This may be an evolving strategic direction emphasizing the necessity for a robust emergency and disaster preparedness system that encapsulates the unique needs of vulnerable populations^{251,258}. Yet, the limited resources, political will, and infrastructural deficits are crucial barriers²⁵¹. Notably, the catastrophic floods of 2022 have laid bare the acute vulnerabilities and underscored the imperative of weaving climate resilience into refugee health strategies. The dialogue around health-EDRM reveals a mixture of efforts towards better coordination, data management, and community engagement. Yet, these need to be improved by systemic inefficiencies, governance gaps, and a pressing need for more inclusive policy frameworks²⁵¹.

There is a potential risk of recall bias as more than two years have passed from the initial waves of the pandemic to the time of the interviews. Qualitative studies typically address recall bias through methods like cross-validation of information across different types of participants and by focusing on consistent themes across various narratives. The study also used a combination of in-depth interviews and focus group discussions to capture a broad range of experiences and perspectives, which can help mitigate some aspects of recall bias.

Recommendations

Based on this study's findings, a set of targeted recommendations is proposed to address the multifaceted challenges faced by Afghan refugees in accessing MNCH services within the context of health-EDRM in Pakistan. Firstly, policy and accountability reforms are crucial to ensure the equitable provision of health services and the implementation of financial protection mechanisms that safeguard refugees from catastrophic health expenditures. This entails explicitly revising existing policies to include refugee health needs and establishing clear accountability structures to monitor policy implementation effectively.

Strengthening healthcare infrastructure is imperative to improve healthcare access and quality, especially in refugee-dominant areas. This includes upgrading existing health facilities, equipping them with essential medical supplies, and ensuring they are resilient to health emergencies and disasters. Enhancing coordination, partnerships, and strengthening referral systems among health providers, humanitarian

organizations, and government agencies will ensure a cohesive approach to health service delivery, optimizing resource utilization and ensuring seamless patient care across different health system levels. Another critical recommendation is to build capacity within the health system, focusing on training healthcare personnel in culturally competent care, emergency preparedness, and refugee-specific health needs. This will improve the quality of care provided and build trust within the refugee community. Establishing and enhancing health information systems and data management is vital for informed decision-making and efficient resource allocation. Robust data systems will enable real-time monitoring of health indicators, disease outbreaks, and the effectiveness of health interventions among the refugee population.

Lastly, community engagement and empowerment are foundational pillars for ensuring the success of health interventions. By involving Afghan refugees in the planning and implementing health services, their unique needs and preferences can be accurately addressed, fostering a sense of ownership and enhancing the utilization of health services. Engaging community leaders and leveraging existing community networks can further facilitate health education and promotion, improving refugees' health literacy and preventive behaviors.

Conclusion

In conclusion, this study underscores the critical need for a holistic and compassionate approach to healthcare for Afghan refugees in Pakistan, integrating health-EDRM into the health system. The challenges highlighted through this research demand urgent action and collaborative efforts to ensure equitable access to quality healthcare for one of the most vulnerable populations. The recommendations offer a roadmap towards a more resilient, inclusive, and effective health system. As we move forward, it is imperative that all stakeholders, from policymakers to healthcare providers and humanitarian organizations, unite in their efforts to transform the lives of Afghan refugees. In doing so, we uphold the fundamental right to health and affirm our collective commitment to humanity, ensuring no one is left behind in our pursuit of a healthier, more equitable world. To extend the results of this study to other

areas of Pakistan, researchers would need to consider regional variations in health infrastructure, cultural norms, and economic conditions. Strategies include adapting the health interventions to local contexts, engaging local stakeholders in the planning and implementation phases, and conducting pilot studies in different regions to tailor approaches based on local needs and resources. The study's findings emphasize the need for policy reforms and community-centered approaches, which could be adapted to different contexts across Pakistan with local-specific adjustments.

Chapter 8: Discussion and Policy Reflection

Across the four studies, several recurring themes emerged that highlight the complex interplay between global health emergencies, conflict, and MNCH outcomes. These themes are critical for understanding the broader implications of the research.

Disruption of MNCH services due to health crises

All four studies consistently emphasize the profound disruption of MNCH services during global health emergencies such as Ebola and COVID-19. The pandemics exacerbated existing weaknesses in health systems, particularly in conflict-affected regions. Disruptions ranged from reduced access to antenatal care and skilled birth attendance to interruptions in child immunization programs. The compounding effects of conflict and pandemics made it particularly challenging to maintain the continuity of care for women and children. Further, prolonged conflict in countries like Sierra Leone has more significant implications in terms of poor maternal health outcomes. Consequently, the health system failed to overcome the preventable causes of maternal deaths even in the long run.

Vulnerability of conflict-affected populations

Populations in conflict zones, especially vulnerable women and children, are disproportionately affected by health crises. The studies highlighted that these groups face unique barriers to accessing care, such as geographical isolation, security concerns, and discrimination. For example, Afghan refugee women in Pakistan encountered significant challenges in accessing antenatal and intrapartum care because of their baseline vulnerability as well as being settled in the most deprived province of Pakistan, revealing the deep vulnerabilities of displaced populations.

Systemic and community-level barriers

The research identified systemic (supply-side) and community-level (demand-side) barriers that hinder service delivery and uptake of MNCH services. Systemic barriers include shortages of healthcare workers, lack of essential supplies and tools, and inadequate infrastructure, all aggravated during emergencies. Community-level barriers, such as cultural practices, mistrust of healthcare systems, and misinformation, also played a critical role in limiting access to essential services.

Importance of health system resilience

The studies emphasized the need for resilient health systems that can withstand and adapt to the dual pressures of conflict and global health emergencies. The research on health-EDRM frameworks demonstrated that integrating these frameworks into primary healthcare systems is crucial for maintaining MNCH services during crises and for displaced populations. Effective strategies include strengthening referral systems, improving healthcare worker training, and leveraging community-based interventions.

MNCH in humanitarian contexts

MNCH remains a critical concern in global health, particularly within humanitarian and conflict-affected settings.²⁸¹ Despite decades of international focus and commitment to improving MNCH outcomes, significant disparities persist between high-income countries and LMICs, especially in regions suffering from conflict, displacement, and political instability.²⁸² These disparities are deeply rooted in the systemic breakdown of healthcare infrastructures, which is often compounded by the effects of pandemics and ongoing conflicts.²⁸³ Understanding these challenges is vital to developing insights into how resilient MNCH systems can be built to withstand such pressures.²⁸⁴ Poor infrastructure, lack of healthcare services, and limited access to skilled birth attendants attribute to preventable deaths, stressing the failures of health systems in crisis-affected regions.²⁸⁵ While global initiatives like the SDGs, UHC, and Agenda 2030 emphasize improving health outcomes, progress has been slow in areas where war, displacement, and weak health systems are prevalent.²⁸⁶

Conflict, political instability, and epidemics strain healthcare infrastructure, displace healthcare workers, and limit essential resources.²⁸⁷ The disruption of routine MNCH services leaves women and children especially vulnerable, as access to prenatal care, safe deliveries, and vaccinations becomes severely restricted.⁴³ The direct consequences of conflict, such as the destruction of hospitals and clinics, combined with the indirect effects like increased malnutrition and displacement, further amplify MNCH challenges.⁴³ Overcrowded refugee camps and IDP settlements are breeding grounds for infectious diseases, making pregnant women and young children even more susceptible to life-threatening conditions.²⁸⁸

Global health crises like the Ebola outbreak and the COVID-19 pandemic have further disrupted MNCH services, particularly in fragile settings.¹⁸⁷ Already weakened health systems were overwhelmed as resources were diverted to tackle the immediate crisis, leaving MNCH services neglected.^{187,188,205,207} Lockdowns, movement restrictions, and repurposing of health facilities for pandemic responses resulted in significant disruptions to antenatal care, childbirth, and post-natal services.²⁸⁹ Many women had no choice but to give birth at home without skilled attendants, further increasing the risk of complications and adverse outcomes.^{117,124,135}

When the host population in LMICs is also struggling with limited resources, the challenges become even more pronounced, intensifying disparities in MNCH outcomes.^{98,148,161,290} LMICs typically need more resources, such as underfunded healthcare systems, shortages of healthcare professionals, and limited access to essential services.²⁹¹ The influx of displaced populations creates additional pressure on these systems, resulting in competition for scarce resources and often needs aid to meet the needs of both the host population and the refugees, leading to deteriorating MNCH services for both groups.²⁹² In such settings, overall health indicators including maternal and child mortality rates, birth complications, and lower immunization coverage highlight the strain on healthcare systems and the worsening health inequities.²⁹² These systemic barriers significantly contribute to poor MNCH outcomes in humanitarian contexts.¹⁶⁶ Health systems in LMICs and conflict-affected areas frequently lack adequate funding, infrastructure, and human resources to meet the demands of their populations. Moreover, cultural and socioeconomic barriers also hinder access to MNCH services.¹⁷⁰ Gender norms, early marriage, adolescent pregnancy, and lack of female autonomy often prevent women from seeking formal healthcare services.²⁹³ Additionally, economic hardship exacerbated by conflict or displacement forces families to prioritize basic needs like food and shelter over healthcare, continuing a cycle of poor health outcomes.²⁹⁴

Policy Implications and Recommendations

To address these obstacles, building resilience and responsiveness in MNCH services is essential, particularly in regions prone to conflict and emergencies.²⁹⁵ The integration of frameworks like health-EDRM into healthcare systems can provide a more coordinated and robust response to crises.¹⁶⁷

Strengthening health systems to be adaptable and resilient ensures that MNCH services can be sustained even in emergencies.²⁹⁶ Keeping Preparedness, response, recovery, and mitigation at the heart of resilience health system, assures MNCH services a priority during disasters, pandemics, and conflicts.²⁹⁷ Additionally, community engagement is vital in fostering trust, understanding local cultural practices, and delivering culturally sensitive care. Training healthcare workers in emergency response ensures that essential services, including emergency obstetric care, remain available even in the most challenging environments.^{143,160,167,295,298} The findings from this thesis have significant policy implications and recommendations for improving MNCH outcomes in conflict-affected populations during global health emergencies:

Integration of emergency preparedness in health systems

Policymakers must prioritize the integration of health-EDRM framework into national health strategies, particularly in conflict-prone regions.²⁹⁹ This integration should focus on ensuring the continuity of MNCH services during emergencies by developing contingency plans, securing essential supplies, and training healthcare workers in emergency response protocols to achieve better population health outcomes and assuring UHC.³⁰⁰

Targeted support for vulnerable populations

There is a critical need for policies that specifically address the healthcare needs of vulnerable groups, such as refugees and IDPs, during global health emergencies.³⁰¹ Governments and international organizations should ensure that these populations have access to culturally sensitive and affordable MNCH services, even in the most challenging settings.³⁰²

Strengthening health infrastructure for vulnerable populations

Investment in health infrastructure in conflict-affected areas or for population affected by conflict is essential for improving MNCH outcomes.^{89,99} Policies should focus on rebuilding and strengthening healthcare facilities, expanding mobile health services, and ensuring that healthcare workers are adequately supported and protected.^{119,143} This approach will help mitigate the impact of future health crises on these populations.

