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Examining Fragility of Health Systems in Afghanistan: Development and Application of a Theoretical Framework for Fragile Health Systems

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree
in Epidemiology and Biostatistics

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Abstract

Globally, health systems face destabilization amidst conflicts and natural disasters, adversely affecting populations' well-being. Understanding domains of health system fragility remains a gap in literature, hampering effective mitigation. In protracted conflict, Afghanistan's health system offers a crucial case for studying health system fragility. This research aimed to bridge gaps in comprehending health system fragility, with research questions:

1. What is the conceptual understanding of the fragility of health systems and its relationship with resilience, and how can it be applied in Afghanistan?
2. Did the introduction of female health workers to support Maternal, Neonatal, and Child Health service delivery by Afghan Red Crescent Society's Mobile Health Teams lead to a change in service delivery outcomes?

Methods

Grounded Delphi Methodology was used to conceptualize health system fragility in Afghanistan. Quantitative approach used Interrupted Time Series analysis, validating findings through qualitative content analysis.

Key Findings

Fragility of health systems is driven by several factors, outlined through a seven-domain framework. Afghanistan's health system is primarily fragile due to its reactive and uncertain nature. Mitigating factors contributing to these fragility domains reduce fragility, as evidenced by the improved delivery of postnatal care services by Afghanistan Red Crescent Mobile Health Team following introduction of midwives, particularly in most insecure provinces.

Conclusion

Health system fragility is complex, context-dependent, intricately related to resilience of systems. Context-driven interventions show promise in improving health system fragility.

Further exploration of the conceptual framework on fragility through real-world cases can enhance our understanding of health system fragility factors and mitigation efforts.

Keywords: Fragility, Resilience, Health systems, Health systems in Afghanistan, Basic Package of Health Services, Mobile Health Teams, Afghanistan Red Crescent, Midwives, Female Health Workers, Maternal Neonatal Child Health Services

Summary for Lay Audience

This study looks at what makes health systems weak or 'fragile' and how that understanding can be applied to real-world situations. Most studies looking at the fragility of health systems in the past focused on the weakness resulting from the overall situation in which the health system was operating (contextual fragility), or they focused on what makes health systems recover after a disaster (resilience). We wanted to understand the different areas that weaken health systems and how they bounce back, focusing on Afghanistan.

We chose Afghanistan because it has had lots of conflicts, and its government has been working to improve healthcare. The Afghanistan Red Crescent (ARCS) worked with the Ministry of Public Health to help women and children in hard-to-reach places using mobile health teams. They also added more female healthcare workers in a sensitive way to improve services.

We had two main questions: First, we asked what makes healthcare systems fragile and how it relates to resilience, using Afghanistan as an example. Second, we checked if having more female healthcare workers in Afghanistan helped women and children.

To find answers, we talked to experts and used data from ARCS. We discovered seven areas linked to the fragility of health systems. In Afghanistan, the healthcare system often could not respond quickly and did not always know how to provide the best care, which made it weak. Adding more female healthcare workers, like midwives, improved some services for women, especially in areas with more conflict. We can use the information from this study to look at other situations where health systems can be weak and apply the findings from our study to find more practical solutions.

Epigraph

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَمَنْ أَحْيَاهَا فَكَأَنَّمَا أَحْيَاهَا النَّاسَ جَمِيعًا

*"And whoever saves a life, it is as though he
had saved the lives of all mankind"
(The Quran, Surah-Al-Ma'idah:32)*

Dedication

This work is dedicated to the loving memory of my father
Dr. Mohammad Abdur Rab (Dec 1949 – Aug 2015)

Thank you Dad for your wisdom, guidance, love, support,
and unwavering belief in me. And for always reminding me
that – you never fail until you stop trying...

..... and to Mom, for showing us every day what resilience looks like as we face our own fragilities.

Acknowledgements

"Alone we can do so little; together we can do so much." – Helen Keller

This dissertation, the culmination of years of research and exploration, is a testament to the collaborative efforts and support of many individuals. It is with deep gratitude that I extend my appreciation to those whose support, guidance, and encouragement made this doctoral journey possible.

First and foremost, I extend my heartfelt gratitude to my doctoral supervisor, Dr. Amardeep Thind, whose support has been the driving force behind the pursuit of this doctoral work. Dr. Thind's guidance, experience, and encouragement were instrumental in shaping the trajectory of this research and fostering my personal and professional growth. His encouragement to explore my interests, embrace new methodologies, and pursue innovative ideas expanded the horizons of this research, leading to a more comprehensive and nuanced study. Beyond the academic realm, Dr. Thind played a pivotal role in opening doors to new opportunities and avenues in the field of global health. His mentorship extended far beyond the dissertation, significantly contributing to the establishment of a meaningful career in global health for myself. I am profoundly grateful for Dr. Thind's commitment, belief in my capabilities, and the indelible mark he has left on my academic and professional journey.

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My association with the Canadian Red Cross has allowed me to foster a deeper understanding of health systems, particularly in vulnerable and fragile contexts. Initially joining as a Health Systems Impact fellow, I am profoundly grateful for the opportunity to be part of an organization where I have built meaningful relationships and continuously expanded my knowledge. The passion, empathy, and hard work displayed by my colleagues at the Canadian Red Cross never ceases to amaze me.

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Embarking on the doctoral journey is a challenging endeavour, and those who have undertaken it recognize the crucial role of a steadfast supporter, someone who holds the fort and allows the doctoral candidate to focus on their work. This demands great sacrifice. In my case, this remarkable individual is my mother, who, in her lifetime, supported not just one but two people through this rigorous process. She stood by her husband as he completed his PhD; years later, she became a pillar of strength for me. My mother has been the unwavering force behind two doctoral dissertations, and I cannot express enough gratitude for her enduring support throughout my life, especially during the completion of my doctoral work.

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List of Abbreviations

Afghanistan Red Crescent Society	ARCS
Antenatal Care services	ANC
Basic Package of Health Services	BPHS
Basic Health Centre	BHC
Community Health Workers	CHWs
Community-Based Health and First Aid	CBHFA
Canadian Red Cross Society	CRCS
Confidence Interval	CI
Document Review	DR
Grounded Delphi Method	GDM
Global Health Unit	GHU
Health Information System	HIS
Health Post	HP
Health Systems Performance Assessment Framework	HSPA
International Committee of Red Cross	ICRC
Internally Displaced Persons	IDPs
International Federation of Red Cross and Red Crescent	IFRC
International Monetary Fund	IMF
Interrupted Time Series Analysis	ITSA
Interrupted Time Series Analysis with panel data	XTITSA
Inter Quantile Range	IQR
Key Informant Interviews	KII
Knowledge Resource Nomination Worksheet	KRNW
Interrupted Time Series Analysis	ITSA
Low and Middle-Income Countries	LMICs
Millennium Development Goals	MDG
Middle East and North Africa Region	MENA

Maternal and Newborn Child Health	MNCH
Ministry of Health	MoH
Ministry of Public Health	MoPH
Mobile Health Team	MHT
Organization for Economic Co-operation and Development	OECD
Pelvic Inflammatory Disease	PID
Postnatal Care services	PNC
Red Cross and Red Crescent Movement	RCRCM
Regional Head Quarters	RHQ
Research Question	RQ
Standard Deviation	SD
Sustainable Development Goals	SDG
Uppsala Conflict Data Program	UCDP
United Nations	UN
United States Agency for International Development	USAID
Universal Health Coverage	UHC
Urinary Tract Infection	UTI
World Health Organization	WHO

Chapter 1

Introduction

Violence, according to the World Health Organization (WHO), is "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either result in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation."¹ Over 1.8 billion people live in conditions directly or indirectly associated with social or political violence, and the figure is expected to rise to 2.3 billion by 2030.² Social violence includes patterns of criminal behaviours and interpersonal or self-directed conflicts. In contrast, political violence entails using organized force to advance the position of a person or a group of people.¹ Social and political violence, over the last few decades, has rendered populations in various regions across the globe vulnerable to physical and psychological harm.³

Violence also contributes to the weakening of infrastructure and a higher risk of plunging into a 'state of fragility' over time.³ 'State of fragility' is a complex concept encompassing violence, economic hardships, and effects of environmental deterioration and disasters affecting the well-being of individuals, the majority of whom live in socially or politically violent conditions or fragile contexts.³ Driven by instability, a state of fragility stems from the destabilization of governments and social structures, disproportionate distribution of wealth, and weakening of systems and infrastructures, ultimately putting people at risk of harm and death.^{3,4}

Health is an integral part of any country's well-being and socio-economic development.⁵ Health systems can become susceptible to weakness through threats to structure (availability and accessibility of services), process (uptake of services) and outcome (physical and psychological well-being and quality of life) in fragile states.^{3,6} Violence, vulnerability, instability and lack of infrastructure impact health systems and hamper the effective delivery of essential healthcare-related services.⁷

'State of fragility' can provide the context to where health systems have already been weakened and contribute further to the deterioration of an overall milieu of weakening systems; this may not always be the case. Weakened, vulnerable or fragile health systems can also indicate the existing or future 'state of fragility.'^{1,2,8} The context and systems are two distinct concepts; therefore, it is essential to distinguish between the context within which health systems operate and the operational abilities of a system to sustain itself. A comprehensive understanding of health systems necessitates an appreciation for their operational context, encompassing factors like geographical location, socio-political dynamics, economic conditions, and the prevailing state of fragility.^{9,10}

Health systems can display resilience even within fragile environments or exhibit fragility amidst stability when confronted by crises that strain their capacities.¹⁰⁻¹² Health systems grapple with vulnerabilities from both external and internal sources. External threats emanate from economic, social, and political instability, while internal vulnerabilities arise from infrastructural deficiencies, healthcare workforce shortages, inadequate financial support, and governance issues.¹⁰ The interconnectedness of various systems means that fragility in one domain can cascade to impact health systems, while fragile health systems themselves can precipitate broader fragility.⁹

Understanding health systems mandates an awareness of their contextual dynamics—the interplay between resilience and fragility and responses to external and internal threats. The global discourse on effective approaches within fragile settings collectively emphasizes the need for a nuanced understanding of health system dynamics in complex and challenging environments.^{9,10,13,14} The concept of resiliency originates from responses to disasters and consists of distinct viewpoints.⁷ One is focused on community resilience

and emphasizes the community's capacity to recover using its inherent resources, integrating a variety of capacities like social capital and economic development.^{9,15} The other highlights the significance of critical infrastructure in building resiliency and its reliance on robust systems, redundancy, resourcefulness, and swift restoration of normalcy.^{7,10}

The understanding of health system fragility in the global context has been evolving over the last decade, with a stronger emphasis on it during and after the COVID-19 pandemic.¹⁶ While initially associated with conflict-affected contexts, the concept's application has diversified.⁹ It now encompasses local communities and extends beyond conflict, emphasizing health system and community resources and their intricate interactions. The term "fragility" has transcended "fragile and conflict-affected states" to encompass seemingly stable environments facing health challenges.⁹ This evolution underscores the intricate interplay between communities and health systems, emphasizing the concept's growing relevance in understanding health complexities across diverse contexts.

Despite the recent attention to health system fragility, there remains a lack of comprehensive understanding regarding the defining domains of this fragility. There is a discernible gap in our knowledge where the intricate nature of health system fragility remains inadequately explored and characterized. The absence of a clear framework or detailed grasp of what constitutes health system fragility hinders our ability to effectively address and mitigate vulnerabilities within these systems.

The challenge in defining the attributes of health system fragility is partially linked to the blurred demarcation between the concepts of fragility and resilience. These terms are frequently interchanged despite their distinct implications, limiting our conceptual understanding. The lack of clear differentiation between fragility and resilience compounds the difficulty of articulating the specific domains contributing to health systems' fragility.

This intricate juncture underscores a significant gap in current research that centers on comprehending the interplay between health system fragility and resilience. The relationship between these concepts holds pivotal implications for understanding how health systems respond to stressors, adapt to challenges, and maintain functionality during crises. However, the dynamics and potential conflicts between fragility and resilience remain insufficiently explored in the existing body of knowledge, signifying a crucial area that requires deeper investigation.

The health system in Afghanistan provides a compelling and intricate context for studying the fragility of health systems and the domains that contribute to it. Despite notable strides in rebuilding health systems over the past few decades, the country continues to grapple with alarming health indicators, a concern exacerbated by the resurgence of the Taliban in 2021.¹⁷ Maternal mortality ratios improved from 2002 to 2020; however, the Taliban resurgence threatens to reverse gains made, particularly evident in maternal and child mortality rates.¹⁸ Under-5 mortality rates in Afghanistan followed a declining trend observed globally, yet the trend in Afghanistan remained higher than the global average.¹⁸ Moreover, the density of healthcare workers remains one of the lowest globally, reflecting a significant gap in healthcare accessibility. The Universal Health Coverage (UHC) index, indicating access to quality healthcare without financial hardship, remains notably lower than the global average.¹⁹ Based on the historical trends reported during the previous Taliban regime, these indicators are expected to worsen after the Taliban took over the country in 2021.¹⁸

External aid from international organizations like the World Bank, USAID, and the United Nations, particularly the World Health Organization (WHO), has been crucial in supporting Afghanistan's rebuilding efforts.²⁰ This need for external assistance is particularly pronounced after the Taliban takeover, underscoring the necessity of ongoing humanitarian support. The collaboration between the Afghanistan Red Crescent Society (ARCS) and the Ministry of Public Health (MoPH) exemplifies determined efforts to extend healthcare to remote and underserved communities. This partnership utilizes Mobile Health Teams (MHTs) to deliver basic health services in challenging and hard-to-reach areas.^{21, 22} These

initiatives highlight the resilience and adaptability of the health system to overcome adversity.

Afghanistan's health system is unique and complex due to its blend of post-war reconstruction and ongoing instability. This dynamic interplay makes Afghanistan an ideal case study for understanding the fragility of health systems and the underlying domains that contribute to it. The juxtaposition of external humanitarian aid and civil will to improve conditions adds complexity to the landscape, pulling the health system toward vulnerability and strength in dual directions.

While existing literature sheds light on Afghanistan's health system interventions and vulnerabilities, a comprehensive exploration of its fragility remains elusive. This gap in the literature becomes particularly evident when viewed through the lens of fragility. Unravelling how the health system's various components interact within the fragile environment and how this fragility interacts with resilience efforts represents a crucial area yet to be comprehensively addressed in the literature.

1.1 Aims

Drawing from the existing gaps in our comprehension of health system fragility's conceptual nuances and its intricate domains, coupled with the compelling need to attain a holistic understanding of health system fragility, particularly in complex settings like Afghanistan, this dissertation seeks an investigation of the health system in Afghanistan from the perspective of understanding its fragility. Thus, this research focused on two aims.

The first aim was to understand the health systems in Afghanistan through the fragility lens by exploring the domains of fragile health systems and the relationship between the fragility and resilience of health systems. The second aim was to apply the fragility of the health systems lens to real-world application through empirical exploration of a health system operating within Afghanistan.

To achieve the second aim, we relied on the Afghanistan Red Crescent's (ARCS) programming to support health systems in Afghanistan. To improve outcomes for women and children in the country, the ARCS supported the Afghan Ministry of Public Health (MoPH) in delivering services through Mobile Health Teams (MHT) to areas that were hard to reach for the MoPH. The ARCS used contextually relevant strategies to introduce female health workers in its MHTs to improve service delivery, particularly for women.

1.2 Research questions

We proposed two research questions (RQ) to achieve these aims.

RQ1 - What is the conceptual understanding of the fragility of health systems and its relationship with resilience, and how can it be applied in Afghanistan?

RQ2 - Did the introduction of female health workers to support Maternal, Neonatal, and Child Health service delivery by Afghan Red Crescent Society's Mobile Health Teams lead to a change in service delivery outcomes?

Chapter 2

Literature Review

The rise of global violence and insecurity has created significant disruptions across various systems.^{23–25} Societies, economies, and governance structures have been impacted as conflicts and acts of aggression spread. This turmoil often results in displacement, loss of life, and economic instability. Moreover, essential services like healthcare and education suffer, leading to increased vulnerability and challenges in maintaining stability.²⁴ The insurgence of global violence and insecurity highlights the interplay between political, social, and economic dimensions, underscoring the urgency for collaborative efforts to restore order and security.^{24,25}

As conflicts brought about more significant challenges, the beginning of the 21st century saw an increase in health system research^{26–33} There was a significant emphasis on grasping how to enhance the strength and adaptability of these systems, particularly following the West African Ebola crisis between 2014 and 2016.⁷

Lately, there has been a noticeable effort to understand the fragility of health systems, a perspective that has garnered prominence alongside discourse centered around resilience.^{9,15} This focus has become even more relevant in the wake of the COVID-19 pandemic,³⁴ which posed a formidable challenge to our understanding of health system resilience and redirected scholarly attention to include fragility.

Understanding the 'health systems' fragility as a concept is challenging as it is often intertwined with contextual fragility. While contextual fragility contributes to health system fragility, it is meaningful to differentiate between these concepts. Hence, our literature review focused on comprehending contextual fragility or fragility of states, followed by an exploration of health systems and their impact on fragility. Subsequently, we delved into the latest conceptual grasp of health system fragility and its comparison with resilience.

Since we are examining the concept of the fragility of health systems within the context of Afghanistan, the next step in our literature review encompassed an appraisal of the country's health systems. Acknowledging Afghanistan's substantial reliance on humanitarian aid, we briefly examined the scope of this assistance, focusing on the Red Cross and Red Crescent Movement (RCRCM) support to primary healthcare systems in the country through the Mobile Health Teams (MHT) operated by the Afghanistan Red Crescent (ARCS), to deliver services to remote and hard-to-reach areas in the country.

2.1 Areas of interest for the literature review

A thorough literature search was undertaken to gain an in-depth understanding of and explore current discussions surrounding six areas of interest: (i) fragile states, (ii) health systems, (iii) impact of fragility on health systems, (iv) resilience and fragility of health systems, (v) health systems within Afghanistan, and (vi) involvement of humanitarian organizations in Afghanistan.

Systematic searches using databases such as PubMed, Medline, Scopus, Web of Science and Google Scholar were conducted using keywords and phrases related to each area (e.g., "fragile states," "health system resilience," "Afghanistan health system," "humanitarian organizations, Afghanistan") for comprehensive search results. The databases for the information sources were also explored manually to search documents in grey literature relevant to the information.

Forward and backward citation methodologies were used to include additional records for review. We used peer-reviewed articles, research reports, and policy papers published over the past two decades, from 2000 to the present; however, we incorporated pertinent resources predating this timeframe that added relevance to our review. Relevant information regarding the six areas of interest for this literature review was extracted, organized, compared, and contrasted to identify emerging trends from the literature and finally summarized. The summary of findings, gaps and research questions emerging from the literature are presented in this chapter.

2.1.1 Fragile states

The definition of the ‘state of fragility’ evolved over the past fifty years as a result of the global response to events and the evolution of thinking around providing support to those living in perilous conditions. In the 1970s, World Bank president Robert McNamara attributed ‘extreme poverty’ to financial disparities in the developing world. Extreme poverty resulted in hunger, illiteracy and population growth, creating a vulnerable population needing assistance.³⁵ Drought and famine due to conflicts, civil wars and poor governance marred the political landscape in the 1980s, with millions dying as a direct result of famine in Cambodia and Ethiopia.^{36, 37} Sub-Saharan Africa was most adversely affected by drought and famine in the 1980s and 1990s, subjecting the region's populations to extreme poverty, resulting in a scarcity of basic needs such as food, water, shelter and education for over one-third of the world’s population.³⁸ The Gulf War, the Croatian independence war, the war in Kosovo and the civil wars in many countries, including Afghanistan, Algeria, Somalia, Congo and several other sub-Saharan countries, contributed to rising economic hardships and poverty across the globe.³⁸ Extreme poverty due to states' failure to provide necessities to sustain a reasonable standard of living for its citizens was the pressing dilemma faced by the international community in the 1980s and 1990s.³⁸

At the turn of the 21st century, the UN-sponsored Millennium Development Goals (MDG)³⁹ committed to “free all men, women, and children from the abject and dehumanizing conditions of extreme poverty.”³⁹ Established in the year 2000, the MDGs represented a set of ideas targeting the eradication of extreme poverty and hunger, improving education, promoting gender equality, improving maternal and child health care, reduction of the spread of infectious diseases, environmental sustainability and global partnership for development.⁴⁰ The number of low-income countries is now half of what it was in 2001 as a direct consequence of MDG-related improvements in poverty reduction, universal primary education, child mortality and maternal health.³⁸ The rates of global poverty fell from 37.1% in 1990 to 9.6% in 2015.^{38, 41–43}

Despite declining vulnerability related to extreme economic hardships, especially in sub-Saharan Africa, conflicts and violence have risen over the last decade.⁴⁴ The conflicts in the Middle East and North Africa (MENA) region in the wake of the Arab revolution in 2011, ongoing conflicts in Afghanistan, Yemen, Iraq and Syria, anti-Muslim violence against the Rohingya minority in Myanmar, civil war in South Sudan, and the political uncertainty in Somalia and the Democratic Republic of Congo are a few examples from across the globe where violence and conflicts have placed populations at risk.⁴⁴ The rising number of casualties and displacement of millions of people in these conflict-affected areas is contributing to newer populations being pushed into extreme poverty and vulnerable to harm.⁴⁴

The conceptual framework for the MDG drew on the notion of providing a ‘safety net’ for people with the fundamental principle that every human being should have their ‘basic needs’ met.^{39,40,45} The MDG framework focused on the delivery and assistance model, which encouraged support by and dependence on donors rather than empowering populations through local ownership of issues through identifying problems and providing sustainable solutions.⁴¹ Post-MDG (after 2015) ushered an era of a shift in focus from predominant reliance on humanitarian aid for vulnerable countries to achieving more sustainable goals for nation-building (the UN Sustainable Development Goals (SDG) for 2030) through engaging local communities to supplement emergency aid.⁴⁶ The core

principles of SDGs revolve around achieving nation-building through systematic improvements in governance, infrastructure development, resource utilization, and the effective operation of existing institutions.⁴⁶

As the concept of vulnerable populations evolved over the last five decades, a framework for defining these populations originated. Over time, populations living under conditions where poor governance or lack of legitimate authority rendered the institutions of the state weak, resulting in declining or failing capacity of the state to meet the needs of its citizens, were considered vulnerable and living in weakened or failing states.⁴⁷

The term fragility, representing weak or failing states with vulnerable populations, is a relatively new concept in the literature.⁴⁸ There is limited consensus on the definition of ‘fragile states,’ or ‘state of fragility,’ ‘fragile statehood,’ ‘fragile countries or regions,’ and ‘fragile contexts.’ Defining what constitutes a ‘fragile state’ is challenging due to the lack of agreement by international stakeholders and the reluctance of states to be labelled as fragile.⁴⁹ Earlier definitions describing fragile states used the terms ‘weakness’ and ‘failed or failing’ states, and later, these were used to identify the level of fragility.^{49–53} The definitions in the literature are presented in Appendix 2.1.

The Organization for Economic Co-operation and Development (OECD) definition of ‘fragile statehood’ is the most comprehensive and pragmatic and is used to describe fragile contexts in this dissertation. The OECD framework recognizes fragility as multi-dimensional, with interlinkages between dimensions of fragility and violence worldwide.⁵ The OECD monitors development indicators based on the economic status of countries worldwide and provides governments with a platform to collaborate for sustainable growth and development of institutions.⁵⁴

In 2016, the OECD definition of the state of fragility was updated, accounting for the changing face of global violence and the impacts of natural disasters around the world; according to the latest definition by OECD ‘state of fragility’ is:³ “characterized as the combination of exposure to risk and insufficient coping capacity of state, system and/or communities to manage, absorb or mitigate those risks. Fragility can lead to negative

outcomes including violence, the breakdown of institutions, displacement, humanitarian crises or other emergencies.”³ The OECD conceptualized fragility as a mix of risks to populations and capacities by systems to cope with the risks over five dimensions-economic, environmental, political, security and societal. The dimensions of fragility vary in severity and overlap in different fragile contexts. The list of fragile countries changes every year.

Although some countries have remained on the list for over a decade, several showed improvements in one or more dimensions, driving those out of a state of fragility. Some countries sometimes fall back into a fragile status after years of stability. The 2022 OECD report on fragile countries listed sixty countries in fragile states.⁵⁵

2.1.2 Health Systems

“Health systems consist of all the people and actions whose primary purpose is to improve health by promoting, restoring or maintaining health.”⁵⁶ Health systems are an interlinked web of public and private services, health promotion and education, health insurance, health occupational and safety legislation, all working together to improve health and health equity through responsive, financially fair and most efficient use of resources.⁵⁷

Health systems have an innate ability to self-organize and respond to processes by adapting to changing environments surrounding the systems.⁵⁸ These systems have a complexity stemming from interdependencies among stakeholders and non-linearity of the processes, creating slowly emerging feedback loops.⁵⁸ These complexities and adaptive mechanisms make it challenging to predict the behaviours of these systems.⁵⁸ Nevertheless, mechanisms to achieve effective and efficient health systems have been described in detail in the literature. The purpose of an effective health system is to offer equitable access to health services and ensure that the local communities are involved in decisions that influence their health and health system.⁵⁹

Health systems are complex, often driven by the context in which they operate, are greatly affected by socio-economic and political instabilities where health services are often depleted and infrastructure either damaged, destroyed or inadequate.⁶⁰ The systems are operationalized through the governance of the health sector based on the contextual policy-centric perspectives, which means prioritizing health issues based on the contexts: emergencies, rehabilitation or transformations.⁶¹

Several frameworks related to health systems have been identified in the literature.^{8,56,57,62–69} These frameworks aim to facilitate conceptual clarity in analytic, technical and operational assessments of health systems for various stakeholders. Operationally, health systems frameworks serve as conceptual or evaluative tools.⁶² Conceptual Health Systems frameworks (HS framework) present a narrative description of the system's aims, structural organization and functioning.^{62,70} Health Systems Performance Assessment Frameworks (HSPA) are based on the conceptual framework and incorporate assessment tools to measure and evaluate performance and provide feedback to the system.^{62,63} Another framework, often part of HSPA, entails very little conceptual understanding or feedback to the system; however, it includes outlining monitoring data processes, serving as a Monitoring and Evaluation (M&E) framework.⁶²

Health systems frameworks have been further classified into three categories: descriptive, analytic and deterministic or predictive.^{62,71} ‘Descriptive frameworks’ provide a description and components of the health systems without assessing the performance of these systems.⁷¹ ‘Analytic frameworks’ provide a deeper analysis of the policy, reforms and interventions through understanding the effectiveness and interactions of various health system components.⁷¹ Factors that influence the effectiveness and interaction of health systems are assessed through ‘deterministic or predictive frameworks.’⁷¹ All these frameworks include service provision, financing, resource generation, leadership and governance, and social, economic, environmental and behavioural risk factors to health.⁶² A summary of key health systems frameworks as they chronologically appear in the literature is presented in Appendix 2.2.

The WHO's basic 'Building Blocks' model is the most used framework that conceptualizes the interconnections within and outside health systems in low and middle-income countries.⁵⁷ According to the WHO model, leadership and governance are responsible for the health sector with clear and transparent policy goals and strategies to accomplish the goals. Health Information Systems monitoring, and evaluation of set goals are necessary to support governance and identify threats to health systems to plan for mitigation strategies and eliminate barriers to care provision. A health workforce that is adequately educated, trained, diverse in numbers and competencies, deployed and distributed according to the health needs of the populations, with support systems and enabling work environments that include cooperation from all stakeholders, is essential. Adequate access to cost-effective medicines and technologies is required. Adequate access to high-quality service delivery through safe, effective, integrated, continuous and people-centred programs with strong primary health care units linked to specialized services for the populations is needed.

In 2015, UN-mandated scaling up disaster relief across the globe escalated, and at the same time, the concept of efficiency and resilience of health systems in the context of natural and human-made disasters was explored in detail.³¹ A new framework of the health system for public health disaster management with resilience at its core supported by the WHO building blocks emerged in 2017³¹ (Appendix 2.3). This approach incorporates disaster reduction response through disaster preparedness, response and post-disaster recovery using the building blocks framework and integrating it with social determinants of health, emergency preparedness programmes, and coordination planning.³¹

The focus on health systems and their framing through the various frameworks presented to date has been on determining the efficiency or performance of these systems. The efficiency and performance indeed give an understanding of the effects of various inputs and processes on health outcomes. Efficient systems, as proposed by the WHO and Canadian Institute of Health Research (CIHR), entail using a people-centred approach to health care delivery where services are justified to meet the needs of the population,^{72,73} along with having long-term vision and strategies, consensus building at the societal level,

flexibility and autonomy at the decision-making level, policy feedback and harmonization with population and cultural preferences.⁵⁹

Based on the WHO building blocks the mechanism for a well-functioning health system operating under the six building blocks described above: leadership and governance, health information system, financing, health workforce, medicines and technologies and service deliveries. Leadership and governance are necessary for the effective long-term operations of a system. Monitoring and evaluating goals and identifying health system threats can help plan for mitigation strategies and eliminate barriers to care provision, reducing financial constraints on individuals and communities.^{72,74} An adequately educated, trained health workforce which is diverse in numbers and competencies provides an efficient balance to a health system. Cost-effective pharmaceuticals, health technologies, and high-quality service delivery through safe, effective, integrated, continuous and people-centred programs with vital primary health care are the pillars of a robust health system.⁷²

In conclusion, effective health systems protect populations against disease and debilitation and the financial burdens of threats to health by improving the health status of individuals, families, and communities through local engagement and improving access and coverage by providing safe and high-quality services.⁷³

2.1.3 Impact of Fragility on Health Systems

The discussion of health systems is incomplete without the context in which the systems operate, which includes geographical location, socio-political and economic situations and the contextual ‘state of fragility.’ Health systems may remain stable in a fragile context or become fragile in stable conditions when a crisis pushes the limits of the system.⁷ Flooding and natural disasters have tested the resilience of health systems in a country like the USA. In contrast, health systems in Bangladesh have shown signs of resilience as a result of a mobilized community healthcare workforce.⁷ Scholarship on health systems research in a fragile context considers both the possibility of a weakened health system infrastructure and the volatility of the context itself.⁹

Health systems are often susceptible to external and internal threats. External threats stem from economic, social and political instability and violence.⁷ Internal threats result from lack of infrastructure, scarcity of healthcare force, inconsistent or inadequate financial support or governance.⁷ Based on the dynamic relationship between different systems, fragility in a region affecting other systems will affect health systems; at the same time, fragile health systems can also have, on their own, a deleterious effect on other systems, contributing to or leading to a state of fragility.⁸

Attributes of successful or effective health systems are not limited in their application to the stable or developed world. Balabanova et al. presented examples of countries with the context of economic, social and political hardships or, in other words, in a fragile state, where the application of fundamental principles of effective health systems resulted in meaningful health outcomes such as improvements in rates of morbidity and mortality and better quality of care.⁵⁹

Kyrgyzstan is an example of a fragile nation that, despite grappling with economic challenges, successfully crafted and executed a healthcare sector development initiative attributed to effective leadership, strong governance within the healthcare sector, and a comprehensive reform program.⁵⁹ Ethiopia is another fragile country where the country's leadership successfully implemented an extensive healthcare initiative providing access to remote areas and garnering international funding for the health sector in the process.⁵⁹ In Bangladesh, a people-centred community-based approach to providing maternal and child healthcare considerably improved health outcomes in the population.⁵⁹ In other fragile countries such as Costa Rica and Sri Lanka, where there are multiple stakeholders and partners in healthcare delivery, an integrated, people-centred approach resulted in gains in health outcomes.⁵⁹

More recently, Qirbi and Ismail defined the health sector's fragility by evaluating the health system's functionality in a low-income country in conflict, using Yemen as a case study.⁷⁵ Applying the WHO principles of effective health systems,⁷² Qirbi and Ismail concluded that fragile systems could not govern themselves because of weak or poor financial

management of resources, resulting in reliance on private rather than public sector, increased out-of-pocket expenses, weak service penetration and poor health outcomes.⁷⁵

Witter et al., while reviewing the evolution of human resources for health services in post-conflict and post-crisis settings, identified poor fiscal management and resource distribution resulting in increased privatization of the health sector as one of the challenges faced by these countries.¹⁴ Reflecting on the health systems' needs and capacities in Northern Uganda, Sierra Leone, Cambodia and Zimbabwe after long-drawn wars and insurgencies, Witter et al. surmised that the most critical issues in the field were a scarcity of healthcare workforce due to conflict and the inability to retain staff, poor performance as a result of training and education and poor distribution of resources.¹⁴

2.1.4 Resilient and Fragile Health Systems

Resilience as a concept emerges from a response to disasters. There are two divergent views of resilience in response to disaster.⁷⁶ One is based on community resilience, implying that resilience is the ability of a community to recover using its resources through a process linking the multitude of capacities (such as social capital and economic development) to responses and changes after adverse events.⁷⁶ The other is based on critical infrastructure and building resilience, relying on systems robustness, redundancy, resourcefulness and rapidity in transitioning back to normality.⁷⁶

Global epidemics such as the Ebola outbreak in sub-Saharan Africa highlighted the importance of understanding the ability of a healthcare system to withstand crises.⁷ Kruk et al. defined health systems resilience as “the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crises, reorganize if conditions require it. Health systems are resilient if they protect human life and produce good health outcomes for all during a crisis and its aftermath.”⁷

Kruk et al. identified five elements of resilient health systems.⁷ (i) systems aware of their strengths and weaknesses; (ii) systems that have the diverse capacity to tackle a wide range

of issues in the health sector; (iii) systems with the capability to self-regulate to pre-identify and contain disasters and public health emergencies with minimum disruption of the system; (iv) systems with a robust integrated network with active sharing of knowledge and resources; (v) systems with a capacity to adapt in response to the health needs of the population in crisis.

In a recent systematic review, an exploration into health system-related fragility within the global health context unveiled a remarkable surge in the application of this concept over the past decade.⁹ While the literature lacks a formal definition or conceptual model for 'health system fragility,' Diaconu et al. have provided insight into how the term is used in global health literature.⁹ The fragility of health systems has primarily been associated with conflict-affected contexts; however, the scope of understanding has evolved to encompass a broader range of applications. The context scope was zeroed in from the national and state levels to local communities. There is a growing emphasis on various stressors beyond conflict and governance weaknesses. Moreover, the concept has shifted its focus, now encompassing health systems and community resources, with an increasing trend toward studying the interaction between the two.⁹

Kruk et al.'s five elements directly focus on resilience, indirectly highlighting fragility as the health system's inability to respond effectively to crisis.⁷ Qirbi and Ismail used the terminology of fragile health systems; however, their methods of assessment and conclusions were based on how well the system performed according to the WHO principles for effective health systems in a conflict situation.⁷⁵ In other words, Qirbi and Ismail assessed if the system could absorb the shocks of crisis, similar to the assessment of the system's resilience.

Witter et al. focused on a single aspect of health systems in crisis or conflict; their conclusions also reflected how well the systems could absorb the shock of the crisis with the ability to reset or rebound after the conflict or crisis.¹⁴ Diaconu et al. found that "fragility" was previously associated mainly with 'fragile and conflict-affected states'; however, its usage has evolved to encompass a broader range of contexts, including

politically stable, secure, and economically prosperous ones. This expanded application indicates significant barriers to achieving progress in health, even in relatively stable settings.

Of particular significance within the global health domain and the framing of interventions, the term "fragility" now frequently denotes breakdowns occurring at the juncture between communities and health systems. This shift in focus highlights the evolving understanding of fragility and its growing relevance in deciphering health challenges across diverse contexts.⁹

Despite the increasing body of literature and enhanced comprehension of health system resilience, which has been well-defined and comprises distinct elements, a substantial gap exists in our conceptualization and framework development pertaining to health systems fragility. Although the efforts of Diaconu et al.⁹ shed light on how health system fragility is portrayed in existing literature, there remains a deficiency in our conceptual understanding of the specific domains linked to health system fragility and its interplay with resilience.

This gap is particularly significant as the absence of a conceptual framework hinders our ability to discern health-related challenges across diverse contexts. While Diaconu et al.⁹ have contributed significantly by delineating the perspective on health system fragility in the literature, the next crucial step involves formulating a comprehensive framework that elucidates the concept of health system fragility.

2.1.5 Health Systems in Afghanistan

Afghanistan has faced prolonged conflict, natural disasters, and civil unrest, which have eroded its systems over many years. Despite ongoing uncertainty, there has been significant attention on the health systems in Afghanistan. The Basic Package of Health Services (BPHS) was introduced with support from WHO and international organizations in the early 2000s, leading to substantial progress. However, vulnerabilities persist within the systems, making Afghanistan an ideal focus for this research.

Afghanistan is a landlocked country in south-central Asia surrounded by Pakistan, Iran and former Soviet states (Turkmenistan, Uzbekistan and Tajikistan) with an area of 625,862 km² and a GDP of 572 US\$ per capita.⁷⁷ Home to the ancient Indus valley civilization, Afghanistan is inhabited by people of various ethnicities, including Pashtuns (55% of the population), Tajiks (25%), Hazaras, Uzbeks, Turkmen, Aimak and Baloch, speaking several languages and dialects with Persian (Dari) and Pashto being the predominant languages.⁷⁸ Islam is the predominant religion in the country, with the majority (80 to 90%) practising Sunni Islam and (10-15%) practising Shia Islam.⁷⁸ Kabul is the capital city.

Afghanistan has been affected by conflict and civil unrest for the last four decades. The protracted conflict has devastated systems and infrastructure in the country.⁷⁹ In the 1980s, the country was at war with the former Soviet Union.⁸⁰ After the exit of Soviet troops, Afghanistan went through a lengthy period of civil war followed by Taliban rule in the majority of the country.⁷⁹ Until August 2021, the country had an elected government with several armed groups controlling vast regions.⁸¹ In August 2021, the Taliban assumed control of the country⁸² and instituted a ban that prevented women, including female healthcare providers, from pursuing work.⁸³ Prior to the Taliban take over in 2021, Afghanistan was in the process of rebuilding, which was going on in a backdrop of continued unrest manifesting at crucial junctures, which pushed the country back to an acute crisis state.^{81,84,85,86} The instability resulted in a substantial population of internally displaced persons (IDPs).⁸⁷ Additionally, before 2021, thousands of refugees without proper homes and shelter returned from neighbouring Pakistan after several decades of

living as refugees.⁸⁷ This return resulted in an unprecedented burden on the systems in the country at the time. The ban on women working has put an additional burden on health systems, with fewer women accessing health services, negatively impacting health outcomes, especially for women and children.^{17,88}

Despite the gains made over the last couple of decades through efforts to rebuild health systems,²⁰ health indicators in the country remain alarming, more so after the recapture by the Taliban in 2021.^{17,89} Maternal mortality ratios declined from 1,277 in 2002 to 620 per 100,000 live births in 2020; this is expected to have risen again significantly after the Taliban capture (as during the previous Taliban regime prior to 2002, the maternal mortality rates were over 1000 per 100,000 live births).^{89,90} Similarly, under-5 mortality rates in Afghanistan followed the global trend of decline of over 50% over the last 20 years,⁹¹ the rates in country in 2002 were at 121 and in 2021 were at 56 per 1000 live births, which was still much higher than the global average of 38 per 1000 live births in 2021.⁹¹ Afghanistan also has one of the lowest densities for healthcare workers, with 4.6 healthcare professionals (medical doctors, nurses and midwives) per 10,000 population.¹⁹ The Universal Health Coverage (UHC) index, which provides an estimate of the people with access to a full range of quality health services without financial hardship,⁹² was 41/100 in 2021,^{93,94} which is much lower than the global average of 68/100 population.⁹⁵

The health system in Afghanistan is organized into multiple tiers (see Figure 2.1). Health Posts (HP) and Mobile Health Teams (MHT) are at the community level. At the primary level, there are Basic Health Centers (BHCs) and Comprehensive Health Centers (CHCs) serving local communities. District hospitals provide secondary care, while provincial and regional hospitals offer more specialized services.^{91,96,97} The Ministry of Public Health oversees the health system, with NGOs and international organizations playing a significant role in service delivery, particularly in remote and conflict-affected areas.²⁰

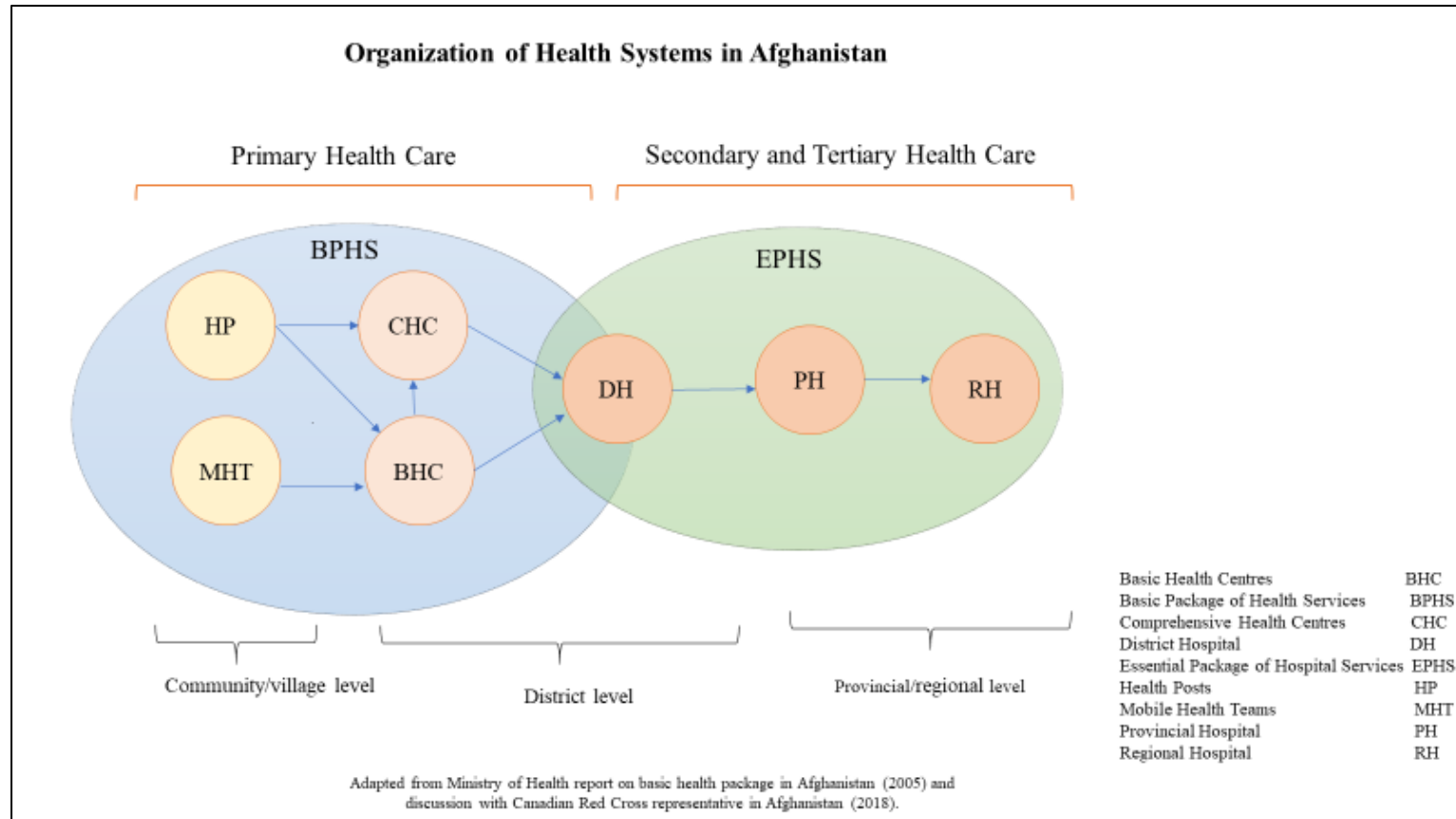


Figure 2.1: Overview of the organization of Health Systems in Afghanistan

From 2000 to 2020, Afghanistan witnessed significant developments and changes in its primary healthcare system. The introduction of the National Solidarity Program (NSP) in 2003 aimed to strengthen local governance and community participation in healthcare decision-making.^{98,99} In the aftermath of the fall of the Taliban regime in 2001, Afghanistan faced a severely damaged healthcare infrastructure. Primary healthcare facilities were scarce, and access to essential services was limited, especially in rural areas. International organizations, including the World Health Organization (WHO) and non-governmental organizations (NGOs), began supporting and rebuilding the healthcare system.^{20,100} The BPHS was introduced in 2003 by the Afghan Ministry of Public Health (MoPH) and its partners, aiming to deliver essential primary healthcare services across the country. The standard ‘basic health care package’ includes services related to maternal and neonatal healthcare services, essential outpatient services, referrals, vaccination and wound care.^{20,101,102}

During the mid-2000s up to 2010, efforts focused on expanding the BPHS to reach more communities, especially those in remote and conflict-affected regions. NGOs were crucial in delivering primary healthcare services in collaboration with the MoPH. Initiatives were launched to train and deploy community health workers (CHWs) to provide basic health services in rural areas, including immunizations, antenatal care, and health education. Efforts were made to enhance the quality of primary healthcare services through the capacity-building of healthcare providers and establishing quality assurance mechanisms. The MoPH, with support from international partners, focused on improving maternal and child health, expanding immunization coverage, and addressing infectious diseases like tuberculosis and malaria.^{103,104,105}

By 2020, primary healthcare services in Afghanistan had significantly expanded compared to the early 2000s, but challenges persisted. Ongoing conflict and security issues continued to affect the delivery of healthcare services, particularly in remote and conflict-affected regions. The COVID-19 pandemic posed additional challenges to the healthcare system, requiring a focus on infection prevention, testing, and treatment.¹⁰⁶ The advancements achieved in the past two decades have swiftly eroded following the Taliban's assumption of power in August 2021.^{17,18} The health and humanitarian conditions in the country have

rapidly deteriorated.¹⁸ Among the most affected are women, who now face the brunt of this decline due to a prohibition on their employment. This ban has not only impeded their access to services but has also obstructed their ability to contribute to healthcare delivery.^{107,108} The persistent instability in Afghanistan is progressively undermining its health systems, further exacerbating the already escalating demand for enhanced health and development resources within the nation.^{106, 109}

Afghanistan is widely recognized as a fragile country with complex interplay of conflict, political instability, and socioeconomic challenges. This fragility has impacted various aspects of the nation, including its healthcare systems. Ongoing conflicts and violence have disrupted healthcare services, causing damage to infrastructure, displacing healthcare workers, and limiting access to essential medical care for large segments of the population. The country's healthcare sector has also faced resource constraints, including a shortage of trained healthcare professionals, limited medical facilities, and inadequate funding. The fragility of Afghanistan's health systems is further compounded by natural disasters, such as earthquakes and droughts, which can strain an already fragile infrastructure. These challenges make it difficult for the healthcare system to effectively meet its population's needs. The distinctive context of Afghanistan's fragility, coupled with the dynamics of its healthcare systems, renders it a subject of significant interest for various research and humanitarian efforts.

2.1.6 Role of humanitarian organizations in supporting health systems in Afghanistan

Humanitarian organizations are essential in fragile and conflict-affected areas, providing emergency relief, protection, healthcare, education, food security, and livelihood support to vulnerable populations. They address immediate needs, such as food, clean water, and shelter, while also working to protect individuals from harm and advocating for their rights. These organizations coordinate efforts to avoid duplication and maximize impact, contributing to short-term relief and long-term development in regions marked by violence, political instability, and socio-economic challenges.¹¹⁰

Humanitarian organizations have played a pivotal role in providing assistance and relief to Afghanistan. These organizations operate to alleviate human suffering, address immediate needs, and contribute to long-term development in Afghanistan. Their activities include emergency relief, healthcare, education, food security, shelter, protection of vulnerable populations, and livelihood support. By working closely with local communities and governments, humanitarian organizations aim to ensure that the people of Afghanistan receive vital assistance and have the opportunity to rebuild their lives amid ongoing challenges.¹¹¹

The health systems in Afghanistan struggle with a significant funding gap, which has led to a heavy reliance on humanitarian aid and support. International organizations, including the World Bank, USAID, European Union, the United Nations (UN), particularly the World Health Organization (WHO), along with several key International Non-Governmental Organizations (NGOs), have played a crucial role in assisting the Afghan government's efforts to rebuild the nation and restore stability.^{87,101,112} The reliance on external funding has become particularly pronounced after the Taliban's takeover, underscoring the acute need for sustained humanitarian assistance. Within the health sector, this aid permeates every facet, encompassing financial backing, coordination, and the execution of programs. Collaborating closely with the National and regional Ministries of Public Health (MoPH), the humanitarian sector provides comprehensive support across various levels.^{113,114}

The Red Cross and Red Crescent Movement (RCRCM) plays a vital role in humanitarian crises by providing emergency response, medical care, disaster relief, and support for restoring family connections. They ensure access to clean water, sanitation, and nutrition, offer psychosocial support, and protect vulnerable populations. Their advocacy efforts raise awareness, and they engage in humanitarian diplomacy, often negotiating access to conflict zones. The Red Cross also contributes to long-term recovery, capacity building, and resilience-building in affected communities, guided by principles of humanity, impartiality, neutrality, independence, voluntary service, unity, and universality.^{115,116}

The RCRCM has actively supported public health emergencies worldwide by providing medical care, essential supplies, and community education during disease outbreaks like Ebola, Zika, and COVID-19. They also assist with vaccination campaigns, contact tracing, and community engagement to help control the spread of diseases and protect public health.^{117,118} The RCRCM has helped Afghanistan's MoPH provide essential healthcare services to remote and underserved communities.^{119–123} The RCRCM extends its support through local partnerships, primarily with the Afghanistan Red Crescent (ARCS), which is an auxiliary to the government and receives backing from the RCRCM.^{21,123} This collaborative effort demonstrates a commitment to delivering essential healthcare services, even in Afghanistan's most remote and difficult-to-reach regions.

To address the considerable disparity in healthcare delivery and accessibility, particularly in remote and underserved communities located far from any established health facilities due to ongoing conflicts and natural disasters, the Afghan MoPH devised a strategic solution. The solution involved the implementation of Mobile Health Teams (MHTs) to provide BPHS in these hard-to-reach areas. To execute this initiative in regions where government authorities faced difficulties accessing, the ARCS undertook the crucial responsibility of deploying these MHTs.^{21,22,124} Starting in 2011, as disaster response in flood and conflict-affected areas, ten ARCS-MHTs were initially deployed to support the ARCS fixed health posts or clinics.^{22,125} As the MHTs were able to access some of the most remote areas, the number of MHTs gradually increased. They were operating in over 20 provinces in 2015 and later in all provinces of the country.^{124,125} The ARCS-MHT operations timeline from 2015 to 2020 is presented in Panel 1 in Figure 2.2.

The MHT staff reported a trend that women were not accessing healthcare services regularly. This issue was linked to the initial composition of the MHTs, which exclusively comprised of male staff. Since MHTs often travelled to remote communities for extended periods, female healthcare workers were reluctant to join due to prevailing socio-cultural norms that discouraged women from venturing outside without a male family member. In response to this challenge, the ARCS adapted its strategy by enlisting 'mahram,' referring to male relatives (such as husbands, fathers, brothers, or sons) of female health workers (midwives). This strategic modification enabled midwives to accompany the MHTs to remote areas and stay for extended durations, ensuring effective healthcare service delivery to women and children in these communities.¹²⁶ A timeline of midwives starting their work with ARCS-MHTs is presented in Panel 2 in Figure 2.2.

While the MHT operations had a monitoring and evaluation framework to assess program implementation and outcomes, the change in the outcomes due to the MHT intervention involving midwives introduced by ARCS has not been comprehensively examined.^a Since the intervention targeted a significant challenge in Afghanistan—ensuring access to healthcare services for women— this crucial gap warrants further exploration.

^a The monitoring and evaluation processes assessed the project in segments over the years, primarily to support program reporting for funding agencies. While the monitoring and evaluation reports offered valuable insights into the operational processes and the effectiveness of mobile health teams, the assessment of impact on midwives across the entire dataset was notably absent.

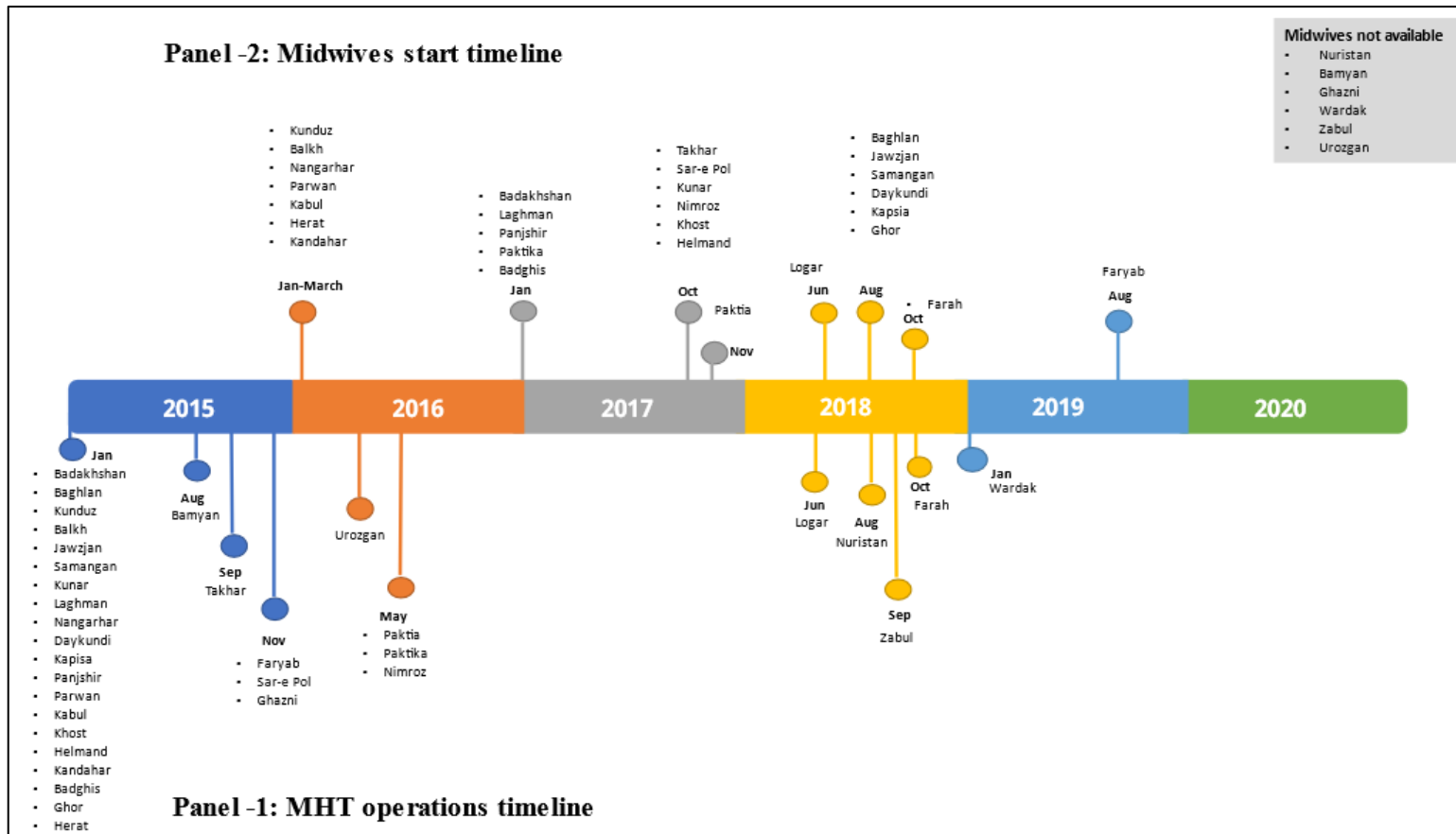


Figure 2.2: Timeline of MHT operations and midwives starting their work with ARCS-MHTs between 2015-2020

2.2 Gaps in the literature and emerging research questions

Health systems are dynamic entities shaped by a multitude of internal and external factors that contribute to the evolution or deterioration of their effectiveness. Our comprehensive literature review underscores the significant increase in discussions surrounding the fragility of health systems over the past decade. This discourse has gained remarkable momentum, especially in the aftermath of the COVID-19 pandemic, which gave the world a renewed perspective on the vulnerabilities inherent within health systems globally.

Historically, the global dialogue on the fragility of health systems was primarily anchored in contextual instability, an understanding that has undergone a progressive transformation over time. An illustrative instance is the systematic review conducted by Diaconu et al.,⁹ unearthing an abundance of recent references pertaining to the fragility of health systems. However, despite the extensive discourse surrounding fragility, the prevailing perception of this concept remains closely linked to contextual elements, and a conceptual framework regarding the fragility of health systems remains elusive.

Nevertheless, the post-pandemic deliberations on health systems have prompted introspection in this regard. Beyond the contextual components contributing to fragility, the impact of sudden and profound disruptions such as pandemics has gained prominence. The existing literature on fragility has also identified community engagement and trust as pivotal elements that stave off the onset of fragility. Moreover, other dimensions of health systems that deviate from the WHO health systems building block equilibrium have been recognized as factors exacerbating fragility, along with concerns related to equity and social determinants of health.⁹

Notably absent from the vast body of literature is a comprehensive delineation of what exactly constitutes or characterizes the fragility of health systems. This conspicuous gap represents the primary deficiency identified in the available body of evidence thus far.

The limited grasp on the attributes and facets defining the fragility of health systems may partly stem from a distinct clarity surrounding the definition and constituents tied to the

concept of health system resilience and a lack of corresponding clarity regarding fragility. The two notions are often employed interchangeably, often positioned as opposites, or at the very least, perceived to hold conflicting connotations. This intricate juncture gives rise to a pertinent inquiry stemming from yet another void within the existing literature: a lack of comprehension regarding the relationship between the fragility and resilience of health systems.

Diaconu et al.⁹ stress the importance of comprehending fragilities within health systems to address various challenges they face. However, achieving this goal necessitates several key steps. First, there is a need to understand what constitutes health systems' fragility and establish a framework for understanding this concept. A deeper understanding of the intricate relationship between fragility and resilience within health systems is also crucial. Finally, applying this framework to a real-world example becomes paramount for gaining insights into how fragility operates within a specific context. This holistic approach enables a more comprehensive grasp of the dynamics at play within health systems.

There are many examples from across the world, identified in our literature review, that could be studied to understand the fragility of health systems. However, Afghanistan stands as a singular context, particularly noteworthy within the realm of health systems due to its remarkable journey of reconstruction and rebuilding following a period of intense conflict. Operating within the dynamic interplay of post-war restoration and ongoing protracted turmoil, Afghanistan's health systems continue to evolve even as the political landscape experiences deterioration. This gap becomes particularly pronounced when viewed through the fragility prism.

The health system in Afghanistan offers an intriguing landscape for in-depth exploration, as it encapsulates the nuances of fragility and resilience. The state of fragility presents an inherent vulnerability, making it an ideal candidate for an in-depth study to unravel the multifaceted impacts at play. The fragility, however, exists in juxtaposition with the external assistance provided by humanitarian organizations, coupled with the determination exhibited by political and civilian actors to enhance the prevailing

conditions. This intricate interplay pulls the health system in two directions – one characterized by vulnerability and the other by strength.

The existing body of literature on Afghanistan's health systems is teeming with evidence from policies and programs that have sought to fortify the system. It has also been instrumental in identifying the intricate web of factors contributing to the system's vulnerabilities, specifically at the national or regional levels. Despite the richness and abundance of this literature, a gap exists in a comprehensive assessment of Afghanistan's health systems through the lens of fragility, especially for health service delivery at the community level.

To understand a country's health system comprehensively, it is vital to recognize that it comprises various subsystems functioning together to address the population's health needs. This understanding should extend to how these systems operate at different levels, including the delivery of services at the community level, a context exemplified by Afghanistan.

Our review of the literature reveals the RCRCM's crucial role in supporting community-level health systems. In Afghanistan, this support involves collaboration with the MoPH to deliver healthcare services in remote and hard-to-reach areas. It is imperative to explore how this support translates into improved outcomes for the population, particularly focusing on women and children, who are among the most vulnerable. The ARCS implemented strategic modifications in service delivery to enhance Maternal, Neonatal and Child Health (MNCH) outcomes. Therefore, examining the change outcomes is essential to understand how health systems, in partnership with organizations like RCRCM, adapt to complex contexts and contribute to population well-being.

Furthermore, given Afghanistan's prolonged conflict spanning several decades, a constant factor contributing to its fragile context, it becomes crucial to investigate whether the alterations in service delivery have influenced MNCH outcomes, particularly in relation to the prevailing security situation.

Our literature review reveals a critical knowledge gap in our understanding of the various domains contributing to the fragility of health systems and how this fragility interacts with the resilience of these systems. Additionally, despite a plethora of evidence on Afghanistan's health systems, there remains a crucial need for a pragmatic examination from the perspective of the fragility of health systems with the impact of contextual fragility – insecurity- on the system.

In light of these gaps revealed by the literature review, two main research questions with five sub-questions have emerged, presented as follows:

RQ1: What is the conceptual understanding of the fragility of health systems and its relationship with resilience, and how can it be applied in Afghanistan?

RQ 1.1: What is fragility of health systems?

RQ 1.2: What is the relationship between fragility and resilience of health systems?