Enhancing data collection and surveillance systems

Reliable data collection and surveillance systems are vital for monitoring MNCH outcomes during health emergencies.⁴³ Policymakers should invest in strengthening these systems, particularly in conflict-affected regions, to ensure timely and accurate reporting of maternal and child health indicators.^{43,303} This data is crucial for informing targeted interventions and evaluating the effectiveness of policy measures.

Develop and implement resilient health systems

Governments and health agencies should prioritize the development of resilient health systems that can adapt to the challenges posed by both conflict and health emergencies.²⁵⁶ This includes integrating health-EDRM frameworks, enhancing the capacity of healthcare workers, and ensuring the availability of essential medical supplies and equipment.²⁹⁹

Increase access to MNCH services for vulnerable populations

Strategies such as mobile health clinics, telemedicine, and community health workers should be expanded to reach those in remote or insecure areas.¹¹⁹

Strengthening community engagement and education

Health programs should include initiatives to educate displaced communities about the importance of MNCH care, dispel myths and misinformation, and promote trust in healthcare systems.³⁰⁴ Involving community leaders and using culturally appropriate communication methods can enhance the effectiveness of these efforts.³⁰⁴

Foster international collaboration and resource sharing

Global health emergencies require coordinated international responses, particularly in conflict-affected regions.⁴³ International organizations, donors, and governments should work together to ensure that resources are allocated efficiently and that best practices are shared across borders.⁴³ Collaboration can also help to pool resources for emergency preparedness and response efforts, reducing the burden on individual countries and reaching the last mile under the UHC agenda.³⁰⁵

Conclusion

The evidence presented in this thesis provides a comprehensive analysis of the challenges and potential solutions for MNCH among populations affected by conflict during global health emergencies. Through a multi-methodological approach, this work has highlighted the severe disruptions to MNCH services caused by pandemics such as Ebola and COVID-19, particularly in conflict-affected regions or populations affected by conflicts where health systems are already fragile. The findings reveal that the intersection of conflict and global health emergencies creates a complex environment in which vulnerable populations, especially women and children, face significant barriers to accessing essential healthcare. These barriers are systemic, including shortages of healthcare workers and medical supplies, and community-level, such as cultural mistrust and misinformation. The compounded effects of these barriers result in reduced access to care, increased maternal and neonatal mortality, and a deepening of health disparities. A critical theme across the studies is the need for resilient health systems that can adapt to the pressures of both conflict and global health emergencies. Integrating health-EDRM into primary healthcare systems is a key strategy for ensuring the continuity of MNCH services during crises and a critical step toward achieving UHC for such population groups. This approach, coupled with targeted support for vulnerable populations and enhanced community engagement, is essential for mitigating the impact of future health emergencies. The policy implications of this research underline the importance of integrating emergency preparedness into national health strategies, with a particular focus on conflict-prone regions as well as vulnerable population groups. Strengthening health infrastructure, improving data collection and surveillance, and fostering international collaboration are also crucial for enhancing MNCH outcomes. There is a surge for a concerted global effort to address the unique challenges faced by conflict-affected populations during health emergencies. By developing resilient health systems, increasing access to care for vulnerable populations, and strengthening community engagement, we can move closer to achieving equitable health outcomes for all. The recommendations provided in this work offer a roadmap for policymakers, health practitioners, and international organizations to build a more resilient and responsive healthcare system that protects the health and well-being of women and children in the world's most vulnerable regions.

Chapter 10: Highlight from other Research Activities

Disclaimer: The manuscript is under interview.

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Abstract

Background

Disasters are catastrophic events that cause significant disruption, damage, and destruction to the normal functioning of communities or societies. Several frameworks have been developed as focus in recent decades has shifted towards prevention and mitigation. The INFORM (Index for Risk Management) initiative is a collaborative effort of the Inter-Agency Standing Committee (IASC) and the European Commission under the Disaster Risk Management Knowledge Centre (DRMKC) to create a more reliable disaster risk assessment tool. It aims to inform where and why risks might occur, facilitating risk reduction, strengthening resilience, and enhancing preparedness. It utilizes 76 indicators, assessing risk by considering three core dimensions: hazard and exposure, vulnerabilities, and lack of coping capacity. Although disasters, conflicts, and other crises affect women and children differently due to varying exposure and vulnerability, the original index has considered broader vulnerable groups. Still, in its original form, it might mask the extreme vulnerability that women and children might face during emergencies. To address this gap, our pilot study recalibrated the existing index by redefining the selective indicators for women and children. Further, it is crucial to fill the gaps in risk assessment and management, which should be tailored to the vulnerabilities of women and children in emergencies.

Methods

INFORM Index Risk formulation is “Risk= Hazard and Exposure $\frac{1}{3}$ x Vulnerability $\frac{1}{3}$ x Lack of coping capacity $\frac{1}{3}$ ” resulting in a total score ranging from 0 to 10, with the higher score being the higher risk. This pilot study utilized secondary data analysis to adjust the INFORM Risk 2024 version 067 formula by including the size of females and children aged 0-14 years population in 67 countries across the Eastern Mediterranean, South Asia, and Sub-Saharan Africa. In calculating the risk for our population of interest, we changed the denominator of the original formula to total female and 0–14-year population. Moreover, we classified 76 indicators into three categories: 1) indicators with available gender-disaggregated data,

2) indicators that can be calculated for the target population using supporting literature, and 3) indicators more generalized that do not require change. When specific data was unavailable, original values were retained for consistency. Disaster and conflict exposure data were adjusted using standardized factors derived from extensive literature based on the percentage of women and children affected by these emergencies out of the total population.

Results

Significant shifts in risk classifications were observed among the 67 selected countries. Originally, 13 countries (19.4%) were classified as ‘very high’ risk, and 18 (26.9%) as ‘high’ risk. Overall, 52 countries (77.6%) showed changes in their scores, ranging from 0.1 to 0.6 points, while 15 countries (22.4%) remained unchanged. Six countries, including Cameroon, Iraq, Kenya, Mozambique, Niger, and Nigeria, were reclassified from ‘high’ to ‘very high’ risk, increasing the total to 19 countries (28.3%). Libya moved from ‘medium’ to ‘high’ risk. Notable increases included Madagascar (0.6-point increase), leading to a rank drop from 27 to 25, and Zimbabwe (0.6-point increase), resulting in a rank drop from 65 to 45. Pakistan saw a 0.5-point increase, maintaining its rank at 23. Changes were primarily driven by hazard exposure, vulnerability, and coping capacity adjustments. For instance, Madagascar, Mali, Pakistan, Togo, Zambia, and Zimbabwe showed the highest increases in vulnerability. Bahrain, Mauritius, Qatar, Seychelles, and UAE remained in the ‘very low’ risk category, with minimal changes. Additionally, 22 countries showed a 0.1-point change, while the remaining 22 countries exhibited no change in their risk indices.

Conclusion

The recalibrated INFORM index signifies the critical vulnerabilities women and children face in high-risk countries, emphasizing the need for targeted, gender-sensitive interventions.

Introduction

Disaster risk management has evolved significantly over the past decades.^{306,307} It has shifted from simply reacting to crises to proactively reducing risks.³⁰⁸ Advances in technology and global collaborations have improved early warnings and community preparedness.^{308–310} Data-driven strategies have been crucial in reducing suffering due to complex humanitarian emergencies.^{311,312} The year 2015 was particularly important because three key international frameworks were adopted: the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals (SDGs), and the Paris Climate Agreement.³¹³ These frameworks highlighted the necessity of employing scientific data to monitor a country's progress.

The INFORM initiative is Integral to this effort, a collaboration between the Inter-Agency Standing Committee (IASC) and the European Commission under the Disaster Risk Management Knowledge Centre (DRMKC).^{314,315} INFORM has become a globally recognized multi-hazard humanitarian risk tool designed to be an open-source initiative. It can be contextualized and calculated over time to assess the risk of complex emergencies and evaluate and compare the vulnerability and resilience of populations to various exposures and hazards.^{314–316} These indices are built to serve multiple critical purposes in disaster risk management, identify vulnerable groups, help humanitarian organizations, and aid in early action for better crisis response regarding effective resource allocation.^{314,315} They help policymakers address the root causes of risk and guide investments in infrastructure, education, healthcare, and other critical sectors to build long-term resilience plans.³¹⁶ Additionally, the risk index enables international comparisons and trend analyses by offering standardized measures, facilitating the identification of best practices, and supporting global strategies for disaster risk reduction.³¹⁶

INFORM Risk Index was officially launched in 2014 with an annual update to enhance its accuracy and relevance.³¹⁵ These updates typically include the introduction of new indicators, revising existing ones, and updating data sources. Key categories of updates involve socio-economic indicators, health metrics, conflict intensity measures, and natural hazard exposure data.^{314,316} Each year, the index incorporates the

latest available data, adjusts methodologies as needed, and refines its indicators to provide a more accurate assessment of global humanitarian risk.^{314,317} The INFORM Risk Index has three core dimensions: 'hazard and exposure,' 'vulnerability,' and 'lack of coping capacity.'³¹⁴ The 'hazard and exposure' dimension assesses the likelihood and extent of exposure to hazards, including natural disasters such as earthquakes, floods, and cyclones, as well as human-induced events like conflict and political instability.³¹⁴ By analyzing historical data and projections, this dimension identifies regions prone to specific hazards, supports targeted preparedness and mitigation.³¹⁴ The 'vulnerability' dimension assesses the susceptibility of populations to the impact of hazards. It evaluates the susceptibility of populations to the impact of hazards.³¹⁴ It considers socio-economic conditions, health status, and the presence of vulnerable groups to provide insights into the root causes of vulnerability. Indicators include poverty levels, educational attainment, and the prevalence of chronic diseases.³¹⁴ The 'lack of coping capacity' dimension measures the ability of populations to cope with and recover from the impacts of hazards.³¹⁴ It includes indicators related to institutional capacity, infrastructure, and economic stability, highlighting areas where resilience needs to be strengthened.³¹⁴

A total of 76 indicators are used in the calculation of this index, of which 34 are linked to 'hazard and exposure', 24 are related to 'vulnerability', and 18 are related to 'lack of coping capacity'.³¹⁴ The index was initially developed for global risk assessment. Still, recently, countries have customized it to the subnational and administrative level to suit their specific contexts, allowing for more granular analysis and localized risk management.³¹⁶ For instance, INFORM subnational projects have been rolled out in Latin America, the Caribbean, Southern Africa, and Central Asia, enabling local lead organizations to assess and address risks at a more precise geographical scale.³¹⁶

The female population and children are at higher risk of disasters due to several interconnected factors exacerbating their vulnerability.³¹⁸ Women and girls often face social, economic, and cultural barriers that limit their access to resources, information, and decision-making power.^{318,319} These barriers can restrict their ability to respond effectively to disaster risks and impacts. For instance, women may have limited access to financial, educational, and technological resources crucial for disaster preparedness and

recovery.³²⁰ gender roles and responsibilities, such as caregiving and household management, can increase their exposure to disaster risks and reduce their mobility during emergencies.³¹⁸ Children are particularly vulnerable due to physical and developmental characteristics, making them more susceptible to injury, illness, and trauma during disasters.^{321,322} Their dependency on adults for protection and care further heightens their risk.^{318,319} On average, women live about 4.7 years longer than men globally, but natural disasters reduce women's life expectancies more significantly. Studies have shown that women die at higher rates than men during disasters due to both direct and indirect impacts.³²³ During the 1991 cyclone in Bangladesh, women were three to five times more likely to die than men, primarily due to limited access to risk information and lack of decision-making power regarding evacuation.³²⁴ Similarly, in the 2004 tsunami in Indonesia, adult women were twice as likely to die compared to men, influenced by physiological differences, socioeconomic factors, and limited mobility.³²⁵ Women also tend to show higher rates of post-traumatic stress disorder (PTSD), anxiety, and depression following disasters and conflict.³²⁶ Likewise, mortality risk among women and children from non-violent causes significantly increases in response to nearby conflict; the risk becomes more significant with higher intensity and prolonged conflicts.³²⁷ Between 1995 and 2015, more than 10 million under-five deaths globally were attributed to conflict.³²⁷ Women of reproductive age living near high-intensity conflicts face a mortality rate three times higher than women in peaceful areas.³²⁸

Global crises significantly impact vulnerable populations, including displaced individuals (due to conflicts, natural disasters, or both), and political and economic instability.^{101,329–331} Despite efforts to improve resilience and outcomes for these groups, substantial obstacles have yet to be overcome.^{298,332,333} Vulnerability in this context often includes limited access to resources, poor infrastructure, and heightened exposure to hazards.^{298,332,333} This is particularly true for maternal, neonatal, and child health (MNCH), where displaced populations are frequently overlooked in risk indexes despite progress in programs and outcomes over the past decade.^{334–337} Therefore, despite the utility of the INFORM Risk Index, it has multiple limitations, particularly in addressing the complexities of humanitarian crises, which are further worsened by conflicts, climate change, and health emergencies. These humanitarian crises affect nearly

300 million people worldwide who need assistance and protection.³³⁸ Women and children represent a disproportionate percentage of those in need.^{339–341} On average, more than half of these individuals are women and girls.^{339,340} According to UN agencies, nearly 614 million women and girls are living in conflict, with a 50% increase compared to 2017,³⁴⁰ 1.05 billion are residing in slums.³⁴⁰ Moreover, nearly 94 million children require protection, education, health, and nutrition support, and more than 200 million people are either living in disaster-prone countries or affected by conflicts.³⁴¹ Furthermore, this highlights the critical need to understand the specific risk these vulnerable groups face.

INFORM Risk index has taken into account the overall vulnerable groups at the population level, but the vulnerability of the female population as well as children become more crucial in emergencies and disasters.^{342–344} Current indicators in the index are broad and not specific to fully capture the unique vulnerabilities of women and children aged 0 to 14 years. Moreover, many indicators are not disaggregated by gender, thereby masking challenges which these groups might face at country level. To address this gap, our pilot study recalibrated the existing index by redefining the selective indicators for women and children. By doing so, we aimed to highlight their unique vulnerabilities and provide a clearer, more specific description of their risk profiles in selected countries.

Methods

Study Design

This pilot study employed a secondary data analysis design to refine the INFORM Risk Index and redefine the risks for vulnerable groups. The study utilized existing data sheets in the form of Excel files, which also contain built-in formulas available online.³¹⁷

Study Population

The pilot study focused on the total female population and children aged 0-14 years in the countries. The inclusion of females and children aged 0-14 years in the INFORM Severity Index is justified due to their unique vulnerabilities during crises, which are often overlooked in broader assessments. General vulnerability indicators typically assess broad and population-level categories such as economic status,

human development index, literacy rate, displacement, access to water and sanitation, etc., capturing the average risk across the entire population. However, such population-level indicators can mask specific vulnerabilities faced by females and children aged 0-14 years. For example, educational metrics might show general literacy at population level but fail to highlight gender disparities.

We specifically selected 67 countries across the Eastern Mediterranean Region of the World Health Organization, South Asia, and Sub-Saharan Africa, covering North, East, West, and Central regions. The selection of the regions is based on a systematic approach to ensuring a comprehensive assessment of humanitarian risks and vulnerabilities. Many selected regions have recently experienced significant humanitarian crises driven by natural disasters, armed conflicts, or severe economic downturns, making them particularly relevant for this study. This targeted selection ensures that the study focuses on areas most in need of detailed risk and vulnerability assessments, providing valuable insights into effective humanitarian response planning. We did not exclude any country in the chosen regions if the country has a "high" income level or if the original index rating was "very low" or "low."

INFORM Risk Index

The main equation for the index is: $\text{Risk} = \text{Hazard and Exposure}^{1/3} \times \text{Vulnerability}^{1/3} \times \text{Lack of coping capacity}^{1/3}$.³¹⁴ These dimensions are calculated based on 76 indicators and using population data from 2015 to 2023. The Index is scored on a scale from 0.0 to 10.0, where lower values indicate better performance in managing humanitarian risk, and higher values indicate worse performance. Based on the scores derived from the equation, the countries are classified as very low (threshold: 0.0 to 2.1), low (threshold: 2.2 to 3.1), medium (threshold: 3.2 to 4.8), high (threshold: 4.9 to 6.7) and very high (threshold: 6.8 to 10.0).³¹⁷ Each of these dimensions is further divided into specific categories and components to provide a detailed assessment framework for humanitarian risk.³¹⁴ The hazard and exposure dimensions are divided into Natural and Human categories.³¹⁴ The Natural category includes components such as earthquakes, floods, tsunamis, tropical cyclones, droughts, and epidemics.³¹⁴ The Human category consists of current conflict intensity and projected conflict risk.³¹⁴ The vulnerability dimension is categorized into socio-economic and vulnerable groups.³¹⁴ The socio-economic category includes

components like development & deprivation (50%), inequality (25%), and aid dependency (25%).³¹⁴ The vulnerable groups category encompasses uprooted people and other vulnerable groups. The lack of coping capacity dimension is split into Institutional and Infrastructure categories.³¹⁴ The institutional category includes components such as Disaster Risk Reduction (DRR) and governance. The infrastructure category comprises Communication, Physical Infrastructures, and Access to Health System.³¹⁴ Based on the scores, countries are ranked between 1 and 191, one being poorly ranked and the worst performing country.³¹⁷ The original index, data used in the calculation, data sources, and all the formulas are open-source and available on DRMKC's official website.³¹⁷

Approach

Recalibrating indicators for female gender and children

For this pilot study, we classified the 76 indicators into three broad categories based on a thorough review of the original index. These categories are: 1) Indicators where gender-disaggregated data is available from different data sources, therefore, can be changed and used as a proxy for our population of interest 2) Indicators that are not explicitly disaggregated but can be calculated for our target population using supporting literature based on the factor derived from the proportion of women and children affected by different types of disasters, and 3) Indicators that are not sensitive to gender, which were therefore not changed. **Table 1 provides a description of the 76 indicators and the methodology adopted.**