RQ1.3: How is the understanding of the fragility of health systems applied in Afghanistan?

RQ2: Did the introduction of female health workers to support Maternal, Neonatal, and Child Health service delivery by Afghan Red Crescent Society's Mobile Health Teams lead to a change in service delivery?

RQ 2.1: Was there a difference in MNCH outcomes after the introduction of female health workers in ARCS-MHTs?

RQ 2.2: Did MNCH outcomes differ between less and more insecure provinces in Afghanistan after introducing female health workers in ARCS-MHTs?

Chapter 3

Methods

Two main research questions were identified in the previous chapter with an overarching aim to explore the concept of the fragility of health systems by examining the health systems in Afghanistan. The first question focused on developing a conceptual understanding of the fragility of the health system and its examination through Afghanistan's health system; the second question aimed to examine the MNCH outcomes of ARCS MHTs introducing female health workers. The two main research questions were explored through five sub-questions presented in the previous chapter. This chapter describes the methodology to explore the questions identified through the literature search.

3.1 RQ1 - What is the conceptual understanding of the fragility of health systems and its relationship with resilience, and how can it be applied in Afghanistan?

To address RQ1, we identified three sub-questions, and the Grounded Delphi Methodology (GDM) served as the study design. While we maintained the overarching study design, it is essential to note that variations occurred in data analysis and interpretation due to the distinct nature of the sub-questions. In the following section, we will introduce the GDM and then outline the specific methodologies for assessing each of the three sub-questions.

3.1.1 Study design

Grounded Delphi Methodology (GDM) was used to explore the concept of fragility and the relation between fragility and resilience of the health system. We engaged experts in a consensus-building process to explore the concept of fragility and to deepen our

understanding of the relationships between fragility and resilience within Afghanistan's health systems.

Delphi methods have been used in medical and health services research to build consensus on operational issues and problem-solving.¹²⁷⁻¹³⁰ In a meta-review of systematic reviews within the health sciences, Niederberger and Spranger highlighted the diverse array of methodologies employed in Delphi processes. These encompass qualitative and mixed methods approaches, all applied to investigate a wide spectrum of topics within the health sector. These topics include complex health phenomena, needs assessments, policy development, knowledge synthesis, and numerous others.^{127,131} Fletcher et al. used Delphi methods in Participatory Action Research on health leadership in Canada.¹³⁰ In another example of utilizing qualitative methodologies within the health sector, Higgins et al. explored the definition of autistic burnout using the GDM approach.¹³²

The GDM provides a structured approach to harnessing expert knowledge while allowing flexibility and adaptability in exploring complex research topics. It combines the advantages of qualitative analysis and consensus-building techniques, offering insights into emerging or underexplored areas of study.¹³⁰⁻¹³³ Since the concept of fragility warrants deeper exploration, the GDM approach emerged as the most suitable methodology and was selected as the preferred methodology for gaining a comprehensive understanding of the research questions at hand.

The GDM is an enhanced method for theory-building and was, therefore, the most suitable method to evaluate the three research sub-questions. The grounded theory approach and expert consensus building through the Delphi method supported a more comprehensive understanding of the fragility and resilience of health systems. An overview of the GDM adapted from Paivarinta et al.,¹²⁸ for this study is presented in Figure 3.1. The figure elaborates on the aspects of GDM drawing from the Delphi method and Grounded theory in parallel to each other. The GDM process entailed expert identification (sampling), key informant interview data collection (asynchronous brainstorming), concept discovery and

categorization, concept prioritization and ranking, concept agreement, and theory development.

We began by recruiting a panel of experts to address the three research sub-questions. Data collection involved conducting interviews and administering two surveys. We analyzed the three sub-questions one by one. First, we explored the concept of fragility within health systems. Next, we examined the relationship between fragility and resilience in health systems. Finally, we applied the insights gained from analyzing the first two sub-questions to our findings from Afghanistan.

Participant selection and initial data collection processes were consistent across all three sub-questions and are outlined here.

Selecting and inviting qualified experts

Selecting qualified experts - sampling methodology

Maximum variation purposive sampling strategy^{134,135,136} was used to recruit experts from various backgrounds with experiences relevant to the study objectives. The minimum sample size was set at ten and the maximum at 18 experts, consistent with the recommended sample size of such studies in the literature.¹³⁷ The Delphi group size does not depend on the statistical sample size; group consensus building is the key to analyzing and interpreting results.¹³⁷ Before identifying the experts, a knowledge resource nomination worksheet (KRNW) was prepared to categorize experts in the field based on their disciplines and organizations to maximize the variation of sampled participants.¹³⁷

The KRNW served as a guide to ensure diversity in the representation of expertise and was the basis for the purposeful sampling of key informants in the field. The KRNW was then populated with disciplines, skills, organizations, and publications in relevant literature. The names, including the participants' personal contacts and network connections, were also noted in a master sheet. The participating experts were also asked to nominate other experts (snowball sampling).

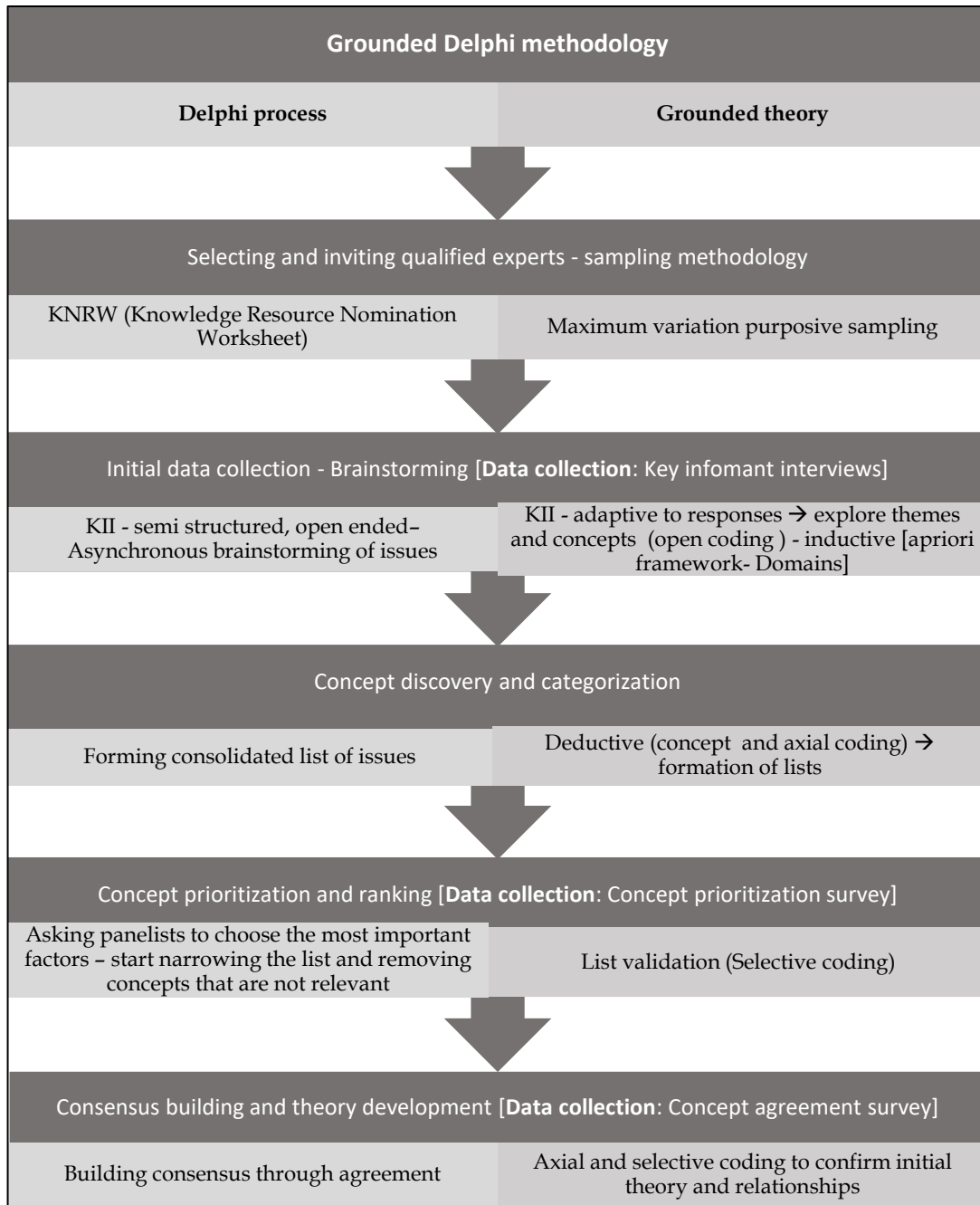


Figure 3.1: Overview of Grounded Delphi Methodology

Note: The figure adapted from Paivarinta et al. shows how the two methodologies (qualitative-grounded theory and Delphi) complement each other by combining qualitative approaches and emerging themes with consensus building through the Delphi process.

Inviting qualified experts - participant recruitment

A list of experts based on knowledge of the field ^b and literature was created with emails and contacts of the potential participants. The potential participants were contacted via email and invited to participate in the study. Successful recruitment entailed discussing the study, their time commitment, and signing informed consent. The recruited participants were invited via email to participate in a one-hour interview followed by two 15-minute questionnaires at a later date. The experts were anonymous to each other and known only to the researcher.¹³⁷ Sampling stopped when 18 experts (maximum number, to account for attrition) were recruited successfully.

Initial data collection (key informant interviews)

Data collection began with recruiting and interviewing participants identified through the KRNW. These interviews lasted 45 minutes to an hour and were carried out between October 2020 and April 2021 by a single researcher (FR). The interviews were conducted in English and were recorded for transcription. Transcription of the interviews was completed by FR and validated by a research assistant, SN. An open-ended semi-structured interview guide facilitated data collection (Appendix 3.1).

The ***research team*** was comprised of four members (FR, SN, AD, GB), all possessing expertise in public health. Among them, three were skilled in qualitative analysis, and two had experience in health service delivery and health systems research. Transcripts, codes, and memos were stored in NVIVO (for Windows) to compare codes and categories for analysis. Excel sheets were also used to import memos and emerging domains for continued debriefings and reflections within the research team.

Various methodological measures were implemented to enhance rigour, including improving internal validity through peer debriefings and incorporating techniques to build data trustworthiness for internal and external validity. We established predefined

^b Field knowledge was based on interaction with global health experts through previous work experience and during conferences, workshops and previous academic interactions.

parameters for trustworthiness¹³⁸, addressing elements such as credibility, transferability, dependability and conformability. The KRNW and a semi-structured questionnaire contributed to the credibility of the data. Member-checking validation techniques, which included sharing findings and incorporating feedback during peer debriefings, were used to improve credibility and data validity.

The data were analyzed and interpreted in three stages in response to the three sub-questions; the research team consistently engaged in reflective exercises throughout data analysis and interpretation to ensure that the data were grounded in participant experience. This involved an ongoing commitment to remain closely connected with the data and to validate interpretations through multiple checks. These checks encompassed intra-interview interpretations involving comparisons within data from the same participant, inter-interview interpretations involving comparisons across different participants, and examinations of divergent perspectives across the dataset as it evolved.

To ensure dependability, a systematic coding mechanism was established, and the findings underwent continuous interpretation with a descriptive overview, followed by a process of constant comparison, as elaborated in the methodology for addressing the three research questions later in this chapter. Additionally, to maintain objectivity and ensure conformability, team discussions on reflexivity played a pivotal role in conscientiously setting aside preconceptions during data analysis and interpretation, facilitating the emergence of a theoretical framework rooted in the data. Finally, contextual details in the peer debriefings and consensus building during the analysis process were leveraged to enhance the reliability and transferability of findings to similar settings.

The methodology for analyzing and interpreting data are described separately for each of the three sub-questions and presented in detail below.

3.1.2 Methods RQ 1.1 - What is fragility of health systems?

Our first research question sought to comprehend the concept of fragility of health systems. Using GDM, our investigation began with the selection and invitation of qualified experts, as described above. Subsequently, we embarked on initial data collection and brainstorming with our key informants. We then delved into concept discovery and categorization into domains of fragility of health systems by analyzing the data from these interviews. Following this, we prioritized and ranked these domains using the first structured survey. The process continued with concept refinement and development through a second survey. Finally, we synthesized all the gathered data, including insights from KII and the two surveys, to formulate and develop our theoretical framework. The details of the methodology used to examine the fragility of health systems are presented here.

Brainstorming

The interview guide (Appendix 3.1) served as a guide to direct conversations and facilitated brainstorming whereby concepts were explored, and emerging concepts were identified as domains critical to the fragility of health systems. The participants were probed about their understanding of the fragility of health systems, and prompts and clarifications were initiated as needed during the interviews.

The data from the brainstorming phase formed the basis for the grounded theory.^{139,140,141,142} Although theoretical saturation was not the primary consideration¹²⁸ for this study design and sampling strategy, the analysis process followed established Grounded Theory protocols. It entailed a continuous, data-driven exploration, starting with inductive coding during the brainstorming phase, which evolved into focused code development and concept discovery, ultimately contributing to the identification of domains of fragility within health systems.^{143–146}

The analysis unfolded in two distinct stages: an initial inductive coding was done during brainstorming, coinciding with interviews, aimed at developing an *a priori*^c framework identifying domains of health system fragility. The brainstorming analysis was followed by additional analysis during the concept discovery and categorization phase, described later in this section.

The brainstorming analysis combined line-by-line coding with descriptive, reflexive and comparative memoing techniques, guided by Charmaz's approach to reflexivity for code prioritization.¹⁴⁷⁻¹⁴⁹ This analysis coincided with the interviews to develop an *a priori* framework for domains of health system fragility. The steps for data analysis during brainstorming were as follows:

- Transcribed statements were analyzed iteratively as data for KII was being collected, involving continuous comparisons within and across interviews during the coding phase, regular debriefings between FR and SN, and collaborative discussions during peer debriefings and meetings with AD and GB.
- Line-by-line coding was performed, accompanied by creating memos to capture initial impressions. Initially, descriptive and reflexive memoing was employed, providing detailed descriptions of codes and constant comparisons to identify critical codes.
- As interviews progressed and more codes emerged, a shift toward comparative memoing occurred, allowing for a deeper understanding of emerging concepts as potential domains of health system fragility.
- Codes were continuously compared and combined to form higher-level focused codes. Charmaz's guidance was applied to prioritize the most focused codes, which were grounded in more substantial data, and to discern situations where codes could be subsumed.

^c 'a priori' method requires that the data fits a pre-determined classification system.¹⁴³

A framework based on the domains of fragility of health systems was developed during brainstorming; this formed the basis of concept discovery and categorization, described below.

Concept discovery and categorization

The domains identified during brainstorming served as an a priori framework for the deductive analysis during concept discovery and categorization. This method has been used in the literature in various fields, including healthcare and education, where a deductive *a priori* classification framework is used to categorize the data and provide an inductive classification framework to discover new concepts.^{143, 144} The steps for data analysis during concept discovery and categorization are presented here:

- This analysis occurred after all interviews were completed and an a priori framework had been developed. It involved further refinement of coding, concept discovery, and categorization, leveraging the insights gained from the initial coding phase and applying them to a comprehensive analysis of the entire dataset.
- Concept coding, accompanied by analytical and theoretical memoing, was employed to gain insight into core concepts that emerged as sub-domains.
- These sub-domains were analyzed for their connections with the domains identified during the brainstorming phase. The resulting sub-domain list was systematically linked to the overarching domains, facilitating a comprehensive understanding of health system fragility. In research team meetings, final coding decisions were deliberated to ensure accuracy and consistency.

This iterative process ultimately led to identifying domains and sub-domains related to the fragility of health systems.

Concept prioritization and ranking

The domains and sub-domains were formalized as a consolidated list, which was sent as a structured survey for concept prioritization to the key informants who had participated in the interviews. The survey (Appendix 3.2; Section 1) asked the participants to rank the domains and sub-domains most critical to health systems' fragility. The purpose of sending the list of questions as the survey was three-fold: (i) validation of the concepts as discussed during the brainstorming phase, (ii) Selective coding, whereby the participants identified and prioritized the key concepts, (iii) and provided additional feedback on conceptualizing the phenomenon under study.

Data were collected through a survey via email using Qualtrics software ¹⁵⁰ to administer surveys, and responses were collected from May 2022 to July 2022. Respondents ranked each domain and sub-domain from 0-100, with 100 being most critically related to the fragility of health systems. Descriptive statistics using medians and frequency distribution were used to analyze the data, and histograms and box plots were used for data visualization. A ranked list of domains and sub-domains was created based on survey analysis.

Consensus building

The ranked list of domains and sub-domains was consolidated in a second survey sent to the same participants who had contributed to KIIs and the first survey. The structured survey (Appendix 3.3; Section 1) was sent between November 2022 and April 2023, to establish consensus regarding ranking domains and sub-domains of health system fragility. Participants were presented with the previously ranked domains and sub-domains and were invited to express their agreement, neutrality, or disagreement with the rankings. This approach was adopted to foster agreement around the concepts.

The survey was disseminated through email using the Qualtrics software platform. The consensus was analyzed by recording the frequency distribution as the percentage of

participants agreeing with the rankings emerging from the previous survey, presented as funnel and bar graphs.

The interrater reliability was measured using the percentage agreement methodology. Percentage agreement^d is a measure to assess the level of agreement between two or more raters or observations on a categorical variable. Percentage agreement was used to assess the interrater agreement for the domains of the fragility of the health system. The agreement levels were categorized as follows: 0 to 0.2 as slight agreement, 0.21 to 0.4 as fair agreement, 0.41 to 0.6 as moderate agreement, 0.61 to 0.80 as substantial agreement, and 0.81 to 1.00 as almost perfect agreement.¹⁵¹

Developing theoretical framework

The theoretical framework was developed through an iterative exploration of the concepts related to the fragility of health systems. The critical domains identified during the brainstorming phase were refined throughout the analysis and concept discovery process and adapted as new information emerged throughout this phase. The final framework was created after the feedback, refinement, and validation processes through surveys and peer discussion. This framework can serve as a theoretical basis for further exploring and understanding the subject.

^d Percentage agreement is the percentage of the number of agreed items (This is the count of items or observations where all raters or observers have provided the same categorical response) divided by total number of items (This is the total count of items or observations being rated or observed). **Percentage Agreement=**
(Total number of items/Number of agreed items)

3.1.3 Methods RQ 1.2- What is the relationship between the fragility and resilience of health systems?

Our next research question was focused on understanding the relationship between the concepts of fragility and resilience of health systems. Given the focus on understanding these interrelationships, our analytical approach shifted towards identifying themes and sub-themes instead of domains and sub-domains. Since exploring this research question involved thematic analysis and did not entail assessing the hierarchy of concepts, we omitted the concept ranking step outlined in Figure 3.1, transitioning to concept agreement after the brainstorming and concept discovery themes and sub-themes. The same experts who contributed insights on health system fragility also participated in discussions regarding the relationship between fragility and resilience. We utilized an open-ended semi-structured questionnaire (Appendix 3.1), following the process detailed in the preceding section. After conducting interviews and analyzing the data, we sought participant feedback on their agreement with the emerging themes and sub-themes through a survey (Appendix 3.3; Section 3). The findings were summarized and presented as themes and sub-themes delineating the intricate relationship between health system fragility and resilience, and a comprehensive description of the analysis and interpretation is provided in this section.

Brainstorming and concept discovery

The interview guide, found in Appendix 3.1, served as a framework for conducting in-depth discussions and fostering brainstorming sessions. Throughout these interviews, emerging concepts were recognized and subsequently categorized as sub-themes and themes. Participants were actively engaged in conversations concerning their perceptions of the relationship between the fragility and resilience of health systems. The participants were prompted to provide clarifications where needed to ensure a comprehensive exploration of their insights and perspectives during the interviews.

We merged brainstorming and concept discovery to analyze this research question because our focus was discovering themes and sub-themes related to the study question. As with our previous analyses, our methodology involved line-by-line coding and descriptive, reflexive, and comparative memoing techniques. The steps for data analysis included:

- Iterative analysis of transcribed statements, including continuous comparisons within and across interviews during the coding phase and regular collaborative discussions during peer debriefings and meetings.
- Line-by-line coding, initially involving descriptive and reflexive memoing, capturing detailed code descriptions and constant comparisons to identify crucial codes.
- As interviews advanced and more codes surfaced, a transition to comparative memoing deepened our grasp of emerging concepts. Continuous code comparisons led to the creation of higher-level focused codes. Similar codes and concepts were grouped as categories and then sub-themes describing the relationship between the fragility and resilience of health systems.
- We followed Charmaz's guidance to determine instances where sub-themes could be subsumed into emerging themes. A list of themes and sub-themes was created at the end of this process.

Consensus building

The list of themes and sub-themes was consolidated as statements in a survey sent to the same participants who had contributed to KIIs. The structured survey (Appendix 3.3; Section 3) was sent to establish consensus regarding the statements describing the relationship between fragility and resilience of health systems. The survey was disseminated through email using the Qualtrics software platform. There were two methods used to assess consensus.

For statements emerging as categories under themes and sub-themes, the participants were asked to agree or disagree with the statements (Appendix 3.3; Section 3). Percentage agreement with 95% CI were used to assess the agreement level for the statements. The

agreement levels were categorized as follows: 0 to 0.2 as slight agreement, 0.21 to 0.4 as fair agreement, 0.41 to 0.6 as moderate agreement, 0.61 to 0.80 as substantial agreement, and 0.81 to 1.00 as almost perfect agreement.¹⁵¹

The participants were asked to rank the agreement on a continuous scale for statements emerging as spectrum-related under themes and sub-themes. The scales were standardized to the range of 0 to 1 (0 was the lowest score, and 1 was the highest score). Means and 95% CI were used to describe the agreements measured on a continuous scale. The results from the KII and the survey were summarized and amalgamated after the interpretation process and presented together.

3.1.4 Methods RQ 1.3 - How is the understanding of the fragility of health systems applied in Afghanistan?

Following our examination of the concept of health system fragility and the relationship between fragility and resilience, we focused on its application within the context of healthcare systems in Afghanistan. Given that many of the experts selected KRNW had experience working in Afghanistan, we initiated discussions on health system fragility and resilience during the initial interviews with key informants; the guiding questions are presented in Appendix 3.1. The data were first analyzed to understand the fragility of health systems in Afghanistan using the established framework; later, we explored the relationship between the fragility and resilience of health systems in Afghanistan with themes and sub-themes identified through the previous research question. Details of analysis and interpretation are presented in this section.

The fragility of health systems in Afghanistan

Following the establishment of the framework for health system fragility, including domains and sub-domains, through the analysis of Research Question 1.1, we once again analyzed the KII, this time focused on discussions on Afghanistan. This analysis was conducted using the health systems fragility framework as the foundational basis, allowing

us to explore and understand the concept of health system fragility within the context of Afghanistan. The steps used in this data analysis were:

- This analysis took place after the conclusion of all interviews and the development of the fragility of the health systems framework with domains and sub-domains.
- First, we engaged in line-by-line coding of the quotes related to concepts and discussions linked to health systems in Afghanistan.
- These coded elements were then summarized and organized into quotes, categorizing them into the domains and sub-domains identified through Research Question 1.1.
- Reflexive memoing, team meetings, and discussions were used to finalize the quotes for the domains and sub-domains.
- A list of domains and sub-domains, mirroring the fragility of health systems explored in Research Question 1.1, was compiled and distributed to key informants for ranking within the Afghan context through a structured survey (see Appendix 3.2, Section 2). Participants were asked to rank domains from one to seven and sub-domains as "critical," "somewhat critical," or "not critical" to health system fragility.
- The structured survey results were analyzed, presenting median and mean rankings for domains and frequency distributions for sub-domains. Domain rankings for health system fragility in Afghanistan were compared to overall health system fragility rankings.
- In the second structured survey (Appendix 3.3, Section 2), domain rankings were presented, and participants were asked to agree or disagree with these rankings to establish consensus. Frequency distributions and percentage agreement measures were employed to assess agreement.
- The outcomes were consolidated and summarized, with quotes related to domains and sub-domains in a table. Additional tables and bar graphs were utilized to visualize the ranking data for enhanced clarity and understanding.

Relationship between fragility and resilience of health systems in Afghanistan

Finally, we analyzed the key informant data to gain insights into the relationship between health system fragility and resilience in Afghanistan. The themes and sub-themes identified in our exploration of Research Question 1.2 served as the framework for this analysis. The following steps were undertaken in this analytical process:

- We conducted line-by-line coding of quotes associated with concepts and discussions related to health systems in Afghanistan.
- These coded elements were subsequently condensed and grouped into quotes, aligning them with the themes and sub-themes identified through Research Question 1.2.
- We used analytic memoing to understand the contextual relevance of the sub-themes within Afghanistan. This process helped us identify and articulate the connections between the sub-themes and the Afghan context. We compiled a list of memos with pertinent quotes categorized under the themes and sub-themes identified through Research Question 1.2, presenting this information in a tabular format for clarity.

3.2 RQ2- Did the introduction of female health workers to support Maternal, Neonatal, and Child Health service delivery by Afghan Red Crescent Society's Mobile Health Teams lead to a change in service delivery outcomes?

After exploring the concept of health system fragility, we transitioned to a real-world example to deepen our understanding of how this concept manifests in health service delivery, mainly through the support of the RCRCM in Afghanistan. This research question addresses a critical aspect of service delivery, focusing on the introduction of female health workers (midwives) as an intervention. Our investigation encompassed two key sub-questions: firstly, we assessed the overall impact of this intervention on Maternal, Newborn, and Child Health (MNCH) services, considering the midwives' role in enhancing service delivery for women and children. Secondly, we examined the influence of security conditions - as the country has been in the throes of protracted conflict for decades - on the quantity of MNCH services delivered.

In this section, we present a comprehensive methodology for both sub-questions. However, before delving into the methodology, we provide a more detailed overview of the context and the intervention.

3.2.1 Context

Protracted armed conflict over the last four decades and the devastating impacts of climate change, with frequent flooding and draughts, have worsened the contextual vulnerabilities in the country, weakening health systems and increasing gaps in the delivery of primary health services to the most vulnerable in Afghanistan.¹⁵² The ARCS has been mitigating some of Afghanistan's health services delivery gaps. The ARCS has worked in rural and remote communities to deliver primary health services through Mobile Health Teams (MHTs) nationwide since 2011. The MHTs offer basic health packages in hard-to-reach

areas, those under the control of armed groups, and areas that are geographically remote and without access to Health Posts (HP) or Basic Health Centres (BHC).^{e,f}

A basic healthcare package of healthcare services (BPHS) ¹⁰³ supported by the Ministry of Public Health (MoPH) included outpatient services for women, children, and men for common communicable and non-communicable diseases, wound care, routine antenatal, post-natal care, referral for skilled birth delivery, and immunizations for children and women of reproductive age were delivered through the ARCS-MHTs. The ARCS-MHTs were operational in all 34 provinces in Afghanistan and travelled to hard-to-reach areas and set up their health clinics for 2 to 3 weeks within the communities before returning for a week's rest and reporting and then heading back again to deliver these health packages.^g See Figure 3.2 for an overview of the MHT operations. The MoPH's provincial branches worked with ARCS's regional branches to decide districts where MHT operations were needed yearly. The ARCS's regional branches coordinated with their provincial branches to organize MHT operations in designated districts. During emergencies such as floods, the MHTs in the province were directed to respond to the emergencies in their region.

From January 2015, the ARCS-MHTs systematically started collecting monthly monitoring data using a template provided by the Afghan MoPH, feeding into the ministry's Health Information System (HIS). The HIS data from the MHTs were recorded on registers during the operations, consolidated and sent to MoPH headquarters in Kabul, from where it was disseminated back to the ARCS regional headquarters to be disseminated to partners and donors for reporting. With the expansion of MHTs across the 34 provinces (see Figure 2.2, Panel 1 for the timeline of ARC-MHTs operations), 2,508 observations^h were available from January 2015 to June 2020.

^e [Canadian Red Cross support to Afghanistan](https://www.redcross.ca/how-we-help/international-programs/international-development/asia/afghanistan). Available at: <https://www.redcross.ca/how-we-help/international-programs/international-development/asia/afghanistan>. Last accessed: October 2023.

^f [Red Cross- Afghanistan Humanitarian appeal](https://www.redcross.ca/about-us/media-news/news-releases/red-cross-launches-afghanistan-humanitarian-crisis-appeal). Available at: <https://www.redcross.ca/about-us/media-news/news-releases/red-cross-launches-afghanistan-humanitarian-crisis-appeal>. Last accessed: October 2023.

^g Discussions and meetings with CRC country representative Hani Dejeni and GHU-CRC Director Salim Sohani. 2018.

^h One observation was the number of services delivered in one month in one province (one row)

3.2.2 Intervention

The intervention for research sub-questions was introducing female healthcare workers (midwives) in ARCS-MHT. Initially, the MHTs consisted only of male staff members comprised of a doctor/nurse or a community health worker as team leader, a vaccinator, a pharmacy dispenser, and a driver. Deep-seated sociocultural beliefs prevented women from exposing their arms for blood pressure monitoring in front of men. More intimate examinations such as antenatal, perinatal, and post-natal checkups were even more prohibitive. Furthermore, female health workers were not allowed to work in areas far from home without a male 'mahram'ⁱ accompanying them.

In 2016, the ARCS introduced trained midwives (female healthcare workers) to the MHTs. The midwives were accompanied by their mahram, who were also hired as drivers or other support staff in the MHT, depending on their qualifications. Midwives were gradually introduced over time in MHTs, with some provinces having midwives starting their work with MHTs in early 2016 while others started their work over the next few months to over a year (also described in Chapter 2, Figure 2.2; Panel 2).

Twenty-eight provinces had midwives starting at some point after 2016, and six provinces did not include midwives in their MHT operations at any point during the study period (Fig. 2.2). Seven provinces had the intervention (presence of midwives) starting in 2016 twelve provinces in 2017 and nine provinces in 2018 and beyond. There were six provinces without intervention (no midwife), and these were treated as control provinces.

ⁱ Mahram – Male members of the family, a mahram is a man directly related to a woman by blood or marriage (husband, brother, father, son).

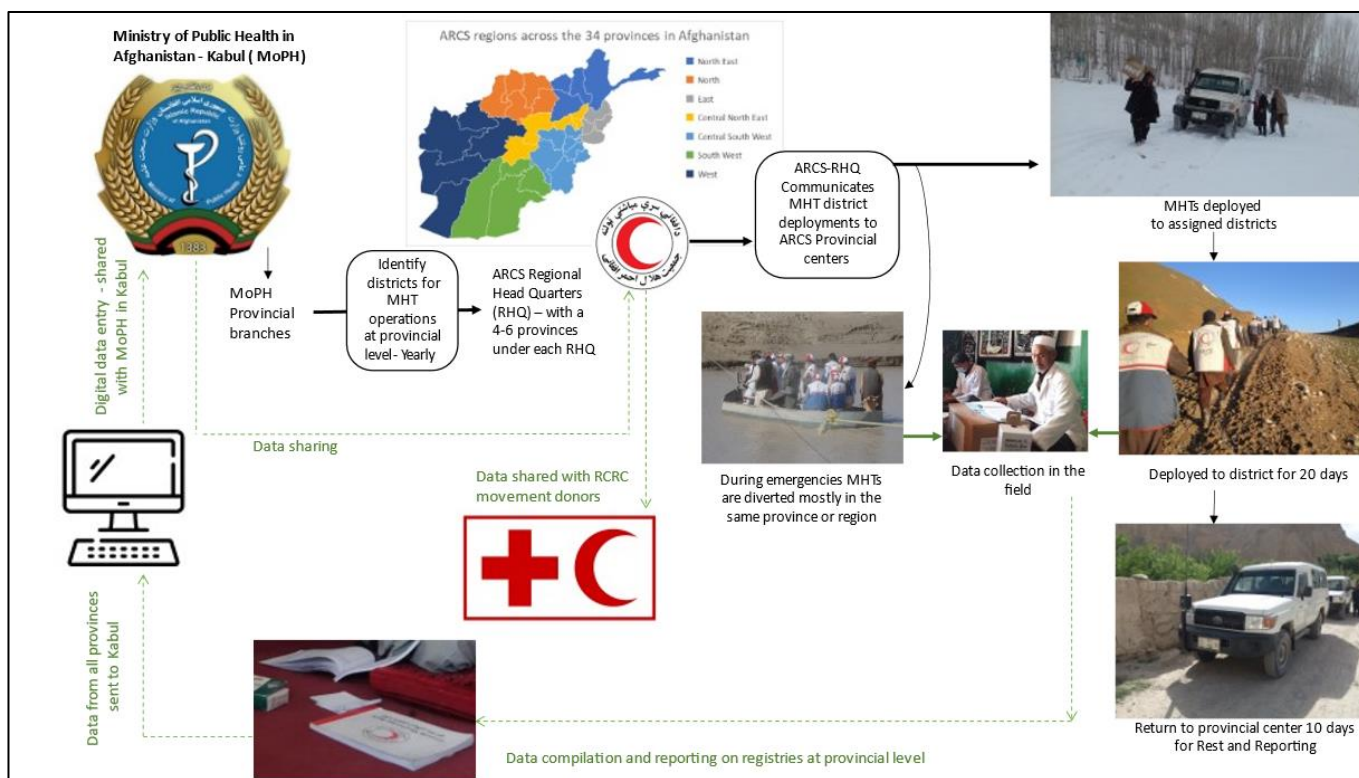


Figure 3.2: Overview of the ARCS MHT operations in Afghanistan

Note: The black arrows show the MHT operations coordination pathways. The green arrows show the MHT data collection and data dissemination pathways. Photo credits: The photos were provided by ARCS to be used for this work and were communicated through CRC's country head in Afghanistan. The pictures on the right show the vehicles, the mobile health units used to transport staff and medicines, and the difficult terrains where MHTs were operating. The middle picture shows the MHTs responding to flood-related emergencies and data collection in the field. The MoPH logo is available from the Afghanistan online website: <https://www.afghan-web.com/health/>. Faiza Rab created the ARCS regional map. The data reporting mechanisms were available from the Afghanistan Basic Health Care Program by ARCS – A review report of ARCS health and care program 2011-2015 by Norwegian Red Cross-Nuran Higgins, March 2015.

3.2.3 Methods RQ 2.1 - Was there a difference in MNCH outcomes after the introduction of female health workers in ARCS-MHTs?

Female healthcare workers were introduced to improve outcomes for women and children by providing them with a safe space to access health services. As described previously, before the introduction of midwives (female healthcare workers) in ARCS-MHTs, it was observed that many women were not accessing MHT services, especially for pregnancy-related services, since an intimate examination was often required. Due to socio-cultural barriers, most women were uncomfortable being examined by male healthcare workers. To understand the difference in MNCH outcomes after introducing female health workers in ARCS-MHTs, we used a study design relying on a quantitative approach. However, we also collected additional qualitative data to explain and validate findings from the quantitative analysis.

Study design

A *quantitatively* driven approach using an Interrupted Time Series Analysis (ITSA) ¹⁵³ was used as the study design to answer this research question - the delta was the change in the number of MNCH services delivered before and after the introduction of midwives. Additionally, content analysis design was used as the *qualitative* approach to explain and validate the findings from ITSA.

Using ITSA accounted for individual variations among the provinces while still capturing the overall trends and effects of the interventions. This robust methodology enabled us to draw reliable conclusions and make meaningful inferences regarding the relationships between time, interventions, and the study variables. The ITSA design evaluates the effectiveness of public health interventions and policy changes, ¹⁵³⁻¹⁶¹ as it interrupts the level or trend of the outcome variable measured serially over time. ¹⁵⁴ Recently developed ITSA designs incorporate panel data to account for correlations similar to the Generalized Estimating Equations (GEE) modelling by accounting for potential correlations among observations within groups or panels. ¹⁵⁸

Since the intervention for this analysis was the introduction of midwives, we centred time at the start of the intervention (t1) as the first month of the year for the provinces where the intervention was introduced that year. There were two reasons for centering t1 this way. First, Panel 2 in Figure 2.2 illustrates a discernible clustering of midwives' start times in MHTs. Some provinces had midwives integrated into MHTs in 2016, many in 2017, and a few experienced this initiation process in 2018 and beyond. Second, where there was no intervention, there was no start time for pre- or post-analysis. Therefore, to compare the change in the number of MNCH services delivered before and after the introduction of female healthcare workers, we grouped the provinces in Afghanistan into three groups based on the year of introduction of midwives for the intervention group and one additional group of provinces having no midwives for comparison as the control group. Six provinces, where no midwife intervention occurred throughout the study, were combined to create the **control group**. Seven provinces where the midwife intervention began in 2016 were appended to form **intervention group 1**. Likewise, 12 provinces with midwife intervention starting in 2017 constituted **intervention group 2**, while 13 provinces with midwife intervention commencing in 2018 and beyond constituted **intervention group 3**.

The ITSA study design, presented in Figure 3.3, entailed comparing intervention groups with control to estimate the outcome difference (MNCH service delivery). January 2016, January 2017 and January 2018 corresponded to the start of the intervention (introduction of midwives) for the three groups and were considered t1 for the three intervention groups, respectively. For control comparison, t1 for control was set as the same as the intervention group; for example, when comparing intervention group 2 with control, t1 for both groups was January 2017. The three intervention groups ($Z=1$) were compared to the control group (absence of midwife) ($Z=0$).

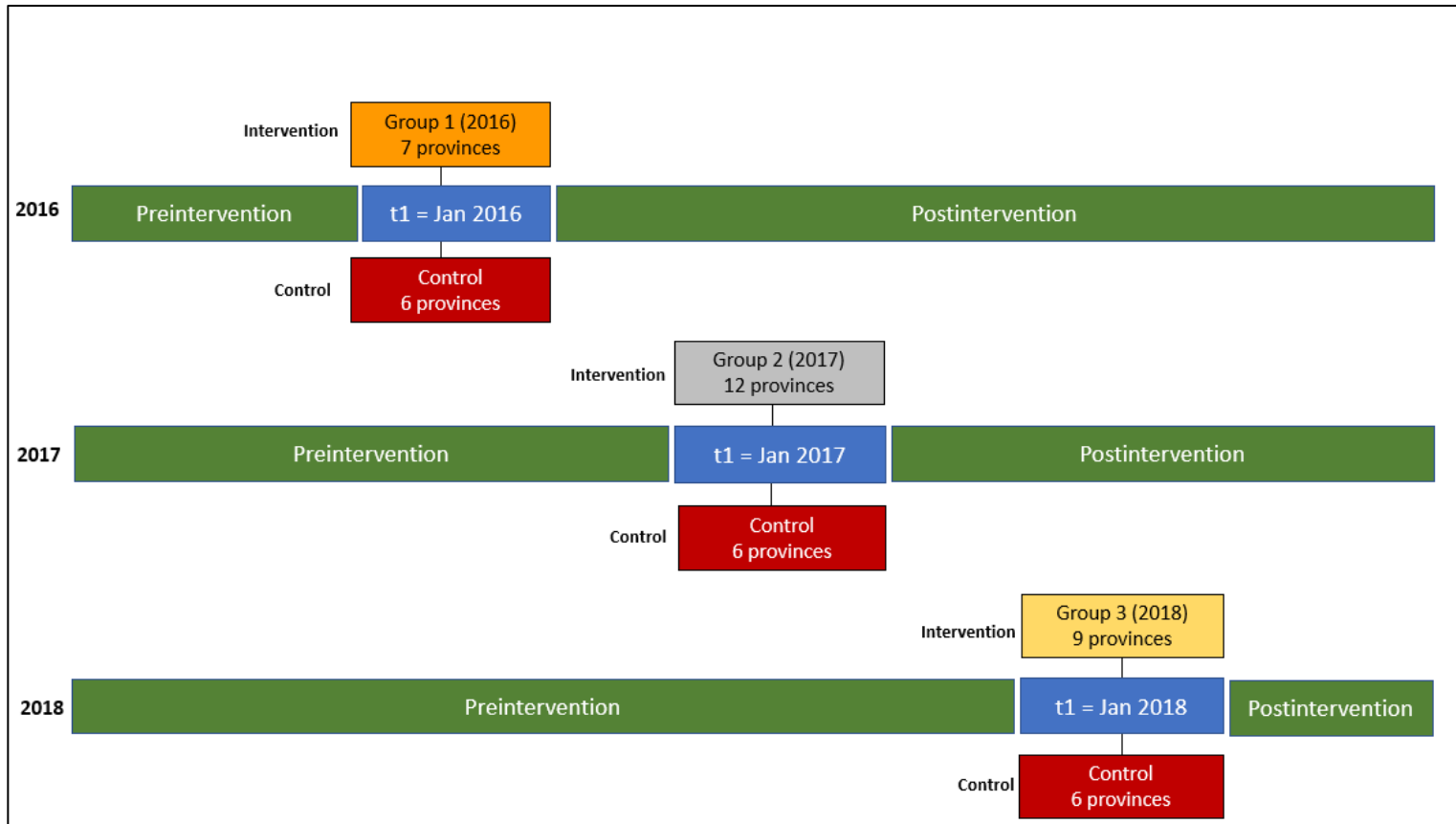


Figure 3.3: Study design to assess the difference in MNCH outcomes after the introduction of female health workers in ARCS-MHTs

The following section will provide a comprehensive overview of the quantitative data collection and analysis methodology using the ITSA design. This will be followed by a more detailed exploration of the qualitative data collection and analysis methodology.

Quantitative data collection and analysis

Data sources and collection

Two types of data were extracted for quantitative analysis. i) Health service delivery data. ii) MHT operations data.

i. Health service delivery data:

Data source

Monthly health service delivery data were collected by the ARCS-MHTs operating in Afghanistan. The data consisted of the total number of health services disaggregated by types of services delivered by the MHTs to children, women and men at district and provincial levels each month. The variables extracted for this study were monthly data delivered by MHTs at the provincial level each month. The data provided the four outcome variables constituting the MNCH services, including childhood vaccinations, tetanus toxoid vaccinations, antenatal care services (ANC) and postnatal care (PNC) services (see Table 3.1 for more details regarding the services).

Data collection process

The MHTs delivered health services to the communities once a month and stayed in the community for almost three weeks before returning to provincial headquarters to rest, report, refuel and re-load for the next community field mission. The Afghan Ministry of Public Health (MoPH) Health Information System (HIS) was used as a tool for data collection. The MHT staff collected health service delivery data on service registries with pen/pencil and paper. The data were then delivered to the ARCS regional headquarters each month by all the MHTs operating in the area. From the regional headquarters, the data were transferred to Kabul, the capital city, where the data were entered into an Excel spreadsheet by MoPH staff and then delivered to ARCS headquarters in Kabul. The data were transferred to CRC using the Red Cross's secure servers. Monthly ARCS MHT health service delivery data for

66 months from January 2015 to June 2020 (January 2015 was when ARCS-MHTs systematically started data collection) was available for this study; see Figure 3.3.

ii. MHT operations data:

Data source

The data were extracted from ARCS operations databases. The database in Excel contained information regarding the logistical aspects of MHT operations. The data elements included information on the location of the MHT (district and province), whether the MHT was operating for a month, the reasons for not going to the communities, or if the MHTs were diverted to Internally Displaced Persons (IDP) camps. The database also contained information on staff deployed in MHTs each month, including if the midwives were part of the MHT that month and the number of days the MHTs were in the community.

Data collection process

The data were entered each month as the MHT prepared to depart for the community. The data were aggregated at the regional ARCS headquarters and sent to the country ARCS headquarters in Kabul. The data were then transferred to CRC using the Red Cross's secure servers, making it available to the investigators for extraction.

Data extraction

The data were extracted in Microsoft Excel ¹⁶² data sheets for each province using the data sources described above. Details of variables extracted with definitions are presented in Table 3.1. Data were extracted monthly from January 2015 to June 2020, and the data were then imported into Stata 14 ¹⁶³ for each province and later appended to create one database for descriptive analysis. Provincial data in Stata was further appended based on the study objectives, which will be described in detail later in this section.

Table 3.1: Variable definition and type

Variable name	Variable definition	Variable type
Month	The time variable was collected with a gap of one month from January 2015 to June 2020.	Ordinal
Province	These were the 34 Afghan provinces. The province was the group or panel variable for the ITSA panel data analysis.	Categorical
Female healthcare workers	The intervention was the presence of midwives (female healthcare workers). This variable had two categories. The time before midwives were introduced in the MHTs (X=0) or preintervention and after midwives were introduced in the MHTs (X=1) or postintervention.	Categorical
Childhood vaccinations (MNCH service)	The total number of childhood vaccinations delivered each month by ARCS-MHTs in each province. The vaccinations included Bacille Calmette-Guérin (BCG), Pentavalent vaccine (with Diphtheria, Pertussis, Tetanus, Hepatitis B and Influenza vaccines), Polio and Measles. This was one of the outcome variables.	Continuous
Tetanus toxoid vaccinations (MNCH service)	The total number of tetanus toxoid vaccination services delivered to women of reproductive age between 15 to 49 years of age (including pregnant women) each month by ARCS-MHTs in each province. This was one of the outcome variables.	Continuous

Continued next page...

Variable name	Variable definition	Variable type
<p>ANC services (MNCH service)</p>	<p>The total number of monthly antenatal care services by ARCS-MHTs in each province. One service consisted of one patient serviced with one or more of the following services offered - general physical examination, health education on danger signs of pregnancy, fetal and vaginal examination and provided supplements, treatment and referrals when needed. This was one of the outcome variables.</p>	<p>Continuous</p>
<p>PNC services (MNCH service)</p>	<p>The total number of monthly postnatal care services by ARCS-MHTs in each province. One service consisted of one patient serviced with one or more of the following services: general physical exam of the mother and baby, health education on general danger signs post-pregnancy, breastfeeding, nutrition, supplements, treatment and referrals when needed. This was one of the outcome variables.</p>	<p>Continuous</p>

Data analysis

The initial step in this analysis involved consolidating the data by appending it and addressing missing values. Subsequently, we conducted univariate and bivariate analyses before proceeding with the three interrupted time series analyses using the panel data.

Accounting for missing

In the database, months when MHT services were not provided for various reasons, such as MHT not being operational, security issues, or training purposes, were coded as '.' to represent missing data. These missing data points were treated as '0' to signify that no services were delivered during those periods. Treating the missing months as '0' allowed us to maintain the integrity of the time series data.

Univariate analysis

Mean and 95% confidence intervals were used to describe the distribution of the four outcome variables for MNCH service delivery (childhood vaccinations, tetanus toxoid vaccinations, ANC and PNC services). Line charts were used to describe the monthly trend for the distribution of outcome variables.

To get a standardized understanding of the distribution of the outcome variables in each province, we used the population-based distribution of average monthly services across the provinces. The steps for calculating the population-based distribution were as follows:

- Afghanistan population census data, with estimated populations for 2019-2020 by the Afghan Central Statistics Office, was used for the calculations.¹⁶⁴
- Calculating children's population:
 - In Afghanistan, the UNICEF data showed that the percentage of children under 5 was approximately 42% of the population in 2015.^j
 - Provincial proportions were unavailable; therefore, for each province, 42% of the total population was calculated as a total estimate of the children's population.

^j The information regarding percentage population was calculated based on Percentage of children under age 5 whose births are registered. Source: UNICEF at: https://data.unicef.org/resources/data_explorer/unicef_f/?ag=UNICEF&df=GLOBAL_DATAFLOW&ver=1.0&dq=AF_G.PT_CHLD_Y0T4_REG.&startPeriod=1970&endPeriod=2023. Last accessed: November 2023.

- Childhood vaccinations population-based distribution calculation:
 - Proportion calculation = [Total number of childhood vaccinations delivered by the ARCS-MHTs in the province /Children population ((42% of the total population) in the province)] *100
- The Tetanus toxoid vaccination, ANC and PNC services were provided for women of reproductive age (15-49 years), and the population of women for each province was available from the census data. The percentage of women of reproductive age in Afghanistan was estimated to be 45.3% of total women.^k
 - Tetanus toxoid vaccination, ANC and PNC population-based distribution calculation:
 - Proportion calculation = [Total number of services (tetanus toxoid vaccinations or ANC or PNC) provided by the ARCS-MHTs in the province)/population of women of reproductive age (45.3% of the total female population) in the province] *100

Population-based distributions of total services between 2015 and 2020 across the provinces were visually presented in Excel using OpenStreetMap software. The relationship between the outcome variables and the four groups was explored using groupwise mean and confidence intervals and visualized using histograms.

^k Reproductive health indicators. Source: Relief Web. <https://reliefweb.int/report/afghanistan/reproductive-health-indicators-afghanistan>. Last accessed: November 2023.

Bivariate analysis

The bivariate relationship between the outcome variables and the four groups (control and three intervention groups) was explored using ordinary least square regression models, with the control group used as the reference category.

Interrupted time series analysis

The ITSA study design (detailed earlier in this chapter) was the basis for this analysis. The description of the variables has been provided in detail in Table 3.1. There were four outcome variables (Childhood vaccinations, Tetanus toxoid vaccinations, ANC services and PNC services); the intervention was introducing midwives. The *unit of analysis* was 'the number of services delivered per month.' For instance, if we take one of the MNCH outcomes ANC services, then an illustration of one unit of analysis would be the total number of ANC services delivered in one province, such as Herat, in one month, for example, May of 2016. We used the 'XTITSA' command in Stata, which accounted for the panel structure of our data (provinces grouped as control or intervention for this analysis). The XTITSA command generalizes the ITSA design for panel data and can specify time-related within-group correlation.¹⁵⁸

Steps for analysis

- A single-group analysis was performed for each intervention group to set up the data for autocorrelation.
- In the second step, the models were tested for autocorrelation using the Cumby-Huizinga test.^{158,165,166} The lag order, up to which autocorrelation was detected, guided the re-estimation of the models.
- Next, multiple-group analyses were conducted to compare each intervention group with the control group for the four outcome variables before and after the intervention.
- The final (multiple group analysis) models accounted for autocorrelation estimated in the second step.

Equation for analysis:

The following equation was used to estimate the trend change in the number of MNCH services in the intervention and control (multiple) groups and estimate the differences between the two groups.^{158,160}

$$MNCH_t(Y_{i,t}) = \beta_0 + \beta_1 T_{it} + \beta_2 X_{it} + \beta_3 X_{it} T_{it} + \beta_4 Z + \beta_5 Z T_{it} + \beta_6 Z X_{it} + \beta_7 Z X_{it} T_{it} + e_{it}$$

MNCH_t : Outcome at time point T (months) for each equally spaced time point ‘t’ at provincial level ‘i’.

β_0 : Intercept or outcome variable at baseline of the study.

β_1 : The outcome for control group

β_2 : The change in control group post-intervention

β_3 : The difference in pre and post-intervention in the control group

β_4 : The difference in the level (intercept) of the outcome variable between treatment and control groups prior to the intervention.

β_5 : The difference in the slope (trend) of the outcome variable between treatment and control groups prior to the intervention.

β_6 : The difference between treatment and the control groups in the level of the outcome variable immediately following the introduction of the intervention.

β_7 : The difference between the treatment and control groups in the slope (trend) of the outcome variable after introduction of the intervention compared with preintervention.

T_{it} : Time since the beginning of the study (1-66 months).

X_{it} : Intervention variable: preintervention period =0, intervention = 1.

Z : Group assignments; Z=0 (control group), Z=1 (intervention).

$X_{it} T_{it}$: Interaction term between intervention variable and time

$Z T_{it}$: Interaction terms representing the difference between control and intervention groups pre-intervention.

$Z X_{it}$: Interaction terms representing the difference between control and intervention groups immediately post-intervention.

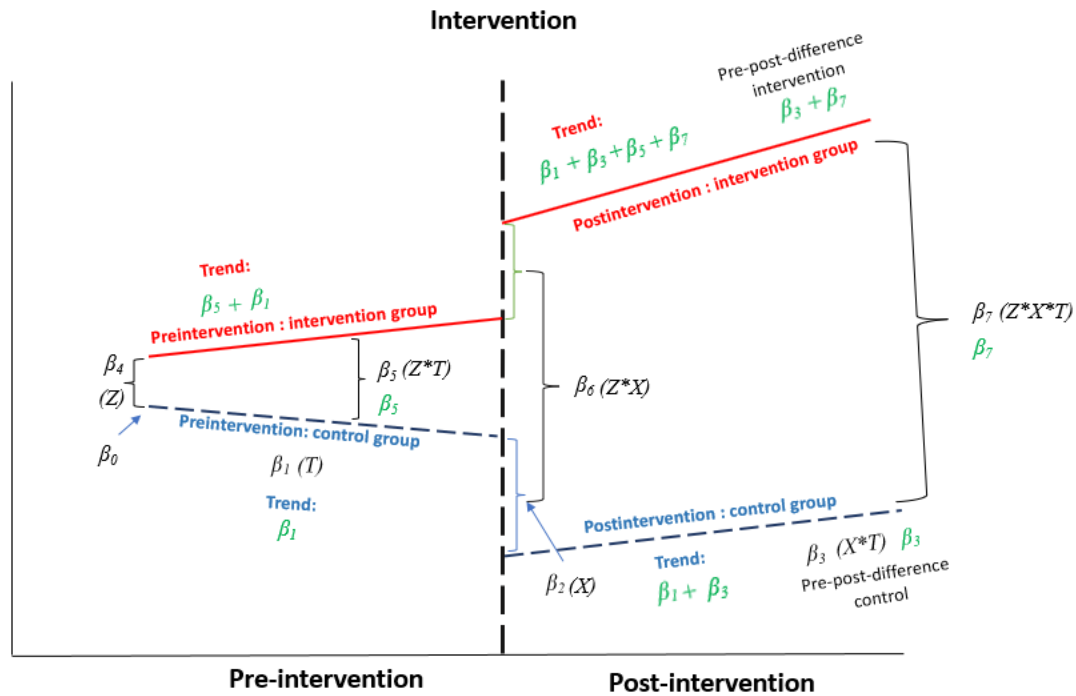
$Z X_{it} T_{it}$: Interaction terms representing the difference of differences between the control and intervention groups

e_{it} : Random errors following a first-order autoregressive process.

The analysis design is illustrated through Table 3.2, which provides an overview of the intersection between measure of interest, equation and model parameters for XTITSA multiple group analysis,¹⁵⁵ and Figure 3.4, which provides a visual description of multiple group XTITSA design based on multiple group analysis.^{167, 154, 159}

Table 3.2: Measure of interest, equation, and model parameters

Measure of interest	Equation parameters	Model parameters (Figure 3.4)
<i>Control group</i>		
Preintervention trend	$\beta_1 T_{ti}$	β_1
Postintervention trend	$\beta_2 X_{ti}$	$\beta_1 + \beta_3$
Difference between preintervention vs. postintervention	$\beta_3 X_{ti} T_{ti}$	β_3
<i>Intervention group</i>		
Preintervention trend	$\beta_1 T_{ti}$	$\beta_5 + \beta_1$
Postintervention trend	$\beta_2 X_{ti}$	$\beta_1 + \beta_3 + \beta_5 + \beta_7$
Difference between preintervention vs. postintervention	$\beta_3 X_{ti} T_{ti}$	$\beta_3 + \beta_7$
<i>Intervention vs. Control groups</i>		
Difference preintervention	$\beta_5 Z T_{ti}$	β_5
Difference post intervention	$\beta_6 Z X_{ti}$	$\beta_5 + \beta_7$
Difference between preintervention vs. postintervention	$\beta_7 Z X_{ti} T_{ti}$	β_7



Measure of interest	Model parameters	Equation parameters
Pre-intervention period		
Difference between intervention versus control groups prior to start of study (baseline)	β_4	Z
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	
Pre-intervention trend: control group	β_1	T
Difference in preintervention slope: intervention versus control groups	β_5	Z*T
Post-intervention period		
Difference between intervention versus control groups immediately after intervention	β_6	Z*X
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	
Post-intervention trend: control group	$\beta_1 + \beta_3$	
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	
Difference pre- post-intervention periods: intervention versus control groups	β_7	Z*X*T

Figure 3.4: Visual representation of the statistical analysis design

Note: The figure represents the statistical analysis design with equation parameters in black and the model parameters in green text. The treatment group is shown in red, and the control group in blue. Adapted from Linden (2015; p.482).¹⁵⁴

Qualitative data collection and analysis

Data sources and collection

Qualitative data was collected using the following data sources:

- i. Primary data collection through Key Informant Interviews (KIIs), and
- ii. Secondary data (document review) of beneficiaries' focus group evaluations, program monitoring, and evaluation reports.

i. Primary data collection through Key Informant Interviews

Sampling methodology and data collection

Since this research aimed to understand the ARCS MHT operations and the changes in MNCH service delivery and the health systems due to the intervention (presence of midwives), purposive sampling methods¹³⁶ were used to recruit the participants for KII. Participants bringing diverse yet relevant perspectives through their interviews and having expertise in implementing and delivering health services through ARCS-MHTs in Afghanistan were selected as key informants for this study. To ensure a balance of stakeholders, we included program implementation staff, MHT staff and female healthcare providers (midwives) as key informants. Eligibility criteria for key informants and a brief description of the recruitment process are presented in Table 3.3. A semi-structured interview questionnaire was used to conduct interviews and is presented in Appendix 3.4. The interviews were conducted between November 2020 and October 2021.

Informed consent was obtained for study participation and recording of the interviews. These interviews were conducted using 'WhatsApp' application on mobile phones, lasted 30 to 40 minutes and were recorded for translation and transcription. The study investigator (FR) spoke one of the local languages (Urdu), and a translator was provided where there was a language barrier. The interviews were conducted by FR, who translated, transcribed and summarized the main points from the interviews for data analysis.

Table 3.3: Eligibility criteria for key informants

Key informant stakeholders	Inclusion criteria	Exclusion criteria
ARCS program implementation staff	<ul style="list-style-type: none"> • Those who are or have been employed by the Afghanistan Red Crescent Society in the last five years. • Supporting mobile health teams in the delivery of primary health care services to communities in Afghanistan. 	< 18 years of age
MHT staff (doctor or nurse or community health worker or vaccinator)	<ul style="list-style-type: none"> • Deployed as member of Mobile Health Team delivering health services to the community in Afghanistan. • Part of MHTs for at least two years in the last five years 	< 18 years of age
Female healthcare providers	<ul style="list-style-type: none"> • Trained as a midwife, practicing in Afghanistan. • Deployed as a member of the Mobile Health Team, delivering health services to the community in Afghanistan in the last five years. • Females 	< 18 years of age Males

Note: Recruitment process: Third-party recruitment methods were used with the support of CRC and ARCS staff. The CRC Program Officer in Afghanistan contacted participants using WhatsApp, and those who agreed to participate were introduced to the investigator via WhatsApp to proceed with informed consent and data collection.

ii. Secondary data extraction

Data sources

For the qualitative aspect of our research, we relied on secondary data derived from documents associated with ARC-MHT operations. These documents fell into two categories:

- i. Administrative Documents: These included Microsoft Word and Excel files containing comprehensive information about the activities carried out by MHTs in the field.
- ii. MHT Monitoring and Evaluation Reports: These reports, submitted to funding agencies, offered a detailed review of ARCS-MHT operations. They delved into operational specifics, challenges encountered, strategies for mitigation, and plans for enhancing operational effectiveness.

Data extraction

A comprehensive review of all documents was conducted to gain insights into the operational intricacies. Key details were systematically highlighted and tagged for further reference. FR crafted a descriptive narrative outlining the context and operational modalities of the MHTs after the document review. This narrative was subsequently condensed and summarized to enhance our understanding of the MHT operations within their contextual framework, and relevant quotes were included in the summary. To ensure the accuracy and completeness of this information, it was cross-referenced and triangulated with data provided by the key informants, as elaborated upon in the analysis section.

Data analysis

Through qualitative analysis, our goal was to conduct a comprehensive and systematic investigation of MHT operations, focusing on services delivered to women and children; for this, we analyzed both documents and interviews together to gain valuable insights regarding MHT operations and service delivery and corroborate findings. We employed a qualitative content analysis approach,^{168,169,170} specifically focusing on the manifest

analysis method.¹ As Bengtsson described, manifest analysis "stays very close to the text, uses the words themselves, and describes the visible and obvious in the text." ¹⁷¹ An overview of the qualitative data analysis plan is presented in Figure 3.5.

The content analysis process comprised four key stages: decontextualization, recontextualization, categorization, and compilation.¹⁷¹ Employing a hybrid deductive-inductive approach, we initiated the analysis by reviewing Key Informant Interview (KII) transcripts to gain familiarity with the subject matter. Subsequently, the data were broken down into meaningful units (*decontextualization*) to understand the MHT operations, issues and other relevant information related to service delivery.

A code list was developed and refined as the analysis progressed by comparing multiple data sources (KII and Document Review) to enhance data understanding. The identified meaning units were then analyzed to ensure all aspects of the content were adequately covered, and their relationship with the codes was scrutinized (*recontextualization*).

The next step involved using the condensed meaning units and codes to create categories, which were further organized into overarching themes and sub-themes (*categorization*). This process allowed for a more structured and systematic arrangement of the data.

For the last (*compilation*) stage, the themes, sub-themes and categories derived from the KII analysis served as a framework for extracting relevant information from the document review. The KII and document review data were combined to validate and reinforce the inferences drawn, ensuring a robust and comprehensive analysis.

The analysis phase engaged two researchers, experienced in qualitative methodologies and well-versed in health services and systems research. FR took the lead in data analysis and summarization, a process further enriched through collaborative peer debriefings with AD to corroborate and validate our findings.