Table 1 | Description of 76 indicators and methodology adopted

Dimension	Indicators	Year	Unit	Methodology adopted for pilot study
Hazard and exposure	Physical exposure to earthquake MMI VI	2023	Number / Year	Indicators not changed
	Physical exposure to earthquake MMI VIII	2023	Number / Year	Indicators not changed
	Annual Expected Exposed People to River Floods	2023	Number / Year	Women and children are at more risk: The original number reported was multiplied by 0.75
	Annual Expected Exposed People to Tsunamis	2023	Number / Year	Women and children are at more risk: The original number reported was multiplied by 0.75
	Annual Expected Exposed People to Cyclone's Wind SS1	2023	Number / Year	Women and children are at more risk: The original number reported was multiplied by 0.75
	Annual Expected Exposed People to Cyclone's Wind SS3	2023	Number / Year	Women and children are at more risk: The original number reported was multiplied by 0.75
	Annual Expected Exposed People to Coastal Floods	2023	Number / Year	Women and children are at more risk: The original number reported was multiplied by 0.75
	Total affected by Drought	1988-2022	Number / Year	Women and children are at more risk: The original number reported was multiplied by 0.75
	Frequency of Drought events	1988-2022	%	Indicators not changed
	Agriculture Drought probability	1989-2023	%	Indicators not changed
	Population exposed to CCHF (zoonoses)	2015	Number	Changed according to population denominator of our interest
	Population exposed to EVD (zoonoses)	2015	Number	Changed according to population denominator of our interest
	Population exposed to Lassa Fever (zoonoses)	2015	Number	Changed according to population denominator of our interest
	Population exposed to MVD (zoonoses)	2015	Number	Changed according to population denominator of our interest
	Populations at risk of Plasmodium vivax malaria (vector borne)	2020	Number	Changed by multiplying prevalence with population denominator of our interest
	% of Populations at risk of Plasmodium vivax malaria (vector borne)	2020	%	Indicators not changed
	Populations at risk of Plasmodium falciparum malaria (vector borne)	2020	Number	Changed by multiplying prevalence with population denominator of our interest
	% of Populations at risk of Plasmodium falciparum malaria (vector borne)	2020	%	Indicators not changed
	Population exposed to Zika (vector borne)	2015	Number	Changed according to population denominator of our interest
	Population at Risk to Aedes (vector borne)	2015	Number	Changed according to population denominator of our interest
	Population exposed to Dengue (vector borne)	2015	Number	Changed according to population denominator of our interest
	Population density (people per sq. km of land area)	2020	people/km sq	Indicators not changed
	Urban population growth (annual %)	2022	%	Indicators not changed: Data searched but not reported for population of interest
	Population living in urban areas (%)	2022	%	Indicators not changed: Data searched but not reported for population of interest
	Household size	2008-2021	Number	Indicators not changed
	People practicing open defecation (% of population)	2014-2020	%	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	People with basic handwashing facilities including soap and water (% of population)	2014-2020	%	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	Number of vets	2015-2019	Number	Indicators not changed
	IHR capacity score: Food safety	2019-2020	%	Indicators not changed
	Population living in slums (% of urban population)	2020	%	Indicators not changed: Data searched but not reported for population of interest
	Children under 5 (% of population)	2023	%	Indicators not changed
	Highly Violent Conflict probability	2023	%	Indicators not changed
	National Power Conflict Intensity (Highly Violent)	2022	Index	Indicators not changed
	Subnational Conflict Intensity (Highly Violent)	2022	Index	Indicators not changed
Vulnerability	Human Development Index	2021	Index	Change to female HDI
	Multidimensional Poverty Index	2011-2021	Index	Indicators not changed
	Humanitarian Aid (FTS)	2021-2023	USD Million	Indicators not changed
	Development Aid (ODA)	2020	USD Million	Indicators not changed
	Development Aid (ODA)	2021	USD Million	Indicators not changed
	Net ODA received (% of GNI)	2019-2021	% of GNI	Indicators not changed
	Volume of remittances (in USD) as a proportion of total GDP (%)	2020-2022	%	Indicators not changed
	Mortality rate, under-5	2021	per 1,000 live births	Indicators not changed
	U5 Under weight	2010-2021	%	Indicators not changed
	Incidence of Tuberculosis	2021	per 100,000 people	Indicators not changed
	Estimated number of people living with HIV - Adult (>15) rate	2021	%	Indicators not changed
	Incidence of HIV (per 1,000 uninfected population ages 15-49)	2021	per 1,000 people	Indicators not changed
	Malaria incidence per 1,000 population at risk	2021	per 1,000 people	Indicators not changed
	Number of people requiring interventions against neglected tropical diseases	2021	Number	Changed according to population denominator of our interest
	Gender Inequality Index	2021	Index	Indicators not changed
	Income Gini coefficient	2009-2022	Index	Indicators not changed
	People affected by Natural Disasters	2021	Number	Women and children are at more risk: The original number reported was multiplied by 0.75
	People affected by Natural Disasters	2022	Number	Women and children are at more risk: The original number reported was multiplied by 0.75
	People affected by Natural Disasters	2023	Number	Women and children are at more risk: The original number reported was multiplied by 0.75
	Internally displaced persons (IDPs)	2023	Number	Women and children are at more risk: The original number reported was multiplied by 0.66
	Refugees and asylum-seekers by country of asylum	2023	Number	Women and children are at more risk: The original number reported was multiplied by 0.66
	Returned Refugees	2023	Number	Women and children are at more risk: The original number reported was multiplied by 0.66

	Average Dietary Energy Supply Adequacy	2023	%	Indicators not changed
	Prevalence of Undernourishment	2023.0	%	Indicators not changed
Lack of coping capacity	HFA Scores Last recent	2013-2015	Index	Indicators not changed
	Government Effectiveness	2021	Index	Indicators not changed
	Corruption Perception Index	2022	Index	Indicators not changed
	Access to electricity	2021	%	Indicators not changed
	Adult literacy rate	2011-2021	%	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	Individuals using the Internet	2017-2021	%	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	Mobile cellular subscriptions	2020-2021	per 100 people	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	Road length	2014	km	Indicators not changed
	People using at least basic sanitation services (% of population)	2015-2020	%	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	People using at least basic drinking water services (% of population)	2016-2020	%	Changed if indicator reported for population of interest. (Women indicator used as proxy for children)
	Physicians Density	2012-2020	per 10,000 people	Indicators not changed
	Proportion of the children with access to 3 doses of diphtheria-tetanus-pertussis	2019-2022	%	Indicators not changed
	Proportion of the children with access to measles-containing-vaccine second dose	2019-2022	%	Indicators not changed
	Proportion of the children with access to pneumococcal conjugate 3rd dose	2019-2022	%	Indicators not changed
	Current health expenditure per capita	2015-2021	current int USD PPP	Indicators not changed
	Maternal Mortality Ratio (modeled estimate)	2020	per 100,000 live births	Indicators not changed
Others	GDP per capita (current US\$)	2020-2022	current USD	Indicators not changed
	Land area (sq. km)		sq. Km	Indicators not changed

Indicators that were changed for this pilot were: adult literacy rate, % of female population, mobile cellular subscriptions, people practicing open defecation (% of the population), people with basic handwashing facilities including soap and water (% of the population), Human Development Index, people using at least basic sanitation services (% of the population) and people using at least basic drinking water services (% of the population). When the indicator data for the population of interest was unavailable for the specified time period in the portals that we explored,^{345–348} we retained the original reported values to ensure consistency in our analysis.³¹⁷ Given that most children aged 0-14 years (all genders) depend on their mothers, most indicators were explicitly examined for the female population and used as proxy indicators for children as well.

Data on indicators representing the population exposed to disasters and conflict were calculated by multiplying a standardized factor, ranging from 0.66 to 0.75.^{318,338,349–352} This factor was derived from an extensive literature review and reports published by the Internal Displacement Monitoring Centre, United Nations Office for the Coordination of Humanitarian Affairs (OCHA) the United Nations Development Programme (UNDP), World Bank Group, European Civil Protection and ReliefWeb.^{173,318,338,348–354} These indicators were: annual expected exposed people to river floods, annual expected exposed people to tsunamis, annual, expected exposed people to cyclone's, wind Saffir-Simpson (SS)1, annual expected exposed people to cyclone's wind SS3, annual expected exposed people to coastal floods, total affected by drought, people affected by natural disasters, For this pilot study, we classified the indicators into three broad categories based on a thorough review of the original index. These categories are: 1) Indicators that can be specifically searched for the female population at the country level using various data sources, 2) Indicators that are not explicitly gender-disaggregated but can be calculated for our target population using supported literature and specific factors, and 3) Indicators that are more general and remain constant without any modifications, internally displaced persons (IDPs), refugees and asylum-seekers by country of asylum, and returned refugees. Moreover, for countries that are top priorities under Humanitarian Action, we obtained the indicator of the population needing humanitarian assistance due to complex emergencies, including IDPs where applicable. The populations at risk of plasmodium vivax

malaria (vector-borne) and plasmodium falciparum malaria (vector-borne) were calculated for target groups based on the prevalence reported in the original index.³¹⁷

Indicators that were kept constant, as they appeared in the original index are:³¹⁷ physical exposure to earthquake modified Mercalli intensity (MMI) VI, physical exposure to earthquake MMI VIII, frequency of drought events, agriculture drought probability, number of vets, IHR capacity score: food safety, population living in slums (% of urban population), children under 5 (% of population), highly violent conflict probability, national power conflict intensity (highly violent), subnational conflict intensity (Highly Violent), multidimensional Poverty Index, humanitarian aid (FTS), development aid (ODA), net ODA received (% of GNI), volume of remittances (in USD) as a proportion of total GDP (%), under-five mortality rate, under-five underweight, incidence of tuberculosis, estimated number of people living with HIV - adult (>15) rate, Incidence of HIV (per 1,000 uninfected population ages 15-49), malaria incidence per 1,000 population at risk, average dietary energy supply adequacy, prevalence of undernourishment, HFA scores last recent, government effectiveness, corruption perception index, access to electricity, road length, physicians density, proportion of the target population with access to 3 doses of diphtheria-tetanus-pertussis (DTP3) (%), Proportion of the target population with access to measles-containing-vaccine second-dose (MCV2) (%), Proportion of the target population with access to pneumococcal conjugate 3rd dose (PCV3) (%), current health expenditure per capita, maternal mortality ratio (modeled estimate), GDP per capita (current US\$) and land area (sq. km).

Based on the INFORM Severity Index methodology, the socio-demographic indicators were adjusted for broader population vulnerabilities by including specific indicators that capture unique vulnerabilities. The methodology uses distinct indicators for females, such as maternal mortality rates and gender inequality indices, and for children, such as child malnutrition rates. These indicators measure different aspects of vulnerability, ensuring that each group's specific risks are accurately reflected without overlapping. Furthermore, the methodology employs both arithmetic and geometric averages for aggregating indicators. The geometric average rewards higher scores, ensuring that significant vulnerabilities are weighed more. This aggregation method prevents redundancy and overlaps, effectively mitigating multi-

collinearity risk. Therefore, using indicators for females and children aged 0-14 years in the INFORM Severity Index is methodologically sound and does not result in double counting. Each indicator uniquely contributes to the overall assessment, ensuring an accurate and comprehensive evaluation of vulnerabilities.

Adjusting the population denominator

The original index used the country's total population in the calculation. Therefore, we adjusted the population denominator using World Bank population data.³⁵⁵ We calculated the cumulative population by adding the total female population (including female population 0-14 years) and male children aged 0 to 14 years for the years from 2013 to 2023.

Data sources

We explored several data portals, such as United Nations Women—Women Count, the World Bank's Gender Data Portal, the Demographic Health Survey's gender-related data, and Our World in Data.^{345–348}

Index calculation

Using the INFORM Risk 2024 version 067 worksheet, which contains all necessary formulas available online, the index for the population of our interest was automatically calculated by changing specific indicators and the population denominator. This involved changes in scores for hazard and exposure, vulnerability, and lack of coping capacity specifically for our population of interest. Recalculations were done automatically to ensure accuracy and consistency with the original methodology.

Results

Among the 67 countries studied, 13 (19.4%) were originally classified as a 'very high' and 18 (26.9%) were 'high'. Countries with a 'very high' original risk index included Afghanistan, Burkina Faso, Central African Republic, Chad, Congo DR, Ethiopia, Mali, Somalia, South Sudan, Sudan, Syria, Uganda, and Yemen. Additionally, countries with a 'high' original risk index included Angola, Bangladesh, Burundi, Cameroon, Congo, Djibouti, Egypt, Eritrea, India, Iran, Iraq, Kenya, Madagascar, Mozambique, Niger, Nigeria, Pakistan and Tanzania. In our pilot study, six countries were reclassified as 'very high' from 'high'

score i.e., Cameroon, Iraq, Kenya, Mozambique, Niger, and Nigeria. Libya reclassified to ‘high’ from ‘medium’ score. As a result, 19 (28.3%) countries appeared under ‘very high’ risk for the population of interest and 13 (19.4%) reclassified as ‘high’.

Table 2 presents a detailed description of changes in the scores, classification and ranking among 67 countries.

Table 2 | Change in Countries INFORM Risk Index and Ranking for population of interest in the pilot

Country	INFORM Risk Index [‡]		Risk Classification [§]	Countries Ranking [¶]		
	Original	Updated		Original	Updated	Difference
Countries with 0.6 level increase in index						
Madagascar	5.5	6.1	High	27	25	2
Zimbabwe	4.1	4.7	Medium	65	45	20
Countries with 0.5 level increase in index						
Pakistan	6.1	6.6	High	23	23	0
Countries with 0.4 level increase in index						
Bhutan	2.8	3.2	Low to Medium	124	98	26
Djibouti	4.9	5.3	High	37	30	7
Mali	6.8	7.2	Very High	15	11	4
Nepal	4.1	4.5	Medium	65	53	12
Saudi Arabia	3.6	4.0	Medium	81	74	7
Countries with 0.3 level increase in index						
Algeria	3.6	3.9	Medium	81	76	5
Bangladesh	5.7	6.0	High	25	26	-1
Burundi	5.6	5.9	High	26	27	-1
India	5.3	5.6	High	29	28	1
Niger	6.6	6.9	High to Very High	19	16	3
Syria	7.2	7.5	Very High	9	9	0
Countries with 0.2 level increase in index						
Afghanistan	8.1	8.3	Very High	4	4	0
Cameroon	6.6	6.8	High to Very High	19	18	1
Chad	7.8	8.0	Very High	5	5	0
Eritrea	6.0	6.2	High	24	24	0
Ethiopia	7.0	7.2	Very High	10	12	2
Guinea	4.5	4.7	Medium	50	45	5
Iran	5.4	5.6	High	28	28	0
Iraq	6.7	6.9	High to Very High	16	16	0
Kenya	6.6	6.8	High to Very High	19	18	1
Lebanon	4.1	4.3	Medium	65	63	2
Morocco	3.6	3.8	Medium	81	79	2
Nigeria	6.6	6.8	High to Very High	19	18	1
Palestine	3.7	3.9	Medium	78	76	2
Sierra Leone	4.2	4.4	Medium	62	56	6
Somalia	8.5	8.7	Very High	2	2	0
Countries with 0.1 level increase in index						
Angola	5.2	5.3	High	32	30	2
Benin	4.3	4.4	Medium	58	56	2
Burkina Faso	7.0	7.1	Very High	12	13	-1
Central African Republic	8.7	8.8	Very High	1	1	0
Congo	5.0	5.1	High	36	35	1
Congo DR	7.7	7.8	Very High	6	6	0
Egypt	4.9	5.0	High	37	38	-1
Gabon	3.2	3.3	Medium	97	94	3
Gambia	3.6	3.7	Medium	81	82	-1
Ghana	3.5	3.6	Medium	91	85	6
Liberia	4.5	4.6	Medium	50	49	1
Libya	4.8	4.9	Medium to High	40	39	1
Mozambique	6.7	6.8	High to Very High	16	18	-2
Oman	2.5	2.6	Low	139	132	7
Rwanda	4.2	4.3	Medium	62	63	-1
Seychelles	1.5	1.6	Very Low	182	179	3
South Sudan	8.5	8.6	Very High	2	3	-1
Sudan	7.3	7.4	Very High	8	10	-2
Tanzania	5.1	5.2	High	33	34	-1
Togo	4.3	4.4	Medium	58	56	2
Tunisia	3	3.1	Low	110	105	5
Yemen	7.5	7.6	Very High	7	7	0
Countries with no change in index						
Bahrain	1.4	1.4	Very Low	184	184	0
Comoros	3.3	3.3	Medium	94	94	0
Equatorial Guinea	3.1	3.1	Low	104	105	-1
Jordan	3.8	3.8	Medium	76	79	-3
Kuwait	2.5	2.5	Low	139	140	-1
Malawi	4.4	4.4	Medium	54	56	-2
Maldives	2.2	2.2	Low	154	154	0
Mauritania	4.3	4.3	Medium	58	63	-5
Mauritius	2.1	2.1	Very Low	157	157	0
Qatar	1.4	1.4	Very Low	184	184	0
Sao Tome and Principe	2.6	2.6	Low	132	132	0
Senegal	4.1	4.1	Medium	65	69	-4
Sri Lanka	3.1	3.1	Low	104	105	-1
Uganda	7.0	7.0	Very High	12	15	-3
United Arab Emirates	1.7	1.7	Very Low	175	175	0

Countries are listed in order of maximum difference from zero.
Changes in risk classification are presented as new classifications in 'red'

[‡] Index ranged 0-10

[§] Classified as Very Low, Low, Medium, High, and Very High

[¶] Countries were ranked between 1-191. 1 being most inferior

The change in score varied from 0.1 to 0.6 in 52 (77.6%) countries and remained unchanged in 15 (22.4%) countries. The two countries which showed highest change of 0.6-point in the score include Madagascar where the risk index rose from 5.5 to 6.1, resulting in a drop in the ranking from position 27 to position 25 and Zimbabwe which showed an increase in risk index from 4.1 to 4.7, leading to a fall in the ranking from position 65 to position 45. In both the countries, there was no change in the risk classification. Pakistan is the only country with 0.5-point increase in their risk index, from 6.1 to 6.6, maintaining its ranking at position 23. Further, six countries showed a 0.4-point increase: Bhutan's risk index increased from 2.8 to 3.2, resulting in a change in ranking from position 124 to position 98, Djibouti's risk index rose from 4.9 to 5.3 with change in ranking from 37 to 30. Mali had an increase in its risk index from 6.8 to 7.2 with shift of ranking from 15 to 11. Nepal's index increased from 4.1 to 4.5, leading to lower the ranking from 65 to 53 and Saudi Arabia's index rose from 3.6 to 4.0, resulting in a ranking shift from 81 to 74. Six countries showed 0.3-point increases in their risk indices. Algeria's index rose from 3.6 to 3.9 with change ranking from 81 to 76. Bangladesh had increase in its index from 5.7 to 6.0, with a slight ranking change from 25 to 26. Burundi's index increased from 5.6 to 5.9, resulting in a ranking alter from 26 to 27. India's index rose from 5.3 to 5.6 with a slight switch in ranking from 29 to 28. Niger had an increase in its index from 6.6 to 6.9, leading to a ranking 16 from 19. Syria's index increased from 7.2 to 7.5, maintaining its ranking at 9. Total 15 Countries showed change of 0.2-point included: Afghanistan, Cameroon, Chad, Ethiopia Eritrea, Guinea, Iran, Iraq, Kenya, Lebanon, Morocco, Nigeria, Palestine, Sierra Leone, and Somalia. Moreover, 22 countries had 0.1-point change which include Angola, Benin, Burkina Faso, Central African Republic, Congo, Congo DR, Egypt, Gabon, Gambia, Ghana, Liberia, Libya, Mozambique, Oman, Rwanda, South Sudan, Sudan, Tanzania, Togo, Tunisia, Yemen. The remaining 22 countries showed no change in their risk indices. Although, few countries showed changed in ranking, such as Equatorial Guinea from 104 to 105, Jordan from 76 to 79, Kuwait from 139 to 140, and Mauritania from 58 to 63 (**Table 2**).