¹ Manifest and Latent analysis are two distinct methods used in content analyses. Manifest analysis involves examining the surface ideas and explicit content presented in the text. On the other hand, Latent analysis delves deeper into the text to derive underlying meanings and identify implicit inferences.

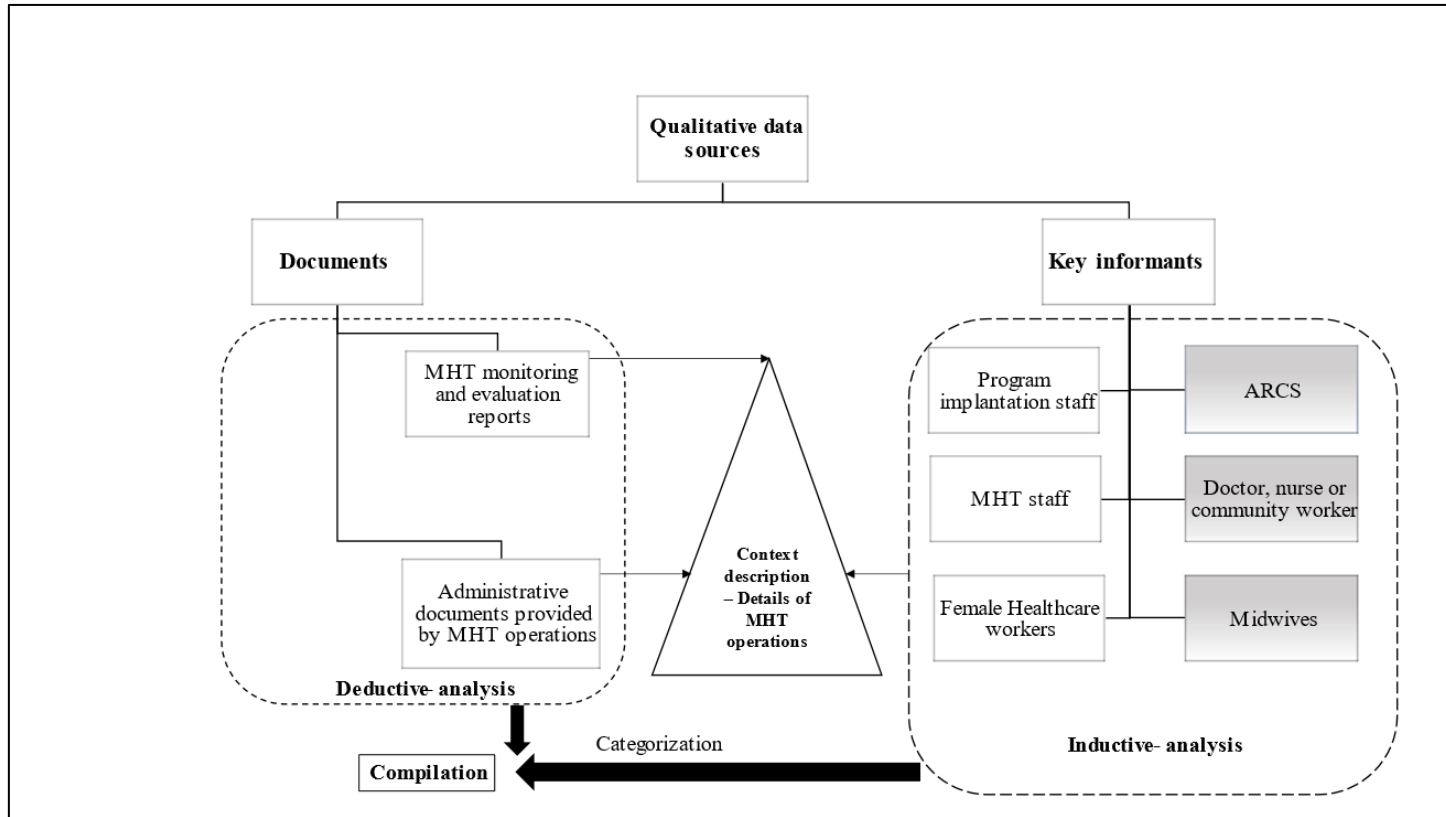


Figure 3.5: Overview of qualitative data analysis plan

3.2.4 Methods RQ 2.2 - Did MNCH outcomes differ between less and more insecure provinces in Afghanistan after introducing female health workers in ARCS MHTs?

Insecurity in Afghanistan has had a profound impact on its health systems. Ongoing conflict and instability disrupt healthcare delivery, leading to reduced access to medical services, shortages of healthcare personnel and supplies, damage to healthcare infrastructure, and overall challenges in delivering adequate healthcare to the population.^{152,172} These factors contribute to increased morbidity and mortality rates, making it exceedingly difficult for Afghans to access quality healthcare services and undermining the health systems in the face of ongoing insecurity.¹⁷³ Given the significance of insecurity within the country, our investigation extended beyond the impact of introducing midwives in ARCS-MHTs. We analyzed whether the outcomes varied depending on Afghanistan's varying levels of insecurity through the last research sub-question.

Study design

A *quantitatively* driven approach using an Interrupted Time Series Analysis (ITSA)¹⁵³ was used as the study design to answer this research question - the delta was the change in the number of MNCH services delivered before and after the introduction of midwives based on the level of insecurity in Afghanistan, see Figure 3.6. Details regarding ITSA have already been presented in describing the study design in section 3.2.3.

Data sources and extraction

The analysis leveraged the data sources outlined in section 3.2.3 and the variables specified in Table 3.1. Furthermore, security-related data were extracted from an open-source database detailed in this section.

Security variable

Data from an international open-source data repository (Uppsala Conflict Data Program) monitoring the security situation in Afghanistan was used to extract security context-related data. The Uppsala Conflict Data Program (UCDP) is the foremost source of

information on organized violence globally, boasting nearly four decades of continuous data collection on civil wars. Its definition of armed conflict has not only withstood the test of time but has also established itself as the universally accepted standard for systematically defining and researching conflicts worldwide.^{173,174} Deaths due to terrorism incidents at the provincial level each month from January 2015 to June 2020 were extracted from the UCDP Repository.

The security variable, representing the number of deaths per month for each province, was collected as a continuous variable over 66 months, spanning from January 2015 to June 2020. The security variable, representing the number of deaths per month for each province, was collected as a continuous variable over 66 months, spanning from January 2015 to June 2020. To facilitate the analysis, the provinces were classified into three categories based on levels of insecurity; with increasing number of deaths corresponding to an increase in the level of insecurity.

The security variable (continuous variable) distribution was explored using the interquartile range (IQR), which served as the basis for creating the three categories corresponding to different insecurity levels. These categories were defined as follows:

1. Least Insecure: Provinces with a mean number of deaths less than the 50th percentile of the overall number of deaths in the county were grouped as "Least insecure."
2. Moderately Insecure: Provinces with a mean number of deaths between the 50th and 75th percentiles of the overall number of deaths in the country were categorized as "Moderately insecure."
3. Most Insecure: Provinces with a mean number of deaths above the 75th percentile of the overall number of deaths in the country were classified as "Most insecure."

Data analysis

Only provinces which had midwife intervention were included in this analysis. The ITSA study design for this analysis is presented in Figure 3.6. The provinces that were Least insecure were appended to create the control group. Provinces in Moderately insecure provinces were grouped to create Intervention Group 1, while those in the Most insecure group were combined to create Intervention Group 2. Groups 1 and 2 ($Z=1$) were each

compared to the control group ($Z=0$). The initial phase of our analysis commenced with dealing with missing data and appending the data sets to create the groups. The handling of missing data followed a similar approach described in detail in section 3.2.3.

Centering time variable

The ITSA study design, presented in Figure 3.6, entailed comparing groups 1 and 2 with control to estimate the outcome difference (MNCH service delivery). Since all the provinces in this analysis had midwives starting at various times (Panel 2; Figure 2.2), we were able to centre the start time t_1 on the actual time when midwives were introduced in the MHTs. The time before t_1 was preintervention, and after t_1 was post-intervention. For example, in Balkh, the midwives started in Jan 2016, and the t_1 was Jan 2016; in Paktia, the midwives started in November 2017; the t_1 was set at November 2017.

Univariate analysis

We used the same outcome variables as in Section 3.2.3. A description of the univariate analysis has been presented in the previous section; a description of distribution based on insecurity was additionally analysed. Mean, standard deviations and 95% confidence intervals were used to describe the distribution of the security variable in each province and to divide them into three groups. The groups were then visually presented using OpenStreetMap software in Excel. We examined the relationship between the outcome variable and the three categories of security variables using groupwise mean, standard, and confidence intervals, presented using histograms.

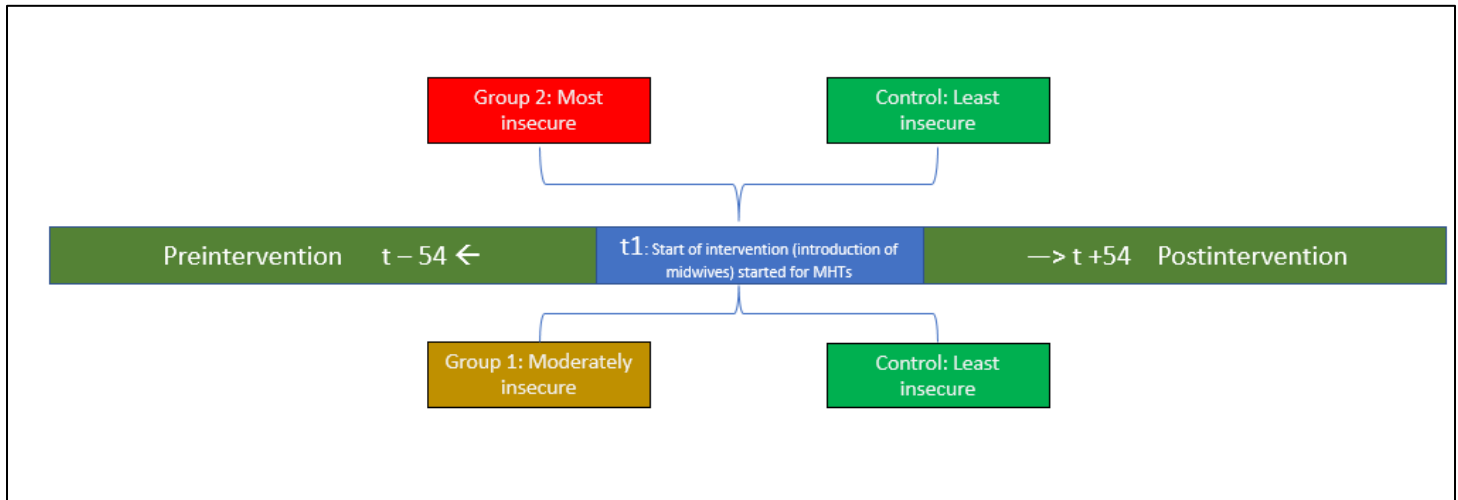


Figure 3.6: Study design to assess the difference in MNCH outcomes after the introduction of female health workers in ARCS-MHTs based on the levels of insecurity

Bivariate analysis

The bivariate relationship between the outcome variables and the three groups (control and two intervention groups) was explored using ordinary least square regression models, with the control group used as the reference category.

Interrupted time series analysis

The ITSA study design was the basis for this analysis. There were four outcome variables (Childhood vaccinations, Tetanus toxoid vaccinations, ANC, and PNC); intervention was the introduction of midwives; the panels or groups for multiple analyses were province combined in control (least insecure), group 1 (moderately insecure) and group 2 (most insecure) (Figure 3.6). The ***unit of analysis*** was 'the number of services per month.' The 'XTITSA' command in Stata was used for this analysis.

Steps for analysis

- A single-group analysis was performed for each intervention group to set up the data for autocorrelation.
- In the second step, the models were tested for autocorrelation using the Cumby-Huizinga test.^{158,165,166} The lag order, up to which autocorrelation was detected, guided the re-estimation of the models.
- Next, multiple-group analyses were conducted, comparing each intervention group (Moderate and Most insecure groups of provinces) with the control group (Least insecure group of provinces) for the four outcome variables before and after the intervention.
- The final (multiple group analysis) models accounted for autocorrelation estimated in the second step.

The equation used for RQ 2.1 (page 66) remained applicable to this analysis. An illustration of the analysis design can be found in Table 3.2, which offers a concise summary of the relationship between the measure of interest, equations, and model parameters in the context of XTITSA multiple group analysis. Additionally, Figure 3.4 provides a graphical representation of the multiple-group XTITSA design based on multiple-group analysis.

3.3 Ethics approval

The study was reviewed and approved by the University of Western Ontario's research ethics board (Application numbers 115184 and 115185) and the Institutional Review Board at the Ministry of Public Health in Afghanistan. The Afghanistan Red Crescent Society (ARCS) also provided an approval letter supporting the study. The photographs used in the dissertation were provided by the Canadian Red Cross country head for Afghanistan with verbal consent from ARCS to be used in this dissertation. The Ethics review approval letters are presented in Appendix 3.5.

Chapter 4

Results

This chapter delves into our study's results, exploring health system fragility through our main research questions and their corresponding sub-questions. The findings presented in sections below are based on the two research questions and five sub-questions.

4.1 Results RQ1 - What is the conceptual understanding of the fragility of health systems and its relationship with resilience, and how can it be applied in Afghanistan?

In this section, we present the findings of our exploratory study, organized into three distinct parts based on the research sub-questions. Firstly, we delved into the concept of health system fragility, as understood and agreed upon by our participants. The second part focuses on the relationship between health system fragility and resilience. Lastly, we explore the fragility of health systems and their relationship with resilience in Afghanistan.

To maximize the insights, we created a Knowledge Resource Nomination Worksheet (KRNW) to guide our participant selection process. We aimed to include professionals from various sectors, such as health systems, health service delivery, humanitarian response, academia, government, non-governmental organizations, the United Nations, the World Health Organization, and the Red Cross movement. Additionally, we sought individuals with published work relevant to our research topic. Figure 4.1 presents an overview of how we prepared the KRNW, executed maximum variation sampling, and the flow diagram for participant recruitment. Please refer to Appendix 4.1 for the complete nomination worksheet with participant demographic information for detailed information.

Thirty-six experts were identified through the KRNW list, and eighteen consented to participate (Fig. 4.1). To ensure a robust and diverse set of perspectives, we conducted detailed key informant interviews between October 2020 and April 2021 and administered

two surveys between May 2022 and April 2023. We conducted the interviews with eighteen participants, four of whom were women. Sixteen out of the eighteen participants (88.9%) completed the first survey, and thirteen (72.2%) participated in the second survey. The results from the interview and the two surveys were combined for interpretation.

4.1.1 Results RQ 1.1 - What is fragility of health systems?

To understand the concept of the fragility of health systems, we will first present the findings from brainstorming, concept discovery and categorization. Subsequently, we will delve into concept prioritization and ranking results, culminating in consensus-building. Ultimately, we will present the framework for assessing the fragility of health systems.

Brainstorming, concept discovery and categorization

During the initial brainstorming phase of the analysis, seven critical domains essential to understanding the fragility of health systems emerged. These domains formed the overarching framework for the subsequent concept discovery stage of the analysis (see Figure 3.1). The codes identified through the analysis were structured into thirty-three sub-domains nested within the seven overarching domains following rigorous discussions. The domains critical to the fragility of health systems emerging through the analysis were unsustainability, inefficiency, uncertainty, unresponsiveness, inflexibility, fragmentation and reactivity.

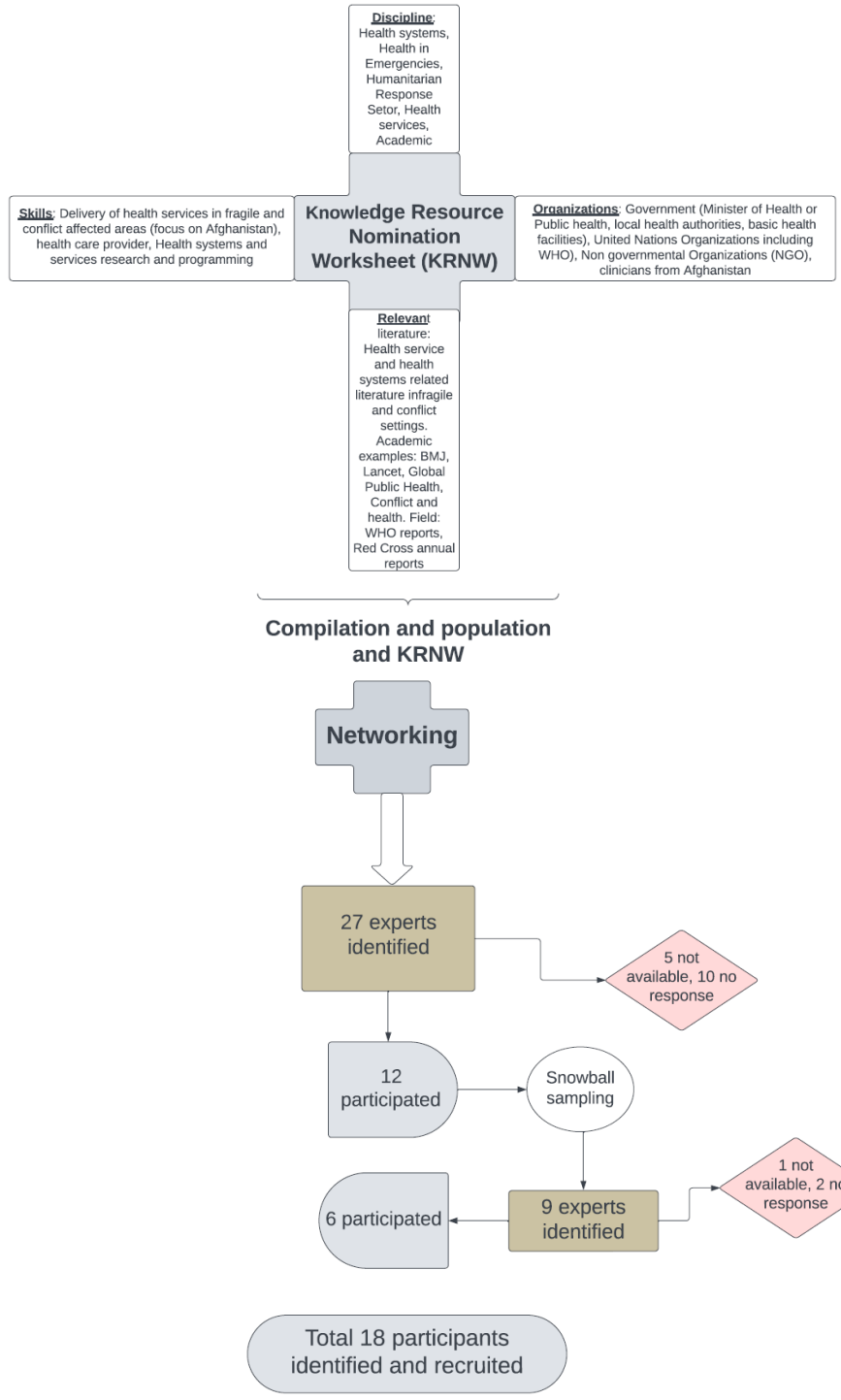


Figure 4.1: Overview of steps and results of the participant recruitment

1. Unsustainable

Our participants described unsustainability as a lack of systematic processes put in place to ensure the continuity of systems. Participants found the lack of sustainability as a contributor to the fragility of health systems. In summing up the concept of unsustainability as it relates to the fragility of health systems, one participant described that to ensure that systems are not fragile:

You need systematic progress that sustains a level of performance and human resources with the right capacity and skills retained in their own professional sites and willing to serve. You also need people who can use those facilities regularly and not force it to migration or displacement or distrust. [Informant 9]

Five sub-domains were linked to unsustainability.

1.1. Lack of ownership

When governments, policymakers, and communities do not own or relate to the services delivered by the system, the systems remain unsustainable and contribute to fragility.

[...] if we do not have committed policymakers, when you ask someone to help and say that you need help, and he tells you we have everything, then you realize that the commitment is completely not there. [Informant 9]

Lack of community trust in the system leads to unsustainability, contributing to the fragility of health systems.

It's about the quality of care you provide and positioning how you are and your image. If you don't have the trust of the community, not only will they not use your services, but they can also create a condition where you cannot operate. [Informant 4]

Informant 4 explained their view through an example:

So, if the community thinks that this health system or clinic here is coming to sterilize our population – like we had 'Nigeria' - so that our women don't give birth and our population becomes smaller as opposed to other tribes, the clinic itself is not going to be operating regardless of all the other service you are providing. So,

it includes uptake but also creates the space, preventing it from threatening healthcare workers.

1.2. Lack of resources

The systems are overburdened and become fragile when there are not enough human resources to sustain the normal functioning of health systems.

[...] those countries today that are facing, you know, health challenges and health system is not delivering the required services to its people because either they cannot properly remunerate the qualified workers or because there is instability and conflict and worker moves from the country to other countries outside its territory or they move to the private sector for-profit sector so this creates the public sector you know not to fulfil its mandate. [Informant 8]

In conflicts where the health workforce leaves the country, becoming forcibly displaced and potentially claiming asylum elsewhere. [Informant 14].

In the excerpts above, the participants emphasize that the systems become fragile when the health workforce is not adequately compensated and, therefore, cannot be sustained by the public sector, or there is an outflux of the health workforce because of conflict, insecurity, or economic challenges.

1.3. Lack of localization

Participants further identified that systems cannot be sustainable without ensuring that services are localized, which relies on input from local stakeholders. In describing the importance of engaging all stakeholders to ensure the services are relevant to the local population and are sustainable, one key informant stated:

It's making sure that you engage the different gatekeepers, delivery of services and always remember to have diverse, inclusive perspectives. I would say not only the chief but also women and whatever other key groups, so everybody has their voice heard to some extent. [Informant 4]

1.4. Unstable partnerships

Unstable partnerships were described as over or underutilizing available partnerships, especially private-public partnerships. The unstable partnership threatens the sustainability of health systems; while discussing partnerships, one participant described the fragility of health systems as a consequence of:

[...] poor utilization at some places, overutilization, lack of proper use of the private sector, lack of public-private partnership to ensure long-term sustainability.
[Informant 18]

1.5. Disruptive

The systems risk becoming more fragile when they are repeatedly disrupted or interrupted from time to time by additional manmade or natural disasters, for example, conflicts, economic challenges, pandemics, floods, etc., in already vulnerable contexts. In describing the disruptions, a participant highlighted the impact of interruptions because of external or internal factors leading to fragility:

When talking about fragile health systems, we are talking about a system where the services are not sustained because they are interrupted from time to time. [Informant 9]

2. Inefficient

One participant encapsulated inefficiency contributing to the fragility of health systems as:

Fragility [...] is a kind of vulnerability and small holes in your system, which, if you know, if we don't fill them, makes the system less efficient. [Informant 15]

Seven sub-domains were identified, each resulting in inefficiencies within health systems and collectively contributing to their fragility.

2.1. Poor financing

Economic challenges and financial insecurity contributed to many domains, rendering health systems fragile. However, the participants predominantly linked poor financing with the inefficiency of health systems directly or through the lack of maintenance of the systems, which contributes to unmet needs.

In response to what comes to mind when they thought about fragility, one participant stated:

Economics is actually the first word that comes to mind when I think about that [...]. [Informant 3]

Another reiterated the same point:

[...] health care system, if left without support, could collapse anytime and when I say support, support is mainly financial support. [Informant 10]

Participants highlighted that systems experience fragility when there is insufficient allocation of resources for healthcare within the budget, combined with a lack of prioritization, leading to citizens being unable to afford essential health services.

If you look at the budgets of many fragile states, most of them are the least in health. They hardly pay attention, and their focus is on other issues. [Informant 9]

2.2. Unable to meet the needs of its populations

Several participants recognized that health systems deteriorate in efficiency when they fail to meet the needs of their population. In describing the inefficiency of health systems leading to fragility, a participant highlighted that:

[...] it's a combination of factors, not only resources but in a combination of factors or elements that can trigger the health service to fail delivering and responding to the legitimate needs of the people, and that's when it becomes fragile. [Informant 8]

One participant emphasized that the health systems are fragile when they cannot meet the needs of its most vulnerable.

[...] simply put [...] a fragile health system is a system that's incapable to deliver essential health care services to vulnerable populations within the system. [Informant 7]

Emphasis was placed on primary healthcare services, with the consensus being that failing to meet these needs renders the systems fragile.

The stronger the primary healthcare level is, the less fragile the health system is.
[Informant 3]

2.3. Uncoordinated

Participants pinpointed coordination challenges, including insufficient logistical arrangements, incomplete operations, and an undue burden on secondary and tertiary care systems, as key factors contributing to the inefficiency of health systems, leading to the fragility of health systems. When characterizing the absence of coordination that contributes to fragility, one participant described it as:

[...] inadequate support healthcare workers in delivery or arrangements. [Informant 7]

Another gave an example of how lack of coordination results in poor referral systems and strains tertiary care, especially when primary healthcare systems are inadequate or bypassed.

People bypass primary healthcare clinics and go straight to the tertiary hospital because they know they will find a doctor there or they will find a drug or some kind of service there. [Informant 3]

2.4. Unable to maintain a functioning system based on WHO building blocks

Most participants discussed the fragility of health systems as a function of the inefficiency of health systems resulting from the weakening or inefficiency of building blocks of health systems identified by the World Health Organization (WHO).

If you think of it in terms of the building blocks, it is often known as the inability to maintain the minimal functions of each building block, whether that is ensuring continued human resources or service delivery or inputs like medical devices and pharmaceuticals. [Informant 14]

A number of determinants make it imbalanced so that you don't have all of those building blocks functioning while communicating while having surge capacity etc.

So, each one of them: human resources, financing, health information systems all those elements have to be there, and there are deficits then the system is imbalanced, and if the deficits are huge that it becomes extremely fragile and starts crumbling. Then the first thing you start seeing is an inability to stick to deliver services within hospitals and clinics. [Informant 13]

2.5. Unable to absorb shocks

Participants highlighted that systems unable to absorb shocks due to acute crises lead to inefficiency in delivering services and can be fragile.

Fragility is when there is any small shock or long-term underdevelopment that could clearly affect the health system's outcome. [Informant 6]

Fragile systems are overwhelmed by the crisis that it is facing no matter what it is, and they also become under-resourced because of that crisis. [Informant 12]

It's the inability of a health system to withstand stresses while continuing to provide all of the basic functions that a whole system needs to provide [...] the whole system can no longer cope, and then it becomes overwhelming. [Informant 7]

2.6. Poor quality services and service delivery

Poor quality would decrease the efficiency of health systems, and the participants identified this as contributing to fragility. While discussing inefficiency contributing to fragility of health systems, one participant highlighted that one of the reasons systems become inefficient is the lack of quality of services. In describing inefficiency, the participant stated:

[...] I would link with the quality of services we provide. [Informant 18]

Another participant elaborated further on how the quality of services can deteriorate if the systems are not providing enough opportunities to progress.

If you have a workforce, [...] if it does not see opportunities [...] would feel like nobody cares what I am doing right here [...] increasing the level of fatigue on the part of health care workers, they are tired, 5-10 years later are just really tired and [...] maybe not seeing people with the same quality of care that they were ten years

before because they do not see things changing within the health care system.
[Informant 3]

2.7. Poor education and training for health care providers

According to the participants, poor education, in general, contributes to the fragility of health systems. In fragile systems, training within the health sector is insufficient and without quality controls.

You can do anything within that hospital; there is no certification process, there is no quality control, there are no standards and compliance to that, so that is a huge risk to the health sector that sucks up a lot of resources mainly out of pockets financing from individuals but quality low and that is also a key fragility factor for the health sector. [Informant 1]

There are healthcare workers who are not trained properly and do not have any degrees at all. [Informant 10].

3. Uncertain

The concept of uncertainty as a contributing factor to the fragility of health systems was a focal point of discussion for most participants. This uncertainty was further associated with seven specific sub-domains presented here.

3.1. Weak governance

Participants identified governance as one of the most critical factors necessary for a health system to remain stable and function with some certainty. One participant highlighted the role of leadership contributing to health systems governance as being vital for ensuring that uncertainty contributing to health systems is minimized:

Among all the factors which I listed, leadership will come first. If we have good leadership, we will find resources and a way to negotiate with those controlling different geographical areas. [Informant 17]

Another participant agreed:

The leadership, if that is there, then you know it makes everything work [...] it should be the government system which is capable of pulling up [...] where are the gaps. [Informant 15]

When delving into the impact of politics and governance on fragility, participants pinpointed specific factors, notably corruption and nepotism. These elements were identified as catalysts for weakening governance, thereby exacerbating the fragility of health systems.

The smallest change in the governance will inflict a big dimension on the health system.[...] When we talk about governance, the inverse is corruption, and the problem is nepotism, misuse of power etc., destroying the health system altogether. [Informant 9]

3.2. Easily collapsible

Participants linked the fragility of health systems with uncertainty stemming from being vulnerable to collapse easily.

The healthcare system [...] when I connect fragility with it, it could collapse anytime. [Informant 11]

3.3. Donor dependency

Donor dependence emerged as another contributor to fragility, with its most pronounced impact observed in its relationship with fueling uncertainty. This arises from allocating funds to specific projects, which cannot be adapted or redirected to address emerging needs, thus amplifying the overall sense of uncertainty.

One of the key factors in thinking about the fragility of the health system would be donor dependency. [Informant 18]

Many fragile health systems depend on foreign aid, so they depend on UN system money. They depend on EU money, in some contexts in LMIC countries and when that funding is earmarked to specific causes, it makes the system more fragile because it becomes very hard to divert funds. [Informant 7]

Informant 7 elaborated with an example from Syria,

We saw that with the Syrian refugees with maternal health, UNICEF was dedicating all its money to maternal child health and the minute that there was an intervention where they needed to focus, for example, on smoking rates, they could not do that because the money was earmarked for child and maternal health. It becomes very difficult when there is an external factor that money donated to support the health system is earmarked for a specific cause.

3.4. Security issues

Insecurity adds to uncertainty; in many contexts where conflict and insecurity exist, health workers feel insecure, adding to service delivery challenges.

Insecurity impacts physical security where the person feels threatened or uncomfortable to operate. [Informant 8]

One of the most important issues is the security itself. So, in a security-compromised area, we won't be able to provide services as we want, so the security also affects the fragility and the continuation of services provision. [Informant 17]

If we want to improve the health system's performance and reduce its fragility, we can work on two main lines. The first is peacebuilding to be integral to health system performance [...] all those countries where peace has come back, take the issue of Rwanda for example, the state has been rebuilt, [...] things started working very well [...] In Somalia, they are fighting against those dimensions [...] they are very harsh and difficult [...] political reconciliation and peacebuilding contribute to the health system and its improvement. [Informant 9]

3.5. Co-dependent systems

Health systems operate within a larger ecosystem and are influenced by external factors and interconnected systems, as elucidated by our participants. This interaction amplifies the levels of uncertainty.

Actors outside the health sector alone can cause or trigger their sector to become vulnerable. [Informant 8]

The co-dependencies were discussed as rhetorical questions by one of the participants.

Are people safe? Is there a road infrastructure? Are the supply lines stable?
[Informant 11]

3.6. Gender unresponsiveness

Gender unresponsiveness emerged as a sub-domain contributing to health system fragility through various pathways, including the inability to address population needs, subpar service quality, and inadequate education. Insights from our participants underscored the diverse mechanisms through which gender unresponsiveness intensifies health system fragility by contributing to uncertainties in service delivery and access. These mechanisms encompassed women's lack of empowerment and education necessary for informed health-related choices and disparities in staffing, training for service provision, and leadership positions. These disparities collectively hinder access to and the delivery of health services, making gender unresponsiveness a salient contributor to uncertainty within health systems.

If there are huge gender disparities and as a result of that violence or gender-based violence, that can create huge issues with the ability, for example, to train because women cannot get out to get trained, they cannot go away to school. They cannot work late at night, there are often not safe facilities for them to sleep in, dormitories or they cannot reach them, they cannot get to libraries to study to be a good doctor or nurse etc. So, all kinds of things feed into that, but also, in terms of the structure within the care or service delivery system, who is delivering that? Is it mostly female nurses and male doctors? What is the power structure there? Who are the leaders in each of those areas in the service delivery? [Informant 13]

[...] inequities in staffing, so lack of women in the healthcare workforce, lack of women in higher positions in health workforce and if your primary beneficiaries are women and children, which is the context of that, I think you will have a more fragile system because you do not have the people in the system in those positions who are going to pick up [...] men will pick up the needs of the women, but women will pick up the broader, more complex needs of women. [Informant 3]

Informant 3 drew upon his experience within communities affected by fragility and conflict to illustrate how a woman's approach to health-seeking behavior differs based on whether males or females provide the services.

When a male goes into the house and sees the baby sick, he says to the family you have to go, and the woman says, ok or the husband says ok- when a woman goes in, a female worker goes into the house and she says same thing, the woman says I know I have a baby, I know I don't feel well I know something's wrong but I have to cook I have to clean, my mother in law is going to ask this, put yourself in my place. Don't force me to go. [Informant 3]

Women in stable conditions cannot decide on their health [...] The system is fragile because a significant proportion of the population cannot demand or seek help as they wish. [Informant 11]

3.7. Natural disasters

Natural disasters are often uncertain, and according to our study, participants contribute to the fragility of health systems.

In a country that is particularly prone to natural disasters, political unrest, economic shocks, and crises, [...] most people who study health systems would look at so many health systems around the world and characterize them as being fragile. [Informant 14]

Natural disasters, earthquakes, and floods can also make a system completely fragile or even a country completely fragile, but it can also become fragile because of man-made disasters. [Informant 11]

4. Unresponsive

A robust discussion among many participants centered on unresponsiveness as a pivotal contributor to health system fragility. During this discourse, four sub-domains closely associated with unresponsiveness were identified.

4.1. Lack of resources

When discussing unresponsive systems, participants highlighted that system fragility often stems from governments' inability to provide services due to a lack of resources. While the previous point in 1.2 emphasized the shortage of human resources, in this context, the focus shifted to the deficiency of other essential material resources necessary for the proper functioning of systems.

“As far as vulnerability is concerned [...] governments are relatively unable to buy services from the private sector, for that matter from other sources. [Informant 12]

4.2. Unmet needs

While unmet needs were previously described as contributing to fragility through inefficiency in section 2.2, a connection was observed, particularly in the context of supply and demand shortfalls contributing to populations' unmet needs and systems becoming unresponsive.

Shortfalls and missing to meet that demand when we see the supplies and required human resources in terms of medical staff, doctors, nurses, elite health workers and also resources to provide quality services at the same time, we always see when we talk about fragility we see those in terms of resources, we don't meet the demand and the supply [...] there is shortfall to meet the realistic demand and the minimum standard and the quality of medical care. [Informant 5]

4.3. Unprepared

Another facet of unresponsiveness encompassed systems that were ill-prepared to address routine and urgent requirements and effectively manage the impact of internal and external influences.

There should always be [...] scenario planning for [...] a major disaster or outbreak or sometimes financial situation in the country [...]. A clear example is Venezuela- a country where you used to have universal health coverage. Syria was not that bad; it was OK before the crisis, but because of the political crisis in Syria and financial crisis in Venezuela, you would see a collapse of the health system and [...] having malaria back to Venezuela and in Syria having polio back. [Informant 6]

4.4. Sociocultural irrelevance

Not paying attention to socio-cultural aspects can make systems unresponsive and fragile. In explaining the need to adapt health messaging to local context, one participant highlighted this point:

[...] in the system, poor resilience is inherent to all these social, political, ethnic attacks and ethnic differences. [Informant 9]

Another participant described the importance of engaging stakeholders to ensure that programming is culturally relevant for those to be responsive to the needs of the people.

[...] keeping in mind all the social norms or all the cultural aspects that need to be taken into consideration in the design or the delivery of the system but also looking at making sure that diverse communities or vulnerable communities are reached out to because, for local resources or local communities, they know more as much as they can, they will know the context, they will know more the issue and they will know more how to address them in a sensitive manner without creating any backlash. [Informant 4]

5. Inflexible

Some participants described inflexibility as a contributing factor to the fragility of health systems. Within this context, three specific sub-domains were identified.

5.1. Unable to adapt

Participants described that systems are less fragile when they have the ability to be flexible and agile. In describing what makes health systems less fragile, one participant described it as:

The ability and agility of the healthcare system to manage and sustain under certain pressures. [Informant 5]

A multitude of pressures and stressors can manifest in various forms.

“Art of fragility is related to [...] pressures to adapt to new programs or new ways of thinking. [Informant 3]

5.2. Unable to learn

Participants linked the lack of data and evidence utilization with the fragility of health systems.

Those systems that are not advancing [...], which are not connected or linked [...] updating their knowledge, especially when we talk about human resources and who do not consider regular or continuous professional development concepts in their institution, seem to be [...] more fragile than others. [Informant 5]

In a fragile system, data is difficult to find, disaggregated data are extremely difficult to find, and then you don't have the capacity at the district, and local level with the planning should be taking place to make it sensitive to local needs because you still staying on the ground in the setup pieces so fragile. [Informant 13]

5.3. Unable to anticipate

Systems exhibit inflexibility when their response time lags due to inaccurate needs estimation. Anticipation was described separately as encompassing long-term planning, with the latter being associated with national and sub-national plans. On the other hand, anticipation refers to preparedness and foresight regarding issues beyond the scope of the underlying planning. One participant elaborated on the implications of a system's inability to anticipate.

System should be able to anticipate, like what is the number of pregnancies in that catchment area. Wherever that system is, it should anticipate, like what diarrheal disease is like, family planning services are required, and if for any reason the system is not able to respond, the system should be able to understand and adapt. [...] You are in a position to adjust the system so that it can work [...] Obviously, they will not be able to work optimally because there will be some little compromise, but that is the system we call a learning system, which can anticipate, adapt, and problem-solve. [Informant 11]

6. Fragmented

The majority of participants emphasized the role of health system fragmentation in contributing to system fragility. Within this context, five sub-domains were identified under the umbrella of fragmentation.

6.1. Lack of oversight

Lack of oversight leads to fragmentation of services as described by informant 4.

In contexts where there's no oversight from the different levels, you can't just build a facility or put human resources in there. You are not getting the salary on time, they are not being supervised, [...] in addition there is a certain level of corruption and there is no accountability because nobody is overseeing anything, nobody is keeping anyone accountable of anything. [Informant 4]

6.2: Lack of linkages

Lack of linkages between various supporting systems leads to fragmentation.

In a number of countries in some areas in Pakistan, Afghanistan, South Sudan, and Liberia, the overall country health system is so fragile and fragmented [...] linkages are not there. [Informant 2]

[...] it's not ensuring all of the basic things that the whole system needs to ensure and it happens to coexist in. [Informant 14]

[...] more precise linkages to proper referrals which may or may not be within the health systems. [Informant 1]

6.3. Lack of standardization

Informant five highlighted that standardization is the key for systems to work efficiently and coherently:

The most important thing is the national standards. [Informant 5]

Another participant described one of the causes of the fragility of health systems.

The lack of clear mechanisms in the country that is one of the causes. [Informant 18]

6.4. Political diversity

Systems operating in many fragile contexts have multiple political players, which makes it challenging for systems, and they are easily fragmented and fragile.

It is fragmentation that is fed by political diversity. In Somalia, there is now a federal government in five or six States and one other state, and they consider all of them themselves independent States; they don't connect to each other at all, which will have a significant impact on the health because then the messages that come from one side will not go to others. So, fragmentation has created a big problem, and that problem is also fed by other countries, other nations who are trying to; what you see now in the big picture in Libya, the country is being attacked from all sides by different nations and countries. [...] So, I think fragmentation because of the political diversity, fragmentation because of the warlord style

approach, you know, it prevents unity of purpose, and when is missing, then the message that comes from one place does not show all sides lose relevance and then the adaptation and trust. [Informant 9]

6.5. Informal systems

Participants described informal health systems taking over when services are not being met, and those start becoming the leading source for health service delivery for communities.

Sometimes, there is the full absence of a formal health system; the informal system or the complimentary system will start becoming the main source of support and definitely it's because either health service delivery is not there, the health workforce is not there, or financing aspects are not there.[Informant 6]

If you go to any of these fragile countries and you go to the village, you hardly get any health care service delivery. It is done by traditional healers, attendants, religious healers, etc. [Informant 9]

7. Reactive

Participants recognized that health systems exhibiting a reactive approach to situations are more likely to contribute to the fragility of health systems. This domain was associated with two specific sub-domains.

7.1. Lack of long-term planning

Participants emphasized the importance of long-term planning to ensure that health systems are proactive rather than merely reactive, distinguishing this proactive approach from anticipating and addressing potential issues described in Section 5.3. Long-term planning focused on routine service delivery, whereas anticipating in Section 5.3 alluded to preparing for unexpected events. In describing how systems can move away from fragility by planning for long-term service delivery, participants stated:

If the system is capable of doing it on its own so it is not a knee-jerk reaction [...] in the way that [...] if we have to do long-term planning, [...] we need to know how many people do we need, what kind of skills are needed and how do we how

are we going to take those people forward you know their career structure and all that. [Informant 15]

A system where the plans can be followed for a long time, and achievements are gradual [...] you can't achieve targets in one day, year, or three years. [Informant 9]

Another participant directly linked fragility with a lack of long-term programming.

Ultimately, all the actors in the fragile state focus on service delivery, which is important and wants to save the people's lives; however, we don't institutionalize the governance system so that there are long-term and better outcomes of the systems. And that is one of the things that happens to a fragile system. [Informant 11]

7.2. Lack of priority settings

Our participants also discussed how the absence of clear priority settings contributes to the fragility of health systems. When describing how this fragility results in reactivity due to the lack of priorities, participants articulated that health systems are vulnerable because:

[...] that is just a question of priorities that whole system because resources are always limited so you have to see that all the system is set up to prioritize the needs of those who are less advantaged and are relatively unable to buy services from the private sector for that matter from other sources. [Informant 12]

We are trying to put a bandage and save some lives, but we are not trying to save the system. [Informant 11]

Concept prioritization and ranking

After the domains and sub-domains were identified, our participants ranked the domains and sub-domains based on how critical those were to the concept of fragility of health systems. Graphs in Figures 4.2 and 4.3 show the distribution and ranking for domains and sub-domains; details are presented in Appendix 4.2.

A higher score suggests that participants viewed the domain and sub-domain as more critical to health systems' fragility. Results from the median distribution show domains clustering around two scores: unsustainable, inefficient, unresponsive, and uncertain domains clustered around a score of 90, while fragmented and inflexible domains clustered around 80. The reactive domain had the lowest median score of 71 out of 100 (Appendix 4.2).

1. Unsustainable

With a median score of 93, unsustainable was ranked by the participants as the most critical domain to the fragility of health systems. The boxplot in Figure 4.2 shows a positively skewed distribution, suggesting responses concentrated towards the higher values and fewer responses for the lower range. Within the domain of unsustainable, lack of ownership and lack of resources ranked most critical to health systems fragility with a median score of 95 and 91, respectively. In contrast, unstable partnerships (median score: 83) and disruptive (median score: 79) sub-domains ranked the lowest in relation to criticality to health systems fragility within the unsustainable domain (Figure 4.3).

2. Inefficient

Health systems being inefficient was ranked as a very close second (median score:91) domain critical to the fragility of health systems. Most of the responses clustered at a higher end, with little variability observed in responses, with the exception of two outliers ranking the domain much lower at a score of 55 and 22 out of 100 (Figure 4.2). Within the domain of inefficiency, poor financing (median score: 87) and unable to meet needs (median score: 85) were ranked higher than other sub-domains, which clustered around 80 (Figure 4.3).

3. Uncertain

The median score for the domain uncertain being critical to the fragility of health systems was 89. The boxplot in Figure 4.2 shows a symmetrical distribution of responses clustered on the higher side of the response with a slight spread in the lower values. Several sub-domains within this domain were considered very critical to the fragility of health systems; weak governance ranked highest among the sub-domains with a median score of 96, followed by easily collapsible (median score: 94) and donor dependency (median score: 90). Security issues also ranked high (median score: 85), while codependent systems (median score: 78), gender unresponsiveness (median score: 76) and natural disasters (median score: 74) were among the lower ranked sub-domains linked with uncertainty (Figure 4.3).

4. Unresponsive

Unresponsiveness was very close to uncertainty in domain ranking based on the median score (88). The boxplot distribution was positively skewed, suggesting responses concentrated towards the higher values and fewer responses for the lower range, Figure 4.2. Lack of resources and unmet needs were the highest ranked sub-domains, with a median score of 90 and 87, respectively. Sociocultural irrelevance was ranked lower than other domains in this sub-domain (median score: 77); Figure 4.3).

5. Inflexible

Inflexible (median score: 79) was ranked at the lower end of the clustering of median scores for domains of fragility of health systems. A slightly positive skewness was observed in the distribution shown in the boxplot in Figure 4.2; there is one noticeable outlier at the lower end. The sub-domains unable to adapt (median score: 88) and unable to learn (median score: 86) were ranked close to each other, whereas unable to anticipate was ranked lower as a sub-domain (median score: 80) and was considered less critical to the fragility of health systems than other two sub-domains.

6. Fragmented

Clustered close to inflexible, the median score for this domain was also 79. There was symmetrical distribution of responses, with lower values having a more extensive range than the upper values (Figure 4.2). Sub-domain median score ranking based on how critical those sub-domains were to the fragility of health systems ranged from 81 to 67, with informal systems ranked lowest at 67 and were considered least critical to the fragility of health systems.

7. Reactive

Reactiveness was ranked as least critical to the fragility of health systems among the domains identified. The boxplot (Figure 4.2) shows that the responses were concentrated in the lower range, with two outliers towards the lower range of the response score. Despite the lower overall score for the domain, the two sub-domains within this domain scored at mid-range with a median score for lack of long-term planning at 82 and lack of priority settings at 82 (Figure 4.3).

Based on the results, the domains linked to the fragility of health systems were ranked as follows:

1. Unsustainable
2. Inefficient
3. Uncertain
4. Unresponsive
5. Inflexible
6. Fragmented
7. Reactive

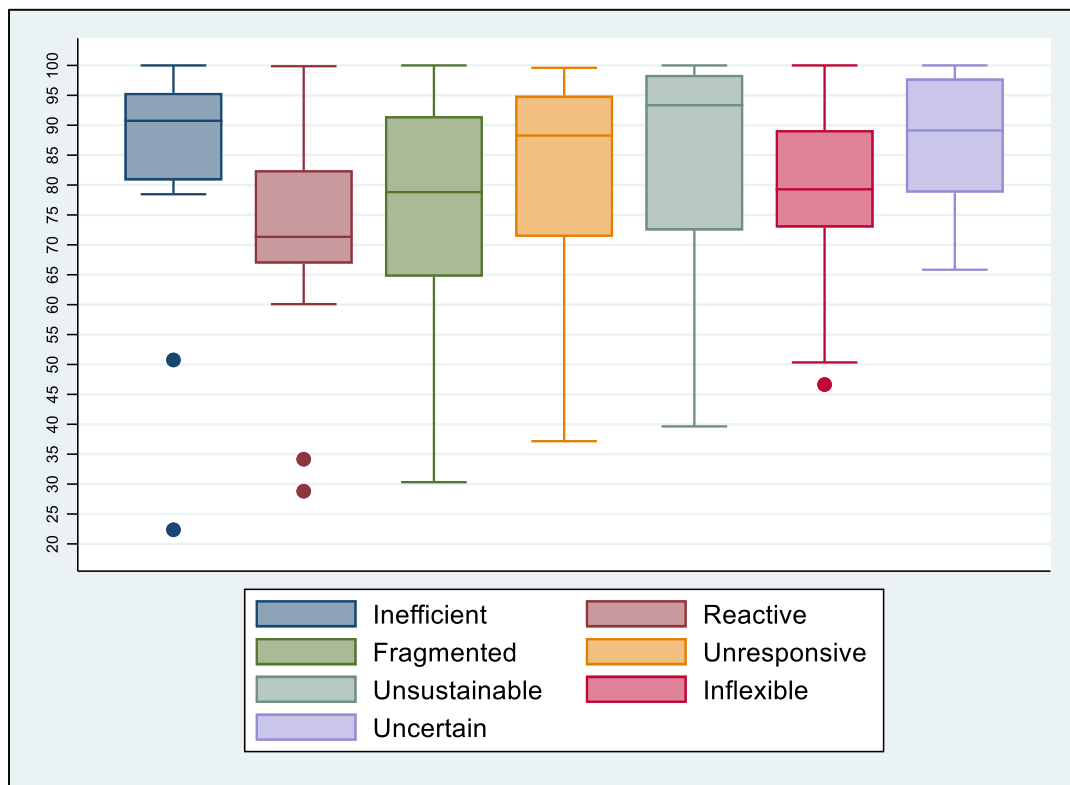


Figure 4.2: Box plots showing the distribution of domains related to the fragility of health systems

Note: Scores of 0-100: The scores represent how critical the domains are to the concept of fragility of health systems. 0- Not critical at all and 100 absolutely critical.

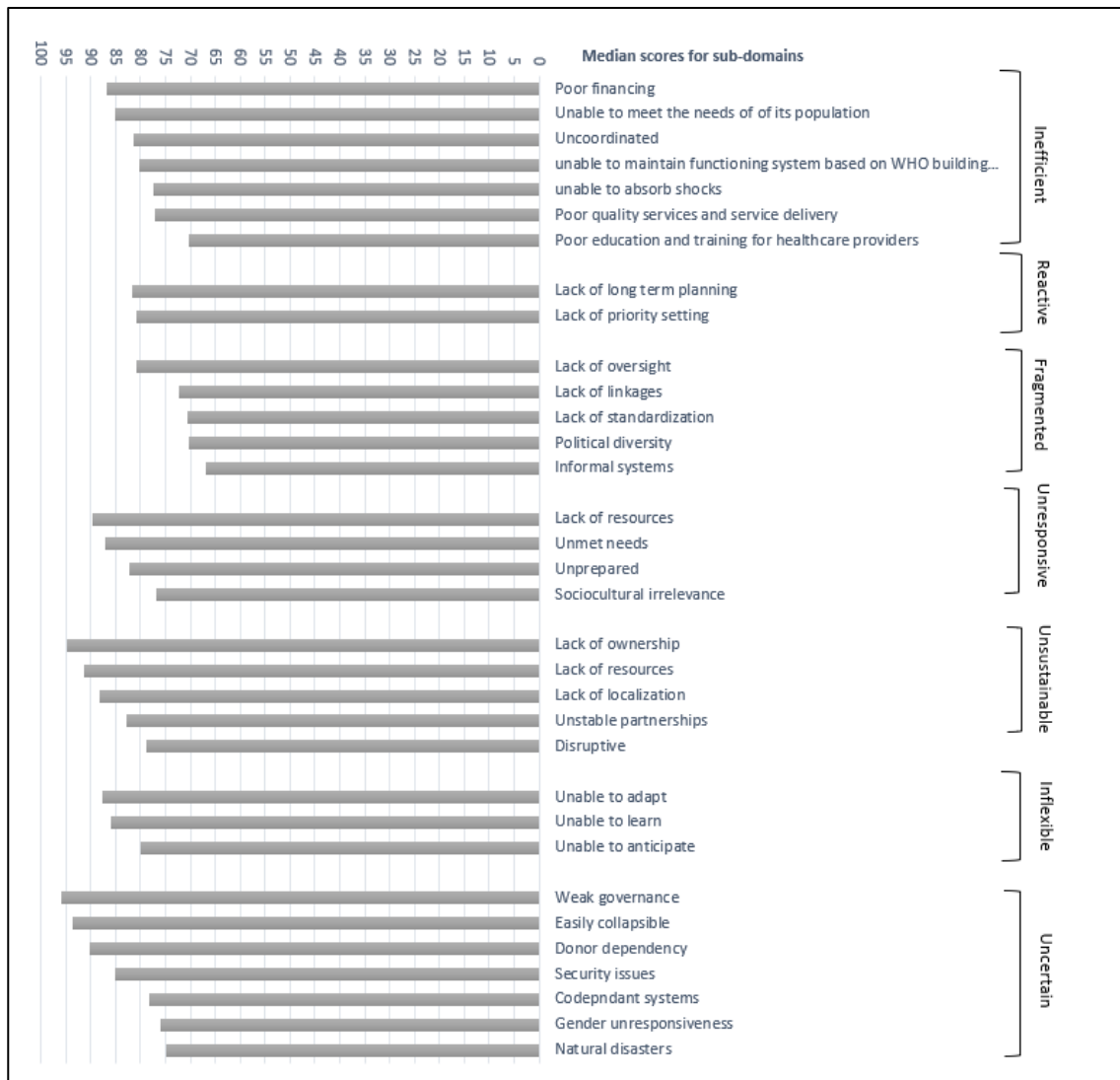


Figure 4.3: Ranking of sub-domains related to domains and fragility of health systems

Note: Scores of 0-100: The scores represent how critical the domains are to the concept of fragility of health systems. 0- Not critical at all and 100 absolutely critical.

Consensus building

The results from the second survey showed an almost bimodal distribution for the agreement regarding the rankings of domains being critical to the fragility of health systems. The four domains with a higher percentage, over 75%, of the participants agreeing with the rankings were unsustainable, inflexible, reactive and unresponsive. The three domains, with less than 75% of participants agreeing with the rankings, were fragmented, uncertain, and inefficient (Figure 4.4 and Appendix 4.3).

The percentage agreement for all domains combined was at 0.63, which showed moderate agreement among the raters for the rankings of domains critical to the fragility of health systems.

1. Unsustainable: Ninety-two percent of participants agreed that unsustainability was closely linked with the fragility of health systems (Figure 4.4). Disruptive systems as a sub-theme contributing to fragility by exacerbating unsustainability of health systems showed the highest agreement, with almost 85% of participants agreeing with the ranking (Figure 4.5), and the remaining were neutral (Appendix 4.3). Although only 54% of participants agreed with the ranking that lack of localization contributes to the fragility of health systems with 39% being neutral regarding this (Appendix 4.3).

2. Reactive: Eighty-five percent of participants agreed with the ranking of reactivity as a contributor to the fragility of health systems (Figure 4.4) while 8% disagreed with the ranking (Appendix 4.3). Both sub-domains within this domain were the largest percentage participants agreeing to the rankings (Figure 4.5).

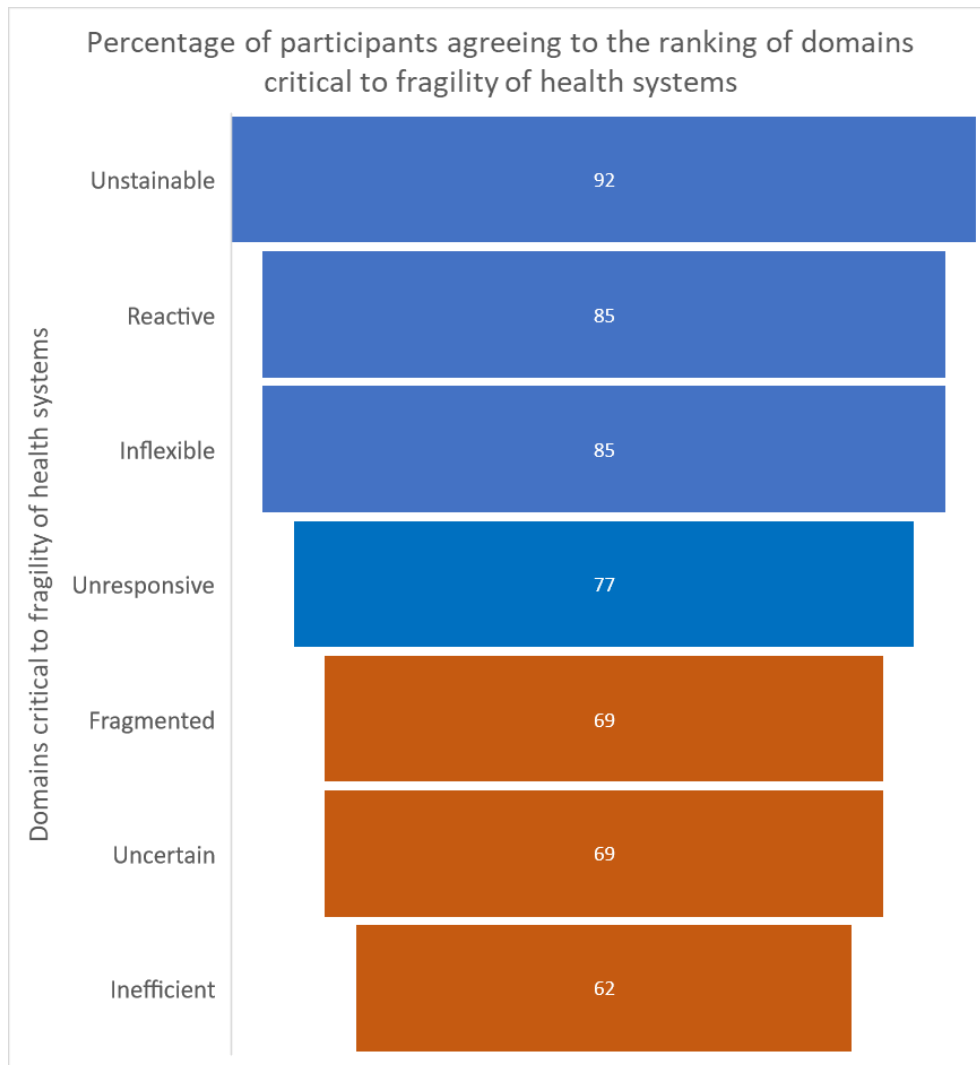


Figure 4.4: Percentage of participants agreeing with domain rankings

Note: There were three categories – agree, neutral and disagree. This figure shows the frequency distribution of the participants agreeing with the domain rankings. The results of the remaining categories are presented in the table in Appendix 4.3.

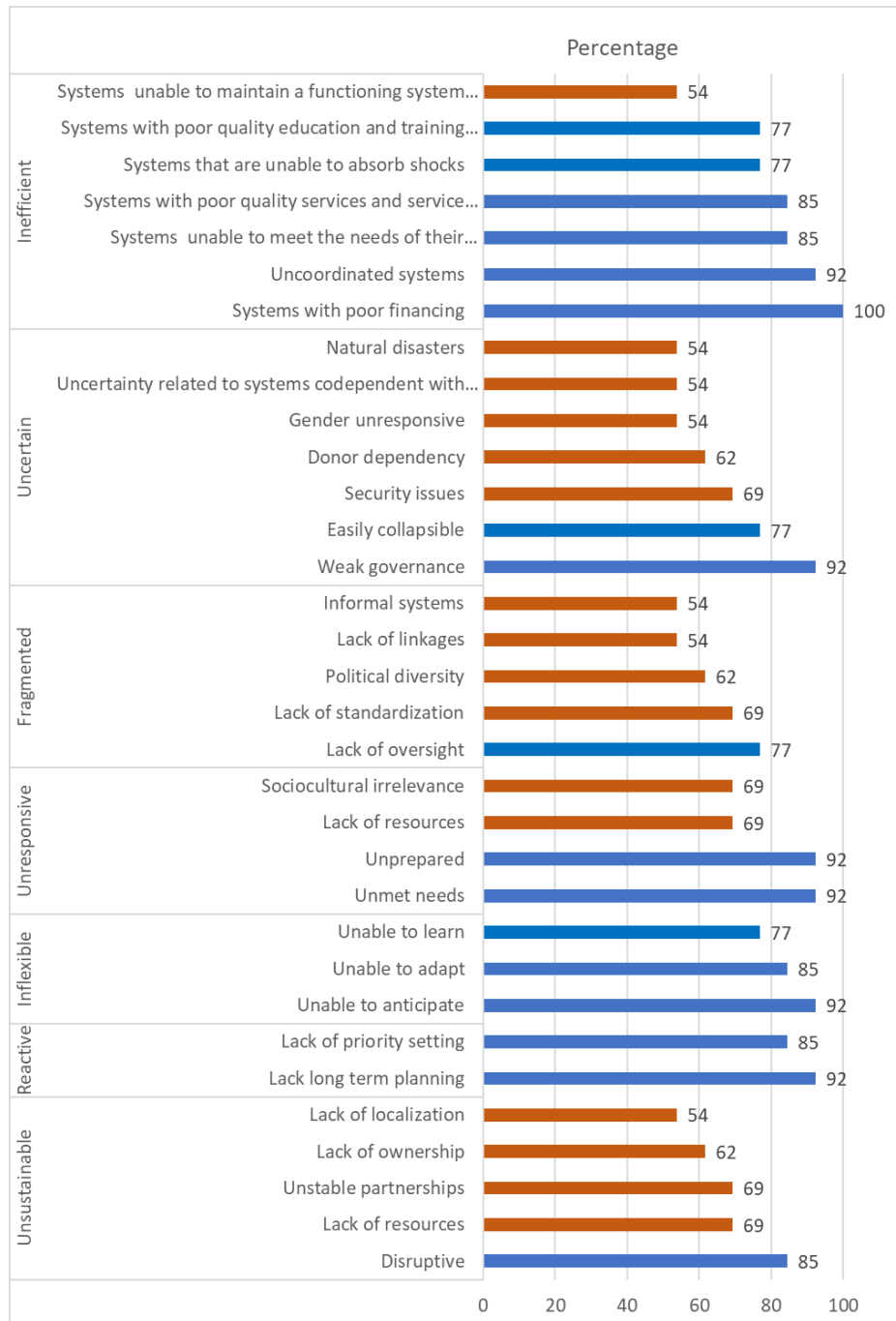


Figure 4.5: Percentage of participants agreeing with sub-domain rankings

Note: There were three categories – agree, neutral and disagree. This figure shows the frequency distribution of the participants agreeing with the domain rankings. The results of the remaining categories are presented in the table in Appendix 4.3.

3. Inflexible: Like reactive, 85% percent of participants agreed, and 8% disagreed with the ranking of inflexibility as a contributor to the fragility of health systems. Most (92%) of the participants agreed that the sub-domain unable to anticipate was critical to the fragility of health systems by increasing inflexibility within the systems. The other two sub-domains within this domain also scored high regarding participants agreeing to their rankings (Figure 4.5) with fewer participants responding as neutral or disagreeing with the ranking (Appendix 4.3).

4. Unresponsive: Seventy-seven percent of participants agreed with the ranking of unresponsiveness as a contributor to the fragility of health systems (Figure 4.4); 15% were neutral, whereas 8% disagreed with the ranking (Appendix 4.3). Most (92%) of participants agreed with the ranking of unmet needs and being unprepared as sub-domains for unresponsiveness contributed to health systems' fragility. On the other hand, lack of resources and socio-cultural irrelevance had a lower agreement at 69% (Figure 4.5), with 23% of participants responding as being neutral to these sub-domain rankings (Appendix 4.3).

5. Fragmented: On the lower end for agreement bimodal distribution for domains, only sixty-nine percent of participants agreed with the ranking of fragmentation as a contributor to the fragility of health systems (Figure 4.4). At the same time, 15% were neutral, and the same percentage of participants disagreed with the rankings. Lower agreement was also observed for the sub-domains for fragmentation, with 77% of participants agreeing that the lack of oversight is critical to the fragility of health systems under the domain of fragmentation. Only 54% of participants agreed with the rankings of lack of linkages and informal systems sub-domains (Figure 4.5).

6. Uncertain: Sixty-nine percent of the participants agreed with the ranking of uncertainty as a contributor to the fragility of health systems, and 23% were neutral.

Ninety-two percent of the participants agreed with the ranking of weak governance as a sub-domain of uncertainty and critical to the fragility of health systems (Figure 4.5). Only 62% agreed with the donor dependency ranking, 23% were neutral, and 15% disagreed with the rankings. For other sub-domains, such as co-dependent systems, gender unresponsive and natural disasters contributing to the fragility of health systems a lower percentage (54%) agreed (Figure 4.5).

7. Inefficient: Only 62% of the participants agreed with the ranking of inefficiency as critical to health systems' fragility (Figure 4.5), while 23% disagreed (Appendix 4.3). All participants agreed with the ranking of poor financing as being critical to the fragility of health systems; 92% agreed that uncoordinated systems contributing to inefficiency are critical sub-domains contributing to the fragility of health systems, while approximately 85% of participants agreed with the rankings of the sub-domains of systems not being able to meet the needs of its populations and poor quality of service delivery (Figure 4.5). Only 53.8% of participants agreed with the ranking of the sub-domain systems unable to maintain a functioning system (Appendix 4.3).

Theoretical framework

While developing a theoretical framework, a quote emerged from a participant responding to the last survey, which encapsulated the significance of domains and the relationship between sub-domains.

In general, all domains seem to be critical as they reflect various facets of fragility. Some of the sub-domains seem to be interdependent. [Informant 10]

The construction of the theoretical framework ensued after the analysis was completed and is visually presented in Figure 4.6. This framework presents the seven domains critical to the fragility of health systems organized based on the prevailing consensus emerging after analyzing the results of the second survey. Four domains, unsustainable, reactive, inflexible, and unresponsive, had a higher percentage of participants agreeing with the rankings based on criticality to the fragility of health systems. There were three domains: fragmented, uncertain, and inefficient, for which fewer participants agreed with the ranking. This does not imply that those factors were not crucial to the health system's fragility. Instead, it suggests the necessity to pursue a deeper understanding of how these domains relate to the fragility of health systems.

Overall, the framework serves as a comprehensive visual summary of the identified domains and their respective sub-domains, shedding light on the multifaceted nature of health system fragility as revealed through this analytical process.

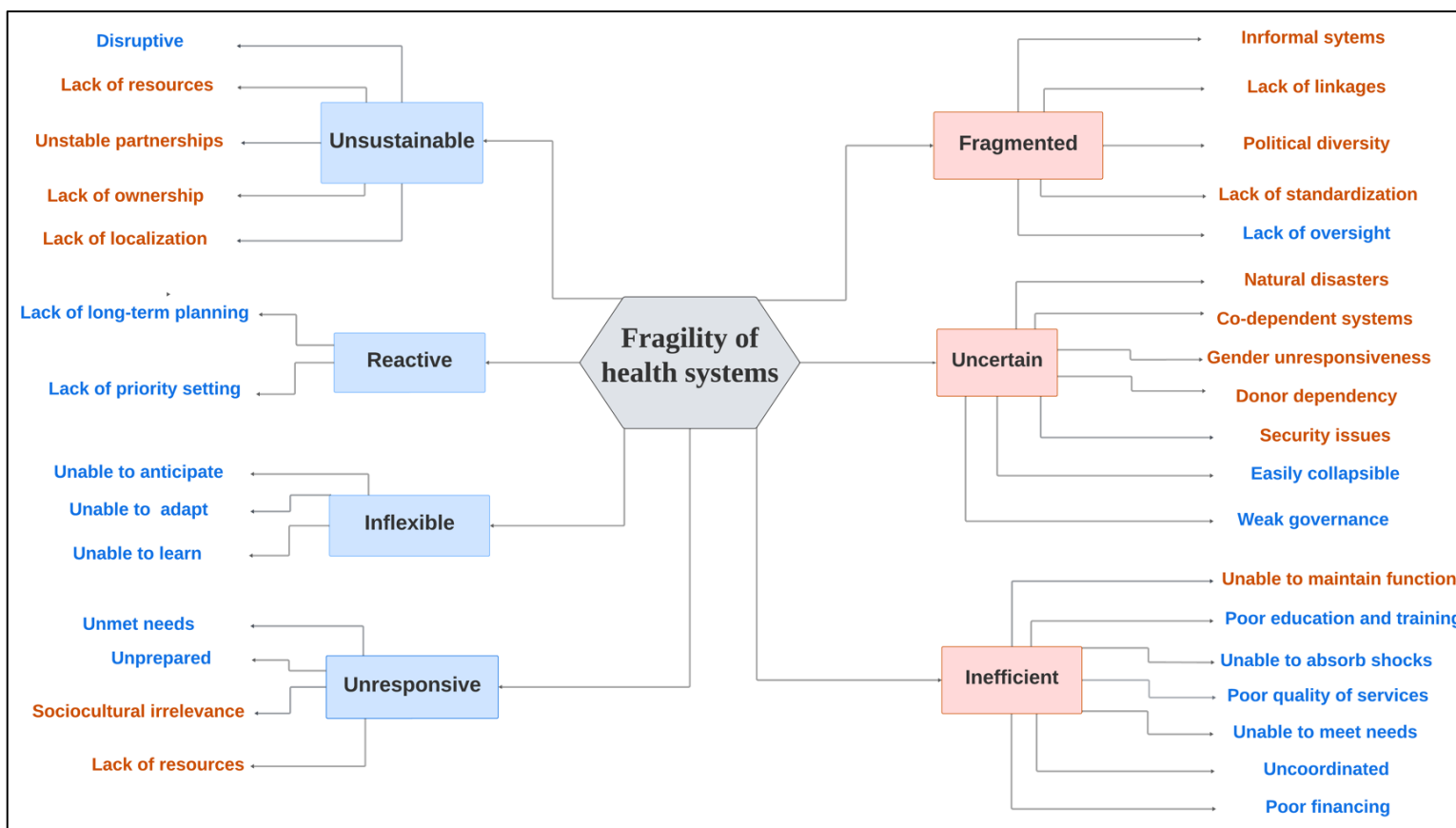


Figure 4.6: Theoretical framework for the concept of fragility of health systems

Note: The Blue box (domains) and text (sub-domains) represent >75% agreement by the participants. The Red box (domains) and text (sub-domains) represent <75% agreement by the participants. The arrows represent linkages between domains and sub-domains and the concept of health systems' fragility.

4.1.2 Results RQ 1.2 - What is the relationship between the fragility and resilience of health systems?

To understand the relationship between the fragility and resilience of health systems, we will first present the findings from brainstorming and concept discovery, followed by concept agreement. The data utilized for this examination encompasses inputs gathered through KII, with a detailed outline of the data collection steps introduced earlier in this chapter and graphically depicted in Figure 4.1.

Brainstorming, concept discovery and categorization

The data for this analysis underwent a categorization process, with ten sub-themes, four themes, and an overarching theme emerging. Figure 4.7 visually illustrates the sub-themes, themes, and an overarching theme.

An overarching theme emerged from the data as an agreement that ‘no health system in the world was completely resilient or fragile’.

There are very few health systems around the world that actually adapt and respond to these kinds of stressors effectively. It is not just a problem of high-income countries or of low-income countries [...] most health systems are incredibly vulnerable to these kinds of stressors regardless of whether they are in a low-income country or a high-income country [...] most people who study health systems, would look at so many health systems around the world and characterize them as being fragile. [Informant 14]

There is no healthcare system in the world that is 100% resilient through all sorts of shocks. In general, all healthcare systems have fragility, but in some countries, some healthcare systems are more fragile than others. [Informant 10]

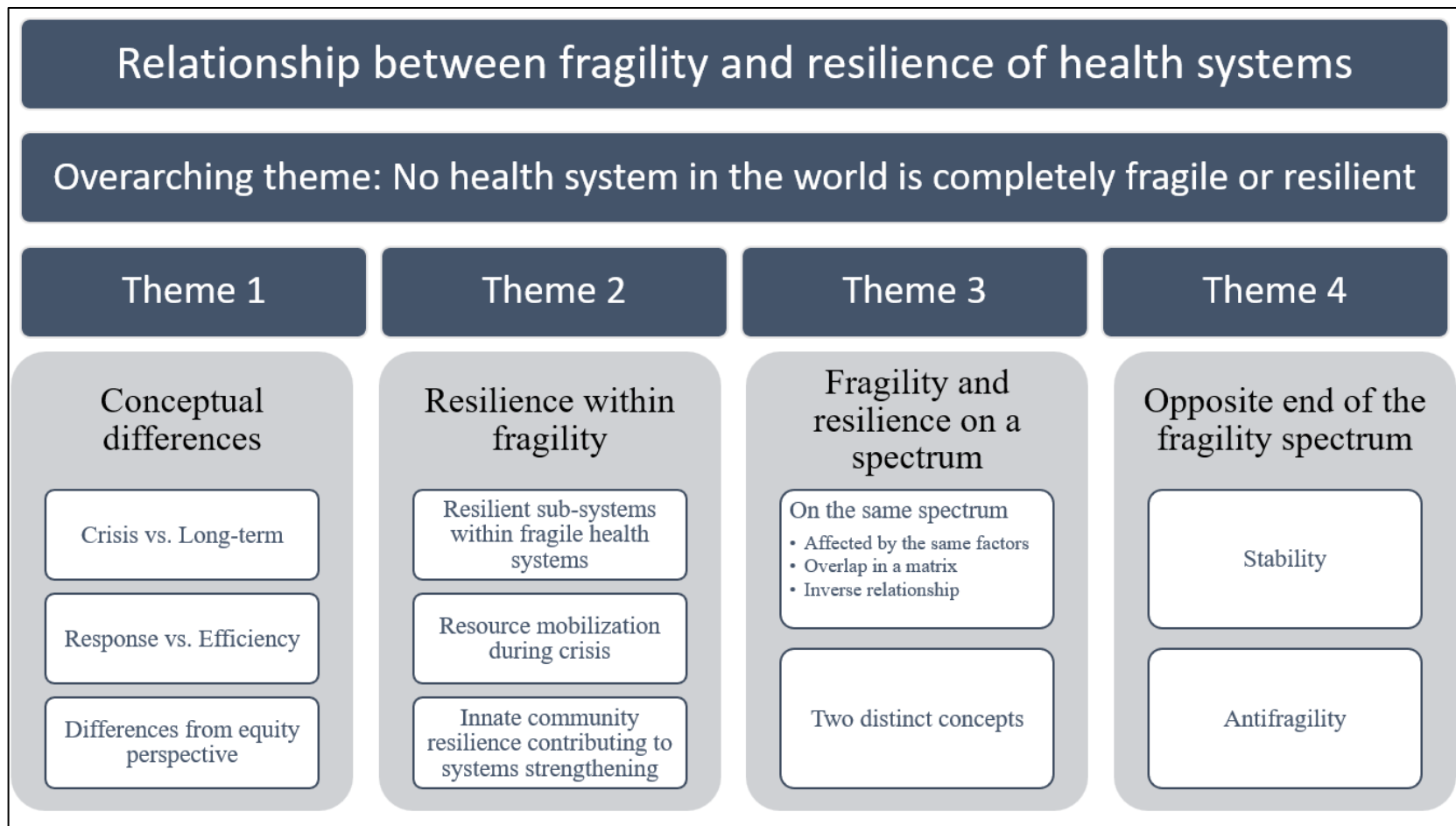


Figure 4.7: Themes and sub-themes emerging through exploration of the relationship between the concepts of fragility and resilience of health systems

In exploring the relationship between health system fragility and resilience, four themes (Figure 4.7) emerged through our analysis.

1. Conceptual differences between the fragility and resilience of health systems

Unveiling conceptual differences between health system fragility and resilience, three sub-themes emerged that focused on the conceptual differences and were grouped. Sub-themes that were grouped under this theme were focused on a conceptual understanding rooted in the differences between the fragility and resilience of health systems. Sub-themes were based on operational differences such as crisis vs response, root causes such as response-driven vs efficiency-driven, and differences in equity perspectives related to health systems fragility and resilience.

Crisis vs. long-term: One of the main differences that emerged between the concept of fragility and resilience identified by the study participants was that resilience is the ability of the health system to respond when a crisis arises. In contrast, fragility is the inability to function even in the absence of crisis or how the system functions in the long term. Describing the difference between the fragility and resilience of health systems, a health systems leader emphasized that there must be:

When we talk about resilience, [...] an example is if you take a rubber band, stretch it, and release it, it returns, so that is resilience. If we go by that definition or analogy, it means that a resilient system should be able to deliver what it was delivering before any vulnerability or crisis. Fragility [...] is a vulnerability and small holes in your system. [Informant 15]

[...] resilience is always seen as a momentous effort, something happens, and any shock happens, epidemic happens, drought is taking place, and then there is a lack of resources and or staff and still the system is able to cope with all these issues. But fragility is a systematic breakdown/systematic fall down of the system where for a prolonged period of time the health system fails to respond to the very routine interventions, suppose the child vaccination and safe delivery of mothers, with

shock or no shock, the system is unable to adjust those important parameters of human life and well-being. [Informant 9]

Response vs. efficiency: Participants discussed the difference between fragility and resilience as the fragility of the health system being related to the efficiency of health systems.

Fragility relates to just the basic performance of the whole system. [Informant 14] In comparison, the participants continued to allude to resilience related to readiness and response to emergencies or crises.

[...] resilient to absorb and respond to shocks and stresses on the system at a certain point of time. [Informant 5]

Differences from equity perspective: While discussing the interplay of inequities with health system fragility and resilience, a distinction was made in how inequities impact system outcomes – resilient health systems improve inequities; in contrast, inequities contribute to health systems' fragility.

In describing the importance of understanding equity-based outcomes as being essential to understanding the underpinnings of building resilience, a health policy, planning, systems and services researcher said that:

When we are talking about a resilient system, we are really talking about the social determinants of health constitute[ing] equity [...] [while] the impact of the other sectors can create the imbalance leading to fragility. [Informant 13]

2. Resilience within Fragility

Recognizing that resilient health systems can exist within fragile systems, sub-themes that emerged under this theme encompassed insights related to resilient sub-systems within fragile health systems, resilience because of resource mobilization during a crisis, and innate community resilience contributing to health systems' resilience.

Resilient sub-systems within fragile health systems: Our participants identified countries where the contextual situation remains fragile. However, some aspects of health systems remain resilient despite those systems being largely fragile.

Stress and sometimes political instability or fragility have a negative impact on the health system in most cases. However, sometimes stress could build resilience, flexibility, and agility of a health system to better manage the situation than other countries. [Informant 5]

One reason provided for areas of resilience within fragile health systems or those operating in fragile contexts was that systems constantly operating in protracted or frequent crises build capacities over time to deal with such crises and thus build pockets of resilience in an otherwise fragile system.

There is expertise in response to these kinds of emergencies that exists in many other countries that simply doesn't exist in high-income countries because there has never been a reason for it to exist. [Informant 14]

If you look at the resilient health system with the COVID-19, why the systems in Italy Spain and US have melt down and the weak system like Pakistan and China they have done much better in Bangladesh, in Africa. So, if the systems are resilient and we should use the same definition for resilience health systems which can take the punches, it has completely failed the whole definition in Italy, the UK, and the US. And the weak systems in Africa and other LMICs have done relatively better. [Informant 11]

[...] example I can share with you from Palestine. Palestine, under occupation, has very limited resources available. It is under continuous exhaustion of the health system by ongoing conflict, clashes, and big wars, and that is hit for the health system targeted specifically. However, at the same time, when you look deep into the health system structure and service delivery and availability of resources and compare it to the region around Palestine, it is amazing you can see a big difference in health indicators and provision of services and the quality of care. Healthcare in Palestine, in general, in Gaza and the West Bank, despite all the limited resources and the stresses on the system, still provides quality care that is [...] better than most of the Middle East and Asia. [Informant 5]

Resource mobilization during crisis: Another perspective emerged that some parts of the system could become resilient with support from external – global or international –

partners or local prioritization of certain areas. Giving an example from the Ebola outbreak, informant 8 described how the intervention by the international community helped control the outbreak.

Like in many fragile contexts, the Ebola outbreak in the eastern part of DRC would not have been controlled. It is an area that's very unruly and very insecure with multiple warring factions, but still, they found their way to engage with the terrible loss sometimes of healthcare workers [...] we should see resilience as a gained capacity; it is not a capacity but given in a short time then you support you can call it an application of aid support. [Informant 8]

Innate community resilience contributing to systems strengthening: In addition to the systems becoming more robust because of contextual fragility, participants identified that people within the fragile communities become more resilient, which contributes to the strengthening of systems by adapting to mechanisms that ensure the functionality of those systems.

This resilience is a kind of collective and accumulative process from the community up to the health care system, so it's not limited only to the health care system.

However, it related more to the resilience of people in general. [Informant 5]

Another participant discussing community resilience contributing to reducing the fragility of the health system said that it happens-

[...] because that would also rely on community-based health systems. [Informant 2]

3. Fragility and resilience on a spectrum

The participants discussed the relationship between fragility and resilience of health, reflecting on whether those could be part of a spectrum. This theme emerged from two diverging views, presented as sub-themes here:

On the same spectrum: Three categories contributed to this sub-theme. Participants described the fragility and resilience of health systems as being affected by the same factors, overlapping in a matrix, or having an inverse relationship.

Participants identified that fragility and resilience are linked to similar factors that affect both. When fragility is improved, it has an impact on resilience.

I look at it as a lever, [...] fragility is moving to resilience, then stable, and then it depends on where there are other contexts in the country and the factors that determine it. [Informant 7]

Some participants discussed the relationship between fragility and resilience as co-existing in a matrix, often overlapping.

I think about the concept of those coexisting [...] as opposed to being polarized, so how do they coexist at an individual level but also part of the coexisted existence level. [Informant 6]

Some participants described an inverse relationship between the fragility and resilience of health systems.

Fragility influences resilience itself because if there is high fragility, the capacity for resilience is negatively affected. So, there is a correlation from that perspective. [Informant 9]

Two distinct concepts: Other participants viewed fragility and resilience as two distinct concepts. Many participants described the fragility and resilience of health systems as not on opposite ends of the same spectrum. Some even expressed that they might not belong to the same spectrum.

We cannot say that fragility is the opposite of resilience, but sometimes, different factors contribute to the fragility that also affects resilience. [Informant 13]

We cannot say that the fragility is the opposite of the resilience. [Informant 17]

I would not really match those two concepts nor put one contradicting the other or as opposed to the other fragility versus resilience. [Informant 10]

4. The opposite end of the fragility spectrum

To fully grasp the concept of fragility, it was crucial to ascertain its counterpart on the spectrum. As we delved further into this spectrum of fragility, participants shared insights. They characterized 'stability' as a factor that strengthens within systems as fragility decreases. Others identified 'anti-fragility' as the concept positioned at the opposite end of the fragility spectrum.

Stability: When discussing the opposite end of the fragility spectrum, it was highlighted that systems must understand their needs, barriers, and operational modalities. When systems can respond based on their operational needs, those start becoming stable. In describing this concept of stability, a participant stated:

Whatever the system is, whether vaccination of the children or family planning- it is all part of the health system. The system should understand that immunization coverage, access to immunization services, and diarrheal disease is right, but that access is important in fragile systems for women and children that should not be compromised. [...] More stable systems are learning systems; within those, there could be some elements of fragility and stability. [Informant 11]

Anti-fragility: The discussion was based on the book 'Antifragile: things that gain from chaos' by Nassim Taleb.^m

One participant described the concept of anti-fragility with examples, focusing on the idea that although resilience may be one component for the system to be anti-fragile, additional strength is required for a system to become anti-fragile. It was emphasized that anti-fragility is often linked with building back better or resilience; however, anti-fragility encompassed more than resilience; the system's robustness, because it is stable, was equally

^m Antifragile: things that gain from chaos - Taleb, N. N. (2013). *Antifragile*. Penguin Books.

important for systems to be anti-fragile. The informant further elaborated that it would be essential to start building more anti-fragile systems before any stress happens to ensure that processes can support the system during stress.

Fragility is the opposite of anti-fragility and there is no real name for anti-fragility, according to the author. If the pure definition of resilience is to bounce back to the same level as you were before, but many people talk about bounce better, build back better. So, this [anti-fragility] is not the literal definition of resilience. Many people talk about anti-fragility, but they call it resilience. [...] the anti-fragility will greatly benefit from a resilient and robust health system. [Informant 6]

Consensus building

Sixty-six per cent of the respondents who completed the KII responded to the concept agreement survey questions related to the relationship between fragility and resilience of health systems. Themes 1 and 2 (Figure 4.7) emerged where statements were categorized, and the agreement was measured using the percentage agreement. The other two themes (3 and 4); Figure 4.7) emerged where the statements described a spectrum, and the agreement was measured on a continuous scale. The results presented here were based on the statements under themes and sub-themes identified during concept discovery and are presented in Table 4.1.

All the participants agreed with the statement describing the overarching theme that no health system in the world is entirely fragile or resilient. Consensus regarding statements related to the relationship between fragility and resilience of health systems are presented under their respective themes and sub-themes below.

1. Conceptual differences between the fragility and resilience of health systems

There was a moderate consensus among participants regarding statements related to all the sub-themes under this theme (Table 4.1). Regarding crisis vs. long-term, the consensus was slightly higher for resilience linked to crisis response (0.59) than fragility as a function of long-term functionality (0.49). There was no notable difference in agreement regarding

statements about response versus efficiency in explaining the distinction between the fragility and resilience of health systems. The only statement where participants agreed marginally substantially was regarding the equity perspective, where participants agreed that equity-related issues emerge as outcomes measured as part of resilient health systems (0.61); the agreement had an extremely narrow confidence interval (Table 4.1). There was a moderate consensus regarding equity-related issues contributing to the fragility of health systems (0.57).

2. Resilience within Fragility

There was almost perfect agreement between participants regarding two of the three statements related to the sub-themes under resilience within fragility. Most participants agreed that there were resilient sub-systems within fragile health systems (0.89). Many agreed that fragile systems can temporarily become resilient when there is an influx of aid due to a crisis (0.81). There was substantial agreement among participants regarding innate community resilience contributing to strengthening health systems (0.62).

3. Fragility and resilience on a spectrum

Many participants agreed that fragility and resilience were affected by the same factors, with a mean score of 0.72 (Table 4.1). Although some agreed the relationship between fragility and resilience overlap in a matrix (mean of 0.67), there was no clear consensus on fragility and resilience having an inverse relationship.

On the other hand, many participants agreed that fragility and resilience were two different concepts and were not even on the same spectrum (mean of 0.66).

4. Opposite end of fragility spectrum

Many agreed that stability was on the opposite end of the fragility spectrum, with a mean score of 0.74 (Table 4.1). However, more participants agreed that antifragility as a concept encompassing the opposite of resilience and other elements that strengthen health systems for long-term was at the opposite end of the fragility spectrum (mean of 0.81).

Table 4.1: Consensus for statements describing the relationship between fragility and resilience of the health system

Themes	Sub-themes	Statements	Percentage agreement* (95% CI)
Theme 1: Conceptual differences	Crisis vs. Long-term	Resilience is linked to crisis response	0.59 (0.3, 0.9)
		Fragility is linked to the long-term functionality of the health system	0.49 (0.4, 0.6)
	Response vs. Efficiency	Resilience is a function of response	0.57 (0.2, 0.9)
		Fragility is a function of efficiency	0.54 (0.4, 0.7)
	Equity perspective	Equity-related issues emerge as outcomes measured as part of resilient health systems	0.61 (0.6, 0.6)
		Equity-related issues contribute to the fragility of health systems	0.57 (0.5, 1.0)
Theme 2: Resilience within fragility	Resilient sub-systems within fragile systems	There are resilient sub-systems within fragile health systems (for example, some countries with protracted war have advanced trauma support capacities)	0.89 (0.7, 1.0)
	Resource mobilization during crisis	Systems within fragile health systems can temporarily become resilient with external support during a crisis (disaster response, vaccination support etc.)	0.81 (0.4, 1.0)
	Innate community resilience	When communities under protracted threat are innately resilient, they contribute to strengthening the system through their innate resilience and ability to withstand pressures	0.62 (0.1, 1.0)

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Themes	Sub-themes	Statements	Mean** (95% CI)
Theme 3: Fragility and resilience on a spectrum	On the same spectrum	Both fragility and resilience are affected by the same factors	0.72 (0.5, 0.9)
		Fragility and resilience of health systems overlap in a matrix	0.67 (0.4, 0.8)
		Fragility and resilience of health systems have an inverse relationship	0.54 (0.3, 0.7)
	Two distinct concepts	Fragility and resilience of health systems are not on the same spectrum- these are difference concepts with their own spectrums	0.66 (0.5, 0.8)
Theme 4: Opposite end of the fragility spectrum	Stability	Agree with the concept of stability being at the opposite end of spectrum of fragility	0.74 (0.6, 0.8)
	Antifragility	Agree with the concept of anti-fragility being at the opposite end of spectrum of fragility	0.81 (0.6,1.0)

* The agreement levels were categorized as follows: 0 to 0.2 as slight agreement, 0.21 to 0.4 as fair agreement, 0.41 to 0.6 as moderate agreement, 0.61 to 0.80 as substantial agreement, and 0.81 to 1.00 as almost perfect agreement

** The scale for continuous variables was standardized between 0 and 1: 0 was the lowest score and no agreement; 1 was the highest score and perfect agreement.

4.1.3 Results RQ 1.3: How is the understanding of the fragility of health systems applied in Afghanistan?

After we examined the concept of health systems fragility and its relationship with resilience, our focus shifted to its application within the healthcare systems of Afghanistan. We first analyzed the data to gain insights into the fragility of health systems in Afghanistan, utilizing the established framework. Subsequently, we explored the relationship between health system fragility and resilience in Afghanistan, using the themes and sub-themes identified through our prior research question.

The fragility of health systems in Afghanistan

Among the participants, fifteen individuals offered valuable insights based on their firsthand experience working in Afghanistan. Notably, ten of these participants either hailed from Afghanistan or had engaged in substantial work within the country over an extended duration (Appendix 4.1).

Concept discovery utilizing the established framework

References related to Afghanistan's health system and what contributes to its fragility were coded and organized within the previously (RQ 1.1) identified sub-domains and domains associated with the concept of health system fragility.

Our results showed that the participants emphasized that Afghanistan's health system is fragile due to challenges like ineffective priority settings, inadequate resource allocation, and weak governance. It relies on temporary strategies, lacks adaptability during emergencies, and struggles with inefficiencies in meeting population needs. Dependence on donor funding, security concerns, and gender unresponsiveness further underscore its instability. The fragility of health systems in Afghanistan was mapped out using the framework developed in Figure 4.6; the details are presented in Table 4.2.

Table 4.2: Overview of the fragility of health systems in Afghanistan

Domains	Sub-domains	Quotes
Reactive	Lack of priority settings	Regarding health system priorities, the participants described the existing packages as insufficient – “Actually the health system, if you look at the basic package, it is very basic services provided, but the need of the community is more than basic package [...]communicable diseases emerging issue in Afghanistan. If you consider maternal mortality, it's only around 14% of adult mortality is attributed to maternal mortality. But if you look at the non-communicable disease, 33% of adult mortality is attributed to noncommunicable diseases, and our system is not responsive to that need of the community. Also, 10 % of the population has limited access to this basic health service, so our system is not well distributed in the country.” [Informant 16]
	Lack of long-term programing	Regarding planning and developing strategies, a participant stated: “New strategies.... are all temporary strategies, that is what is called crisis management it solves crises, but they cannot become a systematic approach of addressing the health system needs and the health system implementation parameters as a whole.” [Informant 9]
Uncertain	Easily collapsible	“...when I see Afghanistan's healthcare system and when I connect fragility with it, it could collapse anytime.” [Informant 10]

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Domains	Sub-domains	Quotes
Uncertain (continued)	Weak governance	<p>Several participants identified corruption as a major issue leading to weak governance: “Corruption is very prominent even in remote areas, so, these are all the factors which are really hampering the quality of health care.” [Informant 10]</p> <p>“Ministry of Health is not capable or will not be capable of taking the standalone decision, all the decisions will be affected by what's happening on negotiation [...] lack of leadership is the major problem that's the major issue once we have the leadership... all these things will affect health service provision.” [Informant 17]</p>
	Donor dependency	<p>Many participants highlighted the dependence of the Afghan health system on donor funding and that the system will collapse if that aid is cut off - “The health system [in Afghanistan] is totally dependent on the external resources... supported across the country by USAID, European Commission, and the World Bank...if you look at the local capacity to contribute or from the national budget, it is impossible to maintain the health system if international support discontinues.” [Informant 16]</p>
	Natural disasters	<p>Regarding Afghanistan, a participant stated - “There are natural disasters, earthquakes, there are floods that can also make a system completely fragile.” [Informant 11]</p>

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Domains	Sub-domains	Quotes
Uncertain (continued)	Donor dependency (continued)	<p>“The biggest threat to or the biggest fragility factor to the country's health system overall is dependency on aid; it is 100% aid dependent. I think maybe that's incorrect [...] higher proportion of the national health system is financed through aid, so anytime the aid is stopped, the whole system will crash, and that's for sure everyone knows that.” [Informant 1]</p>
		<p>“In early 2000, the share of the international agencies was close to 60-70%. Today, after 18 to 19 years it is 18 to 20%. [Informant 8]</p>
		<p>Primary healthcare in the country was said to be entirely dependent on donor support: “One of the key factors thinking about the fragility of the health system would be the donor dependency that is the key, specifically coming to the Primary Health care services that portion; because if donors do not finance it, nothing is there. Only the health facilities in the building are built by the Ministry of Public Health and owned by the Ministry of Public Health; staffing, the payment for staff, the services, supplies, everything is through donors by the contract out outsourced just to those NGOs, and they are implementing and supporting and that is the key.” [Informant 18]</p>
	Security issues	<p>“In general, the political side of this out of the control of the government can have a big impact of this, and then the complex emergency because Afghanistan, for the past 40 years we are in a state of complex emergency. [...] we have the insecurity, we have the internal fight, and all this is also contributing to this fragility.” [Informant 18]</p>

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Domains	Sub-domains	Quotes
Uncertain (continued)	Security issues	<p>“For example, we have active fighting in Helmand and Kandahar and so many other provinces, so we assume that possibly those fighting will close the health facility one day and next that health facility would be open. Same on the staff, today we have relative peace in one of the districts I will not mention the name of, and we have staff with incentives are going and working there, but tomorrow, that district will become insecure, and the staff, particularly the female they leave the place and they leave their health facility empty.” [Informant 17]</p>
	Gender un-responsive-ness	<p>“Even if we look at the family planning issue, the actual need for family planning is 20-25% - it means that 25% of the women who want to use family planning and family planning is not accessible to them... 800 hundred thousand women of reproductive age are living in those areas who have no access to RMNCH services.” [Informant16]</p> <p>“[...] is the cultural factors- that impede access of women and girls to health services. So they may have a health facility in their community or in their vicinity, but because of family reasons and cultural barriers, they may not be able to access services; that is another factor.” [Informant 1]</p>
	Inflexible	Unable to adapt

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Domains	Sub-domains	Quotes
Inflexible (continued)	Unable to anticipate	One participant gave an example - “[...] when we had this cholera outbreak [...] it was so widespread and can't be contained and then the NGO was not able to cope neither it was able to live with [...] what it needed.” [Informant 15]
	Unable to learn	Regarding data and evidence -“does not even have a process usually; people just kind of change the data sent it in right because they can’t understand and use their data.” [Informant 13]
Unresponsive	Lack of resources	“In the context of Afghanistan [...]the financial resources and the human resources, then I think we could look around indicators in those areas and see how to measure the fragility.” [Informant 1]
	Unprepared	The health system in Afghanistan needs to be more prepared based on the needs “[...]so we need to know how many people we need, what kind of skills are needed, and how do we how are we going to take those people forward you know their career structure and all that.” [Informant 15]
	Unmet needs	“If we look at the geography of Afghanistan, more than 90% of Afghanistan is a very mountainous area, so in those areas, if we establish a health facility, for example, the lowest level of the health facility as the health sub-center which is for the 4 to 11 thousand population, if we look at the situation and central Highland, for example, Bamiyan or Daikundi, 4000 population is living in the area of more than 30 kilometers. So, there are a very small population of 1000 to 1500 to 2000 living in one Valley and another 1000 or 2000 population in another valley. So, people live in a very scattered geography, which limits the population's access to those areas. This is why the system is not very responsive to the needs of those populations.” [Informant 16]

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Domains	Sub-domains	Quotes
Unresponsive (continued)	Socio-cultural irrelevance	“[...] trying to implement different projects to sort of strength and some of these building blocks across all of the provinces in Afghanistan trying to do it simultaneously trying to build these like incredibly complex like human resources databases and management systems and so on that maybe would have worked in like a well-functioning health system in the United States somewhere but were destined to fail in Afghanistan.” [Informant 14]
Fragmented	Lack of oversight	“It should be the only Ministry of Public Health leading the whole health issues in the country, but in reality, we have different structures as well [...] regulation system is not working properly, and there is to regulate the private education and private health service providers. At the same time, licensing, although we have established the Medical Council since 2018 who, should work on licensing and regulation, but there has been no progress in the last two years.” [Informant 16]
Fragmented (continued)	Lack of standardization	“General ability to actually regulate the quality of medical care and the inputs that are coming into the whole system like pharmaceuticals or medical devices and to maintain them was really limited.” [Informant 14]
	Informal systems	“What happens is that because the public sector is completely fragmented, you need to have something in place. So, we all know that all quacks and all private sector are bad; they are at least filling the gap. Even the faith healers, in several countries, we have seen that they have such a huge emphasis, the traditional birth attendants, for example, they at least do something, and they are filling the gap.” [Informant 2]

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Domains	Sub-domains	Quotes
Fragmented (continued)	Lack of linkages	<p>“In Afghanistan context and in developing country context, I'm not saying that the private sector is bad, just we ourselves being part of that we are not for profit, so our bottom line is not driven by profit, but if we are not part of a bigger system if I am running a mobile clinic which does not fit into an overall bigger picture then I'm creating an island of success with failure all around, right and that then the island of success will be will soon become irrelevant, I have to do that within the system so that there is the reference chain there is linkage and I'm doing something in support of or my contribution is towards strengthening that help system and not towards fragmenting.” [Informant 2]</p>
	Political diversity	<p>“Political side of this [is] out of the control of the government can have a big impact of the impact of this and then the complex emergency.” [Informant 18]</p> <p>“There are different numbers thrown at us, but at least about 35 to 40% of the country's geography is under the control of the insurgents, so those are the areas that the government cannot access.” [Informant 1]</p>
	Inefficient	Unable to meet the needs of its population

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Domains	Sub-domains	Quotes
Inefficient (continued)	Poor financing	“If you look at the financing issues related to the health system of Afghanistan, unfortunately, the out-of-pocket expenditure is very high. Around 72 to 75% of all health expense expenditure in Afghanistan is out of pocket. Only 20% of the overall health expenditure is covered by the donors, and the government contribution is very little, around 5%.” [Informant 16]
	Unable to absorb shocks	“There is no health care system in the world which is 100% resilient for all shocks. Afghanistan healthcare system or health care system in conflict zones has more gaps, and they're prone to more shocks even not shock, a small stimulus might shatter the whole health care system.” [Informant 10]
	Un-coordinated	“There is poor planning for the health workforce in the country, and we don't have a very coordinated plan... based on one study that was conducted in 2014 by the Ministry of Public Health and WHO, around half of the health facilities were underutilized and main thing is that it is based on the population not based on the geography.... Health information system is also a challenge, although we have established a well-functioning health information system. But if we look at other ministries, no information service can provide this kind of information service or data.” [Informant 16]
	Poor education and training of healthcare providers	“The problems with the Afghan health system are not restricted to the health system itself, right it's also a problem of poorly regulated educational institutions of poor-quality medical schools and nursing schools, and you know, like there's all kinds of problems on top of it that when you consider them as inputs into the health system or are going to weaken the health system.” [Informant 14]

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Domains	Sub-domains	Quotes
Inefficient (continued)	Unable to maintain functioning systems	<p>“When the health system is weakened, there will be a huge investment, of course, at the secondary level because that is a very obvious level, and then primary care sometimes is ignored especially the prevention part, the community health part – sometimes for a good reason - because the immediate need is a huge, however we know that in Afghanistan immediate need will we continue for years and years.” [Informant 6]</p>
	Poor quality services	<p>“Health care was being undermined by the fact that outside of just going to a clinic where you may have had a very good health care provider and that was taken care of you, you had this other parallel private system that was ubiquitous throughout Kabul where you know anybody could effectively walk in off the street and buy something.” [Informant 14]</p> <p>“[in Afghanistan] is the quality of the services is also a concern [...] For example, antenatal care coverage has increased in Afghanistan up to 60 or 62%, but it is only the first ANC; while the previous guidelines of WHO, at least four ANC visits were required according to the revised guideline 2018, at least eight ANC to be completed. While at least four ANC in Afghanistan is only 17%, so with this how we can address the quality of the antenatal care.” [Informant 16]</p> <p>“There was very little capacity to actually monitor the quality of care and the quality of services being provided and then actually to do something about when the quality was deficient.” [Informant 14]</p>
Unsustainable	Lack of ownership	<p>“The community is caught in between, and yes, they want to have the services, but you know the services have to pass into the filter, and that filter is always the one we have to negotiate with and discuss with.” [Informant 9]</p>

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Domains	Sub-domains	Quotes
Unsustainable (continued)	Lack of resources	“They [Afghanistan] don't have enough, let's say, the resources in terms of medical staff, financial resources to upgrade and enhance the health care system.”[Informant 5]
		“Right now, they have a system of top up for doctors and nurses to be sent into insecure places, but the moment you remove that top up, there wouldn't be any resilience at all.” [Informant 10]
	Unstable partnerships	“The role of private sector investing in health care provision or just their participation or their role which is not well defined in the country to have a proper partnership [...] because lack of clear mechanism in the country so far that is one of the causes [contributing to fragility] or one of the external contributors of this fragility of services.” [Informant 18]
	Lack of localization	“The only option would be to prioritize our services [...]needs and just for the community and provide specific sort of, you know, a set of services to be provided by the government, and then the rest can be provided by the private sector and combine, let's say public-private in which the government can even continue with the available services without even cutting any provide the entire services but in partnership with private sectors working on a specific model.” [Informant 18]
	Disruptive	“When you've got and, in a system, where the ministry of health like in Afghanistan where the ministries are very thin on the ground, and they've got the NGOs hiring and working on all things [...]nobody has got a handle on it right like nobody is kind of understanding who's doing what where and so in a fragile health system you've got a massive discontinuity that continuum of care.” [Informant 13]

Concept prioritization and ranking for fragility of health systems in Afghanistan

The participants ranked reactivity as most critical to the fragility of health systems in Afghanistan; the mean, median scores and ranking are presented in Table 4.3. Two clusters of rankings were observed for the domain distribution critical to the fragility of health systems. Reactive, uncertain and inflexible were ranked high compared to the lower-ranked cluster with unresponsive, fragmented, inefficient and unsustainable. This ranking differed from the ranking for the general concept of fragility described in RQ1.1, where unsustainable was ranked highest and reactivity was ranked lowest concerning the fragility of health systems.

Table 4.3: Distribution of ranking of domains critical to the fragility of health systems in Afghanistan

	Median ranking	Mean ranking
Reactive	6	5.31
Uncertain	5	4.54
Inflexible	5	4.38
Unresponsive	4	3.85
Fragmented	3	3.46
Inefficient	3	3.33
Unsustainable	3	3.31

Sub-domains critical to the fragility of health systems in Afghanistan were also ranked; Table 4.4 shows the percentage of participants ranking those as not critical, somewhat critical and absolutely critical. For Afghanistan, weak governance was considered a sub-domain absolutely critical to fragility by most participants (79%), followed by the inability to meet the population's needs with 67% of participants, Table 4.4. Lack of resources and lack of ownership were other sub-domains considered absolutely critical by 64% of the participants, while 62% of participants considered poor financing and easy collapsibility as absolutely critical to the fragility of health systems.

Table 4.4: Distribution of ranking of sub-domains critical to the fragility of health systems in Afghanistan

Domain	Sub-domain	Not critical (%)	Somewhat critical (%)	Absolutely critical (%)
Inefficient	Unable to meet the needs of its population	25	8	67
	Poor financing	39	0	62
	Uncoordinated	46	0	54
	Unable to maintain a functioning system based on WHO building blocks	42	17	42
	Poor education and training for healthcare providers	50	17	33
	Unable to absorb shocks	67	0	33
	Poor quality services and service delivery	54	15	31
Reactive	Lack of priority-setting	69	8	23
	Lack of long-term planning	50	29	21
Fragmented	Lack of oversight	36	7	57
	Lack of standardization	77	8	15
	Informal systems	39	46	15
	Lack of linkages	69	23	8
	Political diversity	64	29	7
Unresponsive	Lack of resources	36	0	64
	Unprepared	62	8	31
	Unmet needs	50	21	29
	Sociocultural irrelevance	58	33	8
Unsustainable	Lack of ownership	36	0	64
	Lack of resources	46	8	46
	Unstable partnerships	50	17	33
	Lack of localization	46	23	31
	Disruptive	58	25	17
Inflexible	Unable to adapt	50	17	33
	Unable to learn	54	15	31
	Unable to anticipate	62	15	23
Uncertain	Weak governance	21	0	79
	Easily collapsible	31	8	62
	Donor dependency	43	7	50
	Gender unresponsive	42	8	50
	Security issues	50	0	50
	Uncertainty related to systems codependent with health systems	46	39	15
	Natural disasters	62	23	15

Very few participants considered sociocultural irrelevance (8%), lack of linkages (8%), and political diversity to be absolutely critical; the majority considered these three sub-domains as not critical to the fragility of health systems in Afghanistan. Interestingly, many participants did not consider being disruptive (58%) and lack of standardization (77%) as sub-domains not critical to the fragility of health systems. For some other domains, such as security issues, gender unresponsiveness and donor dependency, the participant opinion was almost split in the middle, with half considering these sub-domains as absolutely critical while the other half as not critical to the fragility of health systems in Afghanistan (Table 4.4).

Consensus building and comparing the final ranking for domains related to the fragility of health systems with the established framework

There was a moderate overall percentage agreement (0.6) between participants on ranking domains critical to the fragility of health systems in Afghanistan. Most of the participants agreed with the rankings of the domains related to the fragility of health systems in Afghanistan, except for uncertainty and inefficiency, with 69% and 62% agreeing with the respective domain rankings, Table 4.5.

Table 4.5: Distribution of the percentage of participants agreeing with the rankings of the domains critical to the fragility of health systems in Afghanistan

	Disagree (%)	Neutral (%)	Agree (%)
Unstable	8	8	85
Reactive	8	8	77
Inflexible	8	8	77
Unresponsive	8	15	77
Fragmented	8	15	77
Uncertain	15	8	69
Inefficient	15	15	62

Since many participants agreed with the ranking of the domains critical to health systems in Afghanistan, the domain rankings for Afghanistan were compared to the domains in the framework presented in Figure 4.6. The comparison is presented below in Figure 4.8.

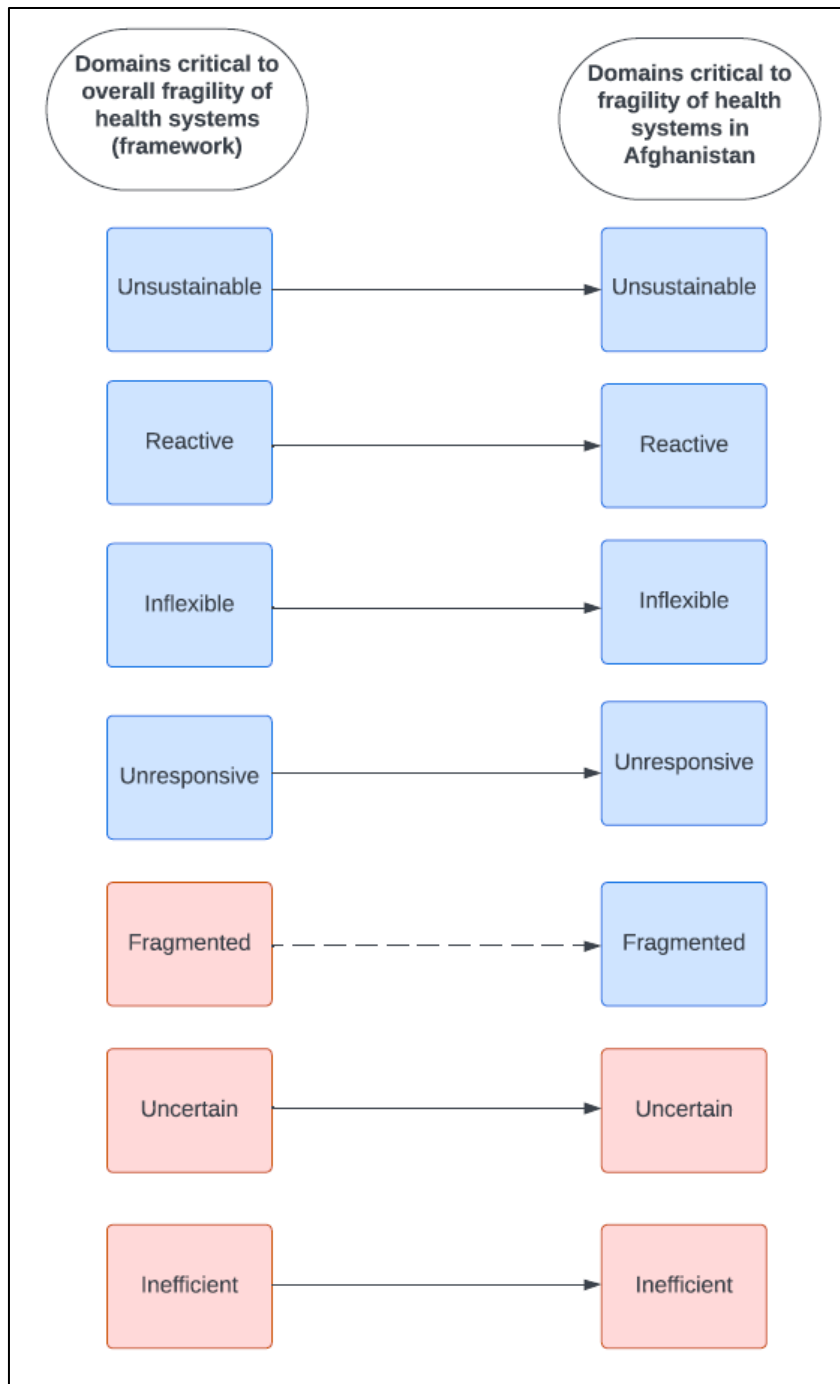


Figure 4.8: Comparing domain rankings between the overall concept of the fragility of health systems and the fragility of health systems in Afghanistan

Note: The Blue box represents >75% agreement by the participants. The Red Box represents <75% agreement by the participants. The dotted arrow represents the change in the ranking consensus from the overall framework to domains ranking critical to Afghanistan's health systems' fragility.

Although unsustainable and fragmented were initially ranked lower there was high consensus among participants regarding the relationship of these domains with fragility of health systems in Afghanistan. On the other hand, uncertainty was ranked higher as a domain critical to fragility of health systems, however, with a lower consensus among participants. The domain reactive was ranked higher and there was high consensus among the participants regarding this domain as well. Similarly, inefficiency was ranked lower and there was a low consensus among participants regarding this domain.

Figure 4.8 compares domains critical to the fragility of health systems in general and those critical to the fragility of health systems in Afghanistan as agreed by our participants. The illustration demonstrates the applicability of the fragility framework to health systems in Afghanistan. Most domains that exhibited high consensus within the general framework also demonstrated high consensus specifically for Afghanistan. The only exception was the "fragmented" domain, which displayed low consensus among participants in the general framework but exhibited high consensus when examined in the context of health systems in Afghanistan.

Relationship between fragility and resilience of health systems in Afghanistan

Our results showed that the participants discussed this relationship in Afghanistan, contributing to three out of the four themes identified through RQ 1.2. The participants did not discuss theme 4, the opposite end of the fragility spectrum, in reference to Afghanistan. An overview of the relationship of the concepts as those relate to the identified themes, along with the quotes related to Afghanistan, are presented in Table 4.6.

1. Conceptual differences between fragility and resilience of health systems

Participants highlighted that the main hindrance in building resilience was that the models for financing and planning were borne out of a crisis, and more planning was needed to decrease the fragility of health systems. Regarding response vs. efficiency, the participants highlighted that the systems are in constant response mode, which hampers building resilience; in addition, a lack of understanding of the health needs of communities leads to inefficiency, contributing to fragility. The lack of a female health workforce was highlighted as contributing to the fragility of health systems, and the equity perspective was explained

through the challenges women face as healthcare providers and consumers. Quotes are presented in Table 4.3.

2. Resilience within fragility

The quotes in Table 4.6 describe the discussion regarding existing elements of resilience within an overall fragile health system in Afghanistan. Using the example of a cholera outbreak and management through available resources as well as response to traumas, resilience was demonstrated by the system through a shared workforce as well as experiential learning; however, it was noted that fragile systems require more time and effort for effective control and building resilience. Resilience was observed in areas with recurring needs and external support, such as malaria control, primarily due to substantial external funding. However, this resilience was contingent on sustained funding and may not withstand shocks like the COVID-19 pandemic. The participant highlighted the role of NGOs in supporting the government during emergencies, emphasizing the dependency on external funding for sustainable response and readiness. Despite challenges, the participant noted a sense of order and functionality in emergency responses, acknowledging the impact on individuals and communities during crises.

3. Fragility and resilience on a spectrum

Regarding fragility and resilience being on a spectrum, it was highlighted that in Afghanistan, there were factors that contributed both to the fragility and resilience of health systems. However, an informant quoted in Table 4.6 emphasized that the two concepts did not overlap and considered those distinct.

Consensus

Since the relationship was mapped on the themes and sub-themes identified through RQ1.2, a separate consensus was not sought for the statements regarding themes and sub-themes as they related to Afghanistan.

Table 4.6: Overview of the relationship of the concepts of fragility and resilience of health systems in Afghanistan

Themes	Sub-themes	Quotes
1. Conceptual differences between fragility and resilience of health systems	Crisis vs long-term	<p>“In Afghanistan, health in many provinces was through a contracting out process. These contracts are with NGOs, local and international. They were borne out of crisis response, transitioning into long-term. The aim was to improve the quality of services, training of staff and capacity building.” [Informant 1]</p>
	Response vs. efficiency	<p>Highlighting that health systems are not well distributed in Afghanistan. They have been set up in response to crises in many areas and are now catching up to focus on improving quality and efficiency. “In Afghanistan, the majority (~ 60%) of the population is under 25 years of age in Afghanistan with specific issues concerning these populations; additionally, non-communicable diseases are a burden in the country, often ignored as systems are busy in crisis response [...]System is not well distributed the country...if you look at the basic package, it is very basic services provided, but the community's need is more than the basic package.” [Informant 16]</p>
	Equity perspective	<p>“Women have difficulty going to work in Afghanistan because of social and cultural restraints. In this situation, if a woman is coming out to work, it means that they have financial burdens and strains. Not providing adequate support to the female health workforce places a burden on health systems, contributing to the fragility of health systems. [...]considering Afghanistan’s dynamics and also working in very remote areas, very distant areas so you can't have people living in capitals and those who would be commuting daily to their workstation, so they had to be living there.” [Informant 15]</p>

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Themes	Sub-themes	Quotes
Conceptual differences between fragility and resilience of health systems (continued)	Equity perspective (continued)	<p>“Cultural factors impede women and girls' access to health services. So they may have health facilities in their community or vicinity, but because of family reasons and cultural barriers, they may not be able to access services.” [Informant 1]</p> <p>“There is an imbalance in gender, distribution, and skill imbalance, which are all happening in Afghanistan. The major portion of workers are concentrated in 4, 5, 6 or 7 major cities and the rest areas we have a shortage, though there is a lot of improvement now almost 80% of the health facility has a qualified female health care provider, but still in most of the areas we lack health care providers, particularly female staff.” [Informant 17]</p>
2. Resilience within Fragility	Resilient sub-systems within fragile systems	<p>While giving an example of a cholera outbreak in Afghanistan, the participant mentioned that the systems could catch up and provide support to control the outbreak, but fragile systems require a lot more effort and time. " fragile system will respond, but it will take a longer time, many more efforts." [Informant 15]</p> <p>“In Afghanistan, we're very much prepared for traumas [...] there might be resilience and in some aspects of the health care system, for instance, or resilience might be present in some areas of the country. Health systems areas in Afghanistan where there is recurring need and external support are more resilient, for example, malaria control within primary health care because there has been a lot of external funding. However, this resilience remains sustainable only until funding is available. “[...] in Afghanistan might be resilient to certain situations. For example, they might be very good in dealing with malaria or providing Primary Health care, but they might not sustain shocks like what we saw in COVID-19 in the pandemic.” [Informant 10]</p>

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Themes	Sub-themes	Quotes
Resilience within Fragility (continued)	When there is a crisis and resource mobilization	In Afghanistan, NGOs supported the government, filling gaps in the health system, and there was a time when emergency response and readiness were built into the NGO contracts. They provided support through flash appeals and resource mobilization and coordination with the District Health Officials. However, this support was also dependent on donor funding and not sustainable without external funding. "the emergency response, both preparedness and response, was part of those NGO contracts." [Informant 15]
	When innate community resilience contributes to systems strengthening	"You hear of many people who died because a certain bridge was blown off, you think of the local people it was someone's near and dear one, someone's breadwinner, so in that context, you feel like maybe you know that that was one thing that was functioning, and it didn't give me at any time that there was a feeling of chaos." [Informant 15]
3. Fragility and Resilience on a spectrum	Affected by same factors but two distinct concepts	"Factors contributing to the fragility [...] Suppose all these factors are dealt with. In that case, resources are there, political issues are somehow handled, and stuff is there, but we have an active war, so no one can go to the health facility that affects the provision of health facility and health services and the health facility remains closed for weeks and even for months so they are interlinked with each other[...] so we cannot say that the fragility is opposite of the resilient but sometimes different factors contributing to the fragility that affect resilient as well." [Informant 17]

4.2 Did the introduction of female health workers to support Maternal, Neonatal, and Child Health service delivery by Afghan Red Crescent Society's Mobile Health Teams lead to a change in service delivery outcomes?

Following our exploration of the concept of health systems fragility in Afghanistan, we delved into a real-life case to gain insight into how this concept materializes in the context of health service provision, with a primary focus on the efforts of the RCRCM in Afghanistan. This part of the research centres on service delivery, specifically the introduction of female health workers (midwives) as an intervention. The context and intervention details have already been presented in the previous chapter; the results will be presented in this section.

Our investigation revolved around two sub-questions. Firstly, we scrutinized the overall impact of this intervention on Maternal, Newborn, and Child Health (MNCH) services, with a particular emphasis on how midwives contribute to improving services for women and children. Secondly, we probed into the influence of the persisting security challenges in Afghanistan, given its protracted conflict over the years, on the quantity of MNCH services provided before and after the intervention.

4.2.1 Results RQ 2.1 - Was there a difference in MNCH outcomes after the introduction of female health workers in ARCS-MHTs?

Service delivery data for ARCS-MHT collected from 34 Afghan provinces between January 2015 and June 2020, resulted in 2,508 observations, where one observation denotes one month. Midwives were part of ARCS-MHTs in 28 provinces, and six provinces remained without midwives during the study period (Figure 2.2). The distribution of the number of provinces and observations based on the presence of midwives is presented below in Table 4.7 and Figure 4.9.

Table 4.7: Distribution of provinces based on the presence of midwives

	Number of provinces	Observations
No midwife	6	396
Midwife starting - 2016	7	462
Midwife starting - 2017	12	792
Midwife starting - 2018	9	858

Note: The year represented when midwives started to become part of ARCS-MHT in a province; for example, in 2016 midwives became part of the ARC-MHTs in 7 provinces.

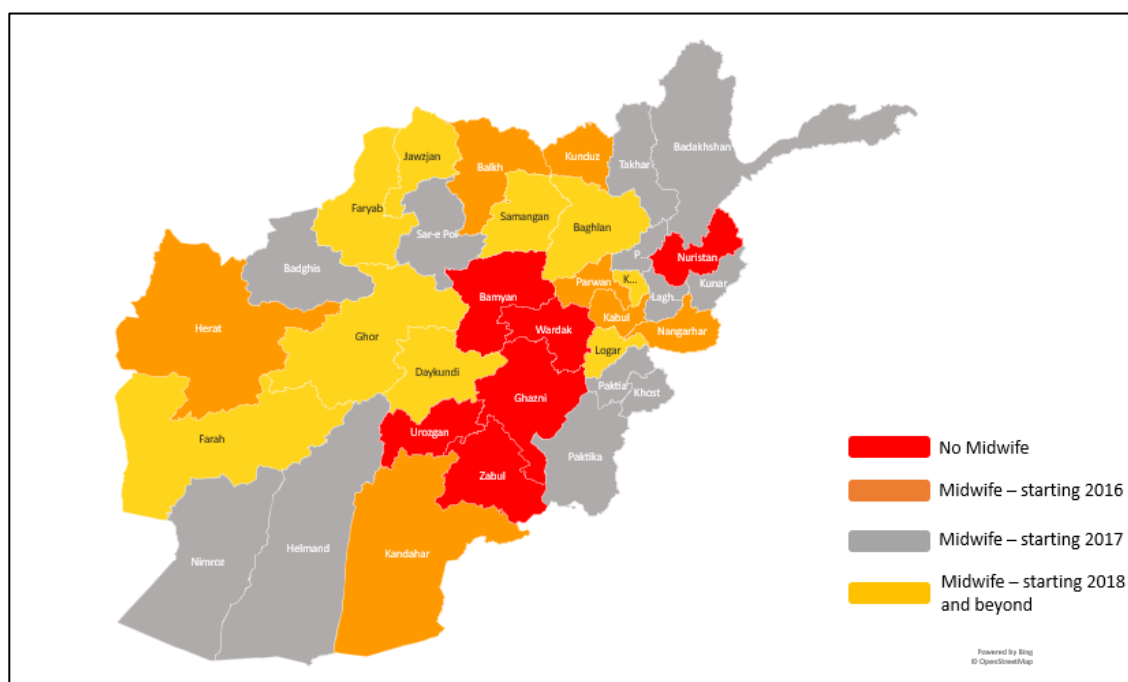


Figure 4.9: Map showing the distribution of the presence of midwives in ARCS-MHTs

Note: Provinces appearing truncated in the map - Lagh: Laghman, K: Kapisa and P: Panjshir

Univariate Analysis

The monthly distributions of all MNCH services delivered between 2015 and 2020 across all ARCS-MHTs in the 34 provinces are presented in Figure 4.10. The line chart illustrates four variables related to the number of services from 2015 to 2020. These variables encompass childhood vaccinations, tetanus toxoid vaccinations, antenatal care (ANC) services and postnatal care (PNC) services, with time measured in months on the x-axis.

A noticeable trend across all services was a consistent increase over time. Among these, ANC services delivery exhibited a steady increase, with a more prominent jump in services starting towards the end of 2017. The PNC services increased following the same pattern as the ANC services, albeit PNC services remained at a lower magnitude compared to ANC services delivered during this period.