The changes were mainly driven by adjustments in the dimensions related to hazard and exposure i.e., number exposed to natural and human-made disasters or number expected to be exposed, vulnerability of the population and lack of coping capacity for population of interest. Hazard and exposure increased in 16 (23.9%) countries, ranging from 0.1 to 0.4, decreased in 15 (22.4%) countries, ranging from 0.1 to 0.2 and remained unchanged in 36 (53.7%) countries. Vulnerability increased in 48 (71.6%) countries, ranging from 0.1 to 2.3, decreased in 3 (4.5%) countries, ranging from 0.1 to 0.3 and remained unchanged in 16 (23.9%) countries. The countries with the highest change in vulnerability ranged from 1.0 to 2.3 and included Madagascar, Mali, Pakistan, Togo, Zambia, Zimbabwe. The lack of coping capacity for the target population increased in 52 (77.6%) countries, decreased in only one country and remained unchanged in 14 (20.9%) countries. Bangladesh, Bhutan, India, Nepal, and Pakistan are the top countries experiencing an increase in the score for lack of coping capacity.

Table 3 presents a detailed overview of changes in score of the three dimensions i.e., hazard and exposure, vulnerability and lack of coping capacity.

Table 3 Change in Hazar and Exposure, Vulnerability and Lack of Coping Capacity																		
	Hazards and exposure		<i>Natural</i>		<i>Human</i>		Vulnerability		<i>Socio-economic</i>		<i>Vulnerable groups</i>		Lack of coping capacity		<i>Institutional</i>		<i>Infrastructure</i>	
	New	Old	<i>New</i>	<i>Old</i>	<i>New</i>	<i>Old</i>	New	Old	<i>New</i>	<i>Old</i>	<i>New</i>	<i>Old</i>	New	Old	<i>New</i>	<i>Old</i>	<i>New</i>	<i>Old</i>
	(0-10)						(0-10)						(0-10)					
Afghanistan	8.7	8.7	5.8	5.7	10.0	10.0	8.8	8.5	8.7	8.3	8.9	8.6	7.5	7.1	7.2	7.2	7.8	7.0
Algeria	4.0	3.8	3.5	3.2	4.4	4.4	3.2	2.8	2.8	2.4	3.5	3.2	4.7	4.4	5.0	5.0	4.4	3.7
Angola	4.2	4.2	2.9	2.9	5.3	5.3	5.1	5.1	5.9	5.8	4.1	4.3	6.9	6.7	6.1	6.1	7.5	7.3
Bahrain	0.9	0.9	1.5	1.5	0.3	0.3	1.0	1.0	0.9	0.9	1.1	1.0	3.3	2.8	4.2	4.2	2.3	1.2
Bangladesh	6.9	6.9	8.2	8.2	4.9	4.9	5.7	5.5	5.0	4.6	6.4	6.2	5.4	4.8	5.0	5.0	5.8	4.5
Benin	2.4	2.5	2.9	3.1	1.8	1.8	5.2	4.8	6.7	6.3	3.1	2.8	6.8	6.6	5.6	5.6	7.8	7.4
Bhutan	1.7	1.5	3.0	2.8	0.1	0.1	3.7	3.7	5.6	5.6	1.2	1.2	5.0	4.0	3.9	3.9	5.9	4.0
Burkina Faso	6.8	6.9	2.4	2.6	9.0	9.0	8.2	7.9	7.8	7.5	8.6	8.3	6.5	6.4	4.7	4.7	7.8	7.7
Burundi	4.2	4.1	3.2	3.0	5.0	5.0	7.2	6.4	7.3	7.2	7.1	5.4	6.9	6.7	6.3	6.3	7.4	7.1
Cameroon	7.2	7.2	3.7	3.8	9.0	9.0	7.3	6.8	6.1	5.9	8.2	7.5	6.0	5.9	4.9	4.9	6.9	6.7
Central African Republic	8.1	8.1	3.0	3.2	10.0	10.0	9.3	9.1	9.1	8.9	9.5	9.2	8.9	8.8	8.0	8.0	9.5	9.4
Chad	7.1	7.1	3.5	3.6	9.0	9.0	8.2	7.8	7.3	7.1	8.9	8.3	8.7	8.7	8.0	8.0	9.3	9.2
Comoros	1.0	1.1	1.9	2.0	0.1	0.1	4.9	4.8	7.2	7.0	1.4	1.4	7.2	7.1	8.1	8.1	6.0	5.9
Congo	3.0	3.0	3.1	3.2	2.8	2.8	5.8	5.7	5.6	5.5	5.9	5.8	7.6	7.5	8.0	8.0	7.2	7.0
Congo DR	7.2	7.2	3.9	4.0	9.0	9.0	8.1	7.9	6.8	6.7	9.0	8.8	8.1	8.0	7.9	7.9	8.3	8.1
Djibouti	3.6	3.2	5.3	4.7	1.3	1.3	6.2	5.9	6.4	6.1	5.9	5.7	6.6	6.1	6.2	6.2	6.9	6.0
Egypt	6.5	6.5	6.1	6.1	6.9	6.9	4.1	3.9	3.9	3.5	4.2	4.2	4.8	4.6	5.4	5.4	4.1	3.6
Equatorial Guinea	1.3	1.3	2.3	2.3	0.1	0.1	3.3	3.3	4.1	4.1	2.5	2.5	7.0	7.0	7.8	7.8	6.1	6.0
Eritrea	7.1	7.0	3.3	3.1	9.0	9.0	4.3	4.1	5.9	5.7	2.1	2.1	7.8	7.7	8.1	8.1	7.5	7.3
Ethiopia	8.2	7.2	7.0	3.7	9.0	9.0	7.8	7.2	6.3	6.1	8.9	8.0	6.8	6.7	4.6	4.6	8.2	8.1
Gabon	1.7	1.7	3.1	3.1	0.1	0.1	3.6	3.4	4.4	4.2	2.6	2.6	6.0	5.9	6.8	6.8	5.1	4.8
Gambia	1.6	1.5	2.9	2.7	0.1	0.1	5.9	5.8	7.6	7.4	3.4	3.5	5.5	5.4	4.8	4.8	6.2	6.0
Ghana	2.1	2.2	3.0	3.2	1.1	1.1	4.2	4.0	5.5	5.2	2.6	2.5	5.2	4.8	4.5	4.5	5.8	5.1
Guinea	2.7	2.8	3.5	3.7	1.8	1.8	5.4	4.7	6.5	6.2	4.1	2.8	7.2	6.9	6.1	6.1	8.1	7.6
India	7.5	7.4	7.9	7.7	7.0	7.0	4.7	4.7	4.6	4.3	4.8	5.0	4.9	4.2	3.5	3.5	6.0	4.8
Iran	7.3	7.4	6.5	6.6	8.0	8.0	5.1	4.8	3.2	2.6	6.6	6.5	4.8	4.5	5.8	5.8	3.6	2.9
Iraq	8.6	8.6	5.6	5.6	10.0	10.0	5.5	5.5	4.0	3.9	6.7	6.7	6.8	6.5	8.1	8.1	5.0	4.0
Jordan	2.0	2.1	3.2	3.3	0.7	0.7	6.3	6.2	4.1	3.8	7.8	7.8	4.4	4.2	5.5	5.5	3.0	2.7
Kenya	8.3	8.3	4.1	4.1	10.0	10.0	6.3	5.9	5.7	5.6	6.8	6.1	6.0	5.8	5.1	5.1	6.7	6.5
Kuwait	1.4	1.4	2.3	2.3	0.3	0.3	3.0	3.0	1.5	1.7	4.2	4.2	3.8	3.7	5.5	5.5	1.5	1.2
Lebanon	2.3	2.1	3.8	3.5	0.5	0.5	7.1	7.1	5.0	4.9	8.5	8.5	5.0	4.5	6.2	6.2	3.4	2.3
Liberia	2.1	2.1	3.7	3.8	0.1	0.1	6.0	5.7	7.6	7.2	3.6	3.7	7.9	7.8	7.6	7.6	8.1	8.0
Libya	3.8	4.0	2.8	3.3	4.6	4.6	4.6	4.0	3.1	3.0	5.8	4.9	6.8	6.8	8.4	8.4	4.1	4.4
Madagascar	4.0	4.0	5.5	5.6	2.0	2.0	7.7	5.7	6.8	6.7	8.4	4.4	7.3	7.1	6.0	6.0	8.3	8.0
Malawi	2.2	2.2	3.9	3.9	0.2	0.2	6.2	6.2	6.5	6.3	5.8	6.0	6.4	6.3	5.3	5.3	7.3	7.1
Maldives	1.4	1.5	2.7	2.8	0.0	0.0	1.9	2.0	2.8	2.9	1.0	1.0	3.8	3.7	5.5	5.5	1.6	1.4
Mali	7.2	7.2	3.7	3.8	9.0	9.0	7.9	6.7	7.3	7.1	8.4	6.3	6.5	6.5	6.1	6.1	6.8	6.8
Mauritania	2.2	2.3	3.9	4.0	0.2	0.2	5.8	5.6	6.7	6.3	4.6	4.8	6.1	6.1	5.8	5.8	6.4	6.4
Mauritius	1.7	1.7	3.0	3.0	0.1	0.1	1.9	1.9	3.1	3.0	0.6	0.6	2.8	2.8	3.7	3.7	1.8	1.7
Morocco	3.4	3.2	4.5	4.3	2.0	2.0	3.3	3.2	4.4	4.0	2.0	2.2	4.8	4.7	5.7	5.7	3.8	3.4
Mozambique	6.1	6.1	4.9	5.0	7.0	7.0	8.1	7.9	7.8	7.7	8.4	8.0	6.3	6.2	4.6	4.6	7.6	7.4
Nepal	3.2	3.2	5.1	5.1	0.6	0.6	4.7	4.1	5.6	5.3	3.7	2.7	6.0	5.4	6.1	6.1	5.9	4.5
Niger	5.2	5.3	3.3	3.4	6.7	6.7	8.4	7.6	7.7	7.5	9.0	7.6	7.4	7.3	5.9	5.9	8.4	8.3
Nigeria	7.4	7.4	4.5	4.6	9.0	9.0	6.7	6.4	5.7	5.6	7.5	7.0	6.4	6.2	5.0	5.0	7.5	7.1
Oman	2.8	2.7	4.9	4.7	0.1	0.1	1.6	1.4	2.2	1.9	1.0	0.9	4.1	4.1	5.4	5.4	2.4	2.4
Pakistan	7.2	7.2	7.3	7.3	7.0	7.0	6.9	5.9	5.7	5.3	7.8	6.4	5.9	5.3	5.3	5.3	6.4	5.2
Palestine	2.3	2.1	2.1	1.7	2.5	2.5	6.3	6.1	4.2	3.8	7.7	7.7	4.2	4.0	6.1	6.1	1.5	0.9
Qatar	1.0	0.9	1.8	1.7	0.1	0.1	1.0	1.2	0.8	1.2	1.1	1.2	2.6	2.6	4.1	4.1	0.7	0.8
Rwanda	2.6	2.5	2.9	2.8	2.2	2.2	6.0	5.9	6.7	6.5	5.1	5.3	5.2	5.0	3.9	3.9	6.2	6.0
Sao Tome and Principe	0.7	0.7	1.3	1.4	0.0	0.0	4.9	4.9	5.9	5.9	3.6	3.6	5.3	5.3	6.0	6.0	4.6	4.5
Saudi Arabia	6.2	6.2	3.5	3.4	8.0	8.0	3.1	2.2	3.2	1.1	2.9	3.1	3.3	3.3	4.5	4.5	1.8	1.8
Senegal	2.5	2.6	4.0	4.1	0.8	0.8	5.0	4.9	6.6	6.4	2.7	2.9	5.4	5.3	5.0	5.0	5.7	5.6
Seychelles	1.6	1.2	2.9	2.2	0.0	0.0	0.9	1.0	1.3	1.5	0.4	0.4	2.7	2.6	3.7	3.7	1.5	1.4
Sierra Leone	2.1	2.1	3.7	3.7	0.1	0.1	5.9	5.7	7.5	7.1	3.6	3.8	6.8	6.4	5.2	5.2	7.9	7.4
Somalia	8.8	8.9	6.5	6.6	10.0	10.0	8.5	8.2	8.1	7.4	8.8	8.8	8.7	8.5	9.0	9.0	8.3	8.0
South Sudan	7.2	7.2	3.7	3.8	9.0	9.0	9.2	9.2	9.1	9.1	9.2	9.2	9.5	9.4	9.3	9.3	9.6	9.5
Sri Lanka	2.7	2.7	4.1	4.0	1.1	1.1	2.7	2.7	3.1	2.9	2.3	2.4	3.9	3.9	4.7	4.7	3.0	2.9
Sudan	7.2	7.2	3.7	3.8	9.0	9.0	8.0	7.9	7.0	6.6	8.8	8.8	7.0	6.7	6.5	6.5	7.4	6.9
Syria	8.5	8.5	5.2	5.1	10.0	10.0	8.2	7.8	7.5	6.5	8.8	8.8	6.1	5.6	6.6	6.6	5.6	4.4
Tanzania	4.1	4.1	4.2	4.3	3.9	3.9	5.5	5.5	6.1	5.9	4.9	5.1	6.1	5.9	4.9	4.9	7.0	6.8
Togo	2.1	2.1	3.7	2.4	0.1	1.7	5.9	4.9	7.5	6.1	3.6	3.5	6.8	7.5	5.2	8.0	7.9	6.9
Tunisia	2.7	2.6	4.2	4.1	0.8	0.8	2.3	2.2	2.9	2.5	1.7	1.8	4.7	4.7	6.1	6.1	3.0	2.8
Uganda	7.2	7.2	3.8	3.8	9.0	9.0	6.9	6.9	6.5	6.3	7.3	7.4	7.0	6.9	6.8	6.8	7.1	7.0
United Arab Emirates	2.8	2.5	4.8	4.4	0.1	0.1	1.0	1.0	0.1	0.1	1.8	1.9	1.8	1.8	2.5	2.5	1.0	1.0
Yemen	6.5	6.5	4.2	4.3	8.0	8.0	8.3	8.2	8.0	7.7	8.6	8.6	8.0	7.9	8.8	8.8	6.9	6.7
Zambia	1.7	1.8	3.0	3.1	0.3	0.3	7.7	5.9	6.5	6.4	8.6	5.3	5.9	5.7	5.1	5.1	6.6	6.3
Zimbabwe	2.3	2.3	3.9	3.9	0.4	0.4	7.6	5.3	6.3	5.9	8.5	4.6	5.8	5.8	5.1	5.1	6.4	6.4