Peaks in childhood vaccinations were evident in mid-2016, early 2017, and again in early 2018. Similarly, peaks for tetanus toxoid vaccinations align with those of childhood vaccinations, though at a lower magnitude. A steady increase can also be seen over time for childhood and tetanus toxoid vaccinations, although from mid-2018, the number of tetanus toxoid vaccinations was higher than childhood vaccinations.

Childhood vaccinations

On average, 1,667 (95% CI: 1446, 1888) childhood vaccinations were delivered monthly by ARCS-MHTs in all provinces of Afghanistan from 2015 to 2020. The population proportion-based map (Figure 4.11-A) shows the variation in the delivery of childhood vaccinations across provinces in Afghanistan, from delivering to 8.6% of the children in Paktia to less than 0.1% of children in Sar-e-Pol and Jawzjan. Paktia was an exception; for most provinces, the ARCS-MHTs delivered vaccinations to 0.1% to 2% of the children, with higher percentages in Kabul and Badghis provinces, 3.1% and 2.4%. For the provinces which did not receive the midwife intervention, childhood vaccinations were delivered to 1.2% of children in Bamyán, 0.7% and 0.6% in Ghazni and Nuristan provinces, 0.3% and 0.2% in Urozgan and Wardak and none in Zabul.

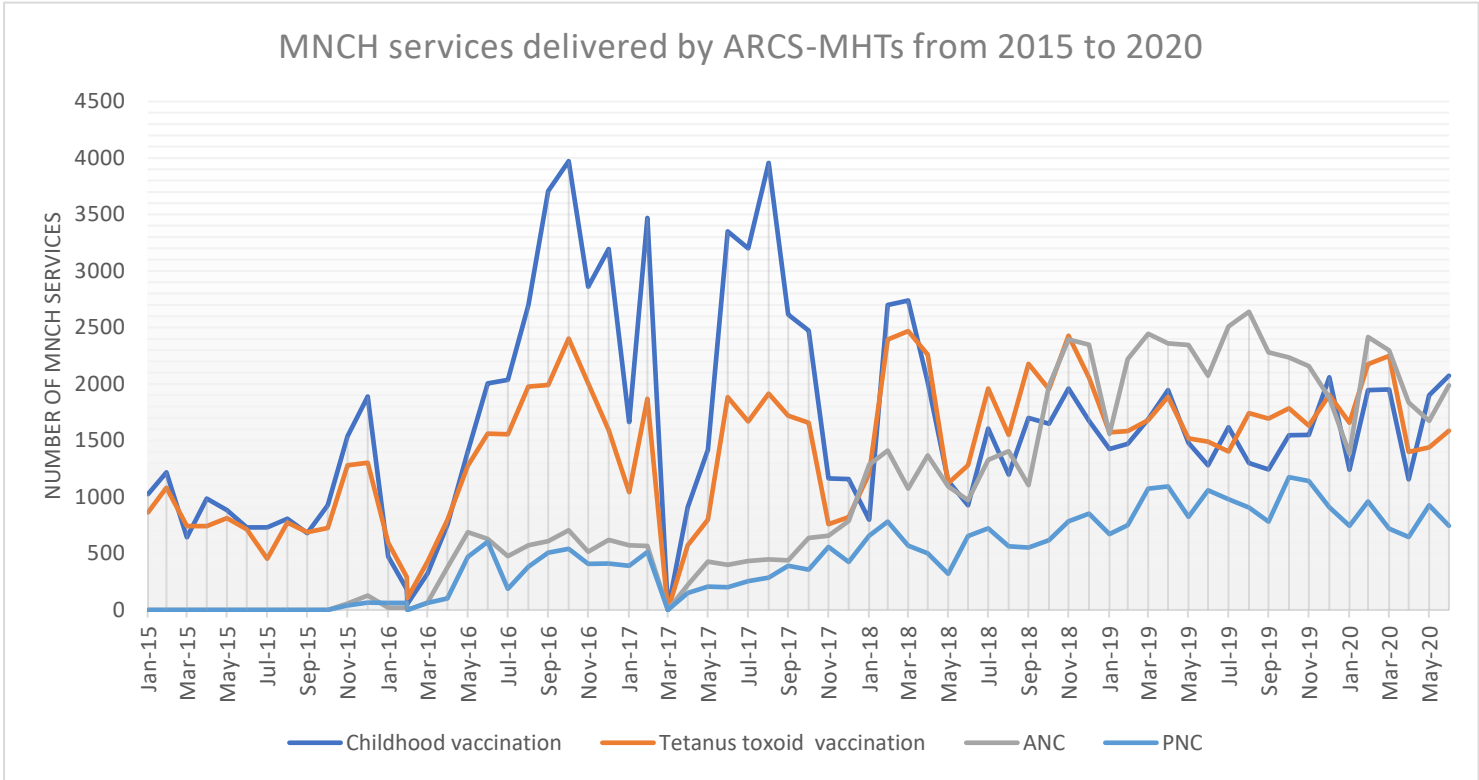


Figure 4.10: Distribution of monthly trends of MNCH services delivered by ARCS-MHTs in Afghanistan

Tetanus toxoid vaccinations

On average, 1,433 (95% CI: 1288, 1578) tetanus toxoid vaccinations were delivered monthly by ARCS-MHTs across all provinces in Afghanistan from 2015 to 2020. The population proportion-based map (Figure 4.11-B) shows that tetanus toxoid vaccinations were delivered to 6% of women of reproductive age in Paktia, 5.8% in Kapisa and 4.9% in Badghis provinces. For most provinces, these vaccinations were delivered by ARCS-MHTs to 0.3% to 4% of women of reproductive age. Logar, Kunar and Jawzjan were the three provinces where only 0.3% of the women of reproductive age had tetanus toxoid vaccinations delivered by ARCS-MHTs. Among provinces where there was no midwife intervention, Zabul and Urozgan had the tetanus toxoid vaccinations delivered to the least number of women of reproductive age in the province at 0.4%, followed by Wardak and Nuristan at 0.8% and 0.9% and then Ghazni at 1.8% and Bamyan at 3%.

ANC services

On average, 988 (95% CI: 774, 1201) ANC services were delivered monthly by ARCS-MHTs. The population proportion-based map (Figure 4.11-C) shows that Farah was the province where most ANC services were delivered by ARCS MHTs, with 3.5% of women of reproductive age receiving these services. Similarly, in Badakhshan, Badghis and Nimroz, ANC services were delivered to 2.7%, 2.6% and 2.4% of women of reproductive age, respectively. For most provinces, ANC services were delivered to 0.4% to 2.2% of women (Figure 4.11-C). For provinces that did not receive the midwife intervention, ANC services were delivered to 0.1% of women of reproductive age in Ghazni province, 0.4% in Wardak, 0.8% and 0.9% in Urozgan and Bamyan provinces, and 1.1% and 1.3% by ARCS-MHTs.

PNC services

On average, 461 (95% CI: 347, 547) PNC services were delivered monthly by ARCS-MHTs. The population proportion-based map (Figure 4.11-D) shows that Badghis was the province where most PNC services were delivered by ARCS MHTs, with 3% % of women of reproductive age receiving these services. Similarly, in Kunar, the PNC services were delivered to 1.3% of women of reproductive age received these services. Most PNC services by ARCS-MHTs were delivered to 0.1% to 1.2% of women of women of reproductive age in those provinces (Figure 4.11-D). For provinces that did not receive

the midwife intervention, PNC services were delivered by ARCS-MHTs to 0.2% of women of reproductive age in Ghazni and Bamyan provinces, 0.3% of women in Urozgan, 0.4% in Wardak and Nuristan and 0.5% of women of reproductive age in Zabul.

Relationship between MNCH services and the presence of midwives

Figure 4.12 shows the monthly averages (with associated confidence intervals) for MNCH services delivered. The data were organized based on the presence of midwives and their start times in the ARCS-MHTs. Our results showed that the average number of MNCH services delivered was generally higher for provinces where the ARCS-MHTs had midwives than those without midwives, except for provinces where midwives started in 2018 and beyond. For the provinces where midwives started in 2018 and beyond, the numbers indicate higher averages for ANC and PNC services; however, the trend deviates when it comes to vaccinations for women of reproductive age and children under five years and resembles the pattern seen in the group without midwives.

Provinces where midwives started in 2016 and 2017 had higher averages (73.5 and 77.7, respectively) of childhood vaccinations delivered by ARCS-MHTs each month in the provinces compared to provinces with no midwives (46.1). The average number of childhood vaccinations delivered by ARCS-MHTs in provinces with no midwives was comparable to the provinces where midwives started in 2018 and beyond (47.3).

The monthly average number of tetanus toxoid services for women of reproductive age was highest for provinces where midwives started in 2016 (69.4). The group with midwives in 2017 had fewer tetanus toxoid vaccinations delivered compared to the group without midwives.

Similar patterns were observed for ANC and PNC services delivered by ARCS-MHTs. Provinces with midwives in 2016 had the highest averages, followed by provinces with midwives starting in 2017 and 2018 onwards. Provinces without midwives had the lowest averages.

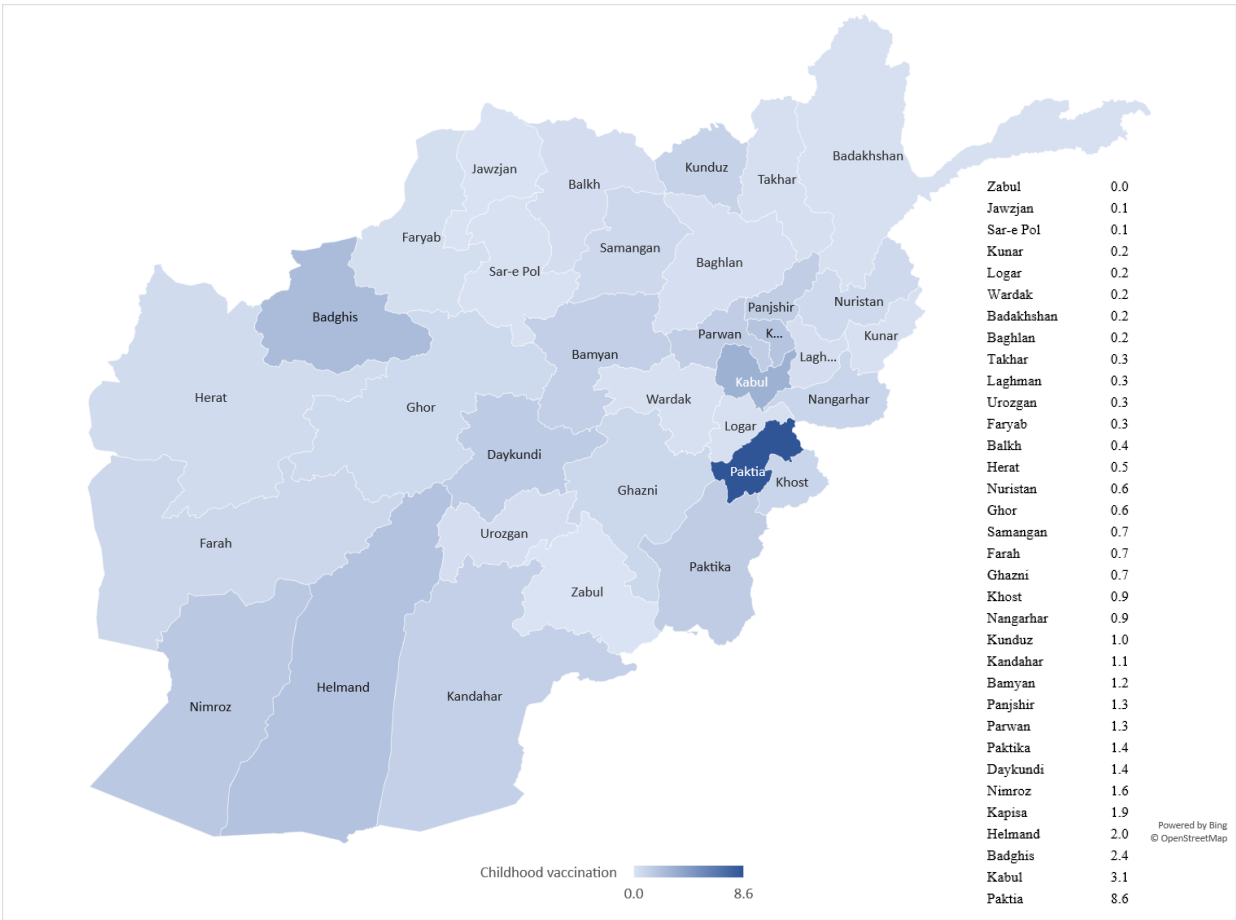


Figure 4.11-A: Map of Afghanistan showing childhood vaccinations across provinces in Afghanistan

Note: The numbers show the percentage of children under five in provinces receiving services by ARCS-MHTs.

The truncated provinces listed in the map - Lagh: Laghman, K: Kapisa

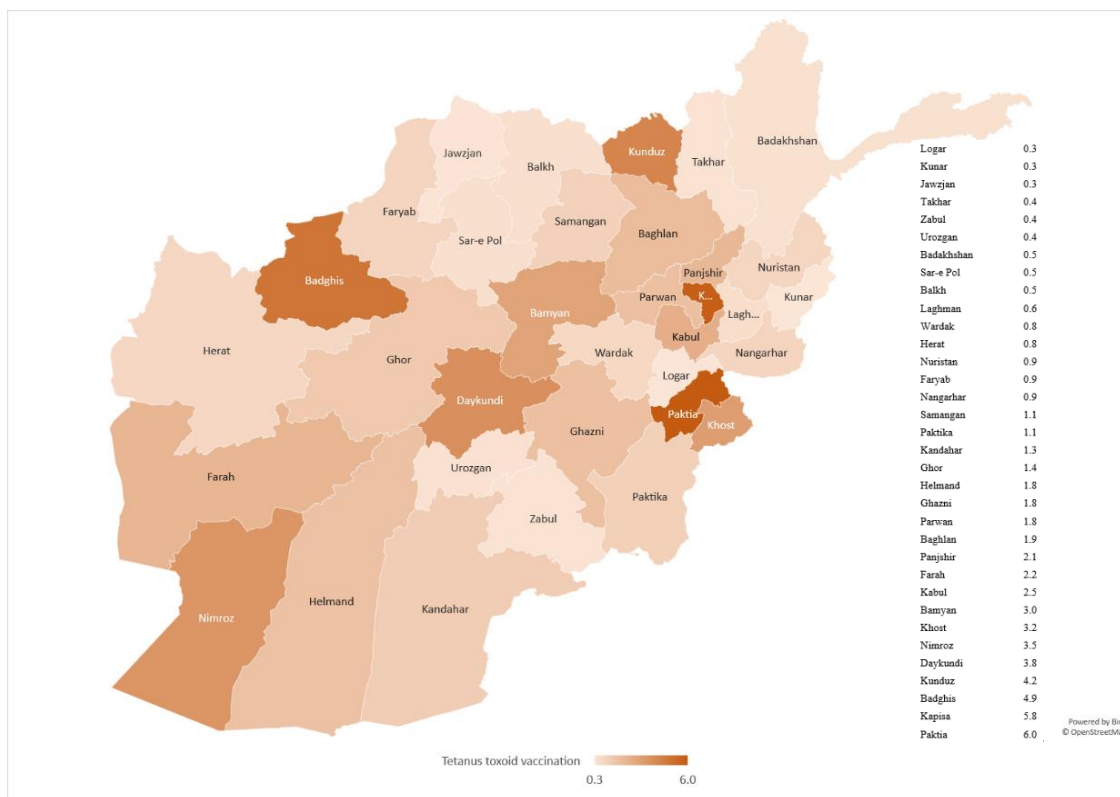


Figure 4.11-B: Map of Afghanistan showing tetanus toxoid vaccinations across provinces in Afghanistan

Note: The numbers show the percentage of women of reproductive age in provinces receiving services by ARCS-MHTs.

The truncated provinces listed in the map - Lagh: Laghman, K: Kapisa

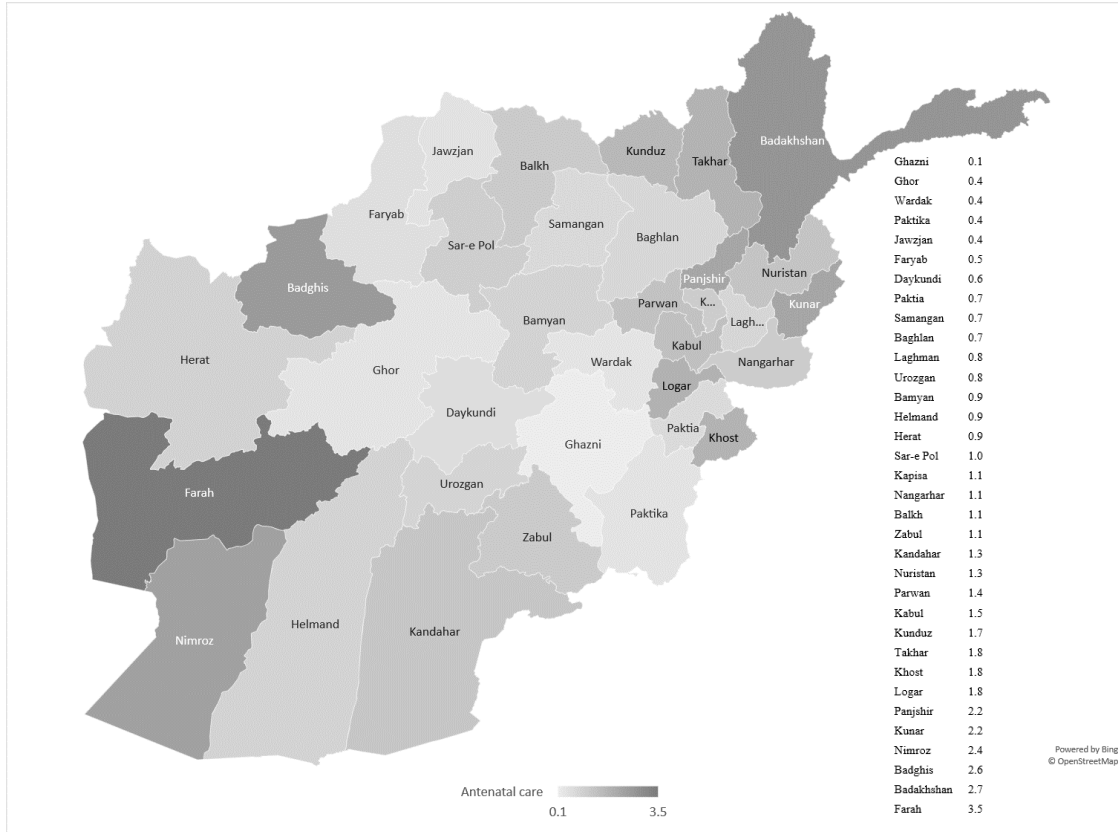


Figure 4.11-C: Map of Afghanistan showing ANC services across provinces in Afghanistan

Note: The numbers show the percentage of women of reproductive age in provinces receiving services by ARCS-MHTs.

The truncated provinces listed in the map - Lagh: Laghman, K: Kapisa

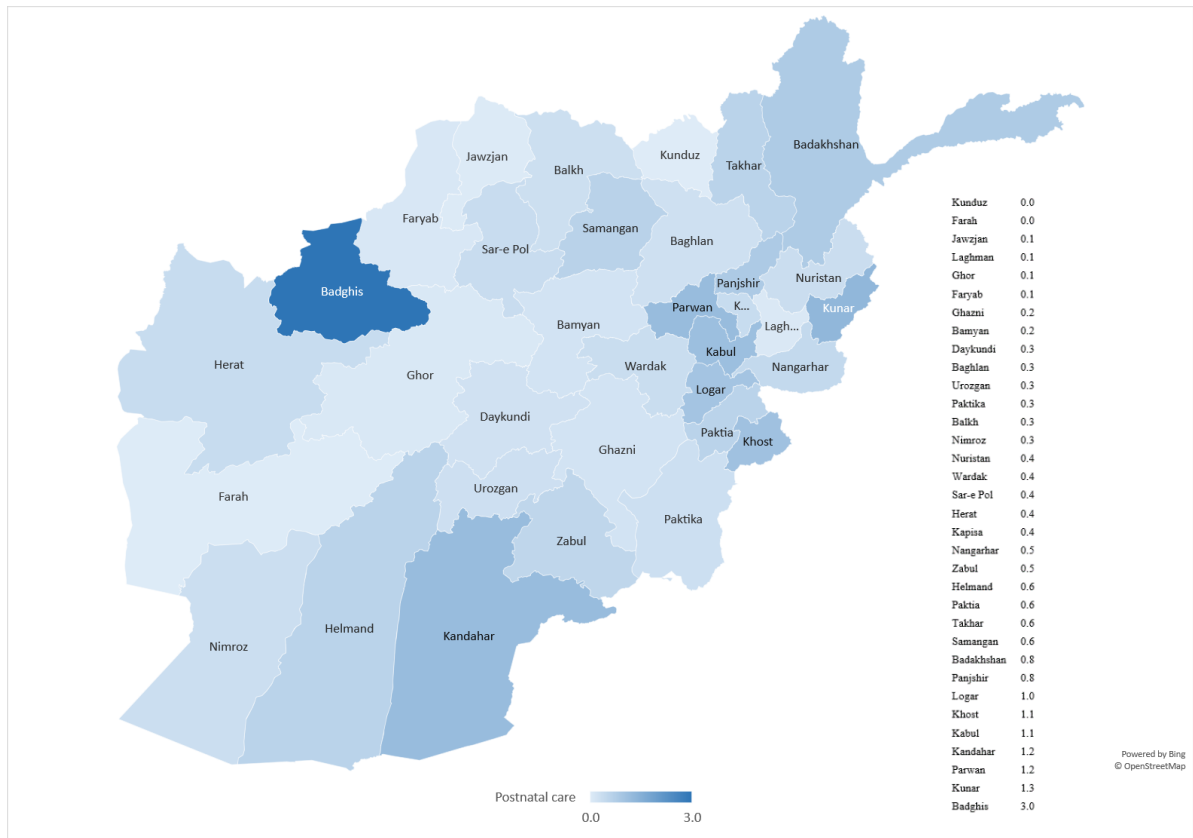


Figure 4.11-D: Map of Afghanistan showing PNC services across provinces in Afghanistan

Note: The numbers show the percentage of women of reproductive age in provinces receiving services by ARCS-MHTs.

The truncated provinces listed in the map - Lagh: Laghman, K: Kapisa

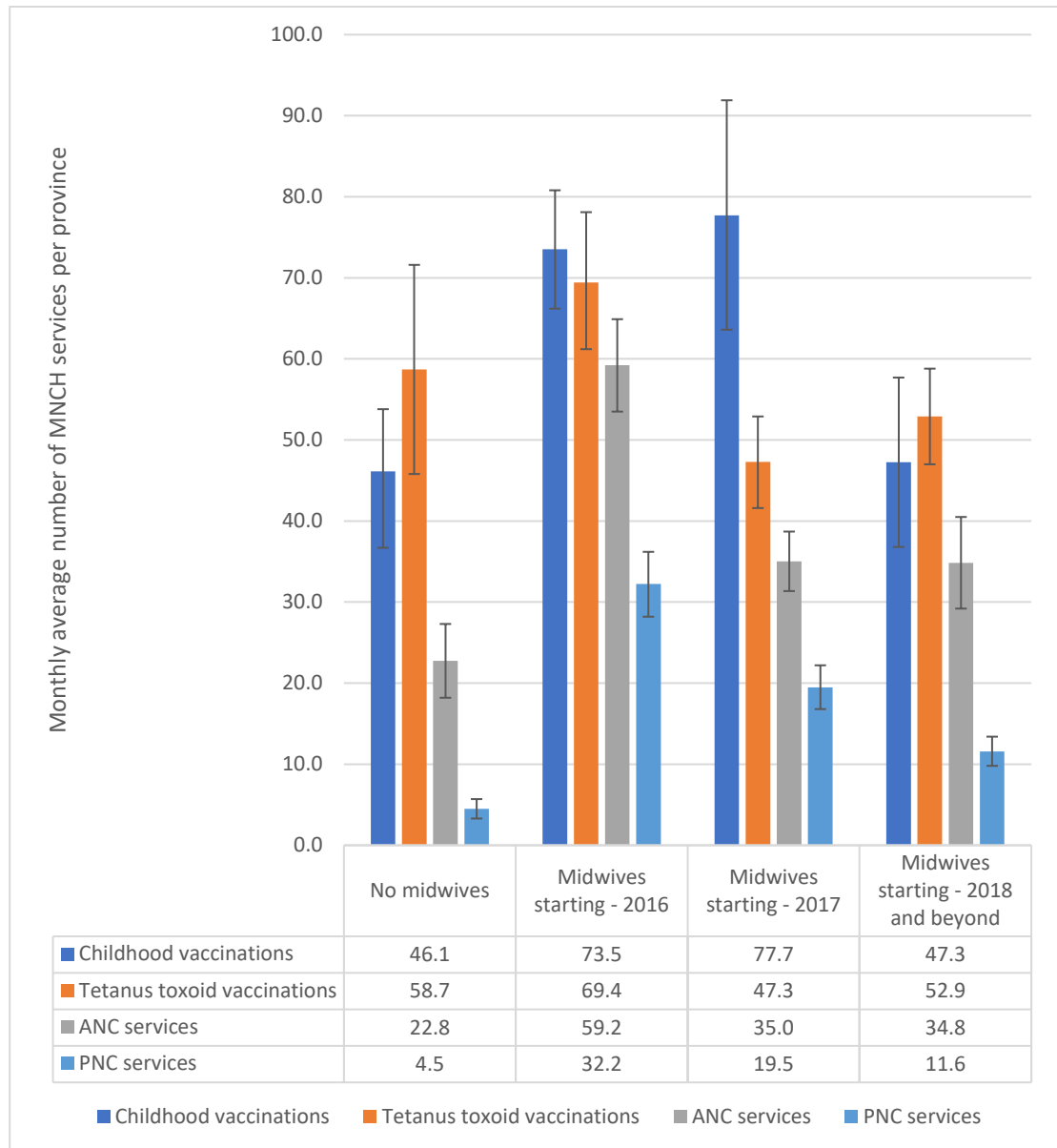


Figure 4.12: Monthly average number of MNCH services

Note: The means for monthly services in respective stratified groups are presented in the data table below the graph. The cross bars indicate the upper and lower limits of the 95% confidence intervals for the mean.

Bivariate Analysis

Our findings (Table 4.8) mainly showed positive trends and statistically significant results, showing that, on average, the number of MNCH services delivered by ARCS-MHTs increased with the presence of midwives.

Specifically, the average ANC and PNC services in all groups with midwives were significantly higher (Table 4.8). For ANC services delivered by ARCS-MHTs in the provinces which included midwives in 2018 showed the highest difference in services, with 65.8 more ANC services delivered by ARCS-MHTs in provinces with midwives as compared to those which did not have a midwife, followed by the intervention group where midwives started and 2016 (59.5) and then the group where midwives started in 2017 (43.8). For PNC services, the provinces where midwives started in 2016 had the highest difference, with 33.6 more services for provinces with midwives compared to those without, followed by provinces where midwives started in 2017 and then 2018 with 25 and 21 more services per month .

We found significant differences in the childhood and tetanus toxoid vaccinations, with more services for provinces with midwives starting in 2016 than those without midwives. However, this was reversed in 2017 and 2018, where the provinces with midwives had fewer vaccinations delivered to children and women of reproductive age in provinces with midwives; these were not statistically significant (Table 4.8).

Table 4.8: Association between MNCH services and the presence of midwives

MNC services	Midwives starting -2016	Midwives starting -2017	Midwives starting -2018
Childhood vaccinations	36.6**	-4.1	-12
Tetanus toxoid vaccinations	30.5**	-8.3	5.8
ANC services	59.5**	43.8**	65.8**
PNC services	33.6**	25**	21**

Note: Simple linear regression model. The group of provinces with no midwives was the reference category; regression coefficients are presented in the table. ** p<0.01

Interrupted Time Series Analysis

There were three sets of ITSA analyses to assess the difference in outcomes on the monthly delivery of MNCH services after introducing female health workers (midwives). Assessing the outcomes entailed comparing each intervention group (with midwives) with the control group (without midwives) (Table 4.9).

Table 4.9: Groups for ITSA analysis to assess the difference in outcomes on the delivery of MNCH services after introducing midwives

Groups for ITSA analyses	Provinces	Observations
2016: Intervention group 1 vs Control group	13	858
2017: Intervention group 2 vs Control group	18	1,188
2018: Intervention group 3 vs Control group	15	1,254

The results are presented as the difference in each MNCH outcome for the three years (2016, 2017 and 2018) the intervention started, comparing the intervention group with the control group. Please refer to Table 3.2 and Figure 3.4 for the description and visualization of the ITSA design.

To understand the baseline dynamics before the implementation of the intervention, we began by exploring the trends in the pre-intervention period. First, we observed the initial mean level differences signifying the difference in the average level of the outcome variable between the intervention and control groups at the beginning of the study, the baseline difference. Then, we observed the baseline slope for both intervention and control groups for significant trends to look for the rate of change prior to the intervention. Finally, for the pre-intervention trends, we looked for a difference in the pre-intervention slope between intervention and control groups to see if there was a significant difference in both groups before the start of intervention.

We then observed the trends in the post-intervention period for comparing the intervention and control groups. Starting with the difference in the two groups immediately after the intervention, which reflects the change in the average level of the outcome variable right after the intervention was introduced. Then, we looked at the post-intervention trends for

the intervention and the control groups and the post-intervention differences. The rate of change reflected by the slope signifies the durability and persistence of the intervention impact beyond the immediate post-intervention period. The difference in post-intervention slopes contributed to establishing an understanding of the effect of intervention beyond the immediate effects of the intervention.

Finally, the pre-post-intervention trend examined the trajectory of the outcome variable before and after the interventions, suggesting whether the intervention had a measurable effect on the outcome variable. The difference between the pre-post trends comparing the intervention with the control establishes whether the observed changes in the outcome variable are associated with the intervention. This comparison forms a causal connection between the intervention and the observed effects.

Childhood vaccinations

Please refer to Table 4.10 and Figures 4.13 to 4.15 to see the details of results from the ITSA analysis assessing the difference in childhood vaccination outcomes before and after the midwife intervention. The outcome was the change in the monthly number of childhood vaccinations delivered between the intervention and control provinces, controlling for any pre- and post-intervention differences and trends.

Comparing intervention vs control in 2016

Pre-intervention period

There was a significant initial difference between the two groups at baseline, with the intervention group having a mean of 56.7 childhood vaccinations greater than the control group (P=56.7, CI: 14.13, 99.34) at the beginning of the study. The pre-intervention trend in both groups was positive but was significant only in the control group (i.e. a monthly increase of 8.08 childhood vaccinations in the control group). The difference in slopes was not significant, suggesting that there was no difference in trends between the two groups in the pre-intervention period.

Post-intervention period

Immediately after the intervention, there was an average increase of 39.6 childhood vaccinations delivered per month in provinces in the intervention compared to the control;

however, this increase was not statistically significant. The postintervention trend for both groups showed a slight positive slope, indicating that the number of childhood vaccinations per month was increasing; but this was not statistically significant. The difference in the slopes was also not statistically significant.

Pre-post differences

Controlling for differences in the pre- and post-intervention levels and trends, our results indicated that the intervention resulted in an overall increase of 5.59 childhood vaccinations per month in provinces in the intervention group; but this result was not statistically significant.

Comparing intervention vs control in 2017

Pre-intervention period

There was no difference at baseline between the intervention and control groups ($P=0.03$, CI: -43.9, 44), and although the slope in the intervention group was positive, it was not significant. The difference in slopes between the groups (i.e. there was a difference in the monthly increase of 2.57 childhood vaccinations between the two groups) was also not statistically significant, suggesting that the groups were comparable in the pre-intervention period.

Post-intervention period

A slight increase was observed in the intervention group immediately after the intervention, but this was not significant statistically ($P=0.51$, CI: -1.04, 1.05). The post-intervention trend for the intervention group showed a small decrease (-0.77) in the monthly number of vaccinations, while there was a small monthly increase (0.2 childhood vaccinations in provinces) in the control group. Neither these nor the differences in the slopes reached statistical significance.

Pre-post difference

Although not statistically significant, our results show that the intervention resulted in a decrease of 3.53 services per month in childhood vaccinations delivered in provinces where midwives started in 2017 after controlling for pre- and post-intervention trends and slopes.

Comparing intervention vs control in 2018

Pre-intervention period

There were no significant findings for pre-intervention levels and trends in 2018, indicating relative stability in the outcomes of interest in the months before the start of the intervention. There was a difference of 21.71 childhood vaccinations between the groups at the pre-intervention baseline, and both groups had a small and positive slope, indicating an increasing trend of monthly service provision. None of these findings were statistically significant.

Post-intervention period

Immediately after the intervention, a decrease of 6.83 childhood vaccinations was observed in the intervention group, but this difference was not statistically significant. The post-intervention trends for both groups showed a small increase (0.66 and 0.08 childhood vaccinations per month in intervention and control groups, respectively), but these were not statistically significant; neither was the difference in slopes.

Pre-post difference

Our results showed that after controlling for the pre-and post-intervention trends, the intervention resulted in a sustained increase of 1.02 childhood vaccinations per month in the provinces where midwives started in 2017; however, this finding was not statistically significant.

In summary, there was a post-intervention increase in the number of childhood vaccinations for provinces where midwives were introduced in 2016 and 2018. In contrast, we saw a post-intervention decrease in vaccinations for the provinces where midwives started in 2017. Since none of these results were significant, we cannot attribute the differences in childhood vaccinations to the intervention.

Table 4.10: Differences in childhood vaccination outcomes

Measure of interest	Model parameter	2016		2017		2018	
		P	[95% CI]	P	[95% CI]	P	[95% CI]
Pre-intervention period							
Difference between							
intervention versus control prior to start of the study (baseline difference)	β_4	56.7**	[14.13, 99.34]	0.03	[-43.9, 43.96]	21.71	[-8.95, 52.38]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	3.21	[-3.3, 9.7]	2.91	[-0.98, 6.81]	0.21	[-0.54, 0.96]
Pre-intervention trend: control group	β_1	8.08*	[0.22, 15.94]	0.35	[-0.10, 0.81]	0.65	[-0.76, 2.07]
Difference in preintervention slope: intervention versus control groups	β_5	-5.46	[-15.11, 4.18]	2.57	[-1.32, 6.45]	-0.44	[-2.05, 1.16]
Post-intervention period							
Difference between							
intervention versus control groups immediately after intervention	β_6	39.36	[-56.42, 135.15]	0.51	[-1.04, 1.05]	-6.83	[-41.19, 27.52]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.47	[-0.38, 1.34]	-0.77	[-2.44, 0.91]	0.66	[-0.26, 1.58]
Post-intervention trend: control group	$\beta_1 + \beta_3$	0.35	[-0.22, 0.92]	0.2	[-0.71, 1.12]	0.08	[-2.18, 2.34]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	0.12	[-0.91, 1.15]	-0.96	[-2.88, 09.93]	0.57	[-1.87, 3.01]
Difference pre- versus post-intervention: intervention versus control groups	β_7	5.59	[-4.01, 15.19]	-3.53	[-8.87, 1.80]	1.02	[-2.89, 4.93]

P: point estimate: number of services per month.

No midwives (control group); Midwives (intervention group)

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

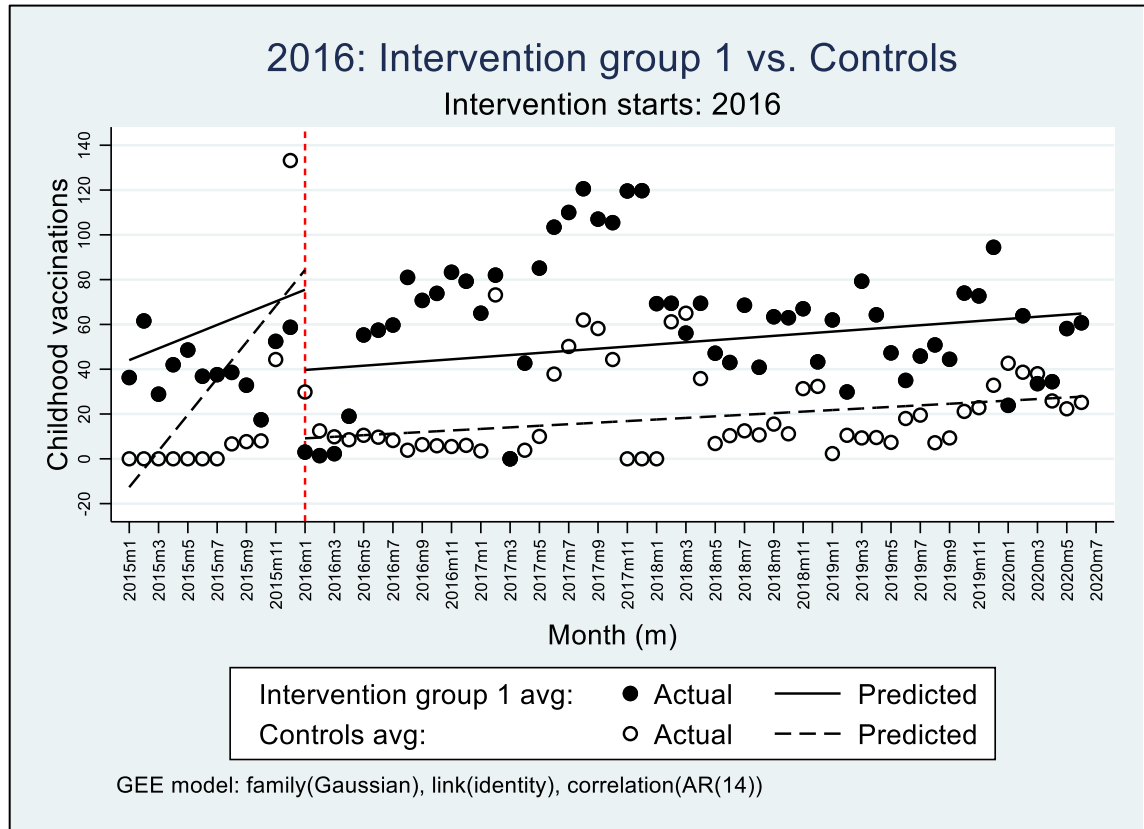


Figure 4.13: Multiple group analysis comparing trends of childhood vaccinations – intervention started in 2016

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 14 (Appendix 4.4). Lag 14 was accounted for in the final model, presented in this figure.

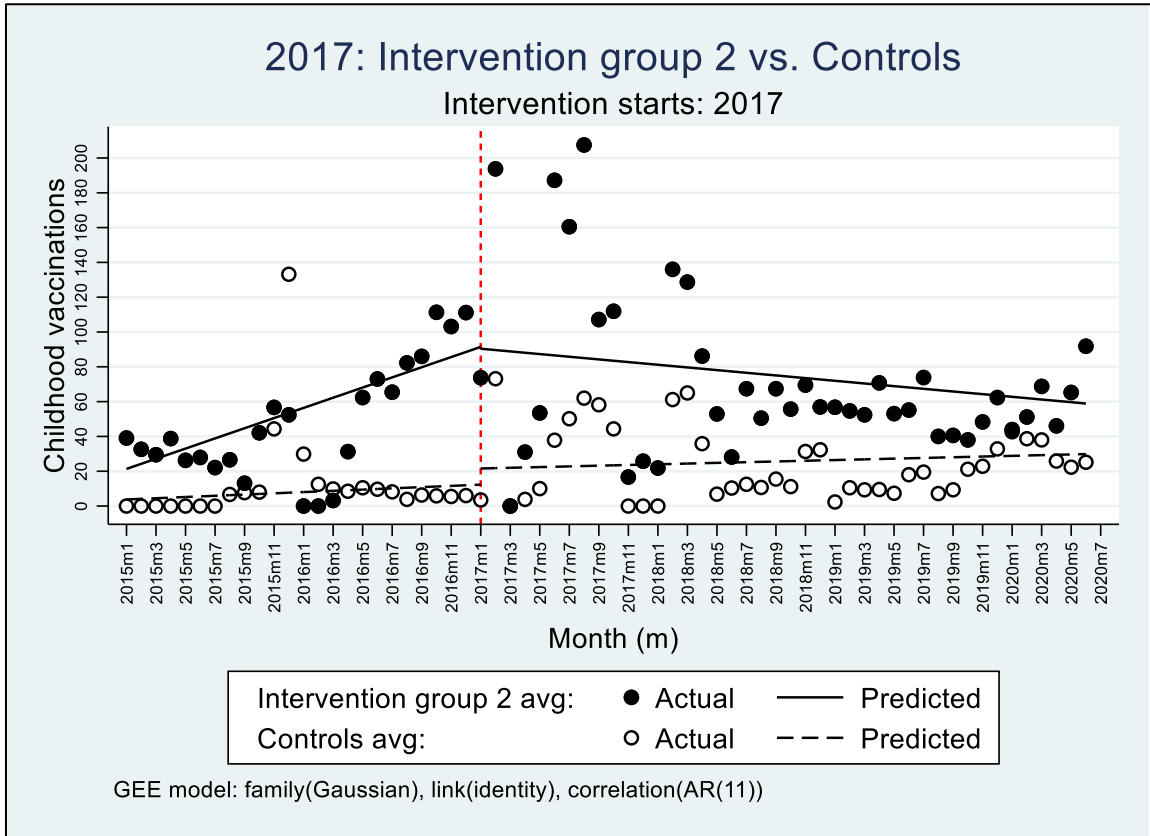


Figure 4.14: Multiple group analysis comparing trends of childhood vaccinations - intervention started in 2017

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 11 (Appendix 4.4). Lag 11 was accounted for in the final model, presented in this figure.

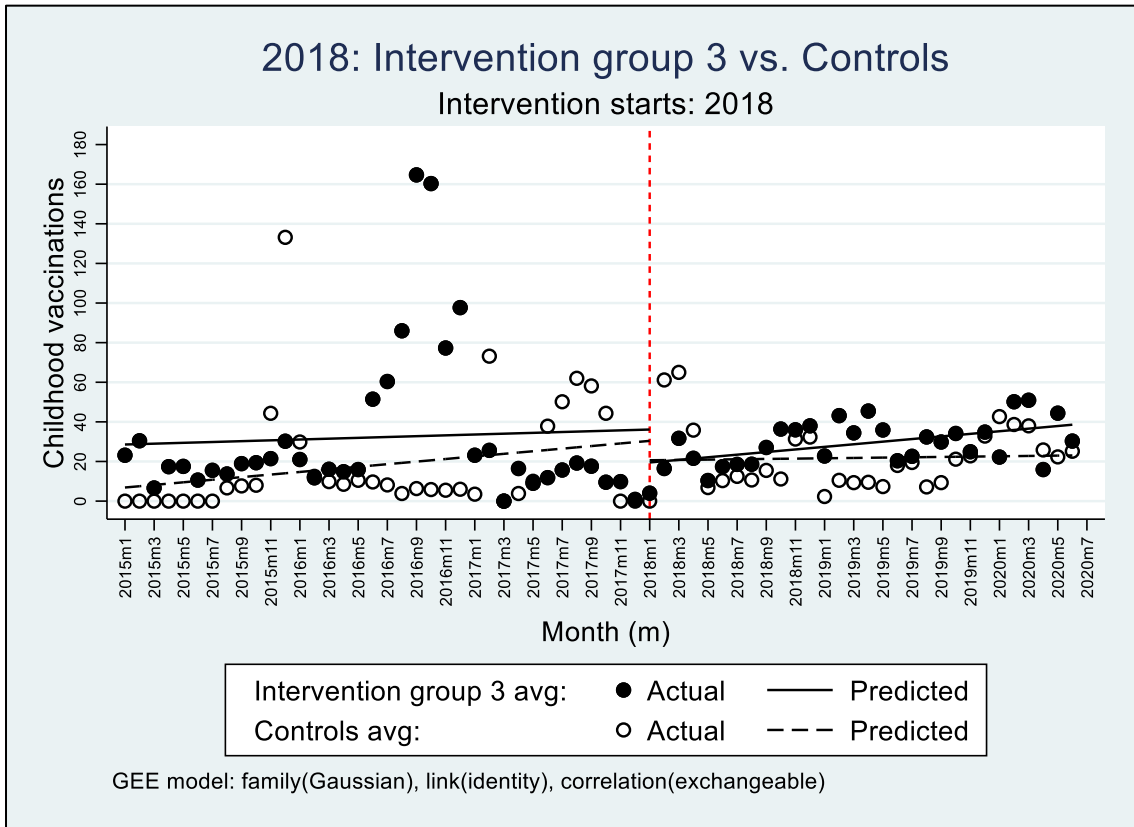


Figure 4.15: Multiple group analysis comparing trends of childhood vaccinations – intervention started in 2018

Note: The model was tested for autocorrelation, and none was found (Appendix 4.4). The final model without any adjustment is presented in this figure.

Tetanus toxoid vaccinations

Please refer to Table 4.11 and Figures 4.16 to 4.18 to see the details of results from the ITSA analysis assessing the difference in tetanus toxoid vaccination outcomes before and after the midwife intervention. The outcome was a change in the monthly number of tetanus toxoid vaccinations delivered between the intervention and control provinces, controlling for any pre- and post-intervention differences and trends.

Comparing intervention vs control in 2016

Pre-intervention period

The pre-intervention period in 2016 shows significant findings. The initial baseline difference between the intervention and control groups was statistically significant ($P=56.88$, CI: 17.59, 76.17), suggesting that at the beginning of the study, the intervention group had a mean of 56.88 more tetanus toxoid vaccinations being provided compared to the control group. The preintervention trend for the control group was also statistically significant ($P=5.6$, CI: 0.21, 10.69); this indicates an increase of 5.6 tetanus toxoid vaccinations per month in the control group. Additionally, the difference in preintervention slope between the two groups was also statistically significant ($P=-6.72$, CI: -12.31, -1.13), indicating that prior to the intervention, the monthly difference in the provision of tetanus toxoid vaccinations between the two groups was decreasing by 6.72 vaccinations.

Post-intervention period

An average increase of 32.48 services was observed immediately after the introduction of intervention; however, this increase was not statistically significant. A statistically significant increase in post-intervention trend was observed for the intervention group, indicating that the monthly increase of tetanus toxoid vaccinations was 0.84 in the intervention group. There was a similar, albeit smaller increase in the control provinces ($P=0.37$), but this was not statistically significant. The difference in slopes between the two groups was also not significant.

Pre-post difference

Controlling for pre-and post-intervention levels and trends, 7.19 more tetanus toxoid vaccinations per month were given in the intervention group; this result was statistically significant. This indicates that the inclusion of midwives in MHTs in 2016 increased the

provision of tetanus toxoid vaccinations for women of reproductive age in provinces where midwives were introduced in 2016.

Comparing intervention vs control in 2017

Pre-intervention period

There were no statistically significant findings for pre-intervention trends, suggesting that in months prior to the intervention, no significant changes were noted in the delivery of tetanus toxoid vaccinations for the control or intervention groups.

Post-intervention period

Immediately after the intervention, there was a mean decrease of 39.16 tetanus toxoid vaccinations in the intervention group. There was a slight increase in the post-intervention slopes for both groups, but this trend was not significant. The slope for the 2017 group remained parallel to the control group post-intervention (Figure 4.17), indicating that there was no difference in the rate of change in the number of services after the intervention.

Pre-post differences

The number of services after intervention decreased by 1.57 vaccinations per month for the group in 2017 as a result of the intervention (Table 4.11); however, this finding was not statistically significant.

Comparing intervention vs control in 2018

Pre-intervention period

There were no statistically significant findings for pre-intervention trends in 2018. This suggests that, in months before the intervention, there were no significant changes in the delivery of tetanus toxoid vaccinations for the control or intervention groups.

Post-intervention period

Immediately after the intervention, there was a statistically significant difference between the intervention and control groups; the intervention group had a jump of 17.06 tetanus toxoid vaccinations compared to the control ($P = 17.06$; $CI = 3.53, 30.58$). There was a slight increase in the post-intervention slopes for both groups, but neither this nor the difference in slopes was statistically significant.

Pre-post difference

Controlling for pre-and post-intervention levels and trends, the introduction of midwives resulted in 2.09 increased tetanus toxoid vaccinations per month in the intervention group where midwives started in 2018 and beyond, but this result was not statistically significant.

The results showed that the increase in the monthly number of tetanus toxoid vaccinations delivered in provinces where the intervention started in 2016 was because of the intervention, which was the inclusion of midwives in the ARCS-MHTs. There was also a significant increase in tetanus toxoid vaccinations delivered immediately after the intervention in the 2018 intervention group. Although there was a slight increase in the number of these services after the intervention, the findings were not significant, and the change could not be attributed to the intervention in 2017 or 2018.

Table 4.11: Differences in tetanus toxoid vaccination outcomes

Measure of interest	Model parameter	2016		2017		2018	
		P	[95% CI]	P	[95% CI]	P	[95% CI]
Pre-intervention period							
Difference between							
intervention versus control prior to start of the study (baseline difference)	β_4	56.88**	[17.59, 76.17]	8.74	[-14.03, 31.52]	28.54	[-2.49, 59.58]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	-0.99	[-3.67, 1.68]	1.82	[-0.83, 4.48]	-0.32	[-0.89, 0.26]
Pre-intervention trend: control group	β_1	5.6*	[0.51, 10.69]	0.33	[-0.63, 1.28]	1.00	[-0.9, 2.9]
Difference in preintervention slope: intervention versus control groups	β_5	-6.72*	[-12.31, -1.13]	1.55	[-1.24, 4.36]	-1.29	[-3.29, 0.70]
Post-intervention period							
Difference between							
intervention versus control groups immediately after intervention	β_6	32.48	[-2.29, 67.26]	-39.16	[-80.63, 2.31]	17.06*	[3.53, 30.58]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.84*	[-0.001, 1.68]	0.03	[-0.67, 0.74]	0.88	[-0.39, 2.15]
Post-intervention trend: control group	$\beta_1 + \beta_3$	0.37	[-0.45, 1.19]	0.05	[-0.68, 0.75]	0.09	[-2.49, 2.67]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	0.46	[-0.71, 1.64]	-0.12	[-1.56, 1.52]	0.79	[-2.08, 3.67]
Difference pre versus post intervention: intervention versus control groups	β_7	7.19*	[1.09, 13.28]	-1.57	[-5.54, 2.39]	2.09	[-2.60, 6.78]

P: point estimate: number of services per month.

No midwives (control group); Midwives (intervention group)

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

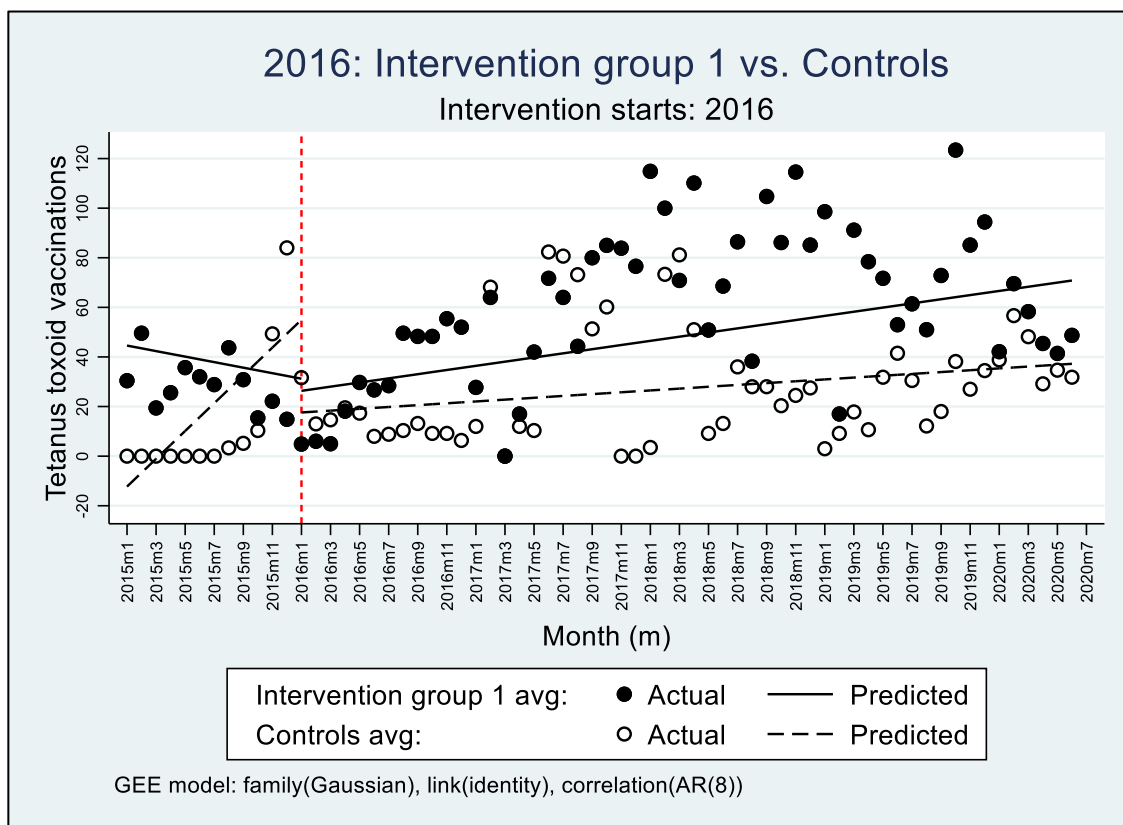


Figure 4.16: Multiple group analysis comparing trends of tetanus toxoid vaccinations – intervention started in 2016

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.4). Lag 8 was accounted for in the final model, presented in this figure.

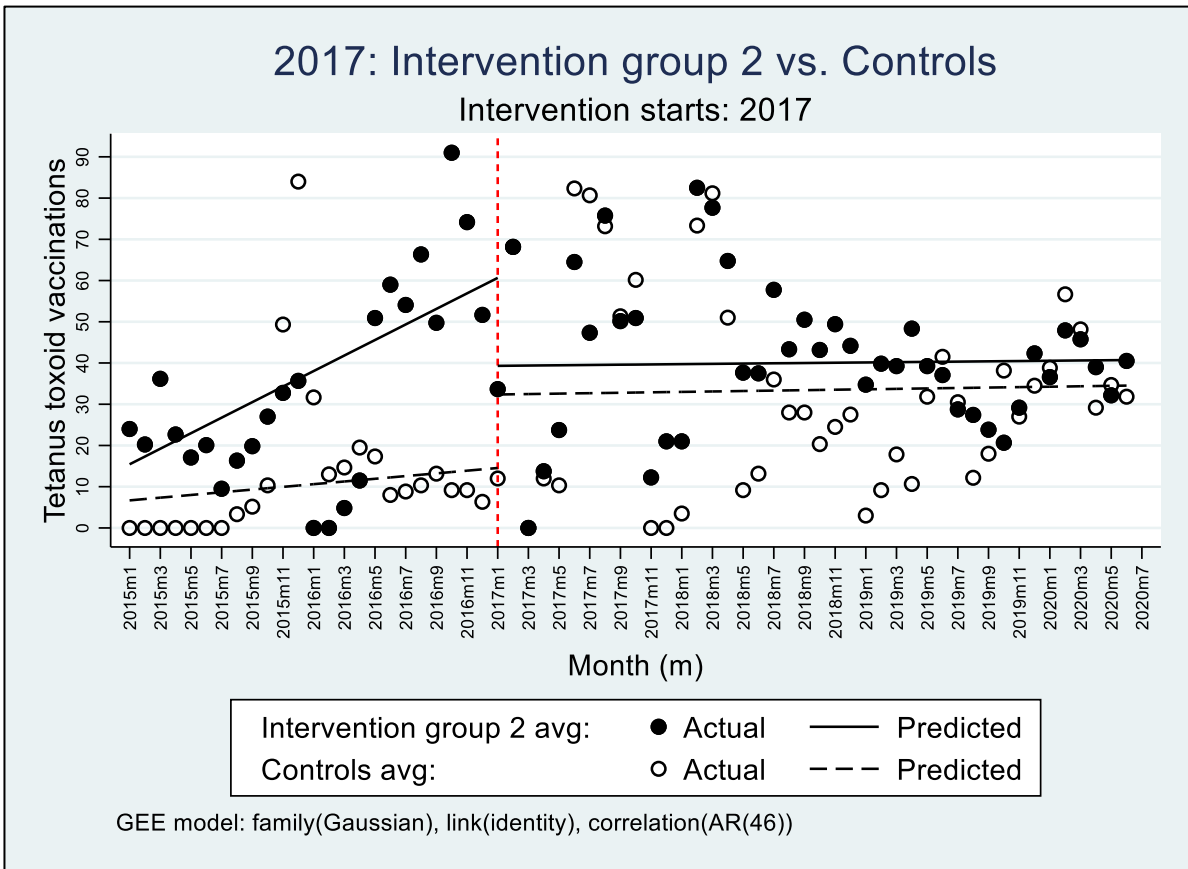


Figure 4.17: Multiple group analysis comparing trends of tetanus toxoid vaccination - intervention started in 2017

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 46 (Appendix 4.4). Lag 46 was accounted for in the final model, presented in this figure.

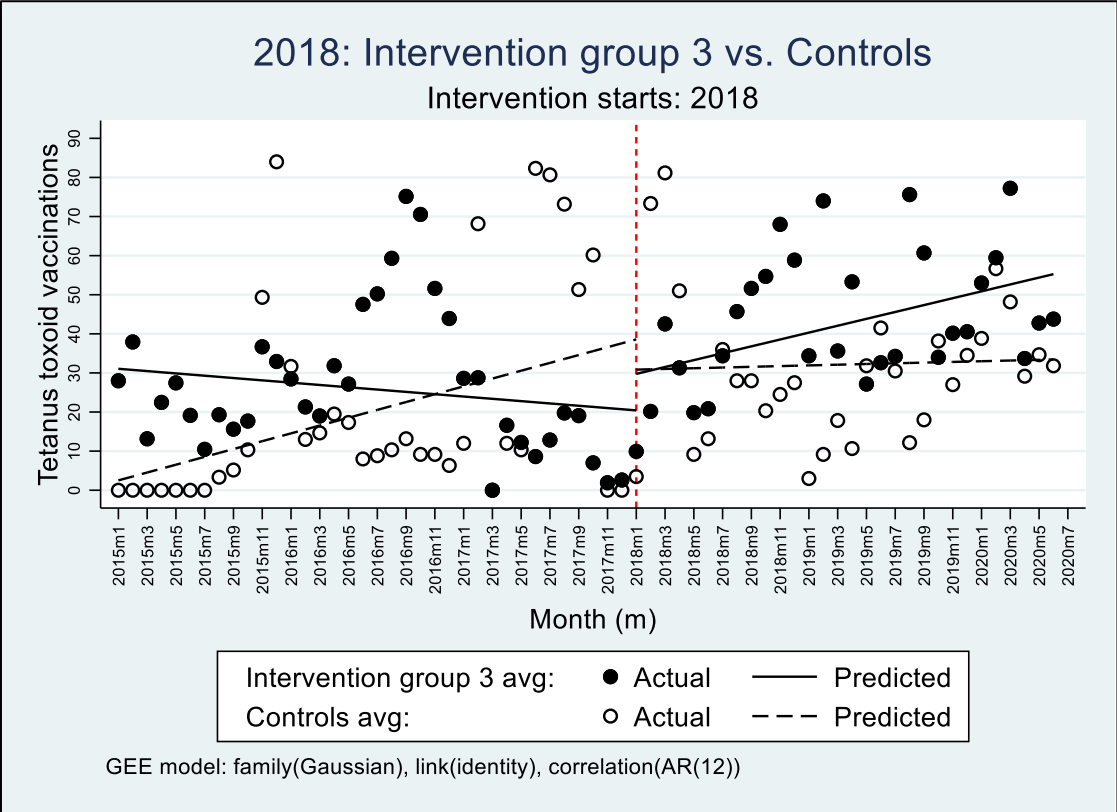


Figure 4.18: Multiple group analysis comparing trends of tetanus toxoid vaccinations - intervention started in 2018

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 12 (Appendix 4.4). Lag 12 was accounted for in the final model, presented in this figure.

ANC services

Please refer to Table 4.12 and Figures 4.19 to 4.21 to see the details of results from the ITSA analysis assessing the difference in ANC service outcomes before and after the midwife intervention. The outcome was the change in the monthly number of ANC services delivered between the intervention and control provinces, controlling for any pre- and post-intervention differences and trends.

Comparing intervention vs control in 2016

Pre-intervention period

The baseline difference was found to be significant. The results showed that the ARCS-MHTs delivered, on average, 8.11 (CI: 1.26, 14.96) more ANC services in the intervention group compared to the control group at the start of the study period. Additionally, the intervention group's pre-intervention trend was significantly positive ($P=1.97$, CI:0.53,3.4), showing an increase of 1.97 ANC services per month in the intervention group during the pre-intervention period. The pre-intervention trend for the control group was also positive but not statistically significant.

Despite the significantly positive trends for the intervention group during the pre-intervention period, the difference between the slopes for the intervention and control groups was not significant ($P=0.61$, CI: -2.22, 3.45), suggesting that there was no difference in the two groups in the pre-intervention period, which can be visualized in Figure 4.19.

Post-intervention period

There was an increase in the number of ANC services immediately after the intervention; ANC services increased by 24.19 in the intervention group, but the difference was not statistically significant. The post-intervention trend for the control group was positive and statistically significant ($P=0.79$, CI:0.5, 1.08), indicating a monthly increase of 0.79 ANC services in the control group after the start of the intervention. The post-intervention trend for the intervention group was also positive (0.68) but not statistically significant.

The difference in the two slopes post-intervention showed a slight deceleration in the number of ANC services (-0.11), which was not found to be statistically significant; the post-intervention slopes for the two groups remained parallel to each other (Figure 4.19),

suggesting that there was no difference in the rate of change in the number of ANC services after the intervention.

Pre-post differences

After controlling for differences in the pre-and post-intervention levels and trends, the introduction of midwives resulted in a slight decrease in the delivery of ANC services (-0.72) per month , which was not significant.

Comparing intervention vs control in 2017

Pre-intervention period

For the intervention group where midwives started in 2017, there was no baseline difference between the intervention and control groups. Our findings revealed a statistically significant positive trend for the intervention group during the pre-intervention period ($P=0.52$, CI: 0.27, 0.77), indicating a monthly increase of 0.52 ANC services . Conversely, a nonsignificant negative trend (-0.02) was observed in the control group.

Although the pre-intervention negative trend in the control group did not reach statistical significance, there was a significant difference in slopes between the intervention and control groups ($P=0.52$, CI: 0.13, 0.92). The difference in the intervention and control group slopes indicated a significant difference in the increase in the number of services for the intervention group compared to the control, suggesting an ongoing change in the outcome before the intervention. This difference can be seen in the pre-intervention slopes in Figure 4.20.

Post-intervention period

No significant change in the number of ANC services was observed immediately after the intervention. However, the slopes of both groups were positive and statistically significant, indicating that the provision of services increased monthly in both groups (by 1.56 ANC services per month in the intervention and 1.10 ANC services per month in the control groups).

Although the difference in the slopes for the two groups was slightly positive (0.55), indicating that the rate of increase in the delivery of ANC services was higher in the intervention group, which can be seen in Figure 4.21, this difference was not significant.

Pre-post difference

The intervention resulted in a negligible monthly increase of 0.03 ANC services in the provinces where the midwives started to work in ARCS-MHTs in 2017; this was after adjusting for the pre-and post-intervention levels and trends.

Comparing intervention vs control in 2018

Pre-intervention period

The results showed that at the start of the study, the intervention group provinces received significantly fewer ANC services ($P=-3.93$, CI: -6.64, -1.22) compared to the control group. However, during the pre-intervention period, there was a significant positive trend in the intervention group ($P=0.28$, CI: 0.02, 0.52), which means that the number of ANC services in the pre-intervention period was increasing at the rate of 0.28 services per month in the group. On the other hand, a decrease (-0.06) in the rate of ANC services delivered in the control group was seen, but this was not statistically significant.

Similar to the differences in the pre-intervention slopes observed in 2017, there was a small albeit statistically significant increase ($P=0.34$, CI: 0.05, 0.64) in the number of services for the intervention group in the pre-intervention period, suggesting an ongoing change in the outcome before the intervention in 2018. The difference can also be observed in the pre-intervention slopes in Figure 4.21.

Post-intervention period

Immediately after the intervention, there was a statistically significant increase in ANC services by an average of 13.93 (CI: 1.21, 26.64) in the intervention group compared to the control group. The post-intervention slopes were also significant; there was an increase of 1.58 (CI: 0.49, 2.67) ANC services delivered per month in the intervention group and 1.43 (CI: 0.72, 2.13) ANC services per month in the control group.

The trends for both the intervention and control groups showed an increase in the rates of delivery post-intervention, but the slopes were parallel to each other, as seen in Figure 4.21. Despite the immediate jump in the number of ANC services post-intervention and a significant post-intervention trend, the difference in the slopes for the two groups was only slightly positive (0.15), indicating that the rate of increase in the delivery of ANC services was marginally higher in the intervention group, but this difference was not significant.

Pre-post differences

Controlling for pre- and post-intervention levels and trends, the intervention resulted in 0.19 fewer ANC services delivered per month in the 2018 intervention group; this decrease was not significant.

In summary, a discernible increase in ANC service delivery was observed within the 2018 intervention group immediately after the introduction of midwives. While all three intervention groups displayed an escalating rate of ANC services during the pre-intervention period, this upward trajectory persisted for the 2017 and 2018 intervention groups in the post-intervention period. Simultaneously, the control group experienced increased services during the post-intervention period across 2016, 2017, and 2018.

Upon accounting for pre- and post-intervention levels and trends, the introduction of midwives resulted in fewer ANC services in intervention groups where midwives started in 2016 and 2018. Conversely, there was a marginal increase in the intervention group where midwives started in 2017. Importantly, these changes lacked statistical significance and could not be attributed to the intervention.

Table 4.12: Differences in ANC service outcomes

Measure of interest	Model parameter	2016		2017		2018	
		P	[95% CI]	P	[95% CI]	P	[95% CI]
Pre-intervention period							
Difference between							
intervention versus control prior to start of the study (baseline difference)	β_4	8.11*	[1.26, 14.96]	-0.53	[-2.44, 1.38]	-3.93**	[-6.64, -1.22]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	1.97**	[0.53, 3.4]	0.52**	[0.27, 0.77]	0.28*	[0.02, 0.54]
Pre-intervention trend: control group	β_1	1.62	[-0.74, 3.99]	-0.02	[-0.33, 0.29]	-0.06	[-0.20, 0.08]
Difference in preintervention slope: intervention versus control groups	β_5	0.61	[-2.22, 3.45]	0.52**	[0.13, 0.92]	0.34*	[0.05, 0.64]
Post-intervention period							
Difference between							
intervention versus control groups immediately after intervention	β_6	24.19	[-1.23, 49.63]	0.01	[-5.89, 5.9]	13.93*	[1.21, 26.64]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.68	[-0.18, 1.55]	1.56**	[0.9, 2.22]	1.58**	[0.49, 2.67]
Post-intervention trend: control group	$\beta_1 + \beta_3$	0.79**	[0.50, 1.08]	1.01**	[0.59, 1.43]	1.43**	[0.72, 2.13]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	-0.11	[-1.02, 0.80]	0.55	[-0.23, 1.33]	0.15	[-1.14, 1.44]
Difference pre versus post intervention: intervention versus control groups							
	β_7	-0.72	[-4.06, 2.62]	0.03	[-0.83, 0.88]	-0.19	[-1.61, 1.22]

P: point estimate: number of services per month.

No midwives (control group); Midwives (intervention group)

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

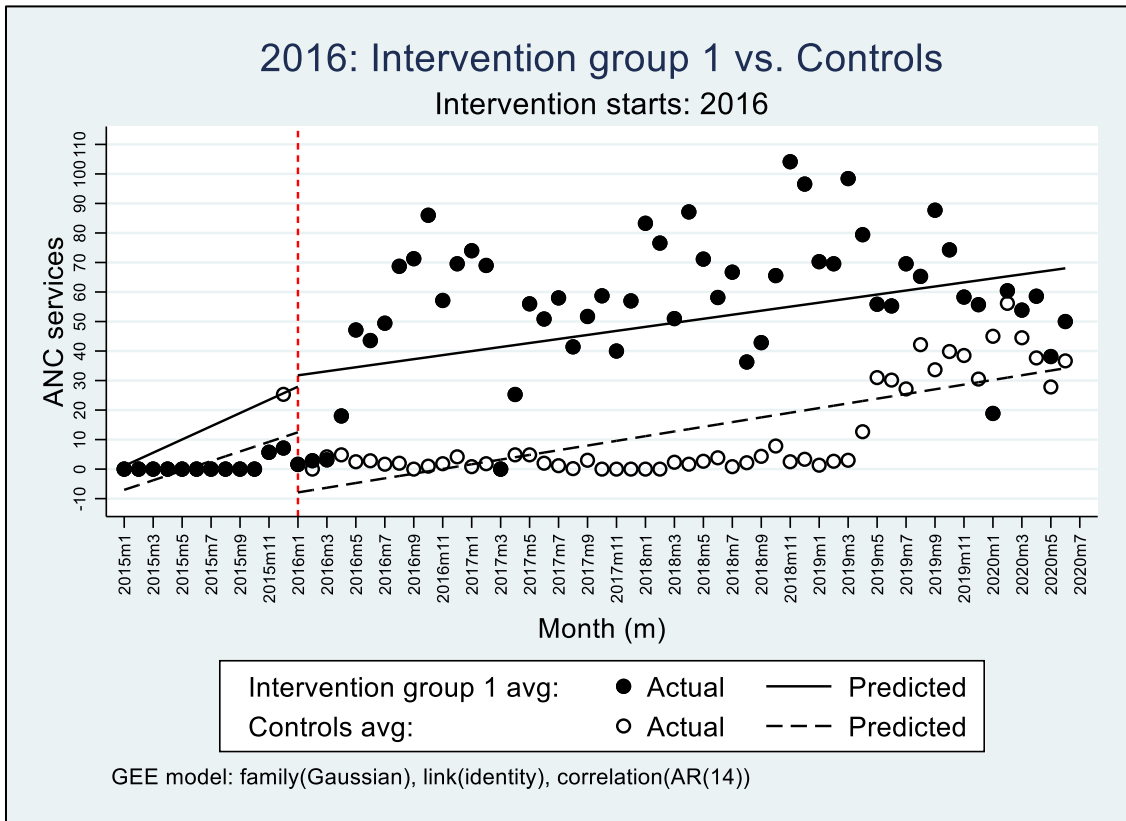


Figure 4.19: Multiple group analysis comparing trends of ANC services – intervention started in 2016

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 14 (Appendix 4.4). Lag 14 was accounted for in the final model, presented in this figure.

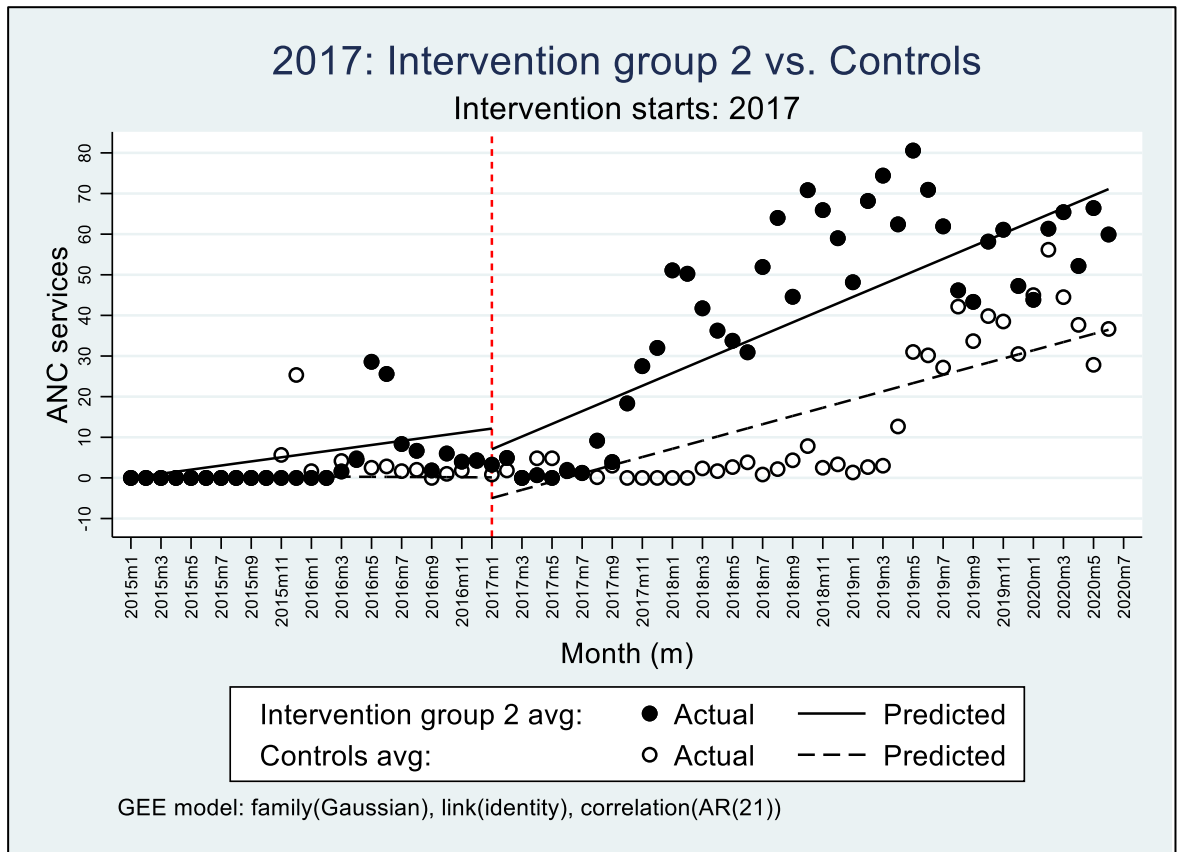


Figure 4.20: Multiple group analysis comparing trends of ANC services - intervention started in 2017

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 21 (Appendix 4.4). Lag 21 was accounted for in the final model, presented in this figure.

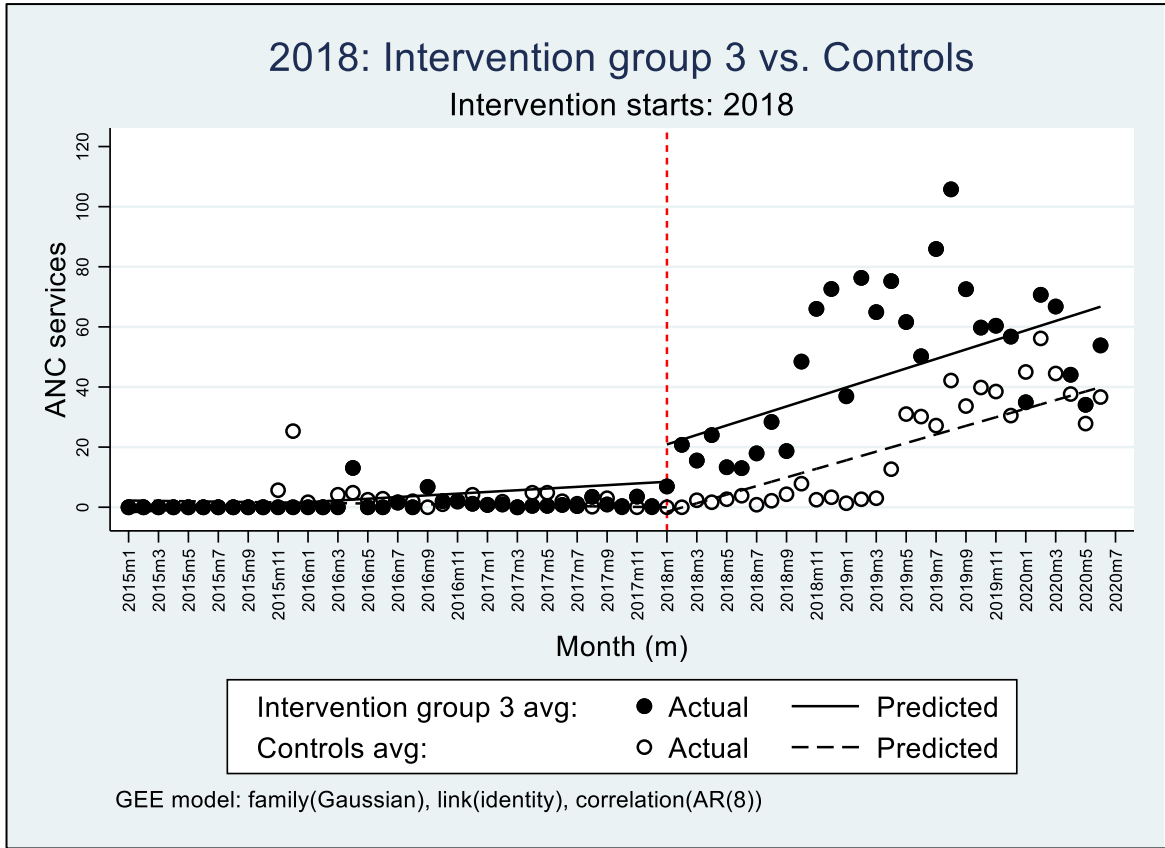


Figure 4.21: Multiple group analysis comparing trends of ANC services - intervention started in 2018

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.4). Lag 8 was accounted for in the final model, presented in this figure.

PNC services

Please refer to Table 4.13 and Figures 4.22 to 4.24 to see the details of results from the ITSA analysis assessing the difference in PNC service outcomes before and after the midwife intervention. The outcome was the change in the monthly number of PNC services delivered between the intervention and control provinces, controlling for any pre- and post-intervention differences and trends.

Comparing intervention vs control in 2016

Pre-intervention period

A statistically significant difference between the intervention and control groups was observed at baseline. Before the start of the study, the intervention group of provinces received, on average, 3.9 (CI: 0.84, 6.96) more PNC services compared to the provinces in the control group. Positive slopes were observed for both the intervention and control groups during the pre-intervention period, with an increase of 1.9 PNC services per month in the intervention group and an increase of 0.75 PNC services in the control group; however, this was only significant for the intervention group (P=1.9, CI: 0.32, 3.49).

Although the positive difference (1.19) in the pre-intervention slope showed that the rate of increase in services was higher in the intervention group, which can also be seen in Figure 4.22, this difference was not statistically significant; indicating that there was no difference in the rate of change of number of PNC services in the pre-intervention period.

Post-intervention period

Immediately after the intervention, there was an increase in PNC services, with 11.5 more services delivered in the intervention group compared to the control group; however, this jump was not statistically significant.

A marginal increase (0.03) in the monthly number of services was observed in the intervention group post-intervention, which was not significant. However, there was a significant monthly increase of 0.34 (CI:0.06, 0.62) PNC services in the control group of provinces.

The difference in the slope for the intervention and control groups showed a decline in the number of services by 0.31 per month in the intervention group compared to the control

group, which was not significant. Figure 4.22 shows plateauing and a slight decrease in the number of services in the intervention group in the post-intervention period.

Pre-post difference

Controlling for differences in the pre-and post-intervention levels and trends, our results indicate that the intervention resulted in an overall decrease of 1.5 PNC services per month in the intervention group; this result was not statistically significant.

Comparing intervention vs control in 2017

Pre-intervention period

There was no difference in the baseline levels between the intervention and the control groups in 2017. In the pre-intervention period, the intervention group exhibited a statistically significant monthly increase of 0.36 PNC services (CI: 0.01, 0.72).

Significantly, the difference in slopes between the intervention and control groups (P=0.38, CI: 0.001, 0.76) indicated a higher rate of increase in PNC services for the intervention group. This discrepancy amounted to 0.38 more PNC services per month in the intervention group compared to the control group, as visually represented in Figure 4.23. This disparity suggests an ongoing change in the outcome preceding the implementation of the intervention.

Post-intervention period

Despite a small and non-significant reduction of 4.13 PNC services in the intervention group compared to the control group immediately after the introduction of midwives in 2017, it is important to note that the post-intervention slopes of both groups were statistically significant. The intervention group exhibited a monthly increase of 0.89 PNC services (CI: 0.39, 1.41), compared to the control group, where an additional 0.5 services were delivered per month (CI: 0.13, 0.86) during this period.

Additionally, the post-intervention difference in slopes for both groups showed that the rate of increase in the number of services was slightly higher for the intervention group (0.39) compared to the control group, also observed in Figure 4.23; this difference, however, was not statistically significant.

Pre-post difference

Controlling for the pre- and post-intervention levels and trends, there was no significant difference in the PNC service provision between the two groups.

Comparing intervention vs control in 2018

Pre-intervention period

The results showed a significant baseline difference, with the intervention group exhibiting an average of 1.56 (CI: -2.88, -0.25) fewer PNC services delivered than the control group. Despite fewer services at baseline, the trend for the intervention group during the pre-intervention period showed a small monthly increase in the number of services by 0.09 (0.001, 0.17), which was significant. A small monthly decrease of 0.04 PNC services was seen in the control group during this time, which was not significant. However, the difference in the slopes of the two groups showed that the rate of increase in PNC service delivery was significantly higher in the intervention group mentioned (P= 0.12, CI: 0.01, 0.24), suggesting different rates of change between the two groups leading up to the intervention, Figure 4.24.

Post-intervention period

A significant increase in the number of services was seen immediately after the introduction of midwives in 2018, with the intervention group receiving an average of 6.14 (CI = 1.78, 11.04) more PNC services compared to the control group. Similar to 2017, the post-intervention slopes for both groups were positive and significant. There was a monthly increase of 0.71 (CI: 0.13, 1.29) PNC services in the control group compared to a monthly increase of 0.43 (0.07, 0.78) PNC services in the intervention group. The difference in the slopes was non-significant, indicating that the difference in the monthly increases between the two groups was not statistically significant.

Pre-post difference

After accounting for the pre-and post-levels and intervention trends, a non-significant decrease of 0.41 services per month was seen after the introduction of midwives.

Our findings revealed that after the introduction of midwives in the ARCS-MHTs, a decline in PNC services emerged in intervention groups where midwives commenced in 2016 and 2018 and beyond, accompanied by a slight increase in the intervention group

where midwives started to be included in ARCS-MHTs in 2017. Nevertheless, these changes lacked statistical significance and were not attributable to the presence of midwives.

Furthermore, there was an increase in PNC services in the 2018 intervention group immediately after the introduction of midwives. Substantial increases in PNC services were noted across all three intervention groups during the pre-intervention period and in the intervention groups of 2017 and 2018 during the post-intervention period. A statistically significant monthly rise in the number of PNC services was also noted in the control group for the years 2016, 2017, and 2018.

Table 4.13: Differences in PNC service outcomes

Measure of interest	Model parameter	2016		2017		2018	
		P	[95% CI]	P	[95% CI]	P	[95% CI]
Pre-intervention period							
Difference between							
intervention versus control prior to start of the study (baseline difference)	β_4	3.9*	[0.84, 6.96]	0.13	[-0.61, 0.88]	-1.56*	[-2.88, -0.25]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	1.9*	[0.32, 3.49]	0.36*	[0.01, 0.72]	0.09*	[0.001, 0.17]
Pre-intervention trend: control group	β_1	0.75	[-0.39, 1.88]	-0.01	[-0.09, 0.08]	-0.04	[-0.12, 0.04]
Difference in preintervention slope: intervention versus control groups	β_5	1.19	[-0.7, 3.13]	0.38*	[0.001, 0.76]	0.12*	[0.01, 0.24]
Post-intervention period							
Difference between							
intervention versus control groups immediately after intervention	β_6	11.5	[-10.92, 33.93]	-4.13	[-9.8, 1.58]	6.41**	[1.78, 11.04]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.03	[-0.59, 0.65]	0.89**	[0.39, 1.41]	0.43*	[0.07, 0.78]
Post-intervention trend: control group	$\beta_1 + \beta_3$	0.34*	[0.06, 0.62]	0.5**	[[0.13, 0.86]	0.71*	[0.13, 1.29]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	-0.31	[-0.99, 0.37]	0.39	[-0.23, 1.02]	-0.29	[-0.97, 0.39]
Difference pre- versus post-intervention: intervention versus control groups	β_7	-1.5	[-4.79, 0.15]	0.02	[-0.69, 0.72]	-0.41	[-1.17, 0.35]

P: point estimate: number of services per month.

No midwives (control group); Midwives (intervention group)

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

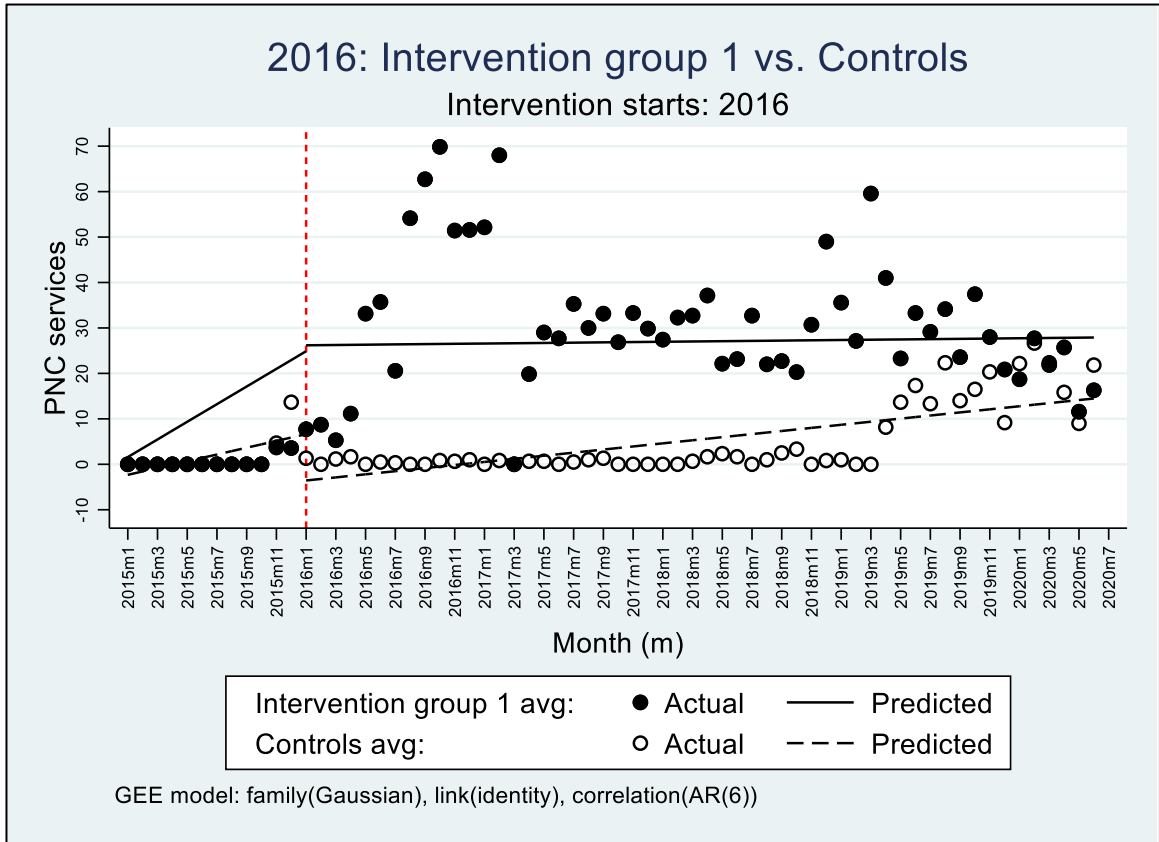


Figure 4.22: Multiple group analysis comparing trends of PNC services – intervention starting in 2016

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 6 (Appendix 4.4). Lag 6 was accounted for in the final model, presented in this figure.

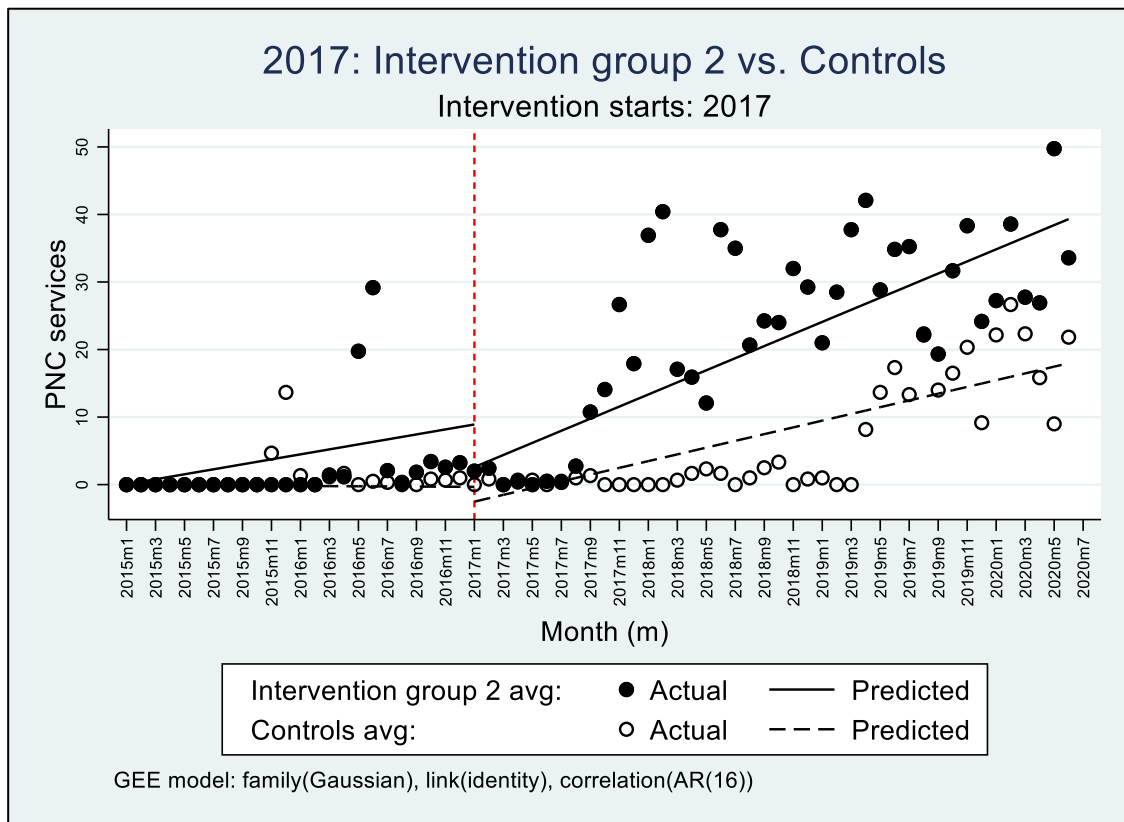


Figure 4.23: Multiple group analysis comparing trends of PNC services - intervention starting in 2017

The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 16 (Appendix 4.4). Lag 16 was accounted for in the final model, presented in this figure.

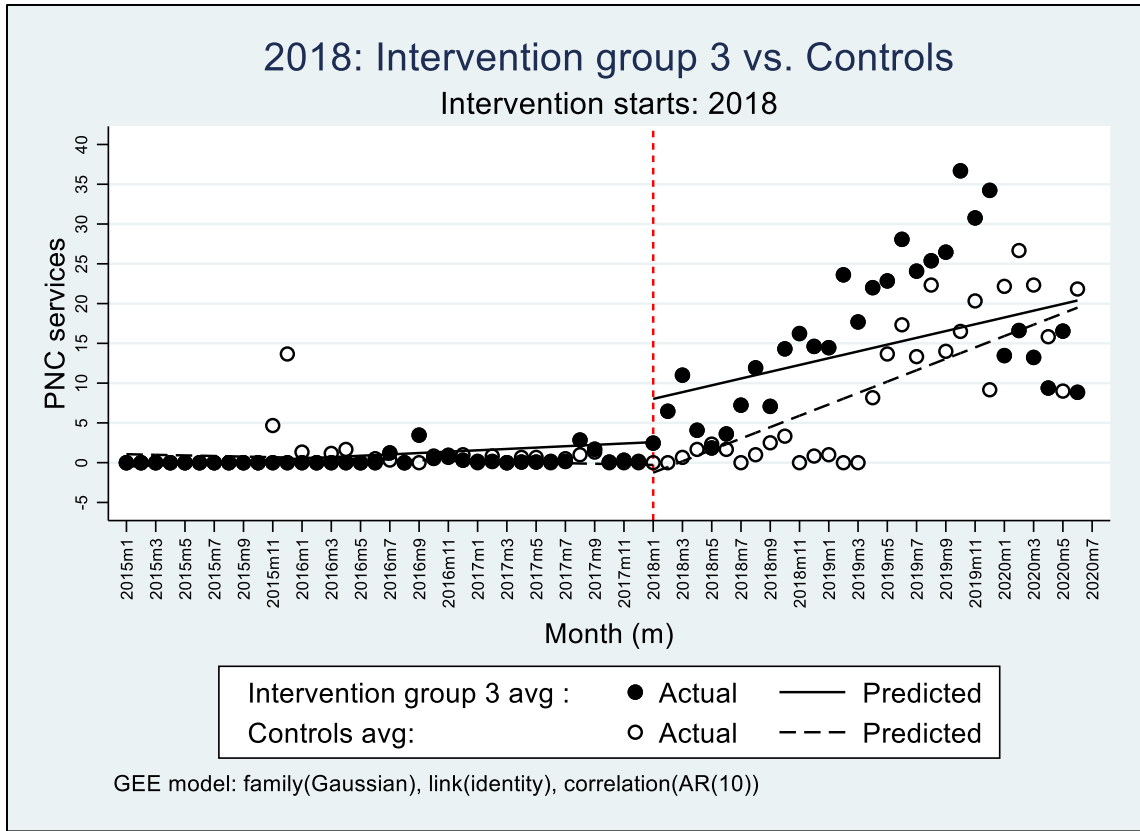


Figure 4.24: Multiple group analysis comparing trends of postnatal care - intervention starting in 2018

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 10 (Appendix 4.4). Lag 10 was accounted for in the final model, presented in this figure.

Results from qualitative analysis

The results of the qualitative analysis entailed a compilation of findings merged from the inductive and deductive analysis using KII and DR, and details are presented in Figure 3.5. In-depth interviews with nine key informants provided valuable insights into various aspects of MHT operations. Key informants shared their perspectives on the significance of including midwives in MHTs and the broader impact of MHTs on healthcare services. They also highlighted the strengths of MHTs and identified the barriers faced in the delivery of services. Demographic details of key informants are presented in Appendix 4.5.

Data from five monitoring and evaluation reports (Appendix 4.5) were carefully analyzed to understand MHT operations and their impact on the health systems in Afghanistan. These reports shed light on the functioning of MHTs, allowing us to evaluate their effectiveness and contributions to the overall primary healthcare landscape.

In our qualitative analysis, we identified four themes that shed light on the impact of MHTs on Afghanistan's healthcare system. The first two themes, "need for MHTs" and "contribution to the primary healthcare system," provided insights into the significance of MHTs' role. Moreover, we explored the operational aspects of MHTs, uncovering "barriers" to their successful implementation and the "strengths" that have facilitated their operations. Our analysis involved grouping the final list of codes into categories and further into 12 sub-themes; this further enriched our understanding of emerging themes and their implications for healthcare services in Afghanistan. Figure 4.25 shows the themes, sub-themes and categories identified through this analysis. Category description, frequencies and distribution are presented in Appendix 4.6.

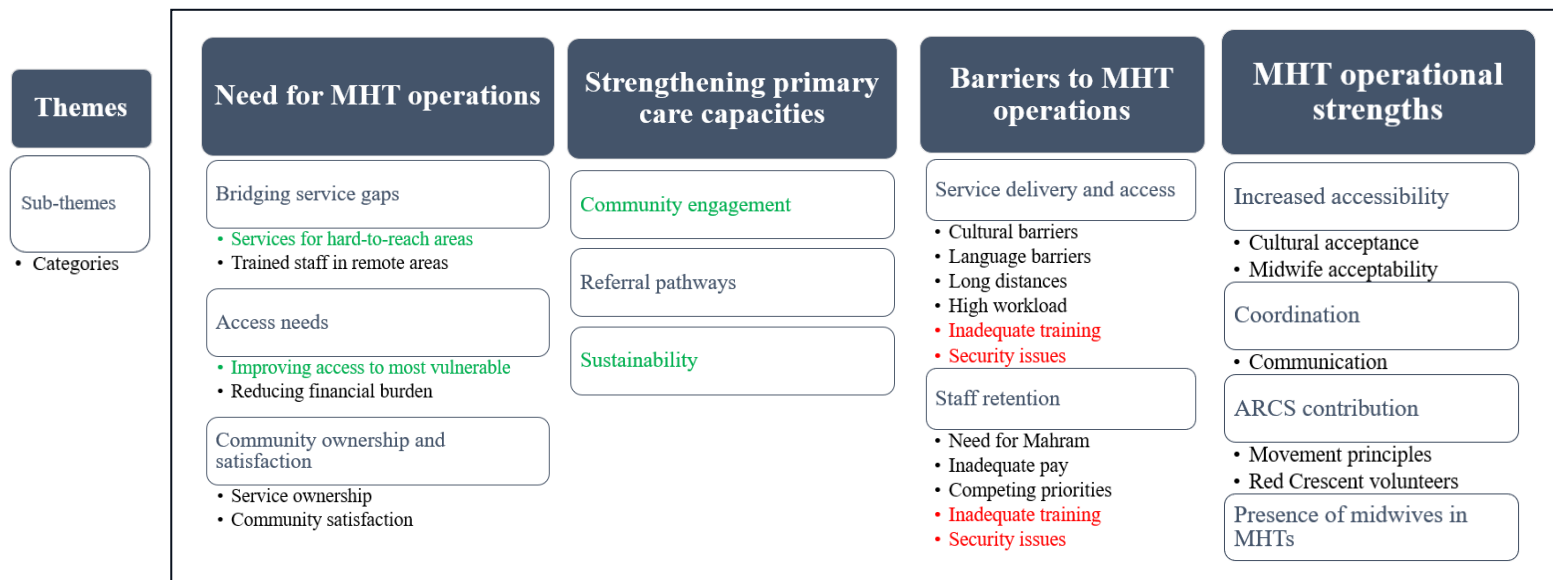


Figure 4.25: Themes, sub-themes, and categories emerging from qualitative analysis of key informant interviews and document review

Note: Our results showed that the categories and sub-themes highlighted in green were closely associated. Meanwhile, the categories highlighted in red informed more than one sub-theme.

The analysis revealed that MHTs effectively provided primary healthcare services to remote and rural areas while also playing a role in strengthening the country's health systems. Overall, they had an impact on addressing healthcare disparities and bolstering resilience in underserved communities.

In general, it was extremely impressive to see MHTs operate under what is a constantly changing and complex environment, adapting each day as best they can and often with limited resources across the various regions. While there is the overall operational foundation that exists across all MHTs, each team has adapted and evolved from its own experience and regional exposure to put in place what is its own marker of resilience which has been a very humbling to witness. [DR – MHT review report, 2015]

1. Need for MHT operations

The participants emphasized the necessity of MHTs in addressing service gaps, improving access for vulnerable communities, and ensuring community ownership and satisfaction with healthcare services, which were the three sub-themes underpinning this theme, Figure 4.28.

1.1. Bridging service gaps

Mobile Health Teams (ARCS-MHTs) were seen as bridging gaps in service delivery for areas that were hard to reach and where the government could not provide primary healthcare services to the population. Hard-to-reach areas included geographically isolated (mountainous) locations and emergencies, including conflict and natural disasters.

The Mobile Health Team's ability to work in hard-to-reach areas where other government or private healthcare providers are not present is the biggest value added. [DR - Final Evaluation Report, 2019]

All our MHTs work in these white areas. White areas mean there is no health facility. MHTs are providing health services [...] There is no permission for other NGOs or governments to go and enter those areas; only ARCS has permission to go there. [KII - Regional Health Officer]

MHTs provide various services and the possibility of providing services for remote, underprivileged people during disasters. [KII- Midwife]

Another aspect of bridging these gaps was ensuring that trained healthcare professionals were able to provide services in these remote and hard-to-reach areas.

The lack of trained health workers is another problem for remote areas. It may not be feasible to establish fixed centres. Therefore, MHTs contribute and are useful. [KII - Program Director, ARCS]

1.2. Access-related needs

The participants and evaluation reports highlighted the importance of improving access to healthcare for the vulnerable within the communities, especially pregnant women. MHTs were recognized as the most feasible way to deliver primary healthcare services in remote areas and during emergencies, making them indispensable for vulnerable populations such as IDPs. Furthermore, it was mentioned that fixed healthcare facilities in the area incurred higher costs, making MHTs more cost-effective for delivering healthcare services to the community.

Communities prefer better access to services closer to them, especially vulnerable like pregnant women.

Think about the mother she is at term of delivery and may have breech or other issues, if she is unable to move or have any other option, the people don't like services that are far from them. [KII-MHT Doctor]

It was emphasized that MHT services were much needed by the communities they served, especially for the most vulnerable.

The services [MHT] are particularly beneficial for pregnant women in conflict-affected areas and those who are living in IDP camps. [DR - Final Evaluation Report, 2019]

MHT is the most feasible way to access health services in the remote areas, basic health services delivery for IDPs during emergencies. [KII- Program Director, ARCS]

Participants discussed that MHTs improve access by reducing transportation costs, consultations, and medicines for the communities, thus increasing access to essential healthcare services.

They [the community] need some facility to reach the clinic as it is too far. But the community doesn't have the capacity or money to reach the health facility or move from here to there. This is difficult, community which is poor is not able to reach the health facility.[KII - Program Director, ARCS]

1.3. Community ownership and satisfaction

The key informants identified that one of the ways to understand the importance and need for the MHTs in the area was through a sense of ownership and satisfaction felt by the presence of these MHTs.

For community people they are a huge support. For example, at night there is no transportation or facility, [they know that] there is an MHT. [KII - Program Director, ARCS]

Most people appreciate us coming into their villages.[KII - MHT doctor]

Their work and services are greatly welcomed by the people, even by the anti-government people. [KII – Program Manager, CRCS (local)]

2. Strengthening primary healthcare systems

Participants identified three sub-themes—community engagement, referral pathways, and ensuring sustainability—wherein they perceived the ARCS-MHTs to be pivotal in strengthening Afghanistan's primary healthcare systems.

2.1. Community engagement

Participants emphasized the significance of community engagement and building trust in delivering healthcare services and for the continuity of operations. Engaging with community leaders and elders was necessary for effective health service delivery.

We rely on communities when we don't have communities helping it is challenging.
[KII- MHT Operational Manager]

To provide services to the community, we have to engage them; they have to feel ownership. We need to start with building trust with the communities, when they see that we are doing good for the community they become more accepting. [KII-Midwife]

It is also important to engage with the community leaders, for example before coming into any village we need to get permission from the community leaders and elders. [KII- MHT Doctor]

The significance of community involvement and trust-building emerged as crucial in reinforcing primary healthcare systems in Afghanistan. This contributed to the sustainability of services, presented as a distinct sub-theme in this section, and the quote below underscores the interconnectedness between these two sub-themes within the theme of strengthening primary healthcare systems.

We have to think about the sustainability of our work in Afghanistan. When we can provide professional health service delivery based on the community's needs, we will build trust in the community, resulting in sustainable health service delivery in the communities.[KII- Health in Emergency Officer]

2.2. Referral pathways

Healthcare providers within the ARCS-MHTs were adept at identifying cases requiring additional health services and establishing efficient referral pathways to ensure patients received necessary care.

For difficult deliveries [when delivery kits are not available], those who are primies [first pregnancies] or those have tears [vaginal tears during birthing process], I do not have episiotomy equipment or surgical equipment. For eclampsia, High BP, blood sugar [...] I advise them to go to the hospital. [KII – Midwife]

Sometimes there are challenges like the whole village has one vehicle, it is difficult for them to go. We convince them by telling them that there is nothing more

important than life. To save your child's life you would have to go. [KII – Midwife]

2.3. Sustainability

The sustainability of providing primary healthcare services in remote areas, particularly in the absence of MHTs, emerged as a concern. Discussions with participants identified challenges associated with sustaining healthcare delivery in remote regions of Afghanistan, particularly when mobile teams are unavailable; those are presented in detail as the separate theme of barriers. Participants emphasized the cost-effectiveness of the mobile model compared to fixed clinics, further underlining the importance of these elements in addressing the complexities of sustaining healthcare services in remote contexts in Afghanistan.

Sustainability [...] is crucial for the primary health system in Afghanistan. Primary health must be at a reasonable price. [KII- Program Director, ARCS]

Fixed clinic has more [running] cost [in remote areas]. [KII – MHT Operations Manager]

Sustainability is an issue that ARCS is facing. The issue is that if there is no MHT then there is no health facility in that [hard-to reach] area. [KII- Program Manager, CRCS (local)]

3. Barriers to MHT operations

The participants identified several barriers to MHT operations, broadly categorized as 'barriers to service delivery and access' and 'barriers to staff retention.'

3.1. Barriers to service delivery and access

Several barriers to delivery and access to health services were identified by the participants and through document review. Some of these, such as inadequate training and insecurity, were similar to barriers to staff retention. According to our analysis, cultural barriers posed challenges to accessing healthcare services, particularly for women. Conservative practices in remote areas limited the ability of MHTs to provide comprehensive care due to gender restrictions. Language barriers could also hinder access to services in Afghanistan's

multiethnic context. Long distances, high workload, inadequate training, and lack of equipment and resources further strained MHT operations. Insecurity, which is prevalent in the country, posed significant risks to the delivery of healthcare services, with potential threats to the safety and effectiveness of MHTs' work.

Staff highlighted the conservative cultural practices, particularly in remote areas, which can limit their ability to carry out a full spectrum of health services due to the composition of the team [...] the major challenge for MHTs lies more around the inability to discuss “women’s health issues” as this is a private matter for women to discuss with women. [DR – Mobile Health Team Review Report, 2017]

Sometimes, in our culture, women would not be allowed to go to provincial hospitals or to travel long distances. [KII – Program Officer, CRCS (local)]

In the past, when we used to go, they would say these are doctors; they don’t wear a burqa and criticize us. [...] when I was not part of the MHT, there were only men; the men in the community did not allow their women to be examined by men. [KII – Midwife]

Culturally the girls and ladies are not allowed to be seen by male doctors [...] Because of culture and different languages, there are issues to access [...] example when we send midwife from Kabul to remote areas, it is difficult [multinational, multiethnic]. The difference when the language she speaks is Persian and the patient speaks Pashto [...] We work in remote locations, the coverage area is very huge. Districts geographically are huge. One hundred houses in one area and have to move 100 of kms. [KII – Program Director, ARCS]

We don’t have delivery kits. ANC and PNC cards where you have to write about the follow up are not available. We used to get delivery kits; this time we did not receive them. There is no specific place to help mothers to deliver. I help them in their homes, deliver or do ANC visits. The delivery kit has plastic, sheets for mother, soap, gloves. [KII – Midwife]

One of the key issues highlighted by MHTs staff related to running costs. All teams raised their concerns with the current allocation is insufficient to meet the needs required to operate effectively. [DR- Review of MHT operations, 2017]

There is still a need, we need medicines, it is not enough. We need a lot of medicines. We have some. For example, pain killers, we need oxygen we have no oxygen, we are buying oxygen to give to patients. Sometimes I buy from my own pocket. [KII – MHT doctor]

They need training and capacity building, which we did not have this year [...] even if midwives received training last year, they need refreshers.[KII – Program Manager, CRCS (local)]

MHTs located in what are considered predominately safe district locations, many remain at high risk, due to the very nature that they are operating in highly violate situations on the frontline. Such factors are important to be reminded of, because whether they are carrying out activities during normal time or in emergencies the security situation on the ground regardless of location can change rapidly leaving them exposed to potential risk. [DR – MHT operations review, 2017]

The major security risks faced by ARCS MHTs [...] has been kidnapping. Alongside this, a MHT in the north were killed and caught in the middle of clashes between AoG [Armed Groups] and the government. [DR – MHT Operations Review, 2017]

Insecurity is another issue- there is armed conflict, and it is difficult to work in these conditions. We never know if we will be able to complete our work. We negotiate safe passage, but there is always uncertainty. [KII – MHT Doctor]

[...] safety is a challenge. More so for MHTs, as those are in unsafe zones. Mobiles don't work there; if we go to the site, we may be robbed by the time we get back. Land mines are another issue, and anything can happen there. [KII- Regional Health Officer]

3.2. Barriers to staff retention

Several challenges affecting MHTs' staff retention were identified through our analysis. The requirement for midwives to have a male family member ('mahram') accompany them during operations posed difficulties in hiring and retention. Inadequate pay, particularly the lack of hardship allowance and delayed payments, led to dissatisfaction among staff. Competing family priorities, especially for female staff, often led to them leaving the job. The scarcity of trained female healthcare professionals and insecurity in the regions also contributed to low staff retention.

It is difficult to convince midwives to enter these areas, and they must go with mahram, brothers, husbands, or fathers. [KII - Program Director, ARCS]

Lack or difficulty in hiring female staff: as they need a mahram going in, husband or brother so it increases our cost. [KII – MHT Operations Manager]

[...] challenge is the salary, the work they do and the areas they have to go to; the compensation is nothing compared to the risks they are taking. [KII – Regional Health Officer]

We have a lot of trained female staff in the main cities. They don't have any special facilities when they have to go to the provinces. Their family members [children] have to go to school, which is challenging for them. [KII – Health Emergency Officer]

Finding the most trained midwives who have the capacity is a challenge. Some midwives face home challenges: for family, kids they have to leave the job. Their husbands may get a job somewhere else, so they have to relocate and leave the job. Insecurity is another issue that hampers the hiring of midwives. [KII – Program Manager, CRCS (local)]

Efforts on training more women have proven to be challenging given the context of Afghanistan. [DR – Final Evaluation Report MHTs, 2019]

4. MHT operations strengths

The participants identified four areas that contributed to ARCS-MHTs strength in the delivery of services: community acceptability, effective communication with stakeholders, vital contributions from the Red Crescent organization, and the presence of midwives within the MHTs.

4.1. Community acceptance

One of MHTs' main strengths was their acceptability within the community. This acceptability was attributed to two factors: cultural acceptance and the presence of midwives. Many factors contributed to the increase in the acceptability of the MHTs among the community; most were related to the staff's knowledge and respect for the local culture and gaining community trust. There was overwhelming evidence through our analysis that the presence of midwives (with their mahram) contributed to acceptance by the communities, especially for catering services for women.

The MHTs are from the community, and they keep the tradition, and they are accepted. In some provinces, the lead doctor is related to the leader in the community, so there is acceptance. The community people told me that they want the midwife for the MHT. The male people were saying that. [KII - Program Manager, CRCS (local)]

It [the presence of midwives] increases the catchment of the community, and the community will more trust our MHT as there is female staff. [KII- Health in Emergency Officer]

The existence of a midwife in the MHT team is very crucial. She consults the pregnant women and newly born children and is also a matter of encouragement for other women and girls to comfortably consult the MHTs in times of need. [DR-MHT midterm evaluation, direct quote from a community elder in Kunar, 2017]

[...] women never go outside of their areas for medical consultation, but MHT is very trustable for women as well as for their men. It has made a remarkable

difference and women get medical services for themselves and for their girl child. [DR – MHT final evaluation report, 2019]

Yes, the introduction of midwife as a female staff has increased the acceptance of the services based on the Afghanistan culture. It has improved the trust of the community to let the girls and women to receive services through the female staff and enhance the access. [KII - Program Director, ARCS]

When midwives became part of the team, women come and see. In many cases, husbands or mothers-in-law do not allow women to see the doctors. There are difficulties, but when we try to make them understand, they listen to us. [KII-Midwife]

4.2. Coordination

Good communication and coordination were other strengths of MHTs.

Good coordination with communities, affected parties and the government like MoPH and Provincial directorate. [KII - Program Director, ARCS]

We work with the government to identify which areas to go into and where there is a need. IDP camps and other areas- districts or where there is an emergency situation. [KII – MHT Operations Manager]

4.3: Contribution of ARCS

According to the participants, the ARCS follows the RCRC movement principles, including being neutral, which was a strength for its MHT operations. Another strength of ARCS-MHT operations is that it works with its volunteers embedded in the communities.

ARCS is neutral and can go there [in armed areas] and serve the people. ARCS is embedded in the community, which supports us to work in the communities. ARCS has 34,000 CBHFA [Community Based Health First Aid] volunteers who help us go into the communities. We have our CBHFA volunteers that are already working in the community; there is trust in the community, and that is why it is easy to go in these areas. [KII – MHT Operations Manager]

ARCS works in white [armed] and remote areas. Our volunteers communicate with the communities, and trust makes good communication with the communities. [KII-Health in Emergency Officer]

ARCS is a national society with volunteers in the community, and they build trust through the volunteers. [KII - Program Manager, CRCS (local)]

4.4. Presence midwives in MHTs

In addition to increasing acceptance of MHTs, as described above, our results showed that the quality of services for women also improved because of the presence of MHTs.

The main health issues women presented with were: PIDs, UTIs, enema, nutritional deficiencies, ANC, and depression. Antenatal care was sought by patients, especially in remote areas but again was limited where only a male doctor existed in the MHTs. In instances where a midwife was in place the consultation was much more extensive and beneficial for the patient seeking health care. Family planning options were much more sought by women where there was a midwife in place, with condoms and the pill the most sought after. Many women spoke of choosing to deliver at home as still their first preference, which was due to challenges with access to health facilities and decision-making authority being with their husbands or mothers-in-law. [DR- Mobile Health Team Review Report, 2017]

ANC and PNC and women's issues related services have increased. This [inclusion of midwives] was very useful for many provinces. Particularly around ANC, PNC growth monitoring, public awareness for family planning was very good. [KII - Program Manager, CRCS (local)]

Specific MNCH needs of women and adolescent girls are met through Midwives within the MHTs. Since the inclusion of the midwives, the MHTs experienced 96 percent increase in maternity care services one year after [...] the introduction of the midwives in 2016. [DR – Final evaluation report, 2019]

4.2.2 Results RQ 2.2: Did MNCH outcomes differ between less and more insecure provinces in Afghanistan after introducing female health workers in ARCS-MHTs?

The pervasive insecurity in Afghanistan has negatively impacted its healthcare systems.¹⁵² The enduring state of conflict and instability within the region disrupts the effective delivery of healthcare services, especially for women and children.^{18,107} Recognizing the importance of the security context, our inquiry extended beyond examining the introduction of midwives into ARCS-MHTs. We analyzed whether the observed outcomes exhibit variation contingent upon the levels of insecurity experienced within Afghanistan. The results of the analysis are presented in this section.

Univariate Analysis

The median for the security variable (number of deaths per month) for all Afghan provinces combined was 23, and the 75th percentile was 65.45 (Figure 4.26) deaths. The average distribution of security variable in Afghanistan as the mean number of deaths per month for each province with 95% Confidence intervals are presented in Table 4.14. The provinces were categorized into three groups based on the level of insecurity corresponding to the increasing number of deaths.

Provinces reporting an average of less than 23 deaths per month, which was the median for the security variable for all the provinces in Afghanistan combined, were grouped as the least insecure provinces. Provinces with an average number of deaths per month ranging from 24 to 64.45 (75th percentile) deaths per month were the moderately insecure provinces, whereas the provinces with an average number of deaths more than 64.46 per month were the most insecure (Table 4.14 and Figure 4.27).

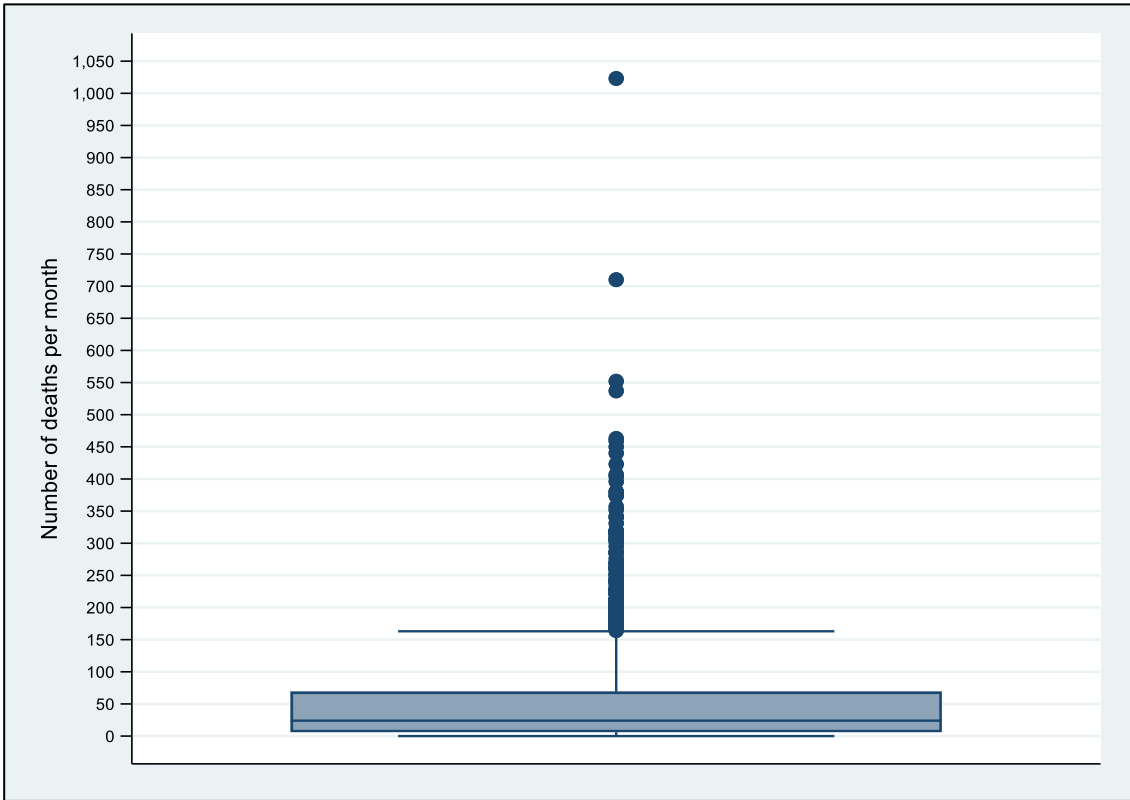


Figure 4.26: Boxplot graph showing the distribution of the security variable in Afghanistan

Table 4.14: Distribution of security variable in Afghan provinces

Group	Province	Mean	[95% CI]	
Least insecure	Parwan	4.6	2.6	6.6
	Samangan	7.0	3.6	10.5
	Nimroz	8.1	5.2	11.0
	Daykundi	9.3	2.1	16.5
	Khost	13.6	9.0	18.1
	Kapisa	16.5	10.6	22.4
	Laghman	23.4	17.7	29.1
Moderately insecure	Kabul	25.1	15.9	34.2
	Ghor	25.8	13.2	38.3
	Kunar	31.4	25.1	37.8
	Sarepol	31.5	21.6	41.4
	Takhar	33.8	24.7	42.9
	Badakhshan	38	27.3	48.6
	Jawzjan	39.4	27.3	51.5
	Paktika	40.1	28.3	51.9
	Herat	41.3	31.5	51.0
	Balkh	42.9	28.8	56.9
	Badghis	46	30.5	61.6
	Baghlan	46.3	35.3	57.2
	Logar	48.8	24.6	73.1
Paktia	49.1	32.2	66.1	
Most insecure	Faryab	96.5	74.1	118.9
	Farah	111.1	55.4	166.8
	Kunduz	121.2	101.0	141.5
	Kandahar	125.9	104.6	147.1
	Nangarhar	161.5	132.6	190.5
	Helmand	180.6	143.9	217.3

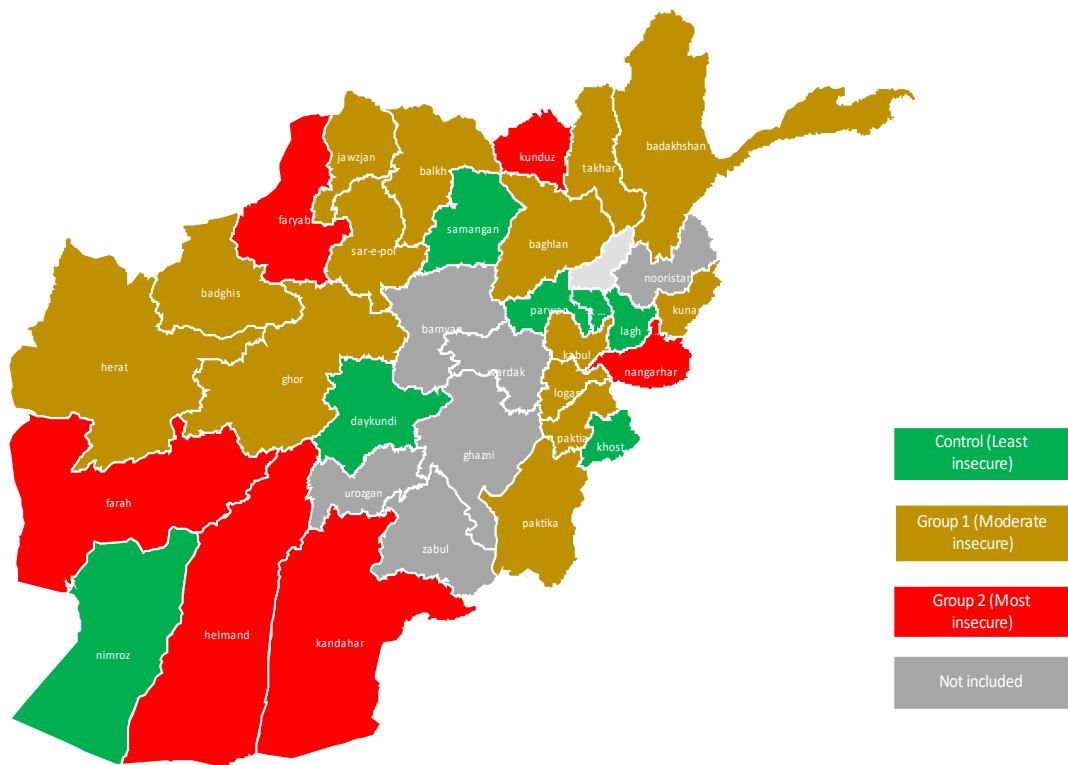


Figure 4.27: Map of Afghanistan showing the distribution of insecurity in Afghanistan

Note: This was based on the average number of deaths in the provinces of the study period (2015 – 2020). Seven provinces were the least insecure (528 observations). Fourteen provinces were moderately insecure (1,056 observations). Six provinces were most insecure (396 observations). The provinces truncated in Figure- K: Kapia, Lagh: Laghman.