The color coding is based on the original index and any change in the score automatically change the color of the box

Furthermore, Bahrain, Mauritius, Qatar, Seychelles, and the United Arab Emirates remained in the “very low” classification, with no change in the score except for 0.1-point in Seychelles. Equatorial Guinea, Kuwait, Maldives, Oman, Sao Tome and Principe, Sri Lanka, and Tunisia originally classified as “low”, remain low with no change in score except for Oman and Tunisia with 0.1-point. Benin, Comoros, Gabon, Gambia, Ghana, Guinea, Jordan, Lebanon, Liberia, Malawi, Mauritania, Morocco, Nepal, Palestine, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Togo, Zambia, and Zimbabwe remained at “medium”. Among these Comoros, Jordan, Malawi, Mauritania, and Senegal showed no change (**Table 2**).

Discussion

When accounting for women and children aged 0-14 years, the INFORM Risk Index shifts significantly in the risk profiles of 67 countries. Whether this represented a genuine shift in risk requires further validation. The adjustment, which incorporates gender-specific indicators, provides ways to see how risk assessment and ranking change when gender and age are factored in, which could potentially impact decision-making. The recalibration of the INFORM Risk Index to specifically address the vulnerabilities of women and children has revealed substantial shifts in the risk landscape. This pilot study highlights that significant changes in risk classification are predominantly driven by increased vulnerability and diminished coping capacities, rather than exposure to hazards alone. The refined indicators shed light on the profound socio-economic and institutional challenges faced by these populations, often masked in broader assessments. These findings underscore the critical need for disaster risk management frameworks to incorporate gender-specific and age-specific data, ensuring that the heightened risks to women and children are accurately captured and addressed. Countries with originally “very high” or “high” indices, tend to show more impact on vulnerability due to preexisting disparities and poor coping mechanism to deal with complex emergencies for women and children.

Countries like Afghanistan, the Central African Republic, Somalia, and South Sudan although showed a change in index but they already had very high index of greater than 8.0. These countries have long history

of protracted conflict, political instability, severe drought, and food insecurity, and natural disasters,^{338,352} Ethiopia's significant increase in the exposure to conflict and natural disasters such as recurrent droughts, floods, and northern conflict increase the vulnerabilities and coping capacity.³⁵⁶ These compounded risks have severe implications for women and children, who are particularly vulnerable to disruptions in health services, Water Sanitation and Hygiene (WASH), nutrition, and safety.³⁵⁷ Madagascar's high hazard index reinforces the urgent need for resilient infrastructure and effective early warning systems to protect these populations from frequent cyclones and natural disasters.³⁵⁸ The rising vulnerability indices in Nigeria, Zimbabwe, and Mali highlight worsening socio-economic conditions that exacerbate disaster risks.^{338,352,359} For instance, Nigeria's increasing vulnerability aligns with findings that socio-economic disparities and inadequate social safety nets significantly heighten disaster susceptibility among women and children.^{338,352,360} Zimbabwe's escalating poverty and health inequities underscore the urgent need for enhanced social protection mechanisms,³⁵⁹ while Mali's socio-economic challenges, coupled with ongoing conflict, emphasize the necessity for integrated development and humanitarian interventions.³⁶¹ Critical gaps in institutional and infrastructural resilience are evident in countries like Madagascar and Pakistan. Madagascar's rise in its coping capacity score reflects reduced institutional ability to manage and recover from hazards,³⁶² while Pakistan's decline in institutional and infrastructural resilience highlights the need for strengthening frameworks that can enhance overall coping capacity.^{363–368} Further, Pakistan is disaster prone country and country is still not fully recovered from the impact of devastating floods in 2022, where data suggest that 80% of the affected were women and children.³⁶⁹

The recalibrated index's focus on gender and age-specific indicators has revealed critical gaps in data availability, particularly the scarcity of gender-disaggregated data. Many indicators in existing data sources do not disaggregate by gender, making it difficult to capture the unique vulnerabilities of women and children accurately. This limitation highlights the need for improved data collection practices that prioritize gender and age disaggregation, as emphasized by UN Women and other organizations advocating for gender-

sensitive data. Although not the main outcome of this pilot, this study indicated that investment in governance and institutional frameworks is vital to enhance disaster preparedness and response capabilities. Countries with significant increases in their risk indices demonstrate the urgent need for comprehensive social protection programs, improved access to healthcare and education, and economic development initiatives. These measures are essential for reducing disparities and enhancing community resilience. This targeted approach provides a better understanding of their vulnerabilities, which are often missed in broader assessments. However, the scarcity of comprehensive gender-disaggregated data remains a significant limitation. Many data sources which have provision of gender data, still have missing indicators or indicators were not available for the specified time frame.