Relationship between MNCH outcomes and security

Figure 4.28 shows the distribution between the MNCH outcomes, and the groups of provinces categorized by the level of insecurity. The graph shows a progressive increase in the average distribution of MNCH services as we move from provinces categorized as least insecure to moderately insecure ones. The highest concentration of services was observed in the provinces identified as the most insecure.

Childhood vaccinations

An incremental increase was noted in the number of childhood vaccinations from the least to most insecure groups of provinces (Figure 4.28). From 37.5 (95% CI, 34 to 41) in the least insecure group to 70.5 (95% CI, 57 to 84) in moderately insecure and 103.3 (95% CI, 93 to 114) vaccinations were delivered per month for each of the provinces in their respective groups.

The population-based distribution of childhood vaccinations can be seen in Appendix 4.7. The map shows the ARCS-MHTs delivering childhood vaccinations to the percentage of the population of children in each province. Interestingly, in contrast to our findings that more services were delivered in the most insecure provinces, when the total population of the province was taken into consideration, a higher percentage of children in the moderately insecure provinces such as Paktia (8.6%), Badghis (2.4%) and Kabul (3.1%) received vaccinations through ARCS-MHTs. For the most insecure provinces, the vaccinations were delivered to 2% of the children in Helmand province, 1.1% in Kandahar, 1% in Kunduz, 0.9% in Nangarhar, 0.7% in Farah and 0.3% of children in Faryab province. These percentages remained lower for the children in the least insecure provinces, where the range for vaccinations delivered ranged from 0.7% to 1.6% of children in the province, with the Parwan (1.3%), Daykundi (1.4%) and Nimroz province at 1.4% of the children who had vaccination delivered to them through ARCS-MHTs.

Tetanus toxoid vaccinations

The distribution of the average number of tetanus toxoid vaccinations for women of reproductive age per month for provinces was clustered together for the least insecure 48.7 (95% CI, 44 to 53) and moderately insecure 46.4 (95% CI, 41 to 52) groups of provinces.

The delivery of tetanus toxoid vaccinations doubled for the most insecure provinces, where, on average, 90.1 (95% CI, 79 to 100) vaccinations were delivered per month, Figure 4.28.

The population proportionate distribution of tetanus toxoid vaccinations, Appendix 4.7, showed a similar pattern as the distribution of childhood vaccinations, with the exception that some of the least insecure provinces had a higher proportionate percentage of women of reproductive age receiving the tetanus toxoid vaccinations delivered by the ARCS-MHTs. The provinces grouped as moderately insecure had the tetanus toxoid vaccinations delivered to a higher proportionate percentage of women of reproductive age, with Paktia and Badghis at 6% and 4.9%, respectively. Kapisa (5.8%) and Nimroz (4.2%) were the two provinces in the least insecure group, with a higher percentage of women receiving tetanus toxoid vaccinations from ARCS-MHTs. For the most insecure group of provinces, Kunduz had the highest percentage for delivery of vaccinations to 5.8% of women of reproductive age, followed by Helmand at 1.8% and Kandahar at 1.3%. The remaining provinces in the most insecure group had tetanus toxoid vaccination delivered to <1% of women of reproductive age population.

ANC services

Our findings showed that there was also an incremental increase in the average number of ANC services from least to most insecure groups per month (Figure 4.28). From 22.1 (95% CI, 19 to 23) in the least insecure group to 44 (95% CI, 40 to 48) in moderately insecure and 65.4 (95% CI, 56 to 74) services were delivered on average per month for each province in their respective groups based on insecurity.

The population proportionate distribution of ANC services across Afghan provinces (Appendix 4.7) shows that compared to other provinces, Farah, one of the most insecure provinces, had ANC services delivered by ARCS-MHTs to 3.5% of the women of reproductive age in that province. ARCS-MHTs in Kunduz province had ANC services delivered to 1.7% of the women of reproductive age in the province, while the rest of the provinces in the most insecure group had these services delivered to 0.5 to 1.5% of the women of reproductive age in those provinces. Some of the moderately insecure provinces with a higher percentage of women of reproductive age having ANC services delivered by

the ARCS-MHTs included Badakhshan (2.7%), Badghis (2.6%) and Kunar (2.2%). The higher percentages for the least insecure group of provinces were for Nimroz, Khost, and Parwan, which had ANC services delivered to 2.4%, 1.8%, and 1.4% of women of reproductive age, respectively.

PNC services

The average number of PNC services delivered each month was 11.9 (95% CI, 10 to 14) in the least insecure group. This number doubled to 21.6 (95% CI, 19 to 24) for moderately insecure and 27.7 (95% CI, 24 to 32) for most insecure provinces, Figure 4.28.

The population proportionate distribution of PNC services across Afghan provinces (Appendix 4.7) shows that Badghis, a moderately insecure province, had the highest percentage (3%) of PNC services delivered to 3% of women of reproductive age. Kunar (1.3%) and Parwan (1.2%) were provinces from the least insecure group with a higher percentage of population or women of reproductive age with PNC services delivered by ARC-MHTs compared to other provinces. Among the most insecure provinces, Kandahar had PNC services delivered to 1.2% of the women of reproductive age; for the other provinces in this group, this figure was <1%.

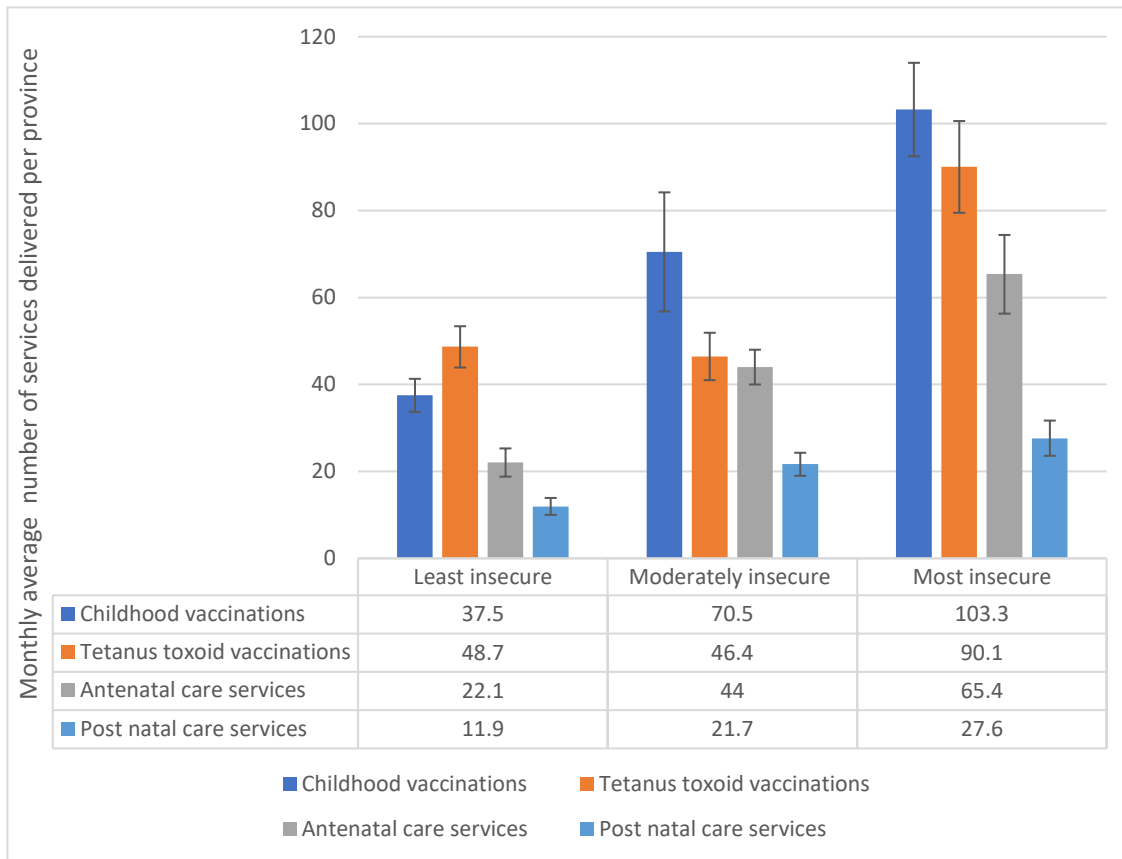


Figure 4.28: Distribution of MNCH services for groups based on the levels of insecurity

Note: The cross bars indicate the upper and lower limits of the 95% confidence intervals for the mean.

Bivariate Analysis

When the outcomes were compared based on levels of insecurity, we found positive trends and significant results, indicating that, on average, the number of MNCH services delivered by ARC-MHT was higher in more insecure provinces (Table 4.15).

The increase was more pronounced in most insecure provinces, where tetanus toxoid vaccinations, ANC, and PNC services were significantly higher than in the least insecure provinces. The most significant difference was in the ANC services, where, on average, 67.94 more services were delivered monthly in more insecure provinces than in the least insecure provinces. A significantly higher monthly average number of services was also seen for PNC (32.21) and tetanus toxoid vaccination deliveries in most insecure provinces.

When comparing moderately insecure provinces with the least insecure provinces, we again saw that, on average, there was a significantly higher number of ANC (57.27) and PNC (28.57) services delivered in moderately insecure provinces. However, fewer childhood and tetanus toxoid vaccinations for women of reproductive age were delivered in moderately insecure provinces as compared to least insecure provinces, but this trend was not statistically significant (Table 4.15).

Table 4.15 Association between MNCH services delivered and the level of insecurity

MNC services	Moderately insecure provinces	Most insecure provinces
Childhood vaccinations	-13.57	10.88
Tetanus toxoid vaccinations	-5.32	27.68**
ANC services	57.27**	67.94**
PNC services	28.57**	31.21**

Note: Simple linear regression model. The least insecure group of provinces was the reference category; regression coefficients are presented in the table. ** p<0.01

Interrupted Time Series Analysis

There were two sets of ITSA analyses to assess the difference in outcomes on the monthly delivery of MNCH services after introducing female health workers (midwives) based on the level of insecurity. The least insecure group was the control group, while moderately insecure and most insecure were the intervention groups. Assessing the outcomes entailed combining each intervention group with the control group; please refer to Table 4.16 below.

Table 4.16: Groups for ITSA analysis to assess the difference in outcomes on the delivery of MNCH services pre and post intervention based on levels of insecurity

Groups for ITSA analysis	Provinces	Observations
Moderately insecure provinces vs Least insecure provinces	21	1,584
Most insecure provinces vs Least insecure provinces	13	924

The results are presented as the difference in each MNCH outcome, comparing each intervention group with the control group. We followed the same presentation format for the ITSA results presented in section 4.2.1, with details of pre- and post-intervention periods and the pre-post difference, to understand whether the intervention had a measurable effect on the outcome. Please refer to Table 3.2 and Figure 3.4 for the description and visualization of the ITSA design.

Childhood vaccinations

Please refer to Table 4.17 and Figures 4.29 to 4.30 to see the details of results from the ITSA analysis assessing the difference in childhood vaccination outcomes before and after the midwife intervention based on the level of insecurity.

The outcome was the change in the monthly number of childhood vaccinations for children under five years delivered, controlling for pre- and post-intervention differences and trends.

Comparing moderately insecure vs least insecure provinces

Pre-intervention period

There was no difference in the intervention and control groups at the start of the study. Although the number of childhood vaccinations increased by 1.39 per month in the moderately insecure provinces during the pre-intervention period, this increase was not significant. A marginal non-significant monthly increase in childhood vaccinations (0.09 childhood vaccinations) was also seen in the least insecure provinces.

The difference in the slope for the two groups (i.e. the difference in the monthly change between the two groups) showed that moderately insecure provinces had a higher rate of service increase. Figure 4.29 shows that this difference was not significant. The findings indicated that the groups were comparable and did not show distinctive patterns, suggesting a degree of stability in the measured variables across the two groups before the intervention.

Post-intervention period

Immediately after the introduction of midwives, the number of childhood vaccinations decreased by 36.27 in the moderately insecure group compared to the least insecure group; however, this finding was not statistically significant.

In the post-intervention period, there was a monthly increase of 0.36 childhood vaccinations in the moderately insecure provinces; this increase was not statistically significant. However, there was a significant decrease in childhood vaccinations in the least insecure provinces during the post-intervention period ($P = -0.57$, CI: -1.08, -0.06), which means that the children in the provinces that were least insecure were receiving 0.57 fewer vaccinations per month after the midwives were introduced.

Although the difference in the slopes for moderate and least insecure provinces was positive (0.93), indicating increasing rates of delivery of vaccinations for children in the moderately insecure group compared to the least insecure group, the difference was not significant, Figure 4.29.

Pre-post difference

Our findings showed that taking into account the pre- and post- interventional levels and trends, the introduction of midwives resulted in 0.38 fewer monthly childhood vaccinations delivered in the moderately insecure provinces compared to the least insecure provinces; this finding was not statistically significant.

Comparing most insecure vs least insecure provinces

Pre-intervention period

At the start of the study period, our results showed that on average, the provinces in the most insecure group had 29.54 more monthly vaccinations delivered compared to the provinces in the least insecure group. There was no difference in the pre-intervention trends or slopes for the two groups, Figure 4.30, which suggested that the groups were comparable and stable.

Post-intervention period

When compared with the least insecure provinces, the number of services increased by 18.76 in the most insecure provinces immediately after midwives were introduced in the ARCS-MHTs, the increase was not significant, but can be observed in Figure 4.30.

There was a slight increase (0.06) in childhood vaccinations per month in the most insecure provinces in the post-intervention period, which was not significant. A statistically significant decrease in the monthly provision of childhood vaccinations in the least insecure provinces during the post-intervention period ($P = -0.58$, CI: -1.14, -0.02) was observed.

Overall, there was no significant difference between the slopes of the most and least insecure group of provinces, Figure 4.30.

Pre-post difference

Taking into account the pre-and post-intervention levels and trends, the introduction of midwives in the ARCS-MHTs slightly increased the monthly delivery of childhood vaccinations by 0.64 for the most insecure provinces in Afghanistan, but the findings were not statistically significant.

Our results showed that the introduction of midwives had no impact on improving childhood vaccinations in moderate or most insecure provinces.

Table 4.17: Differences in childhood vaccination outcomes based on the levels of insecurity

Measure of interest	Model parameter	Moderate versus Least insecure		Most versus Least insecure	
		P	[95% CI]	P	[95% CI]
Pre-intervention period					
Difference between intervention versus control prior to start of the study (baseline difference)	β_4	0.004	[-34.7, 34.71]	29.54	[-38.33, 97.41]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	1.39	[-2.09, 4.88]	0.07	[-0.81, 0.96]
Pre-intervention trend: control group	β_1	0.09	[-0.44, 0.63]	0.03	[-0.52, 0.58]
Difference in preintervention slope: intervention versus control groups	β_5	1.31	[-2.19, 4.81]	0.004	[-0.99, 1]
Post-intervention period					
Difference between intervention versus control groups immediately after intervention	β_6	-36.27	[-108.85, 36.31]	18.76	[-44.49, 82.01]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.36	[-0.87, 1.59]	0.06	[-0.82, 0.94]
Post-intervention trend: control group	$\beta_1 + \beta_3$	-0.57*	[-1.08, -0.06]	-0.58*	[-1.14, -0.02]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	0.93	[-0.39, 2.26]	0.64	[-0.40, 1.68]
Difference pre- versus post-intervention: intervention versus control groups	β_7	-0.38	[-3.54, 2.78]	0.64	[-0.55, 1.83]

P, Point Estimate; CI, Confidence Interval

Least insecure (control); moderately and most insecure (intervention) group of provinces

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

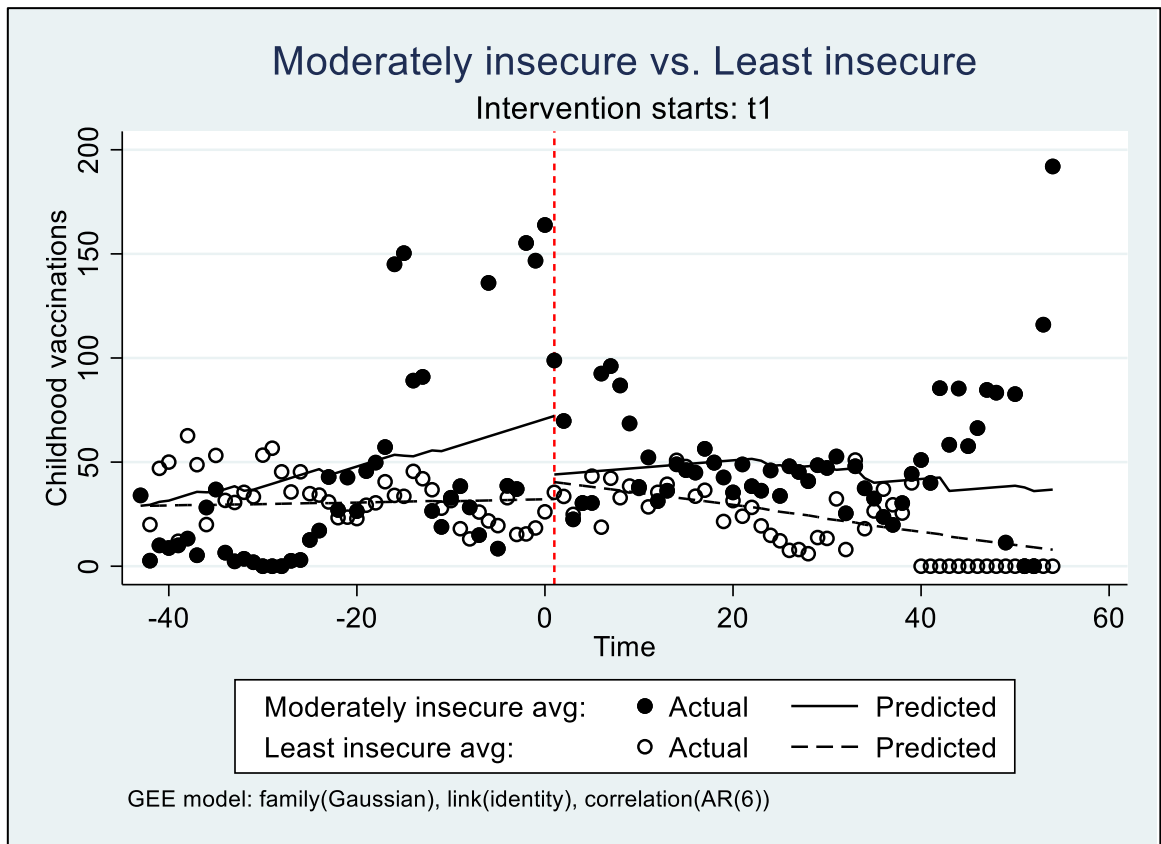


Figure 4.29: Multiple group analysis comparing trends of childhood vaccinations - moderate vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 6 (Appendix 4.8). Lag 6 was accounted for in the final model, presented in this figure.

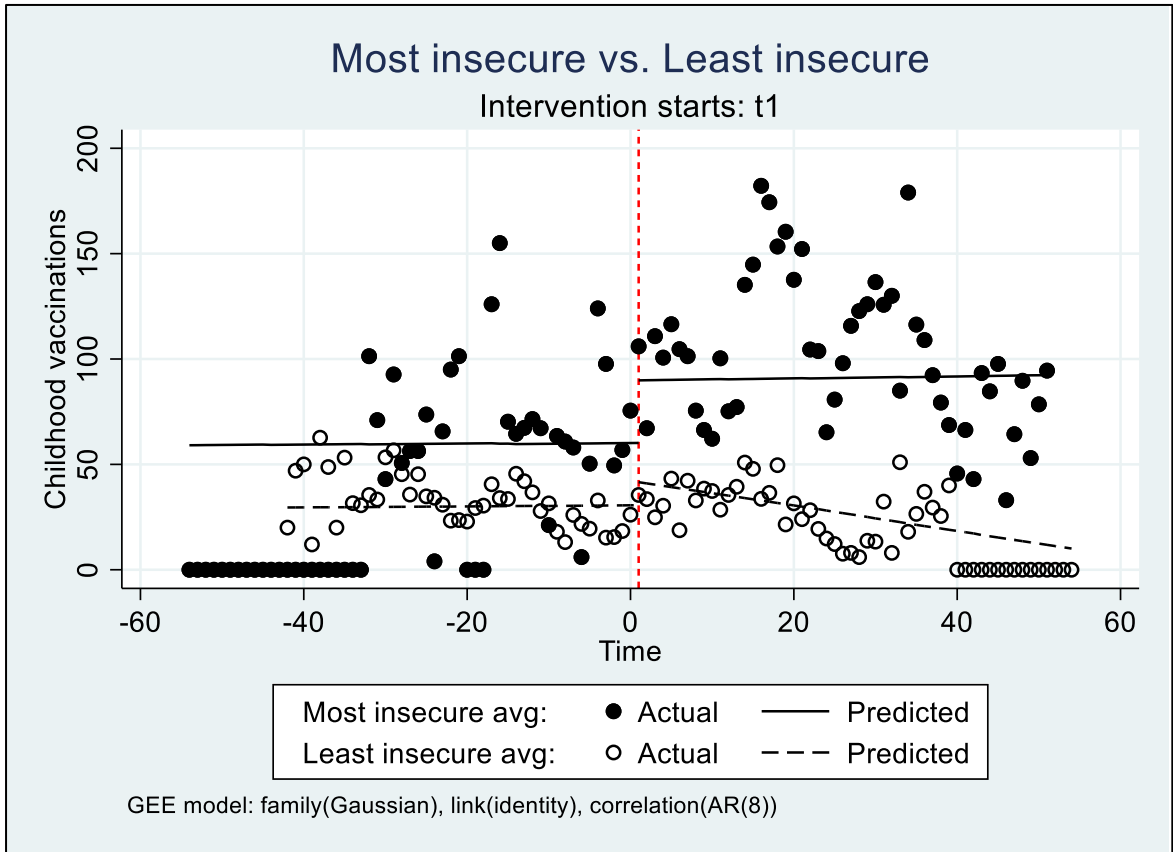


Figure 4.30: Multiple group analysis comparing trends of childhood vaccinations - most vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.8). Lag 8 was accounted for in the final model, presented in this figure.

Tetanus toxoid vaccinations

Please refer to Table 4.18 and Figures 4.31 to 4.32 to see the details of results from the ITSA analysis assessing the difference in tetanus toxoid vaccination outcomes before and after the midwife intervention based on the level of security. The outcome was the change in the monthly number of tetanus toxoid vaccinations delivered to women of reproductive age, controlling for any pre-and post-intervention differences and trends.

Comparing moderately insecure vs least insecure provinces

Pre-intervention period

At baseline, the moderately insecure provinces on average had 17.08 fewer tetanus toxoid vaccinations delivered to the women of reproductive age compared to the least insecure provinces, Figure 4.31.

There was a small increase in the monthly number of tetanus toxoid vaccinations in moderately insecure provinces (0.25 tetanus toxoid vaccinations per month) and a small decrease in these services in least insecure provinces (-0.13 tetanus toxoid vaccinations per month) in the pre-intervention period; however, these trends were not significant. The difference in the slopes for the two groups was not significant either, showing that the rate of change in the delivery of tetanus toxoid vaccinations in moderate and least insecure groups of provinces was comparable before the intervention, Figure 4.31.

Post-intervention period

After the midwives were introduced in the ARCS-MHTs, there was an average decline of 24.28 tetanus toxoid vaccinations in the moderately insecure provinces, which was not found to be statistically significant. After the intervention there was a monthly increase of 0.04 tetanus toxoid vaccines delivered to women of reproductive age in moderately insecure provinces; this increase was also not statistically significant.

However, the number of tetanus toxoid vaccinations decreased by 1.15 (CI: -2.03, -0.28) per month in the least insecure provinces; this was statistically significant. A rapid post-intervention decline in the number of tetanus toxoid vaccinations in the least insecure provinces can also be observed in Figure 4.31.

The results also showed a significantly positive difference between the slopes for the two groups of provinces ($P=1.19$, CI: 0.02, 2.37), which indicates that compared to the least

insecure group of provinces there was a higher rate of increase in delivery of tetanus toxoid vaccinations in moderately insecure provinces, after the introduction of midwives.

Pre-post difference

A monthly increase of 0.77 tetanus toxoid vaccines in the moderately insecure provinces, after controlling for the pre-post-intervention levels and trend. The increase was not significant. This indicates that while there was an observed increase in service delivery, this increase could have occurred due to random variability or factors other than the introduction of midwives in the ARCS-MHTs.

Comparing most insecure vs least insecure provinces

Pre-intervention period

The most insecure provinces, on average, had 19.86 fewer tetanus toxoid vaccinations delivered to the women of reproductive age compared to the least insecure provinces, which was not significant. In the period prior to the start of intervention, the most insecure provinces had a slight increase in monthly provision of services (0.54 tetanus toxoid vaccinations per month), while the least insecure provinces had a slight decrease (-0.13 tetanus toxoid vaccinations per month) ; both trends were not statistically significant. The difference in the slopes of the two groups was also not significant, showing that both groups were comparable during the pre-intervention period.

Post-intervention period

Immediately after the introduction of midwives, there was a jump in the number of vaccinations delivered to the most insecure provinces. On average, there were 27.94 more tetanus toxoid vaccinations delivered in the most insecure provinces at the start of the intervention period. The results also showed a continued increase in the number of vaccinations (0.47 tetanus toxoid vaccinations per month) delivered in most insecure provinces after the midwives were introduced. However, both the immediate and continued increase in number of vaccinations was not statistically significant.

On the other hand, there was a statistically significant increase in the monthly provision of tetanus toxoid vaccinations in the control group, where it increased at the rate of 1.61 vaccinations per month.

A significantly positive difference was also observed between the slopes for the two groups of provinces ($P=1.61$, CI: 0.47, 2.75), indicating a higher rate of increase in delivery of tetanus toxoid vaccinations in most insecure provinces compared to the least insecure province, the difference can be seen in the post-intervention slopes in Figure 4.32.

Pre-post difference

After controlling for the pre-post intervention trends, an increase of 0.94 tetanus toxoid vaccinations per month was seen in the most insecure provinces as a result of the intervention; however, this increase was not significant.

Our findings showed a decline in the number of vaccinations in the least insecure group after the introduction of midwives and increasing rate of delivery of vaccinations post-intervention in moderate and most insecure provinces. Although there was an increase in tetanus toxoid vaccinations in moderate and most insecure groups after the introduction of midwives, the change could not be associated with the introduction of midwives.

Table 4.18: Differences in tetanus toxoid vaccination outcomes based on the levels of insecurity

Measure of interest	Model parameter	Moderate versus Least insecure		Most versus Least insecure	
		P	[95% CI]	P	[95% CI]
Pre-intervention period					
Difference between intervention versus control prior to start of the study (baseline difference)	β_4	-17.08	[-0.78, 0.52]	-19.86	[-65.65, 25.93]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	0.26	[-0.79, 1.31]	0.54	[-0.62, 1.7]
Pre-intervention trend: control group	β_1	-0.13	[-0.78, 0.52]	-0.13	[-0.7, 0.46]
Difference in preintervention slope: intervention versus control groups	β_5	0.42	[-0.83, 1.68]	0.66	[-0.59, 1.92]
Post-intervention period					
Difference between intervention versus control groups immediately after intervention	β_6	-24.28	[-56.93, 8.36]	27.94	[-27.24, 83.13]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.04	[-0.75, 0.82]	0.47	[-0.25, 1.20]
Post-intervention trend: control group	$\beta_1 + \beta_3$	-1.15**	[-2.03, -0.28]	-1.13*	[-2.01, -0.25]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	1.19*	[0.02, 2.37]	1.61**	[0.47, 2.75]
Difference pre versus post intervention: intervention versus control groups	β_7	0.77	[-0.8, 2.34]	0.94	[-0.64, 2.52]

P, Point Estimate; CI, Confidence Interval

Least insecure (control); moderately and most insecure (intervention) group of provinces

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

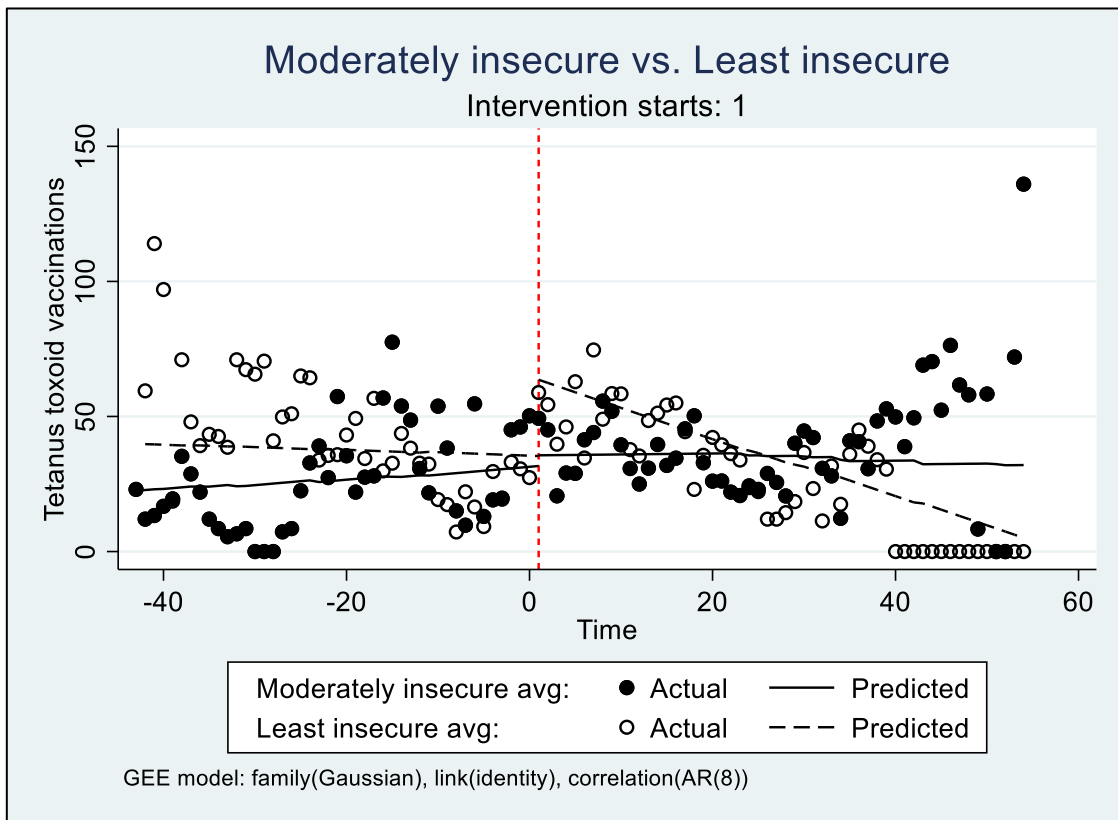


Figure 4.31: Multiple group analysis comparing trends of tetanus toxoid vaccinations – moderate vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.8). Lag 8 was accounted for in the final model, presented in this figure.

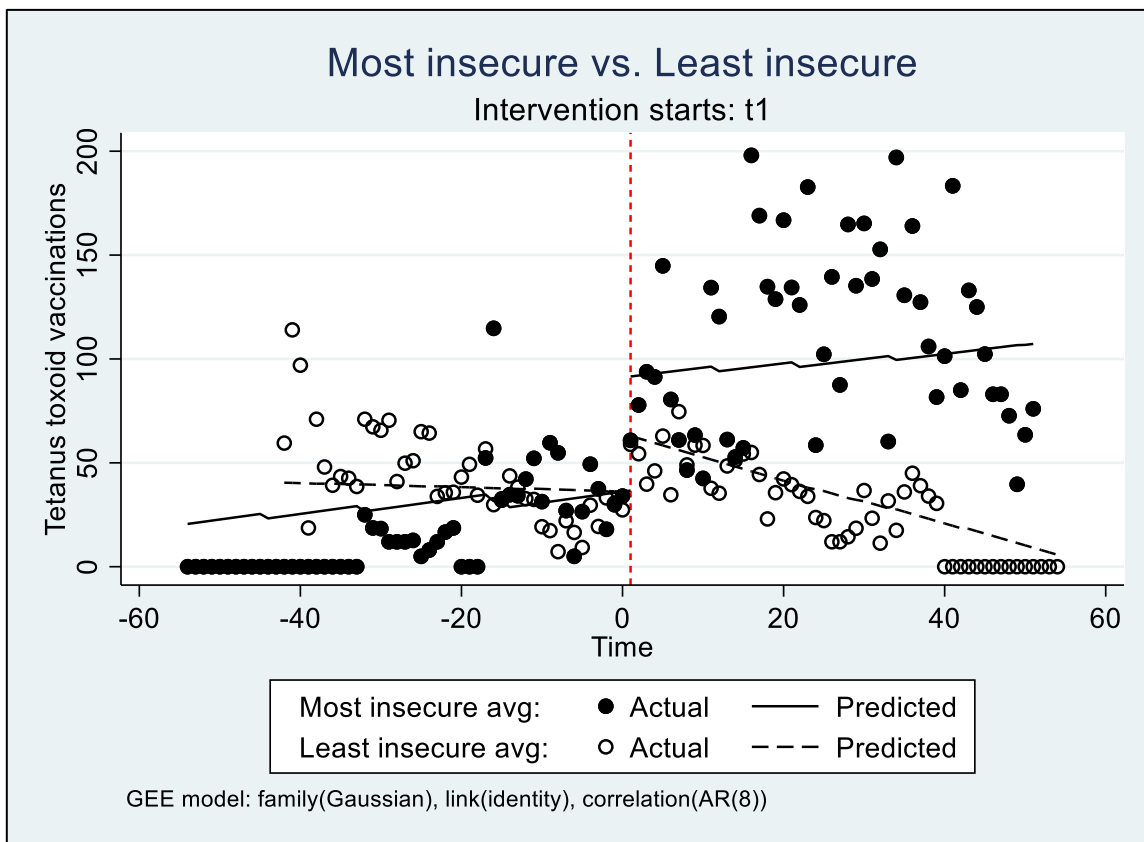


Figure 4.32: Multiple group analysis comparing trends of tetanus toxoid vaccinations - most vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.8). Lag 8 was accounted for in the final model, presented in this figure.

ANC services

Please refer to Table 4.19 and Figures 4.33 to 4.34 to see the details of results from the ITSA analysis assessing the difference in ANC service outcomes before and after the midwife intervention based on the level of security. The outcome was the change in the monthly number of ANC services delivered to pregnant women, controlling for any pre- and post-intervention differences and trends.

Comparing moderately insecure vs least insecure provinces

Pre-intervention period

There was no difference between the two groups at the baseline. A positive trend in the number of monthly ANC services provision was seen for the moderately insecure (0.34 ANC services per month) and least insecure provinces (0.32 ANC services per month), but the trend was only significant for the latter group. No difference was seen in the slopes of the two groups, Figure 4.33.

Post-intervention period

Initially, there was a higher number of services observed in moderately insecure provinces (5.89) compared to the least insecure group immediately after the start of the intervention, but this was not a statistically significant change. There was a monthly increase of 0.38 ANC services in the moderately insecure province during the post-intervention period which was not statistically significant. There was a statistically significant decrease in the number of ANC services ($P = -0.54$, CI: -1.03, -0.06) in the least insecure provinces following the post-intervention period. The difference in the slopes between the two groups showed a positive trend (0.92), which was not significant, Figure 4.33.

Pre-post difference

After controlling for the pre-post intervention levels and trends, a monthly increase in the number of ANC services by 0.92 after the introduction of the midwives in the ARCS-MHTs was seen, but was not found to be statistically significant.

Comparing most insecure vs least insecure provinces

Pre-intervention period

On average, the most insecure provinces had 11.32 fewer ANC services at the start of the study compared to the least insecure provinces. The number of services increased by 0.96 per month in the moderately insecure province in the pre-intervention period but this trend was not significant. A significant trend was however, observed in the least insecure group of provinces before the start of the intervention, with a monthly increase of 0.42 (CI: 0.05, 0.78) ANC services. No difference was seen in the slopes of the two groups, Figure 4.34.

Post-intervention period

The most insecure provinces saw an increase of 47.56 ANC services on average, immediately after the introduction of the midwives in the ARCS-MHTs. The positive trend continued in the post intervention period for the most insecure group with an increase of 0.33 services per month, but this was not significant. There was a significant decrease in the monthly number of ANC services provided ($P = -0.52$, CI: -1.02, -0.01) in the least insecure provinces in the post-intervention period. The difference in the slopes between the two groups showed a positive trend (0.35), which was not significant, Figure 4.34.

Pre-post difference

The intervention resulted in a slight and sustained monthly increase of 0.35 services per month in the most insecure provinces, but this increase was not significant.

Our results showed that there was a marginal increase in ANC service delivery in moderate and most insecure groups after the introduction of midwives in ARCS-MHTs, however since this change was not significant, therefore could not be attributed to the presence of midwives in the MHTs.

Table 4.19: Differences in ANC services outcomes based on the levels of insecurity

Measure of interest	Model parameter	Moderate versus Least insecure		Most versus Least insecure	
		P	[95% CI]	P	[95% CI]
Pre-intervention period					
Difference between intervention versus control prior to start of the study (baseline difference)	β_4	1.97	[-5.27, 9.22]	-11.32	[-24.5, 1.86]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	0.34	[-0.17, 0.85]	0.96	[-0.02, 1.94]
Pre-intervention trend: control group	β_1	0.32*	[0.02, 0.63]	0.42*	[0.05, 0.78]
Difference in preintervention slope: intervention versus control groups	β_5	0.002	[-0.59, 0.59]	0.49	[-0.47, 1.45]
Post-intervention period					
Difference between intervention versus control groups immediately after intervention	β_6	5.89	[-21.97, 33.75]	47.56	[-25.67, 120.78]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.38	[-0.62, 1.38]	0.33	[-1.62, 2.28]
Post-intervention trend: control group	$\beta_1 + \beta_3$	-0.54*	[-1.03, -0.06]	-0.52*	[-1.02, -0.01]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	0.92	[-0.19, 2.03]	0.85	[-1.17, 2.86]
Difference pre versus post intervention: intervention versus control groups	β_7	0.92	[-0.23, 2.07]	0.35	[-1.85, 2.56]

P, Point Estimate; CI, Confidence Interval

Least insecure (control); moderately and most insecure (intervention) group of provinces

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

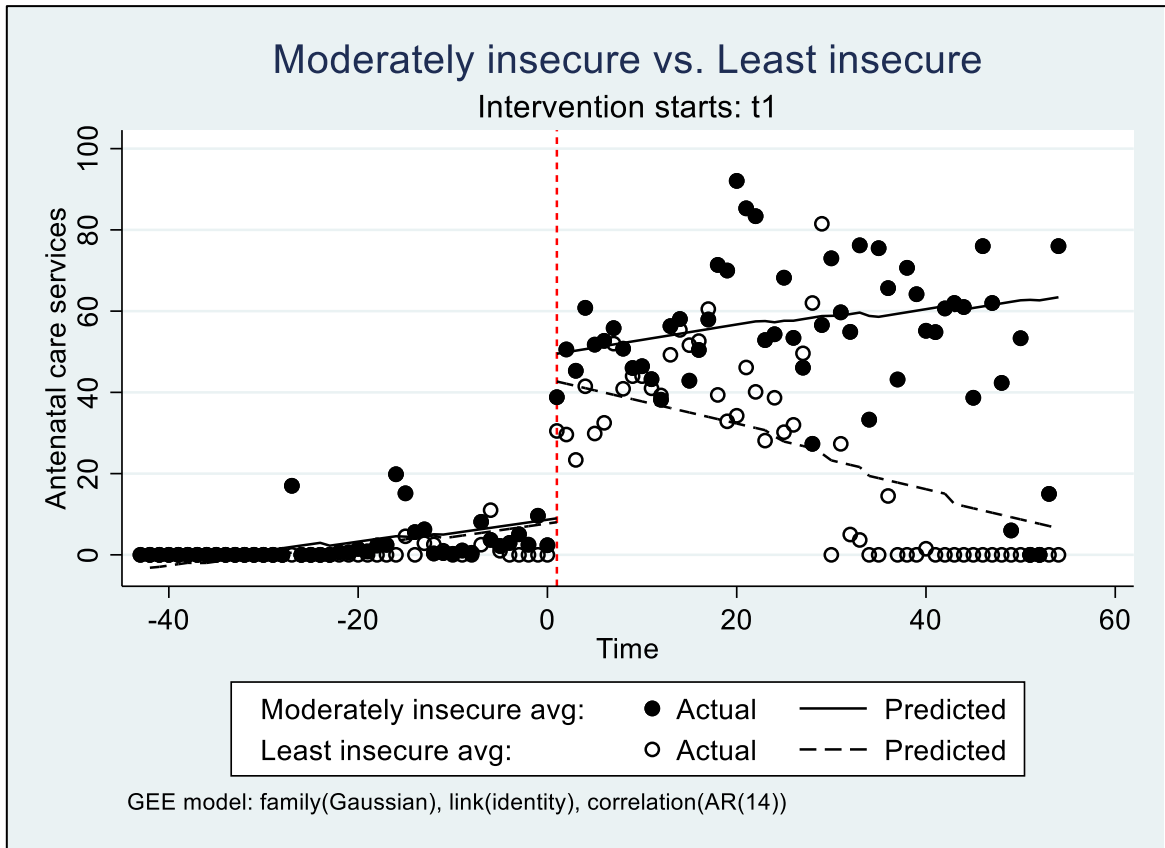


Figure 4.33: Multiple group analysis comparing trends of ANC services - moderate vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 14 (Appendix 4.8). Lag 14 was accounted for in the final model, presented in this figure.

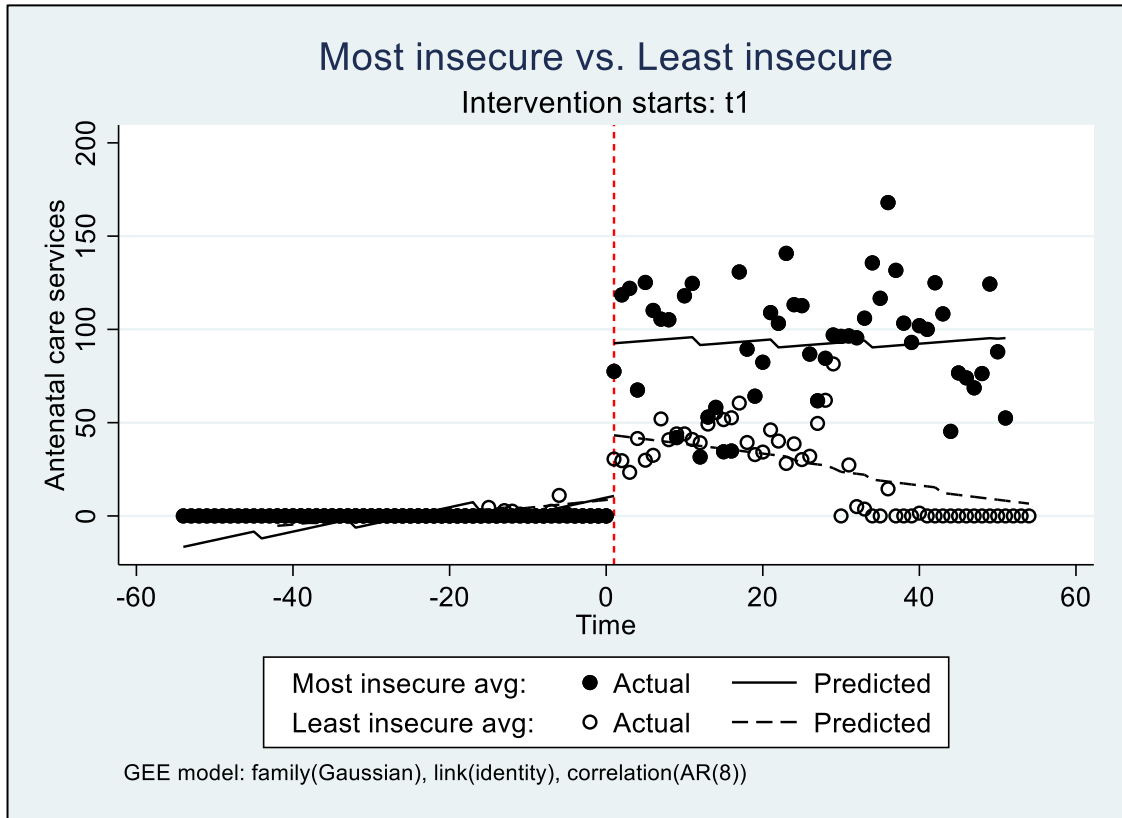


Figure 4.34: Multiple group analysis comparing trends of ANC services - most vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.8). Lag 8 was accounted for in the final model, presented in this figure.

PNC services

Please refer to Table 4.20 and Figures 4.35 to 4.36 to see the details of results from the ITSA analysis assessing the difference in PNC service outcomes before and after the midwife intervention based on the level of security. The outcome was the change in the monthly number of PNC services delivered to post-pregnant women, controlling for any pre-and post-intervention differences and trends.

Comparing moderately insecure vs least insecure provinces

Pre-intervention period

There was no difference observed between the moderately and least insecure provinces in the number of PNC services delivered at baseline and during the pre-intervention period, Figure 4.35.

Post-intervention period

Immediately after the midwives were introduced there was an average decrease of 4.63 PNC services in the moderately insecure provinces, along with a slight positive trend (0.05) in the PNC services delivered per month; both findings were not statistically significant. There was a statistically significant decrease in the number of monthly PNC services delivered in the least insecure group of provinces ($P=-0.52$, CI: -0.88, -0.17).

The difference in the slopes between the two group of provinces showed that the ARCS-MHTs in the moderately insecure provinces were delivering 0.57 more PNC services per month compared to the least insecure group, this difference however was not found to be statistically significant, Figure 4.35.

Pre-post difference

After the introduction of midwives and adjusting for the pre-and post-intervention levels and trends, there was a sustained increase of 0.59 PNC services per month in moderately insecure provinces; however, the increase was not statistically significant.

Comparing most insecure vs least insecure provinces

Pre-intervention period

There was no difference observed between the most and least insecure provinces in the number of PNC services delivered at start of the study or the trends during the pre-intervention period, Figure 4.36.

Post-intervention period

There was a decrease of 6.54 PNC services, on average, in most insecure provinces immediately after the introduction of midwives, but this was not statistically significant. However, the slope was positive and significant, indicating that the monthly services increased by 0.76 (CI: 0.31, 1.22) . In contrast, there was a significant monthly decrease of 0.48 PNC services (CI: -0.82, -0.13) in the least insecure provinces during the post-intervention period.

There was a significant difference between the slopes of the two groups, indicating that the monthly rate of increase in ANC services was higher in the most insecure group of provinces (P=1.24, CI: 0.67,1.81). Figure 4.36 shows this increase in slope in the most insecure group of provinces in the post-intervention period.

Pre-post difference

The results showed that after controlling for the pre-post-intervention levels and trends, the introduction of midwives in ARCS-MHTs resulted in a significant and sustained monthly increase of 1.29 ANC services (CI:0.72, 1.88) per month in most insecure provinces.

In summary, the introduction of midwives impacted the delivery of PNC services in most insecure provinces. There was an increase in the PNC services after the intervention in the moderately insecure provinces; however, this increase was not associated with the intervention.

Table 4.20: Differences in PNC services outcomes based on the levels of insecurity

Measure of interest	Model parameter	Moderate versus Least insecure		Most versus Least insecure	
		P	[95% CI]	P	[95% CI]
Pre-intervention period					
Difference between intervention versus control prior to start of the study (baseline difference)	β_4	2.61	[-3.74, 8.96]	1.54	[-6.47, 9.54]
Pre-intervention trend: intervention group	$\beta_5 + \beta_1$	0.01	[-0.27, 0.29]	-0.01	[-0.43, 0.42]
Pre-intervention trend: control group	β_1	0.04	[-0.22, 0.3]	0.05	[-0.14, 0.23]
Difference in preintervention slope: intervention versus control groups	β_5	-0.02	[-0.39, 0.36]	-0.06	[-0.51, 0.39]
Post-intervention period					
Difference between intervention versus control groups immediately after intervention	β_6	-4.63	[-23.79, 14.52]	-6.54	[-22.76, 9.68]
Post-intervention trend: intervention group	$\beta_1 + \beta_3 + \beta_5 + \beta_7$	0.05	[-0.54, 0.64]	0.76**	[0.31, 1.22]
Post-intervention trend: control group	$\beta_1 + \beta_3$	-0.52**	[-0.88, -0.17]	-0.48**	[-0.82, -0.13]
Difference post-intervention slope: intervention versus control groups	$\beta_5 + \beta_7$	0.57	[-0.12, 1.26]	1.24**	[0.67, 1.81]
Difference pre versus post intervention: intervention versus control groups	β_7	0.59	[-0.01, 1.19]	1.29**	[0.72, 1.88]

P, Point Estimate; CI, Confidence Interval

Least insecure (control); moderately and most insecure (intervention) group of provinces

Before introduction of midwives (pre-intervention period) vs after introduction of midwives (post-intervention period)

* p<0.05; **p<0.01

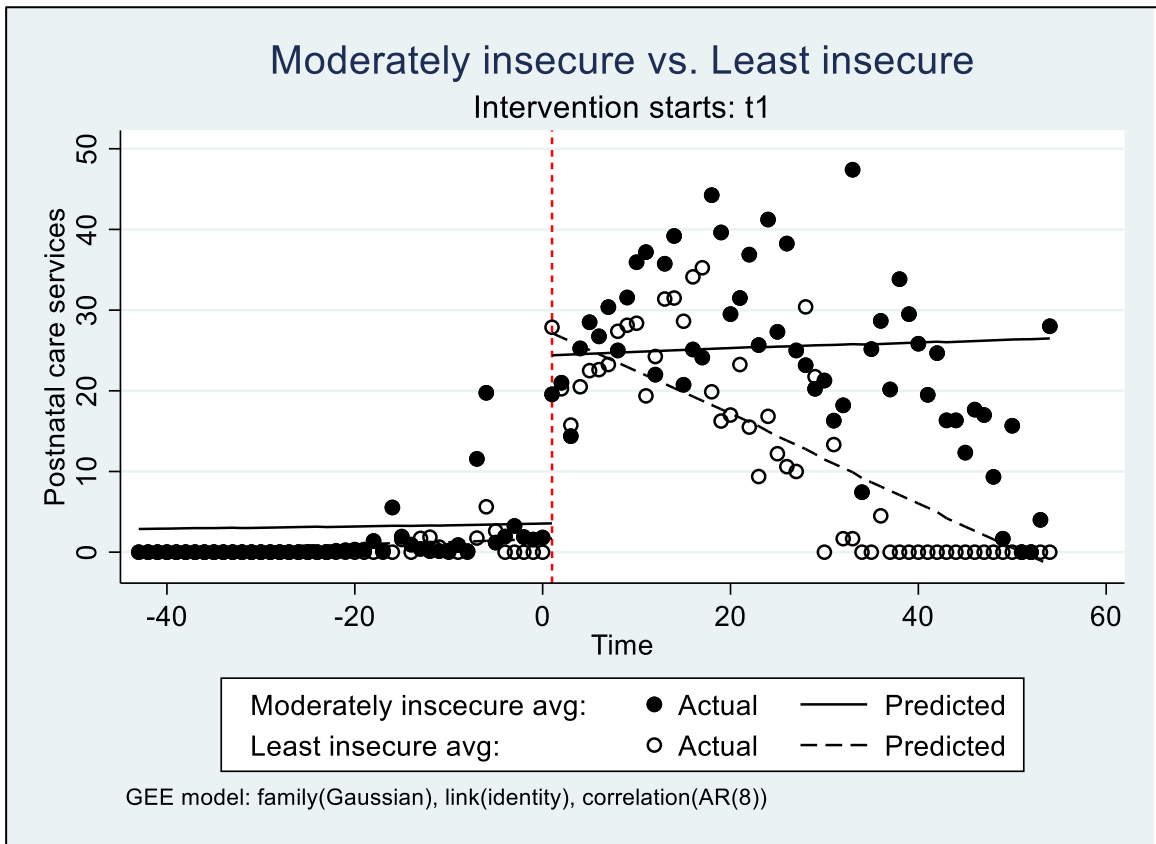


Figure 4.35: Multiple group analysis comparing trends of PNC services - moderate vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 8 (Appendix 4.8). Lag 8 was accounted for in the final model, presented in this figure.

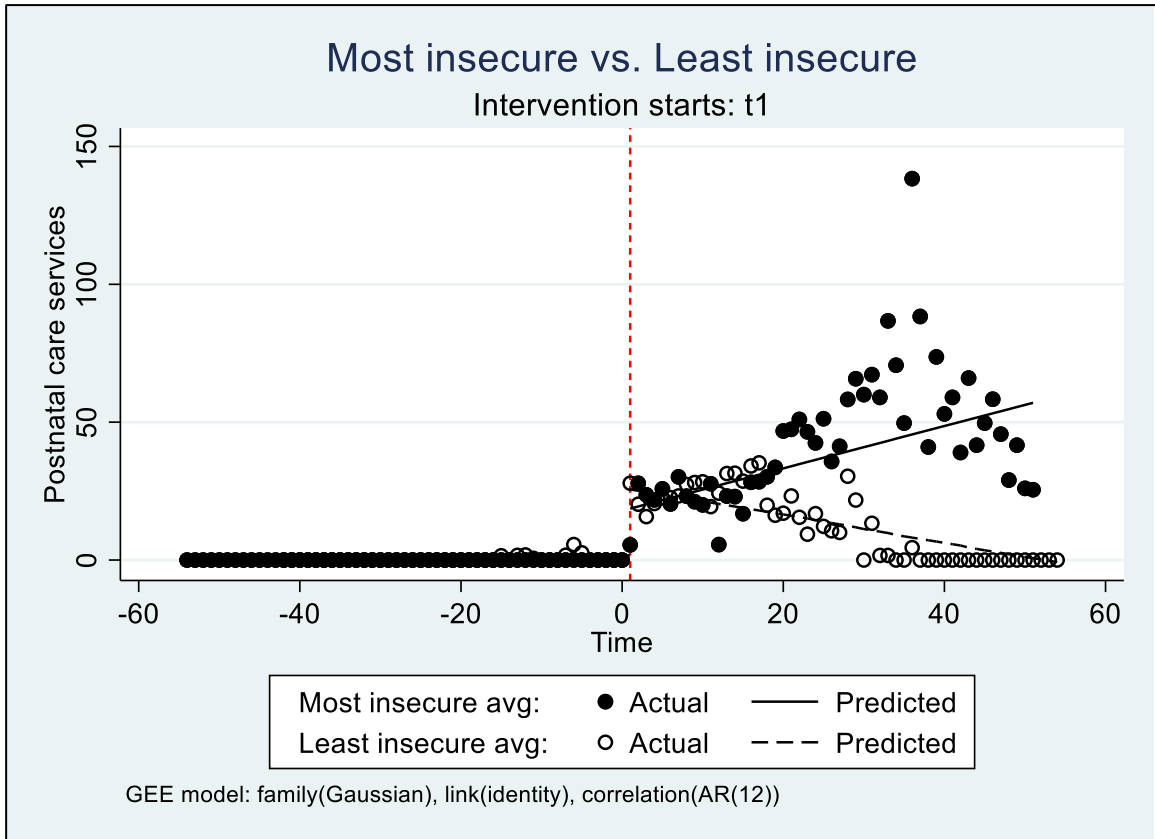


Figure 4.36: Multiple group analysis comparing trends of PNC services - most vs. least insecure provinces

Note: The model was fit after testing for autocorrelation. Autocorrelation was present up to lag 12 (Appendix 4.8). Lag 12 was accounted for in the final model, presented in this figure.

Chapter 5

Discussion

Afghanistan witnessed significant advancements in health, development, and access to vital services over the two decades before the Taliban's resurgence in 2021, with notable reductions in maternal and child mortality rates, improvements in education, and increased political participation by women.¹⁷⁵ These gains were supported by substantial international aid. However, following the withdrawal of US troops and ensuing political upheaval, the country has plunged into uncertainty, facing reduced international support, financial crises, and a humanitarian emergency. Afghan women and children are particularly vulnerable, with escalating maternal mortality, decreased access to healthcare, and widespread food insecurity. Additionally, education restrictions and gender-based barriers further exacerbate challenges, necessitating urgent action from both national and international actors to address these multifaceted crises through measures such as easing sanctions, reinstating development funding, and ensuring continued access to essential health services.^{175,176}

Many of the interventions associated with the domains described in the preceding section can be considered as efforts to support health systems, with the ultimate goal of reducing the fragility of these systems. For instance, measures such as strengthening the health workforce through enhancing the quality of care and implementing practical planning to reduce inefficiency and reactivity have been put forth. However, the pivotal question is whether these interventions succeed in real-world scenarios. Only when they prove effective can we assume that the fragility of health systems will diminish.

The fragility of health systems in Afghanistan has been a focal point of intervention efforts. Measures aimed at strengthening the health workforce and enhancing care quality have been implemented, yet their effectiveness in real-world scenarios remains uncertain. Examining the role of Female Healthcare Workers in ARCS-MHTs provides insights into their impact on mitigating health system fragility, particularly in hard-to-reach areas

affected by conflict and isolation. Examining disparities in the observed outcomes aids in comprehending the potential alterations in the fragility of health systems.

This chapter presents a discussion based on the findings. We will begin by providing a detailed examination of the results for each question separately. Subsequently, we will delve into an exploration of the strengths and limitations inherent in this study. To conclude, we will offer recommendations for future research and discuss the implications of our findings for the broader field.

5.1 RQ1-What is the conceptual understanding of the fragility of health systems and its relationship with resilience, and how can it be applied in Afghanistan?

The findings from our first research question revealed the seven primary domains and thirty-three sub-domains that frame health system fragility. Additionally, our research uncovered the complexity of the relationship between health system fragility and resilience. Some perspectives suggest that fragility and resilience represent separate attributes, with fragility associated more with the long-term character of a system and resilience as a response-oriented attribute. On the other hand, an alternative viewpoint posits that these attributes exist along a continuum, representing opposing ends. Furthermore, our investigation highlighted that the fragility of health systems and their associated domains are context-dependent, with varying significance and strengths in different settings, such as within the context of Afghanistan. The detailed insights derived from our research results are elaborated upon in this section.

5.1.1 RQ 1.1- What is fragility of health systems?

Our research uncovered seven distinct domains that play pivotal roles in the fragility of health systems. The depiction of the health systems' fragility framework, featuring distinct domains and sub-domains, is illustrated in Figure 4.6. Health systems that exhibit one or more of the identified domains—unsustainability, reactivity, inflexibility, unresponsiveness, fragmentation, uncertainty, or inefficiency—contribute to the fragility

of health systems. It is essential to note that the significance of these domains varies depending on the specific contextual factors influencing how these systems operate.

All identified domains in our analysis received a preliminary mean ranking score exceeding 75 out of a maximum score of 100ⁿ and were initially clustered together. Subsequently, in developing an agreement to finalize the framework for the fragility of health systems, participants demonstrated robust consensus, exceeding 75%, in four identified domains, while consensus among participants was less than 75% for three other domains. Similarly, the consensus levels for the sub-domains revealed variability, as visualized in Figure 4.6.

The four domains, unsustainable, reactive, inflexible, and unresponsive, exhibited high consensus in their critical association with the fragility of health systems, as depicted in Figure 4.6. Unsustainability emerged as the top-ranked domain, garnering significant agreement among participants and solidifying its close connection to the fragility of health systems. Despite being ranked lower, reactive remained closely clustered with higher consensus on its critical role in fragility. Similarly, domains like inflexible and unresponsive, positioned in the middle of the ranking list, garnered substantial consensus among participants, establishing them as domains with a high consensus on their relevance to fragility.

The three domains, fragmented, uncertain, and inefficient, showed lower consensus in their critical association with the fragility of health systems. Fragmented, positioned in the middle of the ranking, had variable consensus, leading to a lower agreement among participants regarding its link to fragility. Although uncertainty and inefficiency were initially ranked higher, there was a lower consensus on their relationship with fragility, even though one participant suggested a higher ranking for uncertainty. It is crucial to reiterate that the criticality of these domains concerning fragility can be highly contextually dependent, as demonstrated in later findings when applying this framework to health systems in Afghanistan.

ⁿ A score of 100 indicates absolute criticality to health system fragility, while a score of 0 signifies no critical impact on health system fragility.

While the notion of fragility in health systems has gained considerable attention, especially in the aftermath of the COVID-19 pandemic,⁹ the existing discourse predominantly revolves around linking fragility to contextual vulnerabilities. These contextual vulnerabilities encompass stressors including economic, political, and security factors, the crucial aspect of governance and emphasis on the significance of community trust.⁹ Furthermore, efforts in evidence generation regarding establishing an understanding of the fragility of health systems have been focused on thematic areas such as transition and sustainability, resilience and fragility, gender and equity, accessibility, capacity building, actors and accountability, community engagement, healthcare delivery, health workforce, and health financing.²⁸ Despite these efforts, understanding the specific attributes contributing to health system fragility, as elucidated by the framework in this research, is essential for implementing contextually relevant policy changes within these systems.