Future research should focus on developing robust methodologies for gender-sensitive data collection and analysis to ensure that the distinct needs of women and children are fully captured and addressed in disaster risk reduction policies and practices. There is a strong need for such approaches to consider other indicators which can improve the validity of our pilot with more robustness and accuracy. To enhance the validity, robustness, and accuracy of our pilot study, it is essential to consider additional indicators grouped into several coherent categories. These include violence and conflict impact (gender-based violence and child abuse in conflict zones, accurate numbers of women and children with IDP and refugee status), environmental factors (levels of air and water pollution), educational access and outcomes (primary and secondary school enrollment), nutritional status (prevalence of stunting, underweight, and wasting among children aged 0-14 years, prevalence of undernutrition among women and adolescent girls), healthcare access (access to prenatal, skilled birth attendance, and postnatal healthcare, access to sexual and reproductive health services including menstrual hygiene and safe abortion care), social and legal protection (child marriage rates, access to social protection services, orphanhood rates and child dependency ratios, availability of mental health support services for women and children, availability of legal protection), and childcare and support services (access to childcare services). By organizing these indicators into these categories, we ensure a more coherent and

rigorous approach to improving the study's comprehensiveness with accuracy. With strongly believe the explicit inclusion of these indicators will help in better understanding the more granular needs of these vulnerable groups at the country level. Moreover, strengthening institutional capacities to manage and utilize this data effectively will be crucial in shaping responsive and inclusive disaster management strategies. Additionally, investing in governance and institutional frameworks to enhance disaster preparedness and response capabilities is essential. Comprehensive social protection programs, improved access to healthcare and education, and economic development initiatives are vital for reducing disparities and enhancing community resilience. Developing infrastructure that can withstand natural disasters and support rapid recovery is also critical, not only for immediate protection but also for long-term sustainable development.

Conclusion

In conclusion, the recalibrated INFORM Risk Index underscores the critical vulnerabilities faced by women and children in high-risk countries, emphasizing the need for targeted, gender-sensitive interventions. Addressing the specific risks will enable policymakers and humanitarian organizations to enhance resilience and reduce overall risk profiles for these vulnerable populations. This better understanding of risks and their associated consequences is essential for developing effective, inclusive, and sustainable disaster risk management strategies.

Introduction to Evidence for Global Management of Serious Bacterial Infections in Young Infants Aged 0–59 Days

Current guidelines and rationale

Serious bacterial infections (SBI) such as sepsis, pneumonia, and meningitis remain significant causes of mortality and long-term disability in infants aged 0–59 days, particularly in LMICs. The WHO and UNICEF have developed guidelines to urgently refer infants with suspected SBI to hospitals for antibiotic treatment. However, in contexts where referrals are challenging or impossible, additional guidance is necessary for community-level care, including home visits by community health workers or mobile clinics. The complexity of diagnosing SBI in newborns, compounded by the limitations of blood cultures and the growing concern of antimicrobial resistance, necessitates updated, context-specific management strategies.

Scope of systematic reviews

To support the development of updated WHO guidelines, a systematic overview was conducted to assess the existing evidence on the diagnosis and management of SBI in infants aged 0–59 days. This review aimed to identify systematic reviews that addressed the key research questions, particularly focusing on diagnostic accuracy and the effectiveness of antibiotic regimens in various settings. The results of this overview revealed significant gaps in the literature, especially concerning antibiotic regimens currently recommended in LMICs. Consequently, WHO commissioned several new systematic reviews to address these gaps. These reviews, published as a supplement at PEDIATRICS (Volume 154, Issue Supplement 1), provide critical insights that will inform global public health strategies and the development of policies to improve the care of infants with serious bacterial infections, particularly in resource-limited settings.

I was co-lead for two of the reviews:

1. Predictive Accuracy of Infant Clinical Sign Algorithms for Mortality in Young Infants Aged 0 to 59 Days:
A Systematic Review

2. Diagnostic Accuracy of Clinical Sign Algorithms to Identify Sepsis in Young Infants Aged 0 to 59 Days:
A Systematic Review and Meta-analysis

Abstract of review 1: Predictive Accuracy of Infant Clinical Sign Algorithms for Mortality in Young Infants Aged 0 to 59 Days: A Systematic Review

Context: Clinical sign algorithms are a key strategy to identify young infants at risk of mortality.

Objective: Synthesize the evidence on the accuracy of clinical sign algorithms to predict all-cause mortality in young infants 0-59 days.

Data sources: MEDLINE, Embase, CINAHL, Global Index Medicus, and Cochrane CENTRAL Registry of Trials.

Study selection: Studies evaluating the accuracy of infant clinical sign algorithms to predict mortality.

Data extraction: We used Cochrane methods for study screening, data extraction, and risk of bias assessment. We determined certainty of evidence using Grading of Recommendations Assessment Development and Evaluation.

Results: We included 11 studies examining 26 algorithms. Three studies from non-hospital/community settings examined sign-based checklists ($n = 13$). Eight hospital-based studies validated regression models ($n = 13$), which were administered as weighted scores ($n = 8$), regression formulas ($n = 4$), and a nomogram ($n = 1$). One checklist from India had a sensitivity of 98% (95% CI: 88%-100%) and specificity of 94% (93%-95%) for predicting sepsis-related deaths. However, external validation in Bangladesh showed very low sensitivity of 3% (0%-10%) with specificity of 99% (99%-99%) for all-cause mortality (ages 0-9 days). For hospital-based prediction models, area under the curve (AUC) ranged from 0.76-0.93 ($n = 13$). The Score for Essential Neonatal Symptoms and Signs had an AUC of 0.89 (0.84-0.93) in the derivation cohort for mortality, and external validation showed an AUC of 0.83 (0.83-0.84).

Limitations: Heterogeneity of algorithms and lack of external validation limited the evidence.

Conclusions: Clinical sign algorithms may help identify at-risk young infants, particularly in hospital settings; however, overall certainty of evidence is low with limited external validation.

Disclaimer: The abstract is derived from: “Shafiq Y, Fung A, Driker S, Rees CA, Mediratta RP, Rosenberg R, Hussaini AS, Adnan J, Wade CG, Chou R, Edmond KM, North K, Lee AC. Predictive Accuracy of Infant Clinical Sign Algorithms for Mortality in Young Infants Aged 0 to 59 Days: A Systematic Review. Pediatrics. 2024 Aug 1;154(Suppl 1):e2024066588E. doi: 10.1542/peds.2024-066588E. PMID: 39087802.”

Abstract of review 2: Accuracy of Clinical Sign Algorithms to Identify Sepsis in Young Infants Aged 0 to 59 Days: A Systematic Review and Meta-analysis

Context: Accurate identification of possible sepsis in young infants is needed to effectively manage and reduce sepsis-related morbidity and mortality.

Objective: Synthesize evidence on the diagnostic accuracy of clinical sign algorithms to identify young infants (aged 0-59 days) with suspected sepsis.

Data sources: MEDLINE, Embase, CINAHL, Global Index Medicus, and Cochrane CENTRAL Registry of Trials.

Study selection: Studies reporting diagnostic accuracy measures of algorithms including infant clinical signs to identify young infants with suspected sepsis.

Data extraction: We used Cochrane methods for study screening, data extraction, risk of bias assessment, and determining certainty of evidence using Grading of Recommendations Assessment Development and Evaluation.

Results: We included 19 studies (12 Integrated Management of Childhood Illness [IMCI] and 7 non-IMCI studies). The current World Health Organization (WHO) 7-sign IMCI algorithm had a sensitivity of 79% (95% CI 77%-82%) and specificity of 77% (95% CI 76%-78%) for identifying sick infants aged 0-59 days requiring hospitalization/antibiotics (1 study, N = 8889). Any IMCI algorithm had a pooled sensitivity of 84% (95% CI 75%-90%) and specificity of 80% (95% CI 64%-90%) for identifying suspected sepsis (11 studies, N = 15523). When restricting the reference standard to laboratory-supported sepsis, any IMCI algorithm had a pooled sensitivity of 86% (95% CI 82%-90%) and lower specificity of 61% (95% CI 49%-72%) (6 studies, N = 14278).

Limitations: Heterogeneity of algorithms and reference standards limited the evidence.

Conclusions: IMCI algorithms had acceptable sensitivity for identifying young infants with suspected sepsis.

Specificity was lower using a reference standard of laboratory-supported sepsis diagnosis.

Disclaimer: The abstract is derived from: Fung, A., Shafiq, Y., Driker, S., Rees, C. A., Mediratta, R. P., Rosenberg, R., Hussaini, A. S., Adnan, J., Wade, C. G., Chou, R., Edmond, K. M., North, K., Lee, A. C. (2024). Diagnostic accuracy of clinical sign algorithms to identify sepsis in young infants aged 0 to 59 days: A systematic review and meta-analysis. Pediatrics, 154(Suppl 1), S1-S20.

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