Scholars have examined how weaknesses and vulnerabilities within health systems can limit their effectiveness. For instance, Mills conducted a study that explored various constraints within the system, such as those related to community engagement, service delivery, policy formulation, government approach, and the political environment. These factors collectively contribute to system weaknesses. Mills employed a financial perspective to develop long-term plans and strategies to address these issues.¹⁷⁷ Others like Diaconu et al., through their scoping review, identified a framework of how fragility is perceived in the global health context.⁹ The review gives an overview of how fragility is identified in the global health context and lays out some of the stressors, referents labelled as health systems, population and community level contexts and the level of understanding of fragility at a regional or national level. The review offers a comprehensive perspective on how contextual fragility influences health systems, as described in global health literature. However, it does not thoroughly understand what it truly means for health systems to exhibit fragility.

Our findings addressed the literature gap by elucidating the specific domains that characterize health system fragility. This section below will discuss each domain outlined in the revealed fragility framework (Figure 4.6). While our primary research emphasis centered on exploring health system fragility, it is noteworthy that we encountered

comparable findings within the existing literature despite the literature not explicitly focusing on health systems' fragility. These findings from the literature were particularly drawn from health systems operating in fragile contexts, where fragility stemmed from economic (low and middle-income countries) or contextual factors, such as conflict-affected regions or areas impacted by natural disasters.

1. Unsustainable

Our research identified that one of the most critical pathways to health systems fragility is through lack of sustainability or when systems cannot maintain their functions due to various factors. The sub-domains contributing to fragility by making systems unstable include disruptive forces on the system, lack of resources, unstable partnerships, lack of ownership and lack of localization.

Disruptions such as conflicts, economic crises, pandemics, and natural disasters can exacerbate gaps in sustainability. Furthermore, these events exacerbate fragility by interrupting services and leaving underserved areas even more vulnerable. These occurrences can overwhelm the existing structures, exposing vulnerabilities and straining the capacity to provide adequate healthcare. Conflicts disrupt healthcare infrastructure and supply chains, while natural disasters pose immediate threats to the accessibility and functionality of health facilities.¹³ Pandemics, such as the recent global experience with COVID-19, not only place immense pressure on healthcare resources but also highlight systemic weaknesses.¹⁷⁸

Our results showed that insufficient resources, including human resources, strain health systems and lead to fragility. Economic challenges, the migration of health professionals, and inadequate compensation contribute to the instability of systems, rendering them unsustainable and fragile. These findings can be corroborated with examples from literature. For example, it is known that the concentration of human resources on health is essential to improve outcomes, especially maternal and childhood mortality in lower and middle-income countries.¹⁷⁹ Although Witter et al. were not able to find strong empirical evidence when examining the linkage between state-building and human resources in Afghanistan, Burundi, and Timor-Leste,¹⁰ several studies posited that lack of resources, especially maldistribution of health workforce due to economic considerations is a major

challenge, especially for the continuation of routine delivery of health services.^{180,181,182,183} Examining the scenario in Southeast Asia, Kanchanachitra et al. discovered that resource scarcity, particularly in rural settings, persisted, driven by healthcare professionals migrating to more economically promising regions.¹⁸⁰ Additionally, a noticeable gap was identified between the capacity to produce healthcare providers and their actual employment.¹⁸⁰ Mills also reiterated that the emigration of doctors and nurses to higher-income countries contributes to health system constraints.¹⁷⁷

Another sub-domain contributing to unsustainability was unstable partnerships. Overuse or underutilization of partnerships undermines the sustainability of health systems. Proper utilization of private sector resources and public-private partnerships are crucial for effective response during crises and long-term stability. Gooding et al.¹⁸⁴ emphasized in a report that overuse or underutilization of partnerships can compromise the effectiveness and resilience of health systems. Unstable partnerships may result in dependencies, inefficiencies, and a reduced capacity to respond to evolving challenges. In contrast, fostering proper and sustainable partnerships is crucial for mitigating fragility. Our findings highlight that effective coordination involves inclusive collaboration with diverse stakeholders, clear structural frameworks, organizational capacity building, and high-level political leadership. Establishing and maintaining such robust partnerships bolsters health systems' preparedness and response capabilities and contributes to their overall stability, reducing the risk of fragility.¹⁸⁴

Although there was low consensus for this sub-domain, a crucial contributor to unsustainability, nonetheless, was the lack of ownership of health services by governments, policymakers, and communities. We found similar findings regarding local empowerment to enhance ownership and improve the sustainability of health systems in the literature on health systems in fragile contexts; for example, empowering local governments through devolution of power and decentralization of services so that locals can engage with the systems has been known to improve the responsiveness and sustainability of health systems.^{185,186,187,188} Witter et al. studied health systems reform implementation in Bangladesh, Burkina Faso, Cambodia, Ethiopia, Georgia, Nepal, Rwanda and the Solomon

Islands; they concluded that the uptake of policies was mainly driven by local politics and economic realities and highlighted the impact of local actors influencing health systems.¹⁸⁹

In addition to the lack of ownership, another sub-domain closely linked was the lack of localization. Underpinning both these sub-domains was a lack of trust by the communities and relevant stakeholders. Lack of commitment and community distrust further exacerbates fragility. Engagement of local stakeholders is essential for sustainability. Diverse perspectives and inclusivity among various groups ensure that services are relevant and enduring. Diaconu et al., in their scoping review of the relationship between fragility and health systems, observed that community trust was central to this relationship.⁹ Similar to our study, trust influences health-seeking behaviours and improves service utilization. Martineau et al. further underscored the pivotal role of communities in revitalizing health systems within such challenging contexts, especially after crises and disruption to health systems and service delivery.¹³

2. Reactive

Our results showed that health systems' fragility is rooted in their reactive responses to crises, stemming from inadequate long-term planning and failure to establish pragmatic priorities. Insufficient attention to well-structured, strategic, long-term plans leaves systems unprepared and prone to knee-jerk reactions, exemplified by the absence of human resource projections and career development frameworks. This lack of foresight hampers gradual, sustainable progress. Similarly, disregard for priority setting exacerbates fragility, leading to inequitable resource distribution. This neglect of resource allocation priorities perpetuates an approach focused on immediate life-saving measures while sidelining systemic improvement efforts, culminating in heightened health system fragility.

Consistent with our observations, Martineau et al.,¹³ observed in their assessment of rebuilding health systems in conflict and crisis-affected contexts that interventions and programs in response to those crises are often short-term and do not contribute to strengthening the systems. Newbrander et al.,¹⁹⁰ also emphasized setting priorities early and the importance of transitioning from crisis to long-term planning as key to rebuilding and strengthening health systems in fragile states.

3. Inflexible

The susceptibility of health systems to fragility becomes pronounced when they cannot evolve, resulting in inflexibility. Our study's findings highlight the crucial significance of adaptability and agility, while the absence of these traits contributes to the fragility of health systems. Health systems face fragility when they falter in anticipating the needs of their populations or exhibit prolonged response times, emphasizing the importance of foresight and timely action. The ability to anticipate, followed by swiftly responding to stressors by relying on evidence-driven approaches, coupled with a continuous commitment to learning and improvement, is integral to maintaining strength and effectiveness. In the absence of these qualities, the risk of fragility escalates.

Diaconu et al., in their review, discovered that the perception of health systems' fragility is also associated with the system's inability to adapt and learn from historical, political and personal perspectives.⁹ On the other hand, systems that engage in adaptive practices fare much better in improving outcomes, as evidenced by a case study of two communities in Brazil, which also showed that using adaptive approaches to improve traditional health systems over time resulted in improved access.¹⁹¹ The imperative for adapting the health system has gained importance in the aftermath of the COVID-19 pandemic.¹⁹² Systems that exhibited agility in adjusting their services emerged stronger in response to their response to the pandemic.^{192,193}

Another area where the body of evidence on health system strengthening has been steadily growing pertains to the critical role of learning health systems contributing to the adaptability and agility of health systems;^{11,194,195} countries cannot advance toward achieving health system goals without establishing robust mechanisms for continuous learning.¹⁹⁶ Kabir¹⁹⁵ has provided a framework that empowers health systems by aligning them more closely with their articulated missions and values, advocating for dynamic and collaborative learning approaches to strengthen health systems further.

Given the frequent exposure to disasters in many contexts with fragile health systems, proactive disaster anticipation has gained recognition as a crucial strategy. Ensuring

readiness and adaptability, health systems now emphasize the capacity to anticipate and scale up foresight to respond to changes effectively.^{184,197}

4. Unresponsive

Health systems exhibit fragility when they fail to be responsive. Unresponsiveness signifies a state in which these systems lack awareness regarding the needs of the population they are intended to serve, rendering them incapable of adequately meeting those needs. The WHO defined responsiveness of health systems as ensuring legitimate population expectations for the non-health improving dimensions of the health systems.¹⁹⁸ Our research findings have revealed facets of the domain of unresponsiveness that resonate with broader concepts and definitions documented in the existing literature.^{198,199,200} Specifically, we observed that when genuine needs remain unaddressed, systems cannot adequately cater to those requirements. Vulnerabilities arise when health systems lack the capacity to address routine and urgent needs and unforeseen emergencies. Systems become unresponsive when governmental bodies struggle to provide essential services due to resource limitations and a lack of capability and readiness to procure services from diverse sources.

These aspects collectively influence the system's overall preparedness to deliver healthcare effectively. The lack of alignment between supply and demand, be it in terms of medical personnel or essential resources, emerged as a critical facet that culminates in the fragility of these systems. Fragility is intricately linked to a system's level of preparedness in the face of external shocks, which underscores the significance of being well-prepared when confronting emergencies.

Our findings revealed that systems are unresponsive when not meeting their population's needs. A similar understanding was found in the literature, but more in describing health systems responsiveness. De Silva¹⁹⁹ focused on using a people-centred approach and defined responsiveness in the context of a system as “the outcome that can be achieved when institutions and institutional relationships are designed in such a way that they are cognizant and respond appropriately to the universally legitimate expectations of individuals.” Valentine et al.,²⁰⁰ built upon the work on responsiveness to include the

environment in which patients are treated and the aspects related to how individuals are treated.

Furthermore, our findings highlighted the repercussions of disregarding sociocultural dimensions within health systems, resulting in a loss of responsiveness and subsequent fragility. Engaging with diverse stakeholders, including community leaders and representatives, is essential to ensure the cultural relevance of programming and facilitate the sensitive delivery of services without creating unintended repercussions. Diaconu et al.⁹ identified a lack of cultural norms in designing health programs and services as one of the issues at the ‘core of fragile interaction’ within the health system.

5. Fragmented

While the consensus regarding the fragility of health systems in the sub-domains of fragmentation was on the lower end, noteworthy insights emerged that underscore the contributions of fragmentation to the fragility of health systems. Our findings suggest that the fragmentation of systems that results from having either a dearth of services without adequate standards or a proliferation of unregulated services leads to the fragility of health systems. Lack of oversight and insufficient supervision in communities; lack of linkages, underscoring the importance of interconnectedness between supporting systems to counteract fragmentation and promote system-wide coherence; and lack of standardization, spotlighting the pivotal role of national standards in ensuring streamlined and effective system operations result in fragmentation of services. Political complexities often contribute to a fractured and less cohesive health system. Lastly, the emergence of "informal systems" showcased how communities adapt to address the void left by fragmented formal health services.

Hill et al.,¹² examined health systems in six fragile contexts and studied the emergence of networks by the void left in service delivery by the government or state actors. In addition to the challenges of unreliable and disrupted access and health-seeking behaviours across borders, they observed the ‘opportunistic growth’ of multiple actors, including the private sector, family-based networks, and local and international charitable organizations. Although there are examples from Mogadishu and East Jerusalem where the systems organize themselves to ensure comprehensive access to populations, without oversight,

systems remain burdened. In the wake of the COVID-19 pandemic, there has been a stronger emphasis on adapting publicly financed universal health coverage systems to strengthen health systems.³⁴

6. Uncertain

Our findings revealed that health systems become fragile due to factors stemming from both external and internal uncertainties. Governance emerged as a critical factor for health system stability and functionality. Leadership is essential in securing resources, negotiating with controlling entities, and addressing gaps. Corruption and nepotism weaken governance, thereby intensifying the fragility of health systems. Donor reliance is another significant contributor to fragility, particularly in relation to fostering uncertainty. The inflexible allocation of funds to specific projects hinders adaptability and heightens the overall sense of uncertainty.

Moreover, health system fragility is linked to vulnerability and has the potential for swift collapse, emphasizing security's significance in preventing such scenarios. Uncertainty is impacted by insecurity, the interdependence of health systems with external factors, gender unresponsiveness, and the contribution of recurrent natural disasters.

A growing body of literature has explored health system governance, from developing frameworks to identifying pathways to strengthening health systems by focusing on governance.^{187,188, 60} While specific instances of success in global health can be identified, the wider panorama of global health governance underscores the embedded challenges, especially for low and middle-income countries, which in turn contribute to weaknesses in health systems. These challenges, in turn, cast a shadow of uncertainty over the operational efficacy of health systems. These issues encompass donor dependence, insufficient coordination, the prioritization of national and organizational self-interest, inadequate involvement of aid recipients and intended beneficiaries, lack of accountability, bureaucracy, weak rule of law and enforceability of contracts, political instability and a scarcity of resources.^{177,186,201,202}

Corruption in the health sector undermines governance and has a detrimental impact on health systems.²⁰³ A scoping review of healthcare services in the public sector in South and

Southeast Asia's low- and middle-income countries shows that corruption and weak governance compromise health systems by weakening quality healthcare service delivery.²⁰⁴

The concept of fragility has shown a relationship with contextual vulnerability to violence and insecurity within literature. Security and violence were highlighted as central factors contributing to the fragility of these systems in the scoping review on perceptions of the fragility of health systems.⁹ The presence of insecurity not only introduces unpredictability in the provision of health services but also disrupts the foundational frameworks of funding.¹⁷⁷

Discriminatory social practices lead to lower education among women, impeding access to health services and participation in the delivery of services.²⁰⁵ A scoping review analyzing the participation of women in the health workforce in fragile and conflict-affected areas identified several challenges, including professional hierarchies, gendered socio-cultural norms, and security conditions.²⁰⁶ Citing examples from Afghanistan, Sierra Leone, Timor-Leste, Mozambique, Guinea-Bissau, Zimbabwe, Chad, Cote d'Ivoire, Iraq, Lebanon and Mali; Ayaz et al. highlighted salary disparities, lack of opportunities for growth and leadership, social stigma, pressures from family, political unrest, insecurity and logistical issues such as transportation leading to gender disparities and deterrent for female participation in health sector and system.²⁰⁶

7. Inefficient

According to our findings, fragility can arise from vulnerabilities and gaps within the system that, if left unfilled, diminish its efficiency, leading to a lack of consistent performance. One of the leading causes of inefficiency is the impact of economic challenges and financial instability on the deterioration of health systems. These financial constraints were found to impede the effectiveness of healthcare services directly. For example, constrained budgets can hinder the provision of adequate healthcare and lead to systems that cannot perform consistently.

Lack of proper planning and insurance systems and out-of-pocket expenses impact the most vulnerable, who may need more health services because of socio-demographic

disparities.^{177,188,207,208,209} Rostampour et al., in their systemic review of equity in Healthcare Financing in low and middle-income countries (LMICs), citing work by Kiss et al.,²¹⁰ stated: “*Generally, all financing mechanisms affect the efficiency of healthcare systems and equity in offering services.*”²⁰⁷

Moreover, our findings revealed that inefficiency due to coordination challenges, such as inadequate support for healthcare workers and incomplete operational arrangements, emerged as a critical contributor to health system fragility. This lack of coordination placed undue pressure on secondary and tertiary care systems, further exacerbating fragility. Health systems' inability to sustain functionality based on the World Health Organization's foundational elements, susceptibility to shocks during crises, provision of subpar quality services, inability to meet the needs of its population and insufficient education and training for healthcare providers are all pivotal factors contributing to inefficiency and consequent fragility in health systems.

Poor quality of medical care and health service delivery are the leading causes of mortality and morbidity.²¹¹ Weak technical guidance, program management and supervision also impact service delivery and constrain health systems.¹⁷⁷ Martineau et al. underscored the critical nature of aligning policies with the community's requirements, mainly focusing on those most in need of assistance.¹³

Policy recommendations based on the health systems fragility framework

The domains and sub-domains identified through our identified framework shed light on the underlying issues contributing to the fragility of health systems. Implementing policy changes based on these identified domains and sub-domains, which lead to fragility in specific contexts, can serve as a strategic approach to mitigate these fragility aspects and strengthen health systems. Our findings highlight mutable and immutable policy implications. In the policy realm, "mutable" denotes changeability, allowing for easy alterations or adaptations in response to evolving circumstances. Conversely, "immutable" signifies resistance or difficulty changing, suggesting a structure that remains fixed, less adaptable, or more challenging to modifications.²¹²

Drawing from the fragility of the health systems framework, immutable policy considerations include governance, political complexities, and reducing donor reliance, particularly in acute crises. Governance, vital for stability, demands policies fortifying structures, ensuring transparent leadership, and combating corruption, albeit challenging in fragile contexts. Addressing political challenges, fostering cohesion, and enhancing communication is imperative amid political complexities posing difficulties in altering established health system norms. Reducing donor reliance, crucial for financial stability, faces challenges in fragile contexts marked by economic and political constraints, such as ongoing conflicts.

On the other hand, several policy mutable considerations listed below could serve as recommendations to reduce the fragility of health systems.

1. Policies for empowerment and inclusivity at the local level

Lack of ownership of health services by governments, policymakers, and communities was identified as a contributor to unsustainability. Additionally, a lack of trust by communities and relevant stakeholders and a lack of commitment exacerbates fragility. Engaging with diverse stakeholders, including community leaders and representatives, becomes crucial to ensure the sensitive delivery of services without creating unintended repercussions. Policies play a vital role in addressing various aspects of health system interactions. They should specifically target the absence of cultural norms in designing health programs and services to foster stronger interactions within the health system. Additionally, policies that promote local empowerment through devolution of power and decentralization contribute to enhanced ownership and improvement in health system effectiveness. Recognizing the influence of local actors is crucial for the successful development and implementation of policies. Furthermore, active engagement with local stakeholders is imperative for ensuring sustainability, underscoring the significance of embracing diverse perspectives and inclusivity in policymaking.

2. Policies for long-term planning and agile resource allocation

Health system fragility is rooted in reactive responses to crises, highlighting the importance of long-term planning, exacerbated by a disregard for priority setting, leading to inequitable

resource distribution. Effective policies are instrumental in enhancing health system preparedness and reducing fragility. Encouraging health systems to adopt well-structured, strategic, and long-term plans is paramount. This involves the integration of human resource projections and career development frameworks, ensuring a proactive and sustainable approach. Crucial policies should prioritize pragmatic priority setting, flexible resource allocation, and measures to enhance the health system's adaptability to changing circumstances. Equitable distribution of resources, prevention of sidelining systemic improvement efforts for immediate lifesaving measures and fostering a balanced and sustainable healthcare approach are central to policy considerations.

Additionally, policies must address financial stability through effective resource allocation, tackling constrained budgets, and promoting financial mechanisms to provide adequate healthcare services. Strategies such as optimizing budgetary allocations, flexible fund allocation strategies, allowing for adaptability based on changing needs and priorities and exploring innovative financing models can mitigate the direct impact of financial constraints on healthcare effectiveness.

3. Policies fostering continuous learning and timely action

Our findings identified the importance of continuous learning and timely action in averting fragility. Policies can be designed to promote a culture of learning within health systems, encouraging the adoption of evidence-driven approaches, regular training, and quality improvement initiatives to mitigate the risk of fragility. Additionally, policies may be directed at instilling a proactive approach within health systems, emphasizing anticipating population needs and reducing response times. Strategies could include developing tools, protocols, and training programs that enable swift, evidence-driven responses to potential stressors.

4. Partnership Policies and Public-Private Collaboration

Our findings emphasized the significance of stable partnerships and proper utilization of public-private collaborations for effective crisis response and long-term health system stability. It suggests that overuse or underutilization of partnerships can compromise the resilience of health systems. Policy considerations involve promoting and regulating

public-private partnerships, ensuring transparency, and establishing sustainable collaboration frameworks.

5. Human resource management

Insufficient human resources strain health systems and contribute to fragility. Economic challenges, migration of health professionals, and inadequate compensation were identified as factors destabilizing health systems. Policy implications involve addressing economic incentives, compensation structures, and migration patterns through targeted policies to ensure an adequate and well-distributed healthcare workforce. Policies may involve training programs, resource optimization, and supportive frameworks to strengthen overall coordination within health systems.

6. Policies improving coordination

Inefficiency due to coordination challenges was identified as a contributor to health system fragility. Policies can target improved coordination mechanisms, providing adequate support for healthcare workers and ensuring complete operational arrangements. Enhanced coordination is essential to alleviate pressure on secondary and tertiary care systems, thus reducing fragility.

7. Standardization and oversight

Lack of standardization, oversight and insufficient supervision in communities contributes to the fragmentation of health systems. Additionally, the emergence of "informal systems" as a response to fragmented formal health services underscores the need for policies that recognize and integrate these community-driven initiatives.

To ensure the delivery of high-quality services, policies must establish robust oversight mechanisms and supervision frameworks, incorporating regulatory measures and monitoring systems. Additionally, bridging the gap between formal and informal healthcare structures requires acknowledging community adaptations, with policies exploring ways to leverage these initiatives. Promoting interconnectedness between supporting systems becomes a focus, countering fragmentation and encouraging system-wide coherence. To further address fragmentation, policies should emphasize national

standards, streamlining and enhancing the effectiveness of system operations for a consistent and standardized approach across healthcare services.

8. Security and disaster preparedness

Health system fragility is linked to vulnerability, emphasizing the significance of security in preventing swift collapse. Policies should prioritize security measures within healthcare settings, including disaster preparedness and response plans. This involves ensuring that health systems are equipped to handle external factors and recurrent natural disasters.

5.1.2 RQ 1.2 - What is the relationship between fragility and resilience of health systems?

Our findings reveal a unanimous agreement that no health system worldwide can be categorized as entirely resilient or completely fragile. This shared perspective is substantiated by diverse voices within the discussions, highlighting that only a few health systems globally can adapt and respond to stressors effectively, regardless of their economic standing.

This viewpoint gains further credibility from recognizing that even the more economically and financially stable nations have exhibited vulnerabilities and reduced resilience during the COVID-19 pandemic.²¹³⁻²¹⁶ The prevailing understanding is that no healthcare system is entirely resistant to shocks, and while all systems possess a degree of fragility, the extent varies, with some systems showcasing more fragility than others.^{9,217}

In exploring the relationship between health systems fragility and resilience, our findings revealed a conceptual difference in understanding the fragility of health systems and highlighted that there may be elements of resilience within fragile health systems. Moreover, divergent perspectives emerged regarding whether the fragility and resilience of health systems exist on a unified spectrum. Finally, our findings shed light on the contrasting attributes associated with the opposite end of the fragility spectrum.

1. Conceptual differences between the fragility and resilience of health systems

This study identifies distinct conceptual differences between the concepts of fragility and resilience. The first identified difference was that resilience reflects a health system's capacity to respond during crises, while fragility pertains to the inability of the system to function effectively, even in non-crisis situations or over the long term. This distinction is illustrated through the analogy of a rubber band's ability to bounce back versus its systematic fallibility. Additionally, fragility is linked to regulatory policies and frameworks, with their absence reducing a health system's ability to cope with crises.

The literature on resilience gained traction in the aftermath of the Ebola crisis in West Africa from 2014 to 2016,²¹⁸ when Kruk et al.,⁷ defined resilient health systems as:

"the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, reorganize if conditions require it."

On the other hand, Diaconu et al. recently described the fragility of health systems as being associated not just with the immediate performance but also with the enduring character and functionality of the health system, extending to its long-term interactions with communities. This broader application of fragility considerations encompasses discussions about the vulnerability of populations and underscores a more comprehensive understanding of the sustained challenges within health systems.²¹³

Secondly, our findings revealed that fragility was related to the health system's efficiency and performance in delivering essential services. Resilience, in contrast, was repeatedly tied to preparedness and responsiveness during emergencies or crises. Some participants likened resilience to the ability to absorb shocks and stresses, while efficiency was seen as a marker of fragility, emphasizing the efficient utilization of resources under pressure.

There is an ongoing discourse on the distinctions between Kruk's model of health systems resilience, focusing on crisis management and preparedness, and Diaconu's examination of fragility within the broader health systems; notable variations emerge in the literature. Kruk's emphasis on crisis resilience underscores the importance of proactive measures for effective emergency response, contributing to improved healthcare quality and efficiency.⁷

In contrast, Diaconu's exploration of fragility sheds light on the inherent vulnerabilities within health systems that may impact their long-term functioning.²¹³ These nuanced perspectives reflect an evolving discourse, suggesting a need for a comprehensive understanding of both crisis resilience and fragility to enhance health systems' overall resilience and efficacy.

Lastly, our findings highlighted a crucial distinction regarding the interplay of inequities with health system fragility and resilience. It was noted that resilient health systems have the potential to improve inequities, whereas inequities contribute to the fragility of health systems. Emphasizing the significance of understanding equity-based outcomes in building resilience, a health policy, planning, systems, and services researcher emphasized that a resilient system essentially addresses the social determinants of health, thus impacting equity. Conversely, the impact of other sectors can create an imbalance, leading to fragility in health systems. Diaconu et al.⁹ delved into the perspectives on health system fragility, revealing that contextual crises contribute to health system fragility along with factors like financing, governance, and community and population-level dynamics also revealed as related to the fragility of health systems in our research.

2. Resilience within Fragility

Despite the differences, our participants acknowledged that fragile health systems could also demonstrate resilience in certain aspects, creating a complex dynamic. There are often resilient sub-systems within fragile health systems, indicating that despite a generally fragile context, pockets of resilience could emerge within specific system components.

Furthermore, the findings revealed that crisis response and resource mobilization could bolster resilience even within fragile environments, with examples like the Ebola outbreak demonstrating the role of external support in enhancing resilience. Additionally, innate community resilience can contribute to overall system strength as communities adapt mechanisms to ensure system functionality. This notion of coexisting resilience within fragility highlighted the multifaceted nature of health systems' capacity to respond and adapt.

Expanding on the discussion, Diaconu introduced the concept of human fragility as an additional dimension impacting the overall fragility of health systems.²¹³ This concept, introduced in 2022, recognizes diverse factors influencing the realization of individuals' well-being and potential. Our participants highlighted innate resilience as a factor contributing to the fortification of health systems.²¹³ To illustrate resilience within fragility, we can delve into the example of the Ebola crisis.

Beginning in Guinea in December 2013, the Ebola outbreak quickly spread to Liberia and Sierra Leone, prompting its declaration as an international public health emergency in August 2014. At the outset, the health systems in these countries faced limitations, with critical functions such as qualified health workers, infrastructure, logistics, health information, surveillance, governance, and drug supply systems not performing optimally. This hampered the development of a timely and effective response. Challenges included inadequate numbers of qualified health workers, weak infrastructure, and sub-optimal organization and management of health services, compounded by low government health expenditure and relatively high private out-of-pocket payments.^{219–221} In addition, non-Ebola mortality also increased in the countries.^{219,220} African communities employ communal strategies to address internal challenges, proactively managing crises rather than relying solely on external assistance. By emphasizing the strengths of formal and informal African institutions, researchers have gained insights into adaptive processes that sustain lives and livelihoods, thereby contributing to the resilience of health systems.²²² Meanwhile, the international community was actively addressing the Ebola epidemic in West Africa. While this response may have been temporary and not a long-term solution, it temporarily bolstered the outbreak response aspect of the health system more effectively than in other areas.²²²

3. Fragility and resilience on a spectrum

Our findings revealed a nuanced discussion with diverse perspectives on the relationship between fragility and resilience in health. Some participants saw fragility and resilience as interconnected on the same spectrum; this perspective included views of a matrix-like coexistence. On the contrary, others viewed fragility and resilience as two distinct concepts, asserting that fragility should not be considered the opposite of resilience.

In literature, a more developed comprehension of the 'state' of fragility exists than that of resilience, particularly in economic and political contextual understanding.²²³ Interestingly, the discourse within health systems has delved more comprehensively into 'resilience' than fragility.²⁷ From a health systems perspective, there is an implicit understanding in the literature that fragility and resilience may exist on a spectrum, providing a comprehensive and practical approach to bolstering health and well-being, ensuring resilience, and maintaining health security during crises and recovery phases.²²⁴

Baker, in redefining fragility, acknowledged that the present understanding of the relationship between fragility and resilience remains that they are at the opposite end of the spectrum with similar factors affecting both; however, without an in-depth understanding of what the 'state' of resilience looks like it, the description of the relationship at least from economic and political standpoint remains nuanced.²²³

Manyena and Gordon contribute to this evolving discourse by asserting that fragility results from the breakdown in the social contract between a government and its citizens. Resilience is crucial in mitigating fragility by bolstering preventive, anticipatory, absorptive, and adaptive measures. They advocate for a heightened focus on developing a social transformative capacity as an additional layer of stability to alleviate fragility further.²²⁵

4. The opposite end of the fragility spectrum

So, what lies at the opposite end of fragility, and how does that relate to the resilience of health systems? That was the enigma we tried to solve as we delved deeper into our understanding of the relationship between the two concepts. Stability and anti-fragility were the two concepts that emerged opposite to fragility.

Our findings described stability as a state in which health systems understand their operational requirements, respond effectively to crises, and exhibit adaptability based on lessons learned. This concept received strong agreement from participants, reinforcing the importance of system stability as an essential characteristic. Manyena and Gordon characterized stability as the transformative process and rebuilding as the stability, which, coupled with an adaptive response as resilience, collectively mitigate fragility.²²⁵

Regarding anti-fragility, our findings revealed that it refers to systems or components that not only withstand stress and shocks but also improve and become more potent when exposed to such challenges, something akin to building back better. According to Hillson, anti-fragility represents a more robust response to stressors and the state of fragility when compared to resilience or robustness, yet as the concept is still emerging, it necessitates a more thorough comprehension.²²⁶ Nevertheless, instances within the health systems literature have already referenced anti-fragility as the antithesis of fragility in health systems.^{227,228} Tokalic et al. referenced the healthcare system experiences in Croatia and Bosnia, citing their utilization of the stressors from the protracted war to reconstruct healthcare systems that were not only resilient but also anti-fragile. These systems proved adaptable, supported by a resilient health workforce, as demonstrated through their rapid response to the COVID-19 pandemic.²²⁷ Al-Azri drew insight from Naseem Taleb's concept of anti-fragility and applied it to health systems. The core premise was that anti-fragile systems should endure crises and prosper in adversity. Amid the evolving crisis, healthcare systems have a valuable window to proactively refine their organizational capabilities, turning the challenges into a chance for growth and resilience.²²⁸

Significance of the evolving discourse on health system fragility and resilience

The discussion on the fragility and resilience of health systems is important, as our findings underscore a unanimous agreement that no health system can be entirely categorized as resilient or fragile. This realization holds particular weight in light of the recent global COVID-19 pandemic, where even economically stable nations have exhibited vulnerabilities and reduced resilience.

The nuanced understanding that no healthcare system is entirely resistant to shocks and that the extent of fragility varies, emphasizes the need for a comprehensive approach to health system analysis. The conceptual differences identified in our findings regarding fragility and resilience highlight the complexity of these terms, with fragility associated with a system's long-term functionality and resilience linked to crisis response and adaptability.

The evolving discourse on health systems' resilience and fragility also explores the interplay of inequities, recognizing that resilient health systems have the potential to

improve inequities while inequities contribute to system fragility. The acknowledgement that fragile health systems can demonstrate resilience in certain aspects further complicates this dynamic, emphasizing the multifaceted nature of health systems' capacity to respond and adapt.

Furthermore, exploring the fragility spectrum revealed additional relationships, including stability and anti-fragility. These concepts offer valuable insights for developing health systems that can thrive and adapt in the face of evolving challenges, ultimately contributing to improved health and well-being.

5.1.3 RQ1.3- How is the understanding of the fragility of health systems applied in Afghanistan?

Our study showed that the domains and sub-domains of the fragility of health systems identified through our model (Figure 4.6) contributed to the fragility of the health system in Afghanistan. It is noteworthy that participants were requested to share their viewpoints on the country's health systems before the Taliban assumed control in August 2021. Nonetheless, given that the study's duration extended beyond that period, it is plausible that the perspectives also encompassed the circumstances following the Taliban takeover.

While there were variations in rankings, the consensus regarding the fragility domains of health systems in Afghanistan aligned with the general framework for the fragility of health systems (Figures 4.6 and 4.8). However, an exception emerged in the form of "fragmentation," which obtained a higher ranking in the context of the fragility of the health system in Afghanistan but fell within the lower-ranked group in the general framework for the fragility of health systems.

The domain of fragmentation showed a deviation from the general fragility framework for health systems to its specific application in Afghanistan (Figure 4.8), suggesting a contextual specificity in the role of fragmentation in contributing to the fragility of health systems²²⁹ within the Afghan context. This observation is consistent with existing literature on health systems in Afghanistan, which underscores fragmentation as a significant obstacle, particularly in the delivery of health services, especially in areas affected by conflict.^{12,173,230–233} The literature highlights the association of health systems

financing ^{230,231} and the absence of governmental oversight ²³¹ in Afghanistan with the fragmentation of the delivery of services, putting a strain on health systems.

Within the domain of fragmentation, our findings showed a more pronounced connection between the sub-domain of lack of governmental oversight and the perpetuation of fragmentation, ultimately exacerbating the fragility of health systems. Aligning with Cross et al.'s argument ²³¹, our study underscores the potential impact of fragmentation on health systems in Afghanistan through enhanced government stewardship and oversight. This includes a focused approach to developing robust policy frameworks, establishing institutions, and implementing systems to ensure higher-quality private services. Similarly, Hill et al.,¹² in their discussion on optimizing health service provision in conflict-affected regions, including Afghanistan, highlighted the critical importance of bolstering local capacity and governance. According to Hill et al., the effectiveness of health service delivery in areas marred by conflict hinges on a strategic investment in and empowerment of local entities, particularly those that align with a public-good ethos at the grassroots level.¹²

Another sub-domain with the highest consensus in contributing to the fragility of health systems was weak governance. Despite our findings linking this sub-domain with uncertainty, which, on the whole, garnered low consensus among participants, it is evident that within the specific context of Afghanistan, there was a pronounced unanimity among participants regarding the substantial role played by weak governance in contributing to the fragility of the health system. This indicates a noteworthy contextual emphasis on the impact of governance challenges as a critical factor influencing the fragility of the health system in Afghanistan. Our findings showed that corruption and a lack of leadership impeded the system's effectiveness, though the government had made efforts to improve stewardship. This ranking might stem from the prevailing political circumstances wherein the system remains reactive to ongoing political shifts.^{234,235} Over more than four decades, the country has grappled with profound political instability, exerting a profound impact on governance and various systems, including health systems.^{82,236}

The robustness of governance has been described as a determinant of the effectiveness of health systems, especially in regions grappling with conflict, where governmental capacity, willingness to deliver health services, political legitimacy, and the ability to ensure stability and security are pivotal.¹⁰ A quasi-experimental study conducted in Afghanistan bolstered this connection by revealing that tangible health system improvements ensue when governing bodies are afforded governance reform opportunities.²³⁷ This study not only underscores the critical role of governance in shaping health systems but also highlights the potential positive outcomes that can be achieved through deliberate and strategic governance reforms, particularly in conflict-affected areas like Afghanistan.

Our finding further highlighted other sub-domains contributing to the uncertainty of Afghanistan's health systems through its dependence on donor funding, leaving it vulnerable to collapse if aid is discontinued. Security issues stemming from ongoing conflicts and political diversity within the country's regions contribute to the system's instability and uncertainty. With the temporary pause in international aid after August 2021, there were immediate concerns about a collapse of health systems in the country.^{18,238,239} However, funding for short-term financing commitments, mainly through UN organizations, resumed within six weeks.⁸⁸ There was an initial decline in services by 15% in the first half of 2022 compared to the same period in 2019; a rebound of 7% was later observed.⁸⁸ Although Afghanistan's health system did not collapse after the Taliban takeover, the events (stoppage and resumption of international aid) following August 2021 underscored the dependence of the system on international funding to support the systems.^{88,17}

Our finding reinforced gender unresponsiveness in the delivery of health services, and limited access to care for remote populations due to geographical challenges and cultural factors also contribute to the system's uncertainty. Several studies have reviewed the consequences of gender unresponsiveness on Afghanistan's health systems and service delivery.^{240,241,19,242} An examination of gender equality in Afghan healthcare indicated substantial improvement in rectifying health disparities resulting from the Taliban regime in 2002.²⁴⁰ Despite this progress, the inequality index revealed a 70% deficit in development a decade later, mainly due to the limited involvement of women. Cultural

norms acted as barriers, deterring women from accessing healthcare services, which subsequently led to heightened rates of mortality and morbidity.²⁴⁰

Another study underscored the limited opportunities for women to engage in healthcare delivery.²⁴¹ The Ministry of Public Health (MoPH) in Afghanistan expressed its commitment to address these gender imbalances, albeit with a primary focus on reproductive health, thereby limiting attention to maternal and child health concerns.²⁴³ A scoping review in 2021 revealed that substantial improvements regarding female participation in Afghanistan had increased from 21% to 47% from 2002 to 2016. Despite this increase, the overall proportion of nurses (18%) and doctors (22%) remained low in the country.^{241,243} The need for women to deliver healthcare services is so high that despite a ban on women working, many female health workers have continued their work with international NGOs in the country.¹⁷

Our results showed that Reactive as a domain deemed crucial to the fragility of health systems garnered significant consensus in both the general framework and its specific application to Afghanistan, and an interesting divergence in rankings was observed. The reactive systems domain also emerged as the top-ranked element. This underscores the critical role and impact of reactive systems within the broader framework of health systems fragility, emphasized by the contextual considerations when applied to specific regions, such as Afghanistan.

The discourse within the literature has consistently stressed the importance of moving away from reactive responses to crises and establishing sustainable, long-term programs in Afghanistan.²⁰ Implementing the Basic Package of Healthcare and performance-based partnership agreements was envisioned as a foundational step in fortifying the country's health systems through a more enduring and comprehensive strategy.^{20,244} In principle, these service delivery and financing models offer viable solutions for the country's healthcare needs. However, it is worth noting that these solutions still heavily rely on donor funding and lack inherent sustainability.²⁴⁵ The World Bank's "Sehatmandi program" is a stride towards assisting the vulnerable population and holds promise for addressing the long-term challenges in the country's health systems.²⁴⁶ Nevertheless, the current predicament concerns the uncertainty regarding long-term programming posed by

contracts and agreements with health service partners and local NGOs.²⁴⁵ These hurdles impede the establishment of enduring programs and hinder priority-setting crucial for bolstering the health system – a concern that aligns with the findings of our study.

Inefficiency ranked lower regarding their criticality to the fragility of health systems in Afghanistan, with low consensus among participants. As previously discussed, the country's extensive reliance on foreign aid and funding underscores its financial dependency. The emphasis on financing contributing to inefficiency in our study as a sub-domain could partially be attributed to the ongoing implementation of a pay-for-performance system supported by the World Bank, which currently provides a degree of financial support.²⁴⁶ However, it is essential to recognize that while this initiative contributes to stabilizing partnerships, it does not necessarily guarantee sustainable solutions for the future.²⁴⁵

Other sub-domains identified within the broader domain of inefficiency, as highlighted by our findings, pertain to the notable challenge of systems in Afghanistan falling short of adequately meeting the needs of its population and poor financing. Despite renewed commitments to health system development in the country, considerable challenges persist. The fragility of the health systems is perpetuated by significant out-of-pocket expenses (constituting 76% of total health expenditure) and unaddressed fundamental necessities.²⁴⁷ In 2023, approximately 28.8 million Afghans required health aid, with 14 million individuals, encompassing 7.5 million children and 3.1 million women, specifically targeted for assistance. Additionally, about 8 million Afghans are anticipated to lose access to crucial life-saving health services, compounding the challenges faced by the most vulnerable sectors of the population.²⁴⁷ Furthermore, the imperative for effective coordination with other interconnected systems, including establishing robust knowledge-sharing mechanisms, remains pressing.¹⁰ This is further compounded by poor education and training of health professionals, resulting in poor quality of service delivery.²⁰

Despite extensive endeavors to bolster Afghanistan's health system against disruptions,¹¹⁴ our findings revealed low consensus on the notion that these disruptions contribute significantly to the fragility of health systems in Afghanistan, rendering them unsustainable. Conversely, within the fragility domain, the sub-domain of lack of

ownership garnered higher consensus relative to its impact on the fragility of health systems in Afghanistan. Edward et al. also highlighted the significance of improving acceptance of health service uptake by increasing trust and ownership within communities, linking improved ownership to enhanced governance and strengthening health systems in Afghanistan.²⁴⁸

In Afghanistan's context, the distinctions between fragility and resilience within health systems became evident through various aspects. The contracted-out health provision system emerged as a crisis response, transitioning to a long-term strategy to improve service quality and capacity-building, yet aid dependency contributed to fragility. Health system distribution issues, set up in response to crises, now strive to enhance efficiency and quality—the country's young population and burden of non-communicable diseases further challenge system priorities. Gender-related challenges are apparent, with women facing barriers due to cultural constraints and lack of support for female health workers contributing to fragility, but there are instances of resilience through UN-supported training programs. The existence of fragile and resilient sub-systems within the broader health system was exemplified by the ability to control a cholera outbreak with additional effort, yet the recurrent need for external support reveals a reliance on funding. Intrinsic community resilience allows the health system to function amid security threats.

Notwithstanding the obstacles contributing to the fragility of health systems uncovered in our study, Afghanistan had been making gradual yet consistent strides towards stabilizing its health systems over the past two decades before the Taliban takeover in 2021.^{18,238} Despite remaining among the countries with some of the lowest health indicators globally, the improvements in maternal, infant, and childhood mortality rates observed in Afghanistan over the past few decades signify substantial enhancements in health-related outcomes.^{18,238,249–251} Additionally, health systems indicators showed a steady increase in system performance, especially inpatient and community satisfaction and pro-poor quality health service delivery.^{100,252}

5.2 RQ2- Did the introduction of female health workers to support Maternal, Neonatal, and Child Health service delivery by Afghan Red Crescent Society's Mobile Health Teams lead to a change in service delivery outcomes?

Many of the interventions associated with the domains described in the preceding section can be considered as efforts to support health systems, with the ultimate goal of reducing the fragility of these systems. For instance, measures such as strengthening the health workforce through enhancing the quality of care and implementing practical planning to reduce inefficiency and reactivity have been put forth. However, the pivotal question is whether these interventions succeed in real-world scenarios. Only when they prove effective can we assume that the fragility of health systems will diminish.

Our literature review revealed that ARCS-MHTs played a pivotal role in addressing service gaps, improving access for vulnerable communities, and delivering primary healthcare services in regions where the government or other organizations faced challenges in access, especially in geographically isolated and conflict-affected areas. To gain a deeper understanding of the role of MHTs in mitigating health system fragility, we explored the changes in service delivery outcomes after introducing female healthcare workers into these teams. This section discusses the findings from our analysis of the impact of introducing midwives in ARCS-MHTs operating in hard-to-reach areas. Examining disparities in the observed outcomes aids in comprehending the potential alterations in the fragility of health systems.

5.2.1 RQ 2.1 - Was there a difference in MNCH outcomes after the introduction of female health workers in ARCS-MHTs?

The introduction of midwives only resulted in a significant increase in tetanus toxoid vaccinations provided to women of reproductive age within provinces where midwives were introduced in 2016, as seen in Table 5.1. Despite an increase in the ANC and postnatal care (PNC) services immediately after the midwives' introduction in 2018 and a positive post-intervention trend in 2017 and 2018, the impact of the intervention for all MNCH

outcomes, other than the delivery of tetanus toxoid vaccinations, remained statistically non-significant.

The non-significant findings could be attributed to a variety of potential reasons. It is worth noting that we observed the only MNCH outcome, tetanus toxoid vaccinations, improve in the group where midwives had served the longest, which may be attributed to building trust and acceptance of female health workers within communities over time, which has been reiterated in the literature.^{19,204, 254,255,253}

Extended durations of health services provision play a pivotal role in enhancing trust within communities in Afghanistan.²⁵⁶ As health services delivered by midwives persist over a more extended period, community members have an increased opportunity to witness the consistent and reliable support midwives provide.^{256,257} This prolonged engagement fosters a sense of reliability, familiarity, and dependability, contributing to establishing and reinforcing trust.^{118,256}

The non-random selection of provinces, lacking the rigour of randomization, introduces the possibility that unmeasured confounders may have influenced the study's outcomes. The data were collected initially for program monitoring rather than structured for a research project, which inherently possesses limitations in its scope. Challenges inherent in utilizing real-world data for research purposes are underscored, suggesting that more robust data might be attained through a meticulously designed a priori research project, as opposed to the post-hoc analysis conducted in this study.

Additionally, the presence of significant pre-intervention trends indicating a potential imbalance in the pre-intervention groups may have diluted the impact of the findings. It is imperative to acknowledge that the quantitative outcomes only provide insights regarding the frequency of service interactions, offering no insights into the qualitative or comprehensive aspects of the services rendered. Inconsistent staffing and supply issues for diverse MHTs over time, not comprehensively captured in the data, may have further contributed to the observed non-significant impact of the intervention. Another explanation is of a spillover effect, characterized by an overall increment in service delivery across all ARCS-MHTs over time.

Table 5.1: Overview of the impact of midwife inclusion on MNCH outcomes, comparing intervention and control groups

Year when intervention started	Childhood vaccinations			Tetanus toxoid vaccinations			Antenatal care services			Postnatal care services		
	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Pre-intervention period												
Difference between intervention versus control prior to start of the study (baseline difference)	56.7**	-	-	56.88**	-	-	8.11*	-	-3.93**	3.9*	-	-1.56*
Pre-intervention trend: intervention group		-	-	-	-	-	1.97**	0.52**	0.28*	1.9*	0.36*	0.09*
Pre-intervention trend: control group	8.08*	-	-	5.6*	-	-	-	-	-	-	-	-
Difference in preintervention slope: intervention versus control groups	-	-	-	-6.72*	-	-	-	0.52**	0.34*	-	0.38	0.12

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	Childhood vaccinations			Tetanus toxoid vaccinations			Antenatal care services			Postnatal care services		
Year when intervention started	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Post-intervention period												
Difference between intervention versus control groups immediately after intervention	-	-	-	-	-	17.06*	-	-	13.93*	-	-	6.41**
Post-intervention trend: intervention group	-	-	-	0.84*	-	-	-	1.56**	1.58**	-	0.89**	0.43*
Post-intervention trend: control group	-	-	-	-	-	-	0.79**	1.01**	1.43**	0.34*	0.5**	0.71*
Difference post-intervention slope: intervention versus control groups	-	-	-	-	-	-	-	-	-	-	-	-
Difference pre- versus post-intervention: intervention versus control groups	-	-	-	7.19*	-	-	-	-	-	-	-	-

Note: * shows that the results were significant (p<0.05) and ** (p<0.01)

Despite a lack of statistical significance in the quantitative findings, our qualitative analysis shed light on the importance of the work conducted by MHTs and emphasized the pivotal role played by the integration of midwives within these teams. Midwives in Afghanistan have been shown to improve maternal and newborn care by providing essential support and guidance, educating women on the danger signs before, during and after pregnancy and safe modalities for childbirth. Their roles extend to educating mothers on optimal breastfeeding practices and ensuring comprehensive care that promotes maternal well-being and the health of newborns.^{258–261}

Furthermore, our qualitative findings underscored the gradual development of community trust in the ARCS-MHTs over time, with the inclusion of midwives likely contributing to the increase in trust. Additionally, our participants also noted that pre and postnatal examinations involve a more intimate aspect, and cultural barriers sometimes hinder proper physical examination by male doctors. Thus, including midwives enhanced the quality of examinations for the women.

Improvements in quality of care and health systems strengthening

Findings from our qualitative assessment showed that introducing midwives improved the quality of care provided to women, as midwives could engage in more comprehensive interactions and examinations, aligning better with women's cultural context and needs. The analysis underscores the essential role of MHTs in addressing critical healthcare service gaps, improving access to healthcare for vulnerable communities, and ensuring community ownership and satisfaction with healthcare services. Service gaps in areas where the government and other organizations could not reach and where trained staff were unavailable were effectively filled by MHTs, particularly in geographically isolated regions in Afghanistan. Access to healthcare for vulnerable populations, especially pregnant women, was significantly improved through MHTs, which were more accessible than fixed healthcare facilities.

Furthermore, the ARCS-MHTs played a pivotal role in strengthening health systems community engagement, facilitating referral pathways, and ensuring sustainability. Participants stressed the importance of community engagement, highlighting trust-building and community support as essential for the continuity of healthcare operations. Engaging

with community leaders and elders was necessary for effective health service delivery. The MHT healthcare providers were adept in identifying cases requiring additional services and established efficient referral pathways. Concerns regarding sustainability in delivering primary healthcare services in remote areas were raised, emphasizing the role of a centralized system, community involvement, and reasonable pricing in achieving sustainability. Building trust and community support were emphasized as critical elements in ensuring the sustainability of health services in remote areas. The community's strong sense of ownership and satisfaction with MHT services emphasized the vital need for their presence in these areas, where they provided invaluable support and were well-received by the communities they served.

Barriers to the delivery of health services in Afghanistan

The participants identified various barriers to ARCS-MHT operations, broadly categorized into 'barriers to service delivery and access' and 'barriers to staff retention.' Under 'barriers to service delivery and access,' cultural practices, particularly in remote areas, posed challenges to accessing healthcare services, especially for women, as gender restrictions limited the scope of care MHTs could provide. Language barriers within Afghanistan's multiethnic context also hindered access, while long distances, high workloads, inadequate training, and insufficient resources strained MHT operations. Insecurity, prevalent in the country, poses significant risks to the delivery of healthcare services. Under 'barriers to staff retention,' the requirement for female staff to have a male family member ('mahram') accompany them during operations led to difficulties in hiring and retention. Inadequate pay, competing family priorities, the scarcity of trained female healthcare professionals, and insecurity in the regions also contributed to low staff retention.

Barriers such as staff retention, high workload, inadequate training and insufficient resources were also identified in a systematic review by Homer et al.,²⁶² exploring barriers and facilitators of midwifery care in humanitarian settings with Afghanistan as one of the case studies. In addition to the barriers highlighted by the review, our study shed light on the issue of inadequate salaries, considering the hardships endured and pointed out language barriers stemming from Afghanistan's diverse ethnicities. Furthermore, our study

uncovered the need for a mahram to deploy with MHTs, high workloads and conflicting domestic responsibilities as additional obstacles midwives face.

Contributions of ARCS-MHTs in the delivery of health services in Afghanistan

Our study showed that the ARCS-MHTs were recognized for their strengths, such as the MHTs demonstrating effective communication and coordination with various stakeholders, including communities, government bodies, and affected parties, though there was room for improvement. Additionally, the Red Crescent organization's neutral stance and the involvement of its community-based health and first aid (CBHFA) volunteers supported MHT operations, enhancing trust and communication with the communities in Afghanistan. The IFRC's volunteer support, offered through programs like CBHFA, has consistently bolstered community trust and enhanced service delivery in diverse contexts.^{263–265} A noteworthy factor contributing to this acceptability was the longstanding presence of ARCS volunteers as community first aid providers, fostering familiarity and trust within the communities. Effective collaboration between ARCS and the Ministry of Public Health (MoPH) was also pivotal in identifying and addressing healthcare gaps in inaccessible areas.

Despite the challenges faced during its launch and implementation in Afghanistan in the early 2000s, the midwifery program has achieved remarkable success.^{257,260,266–269} Driven by the collective efforts of the government, international community, and civil society, this initiative aimed to address gender disparities in service delivery by establishing accredited midwifery schools and programs within the country.^{260,270,271} This comprehensive approach is a testament to overcoming hurdles in a fragile and conflict-affected context and provides a valuable model for other nations undergoing post-conflict reconstruction.^{270,271} Over the last two decades, maternal mortality has been reduced by half, attributed mainly to over a 15% increase in birth attendants by midwives.²⁶⁶

Our qualitative findings revealed a gradual uptake of community acceptability for midwives, which gained momentum once the positive impacts became evident. The familiarity of MHT staff with local culture and the trust they built within the community contributed to their acceptance, and the presence of midwives was particularly crucial for providing healthcare services to women. Homer et al.²⁶² also emphasized the broader

concept of community engagement as a facilitator for midwifery care. The existing body of literature also underscores the positive impact of midwives in enhancing women's access to healthcare services.^{266, 267}

5.2.2 RQ 2.2 - Did MNCH outcomes differ between less and more insecure provinces in Afghanistan after introducing female health workers in ARCS-MHTs?

Our findings showed that the midwife intervention impacted postnatal care services in the most insecure provinces in Afghanistan. A summary of the significant findings obtained from our analysis is provided in Table 5.2. While there was an increase observed in the post-intervention period in the delivery of tetanus toxoid vaccinations in the moderate and most insecure provinces when compared with the least insecure provinces, there was no impact of the intervention observed for MNCH outcomes except for the increase in delivery of PNC services.

Beyond the considerations of temporal coverage, spillover effects, and the non-randomized selection of provinces with potential unmeasured confounders, as elucidated in the previous section, alternative explanations for these findings may encompass the potential influence of security conditions themselves. For example, delivering more childhood vaccinations in regions characterized by heightened insecurity is notable as the analysis of the 2015 Afghanistan DHS survey underscores that insecurity in Afghanistan often hinders the delivery of vaccinations for children, with most vaccines typically administered in comparatively safer areas.²⁷²

Our key findings, however, centred on the increase in postnatal care services following the introduction of midwives in Afghanistan's most insecure provinces. This result is particularly important because providing these services, especially postnatal care, faces significant challenges and is often not well-covered in existing literature.^{262,272 273,274}, underscoring. Our finding is in contrast to general findings in Afghanistan, where severe conflict resulted in lower levels of MNCH services.¹⁷³

One possible explanation for this finding could lie in the extra pay given to staff going to more insecure regions as a hardship incentive. This could have led to optimal staffing of

the MHTs, thus leading to increased service provision. However, it remains unclear as to why the impact of higher remuneration was limited only to PNC services in our dataset. ¹⁵

From a health policy perspective, strategic engagement with organizations like the Red Cross Red Crescent may improve the delivery of services in more insecure areas. Leveraging their community connections at the ground level, these organizations can play a vital role in ensuring the effective provision of MNCH services, addressing the unique challenges posed by conflict-affected regions. From a programmatic implementation perspective, advocating for the engagement of female health workers in conflict settings, coupled with enhanced incentivization, can effectively address gaps in universal health coverage, particularly in more insecure areas. This strategic approach aligns with the imperative to mitigate healthcare disparities and strengthen the resilience of health systems in regions affected by conflicts, ensuring broader access to essential health services.

¹⁵ Explanation provided by the CRC country representative in Afghanistan, with documentation available through program administrative data.

Table 5.2: Overview of the impact of security on MNCH outcomes after the introduction of midwives

Comparing groups	Childhood vaccinations		Tetanus toxoid vaccinations		Antenatal care services		Postnatal care services	
	Moderate vs. Least insecure	Most vs. Least insecure	Moderate vs. Least insecure	Most vs. Least insecure	Moderate vs. Least insecure	Most vs. Least insecure	Moderate vs. Least insecure	Most vs. Least insecure
Pre-intervention period								
Difference between intervention versus control prior to start of the study (baseline difference)	-	-	-	-	-	-	-	-
Pre-intervention trend: intervention group	-	-	-	-	-	-	-	-
Pre-intervention trend: control group	-	-	-	-	0.32*	0.42*	-	-
Difference in preintervention slope: intervention versus control groups	-	-	-	-	-	-	-	-

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Comparing groups	Childhood vaccinations		Tetanus toxoid vaccinations		Antenatal care services		Postnatal care services	
	Moderate vs. Least insecure	Most vs. Least insecure	Moderate vs. Least insecure	Most vs. Least insecure	Moderate vs. Least insecure	Most vs. Least insecure	Moderate vs. Least insecure	Most vs. Least insecure
Post-intervention period								
Difference between intervention versus control groups immediately after intervention	-	-	-	-	-	-	-	-
Post-intervention trend: intervention group	-	-	-	-	-	-	-	0.76**
Post-intervention trend: control group	-0.57*	-0.58*	-1.15**	-1.13*	-0.54*	-0.52*	-0.52**	-0.48**
Difference post-intervention slope: intervention versus control groups	-	-	1.19*	1.61**	-	-	-	1.24**
Difference pre- versus post-intervention: intervention versus control groups	-	-	-	-	-	-	-	1.29**

Note: * shows that the results were significant (p<0.05) and ** (p<0.01)

5.3 Strengths and Limitations

Our research was underpinned by a comprehensive design; however, it is essential to acknowledge the presence of certain limitations that warrant discussion. While not detracting from the overall quality of the research, these limitations offer insights into the scope and potential impact of our findings. In this section, we will underscore the strengths that distinguish our study. We will also elucidate the limitations, outline their potential implications on the research outcomes, and discuss the strategies we employed to mitigate their effects.

Strengths

This research stands out for its unique examination of the fragility of health systems, particularly in Afghanistan. Our study's strengths lie in its multifaceted methodology, ability to capture nuances in panel data, reliance on real-world examples, and inclusion of diverse perspectives and voices from the field. These strengths collectively enhance the rigour and relevance of our research, contributing to a deeper understanding of health system fragility and its implications in Afghanistan and beyond.

One of the main strengths of our research was the utilization of a mixed methods study design to address our research questions. To explore the concept of fragility and its relationship with resilience, we integrated a qualitative approach for concept exploration and employed the Delphi methodology to establish consensus on the concepts and our data interpretation. Similarly, we primarily used a quantitative approach to understand disparities in MNCH outcomes. However, to ensure the validation of our findings and to gain a more nuanced understanding of the results, we also incorporated a qualitative approach involving key informant interviews and document reviews.

By establishing a comprehensive conceptual framework for fragility before delving into the specifics of Afghanistan, we bolstered the generalizability of our study. This broader perspective enables us to contextualize our findings globally, transcending geographical boundaries. Our study bridges theory and practice by incorporating real-world examples and data. Integrating empirical evidence from the field strengthens the reliability of our

study's outcomes, supports the validity of our insights, and bolsters their applicability in healthcare policy and practice.

Utilizing the Interrupted Time Series (ITS) design allows us to observe changes over time, offering a longitudinal perspective that adds depth to our findings. Another advantage of using the ITS was that the models are generally unaffected by confounding variables such as demographics or socio-economic status. Time-varying confounders may bias the results, which is mitigated by using control groups and multiple baselines and was reflected in our study design.

A distinctive strength of our approach was incorporating a wide range of perspectives. We considered academic and programmatic viewpoints while exploring the concepts of fragility and obtaining insights from individuals working at the field level, including midwives, MHT doctors, and those directly involved in program implementation. Beyond the diversity of perspectives, our examination of Afghanistan's post-conflict health system landscape offers relevant insights into Afghanistan and conflict-affected regions worldwide.

Limitations (with mitigation strategies)

1. ***Data availability and quality:*** Secondary data were used for the quantitative part of our research. This data were collected as part of monitoring the program's implementation and was not collected with this research in mind. Within the context of insecurity and challenges in data collection, transportation and dissemination, the reliability and posed challenges could influence the precision of our analysis. For example, the method of recording services provided also merits consideration. Due to cultural considerations, intimate examinations by male healthcare providers may not be acceptable. While services might be labelled as antenatal or postnatal care, if administered by male healthcare providers, those involved superficial examinations or history-taking. As a result, the quality of services could be compromised, which was not reflected in the quantitative data.

To mitigate these challenges, we used qualitative data to validate our findings and strengthen their reliability and validity.

2. ***Sample size and representation:*** To explore the concept of fragility, we used convenience sampling methodology, engaging a diverse pool of experts for our consensus-building

approach. While we employed a well-suited approach for sampling, it is essential to acknowledge its potential for introducing bias. This bias can arise from selecting participants with limited theoretical perspectives. Consequently, there is a risk of constraints in fully encompassing the entire range of viewpoints, which could curtail the breadth of insights acquired. To mitigate this potential bias, we adopted a two-pronged strategy. Firstly, we focused on developing a comprehensive Knowledge Resource Nomination Worksheet (KRNW) to guide our participant selection process. Through this approach, we aimed to include individuals from diverse backgrounds, ensuring the inclusion of various theoretical understandings of the concepts at hand. Secondly, we employed an open-ended questionnaire as a foundational guide during the initial interview phase. However, we maintained a flexible approach by allowing the discussions to be guided by participants' responses. They were actively encouraged to challenge and critically assess their grasp of the concepts, thus facilitating a more thorough exploration of ideas and leading to a more comprehensive depth of insights. By combining these two strategies, we sought to counteract potential bias and enhance the richness of perspectives that contributed to the robustness of our study's findings.

3. ***Consensus building and framework development***: Striving for consensus is a central aim within the Grounded Delphi method. Nonetheless, it is imperative to acknowledge that consensus does not necessarily equate to an unequivocal objective truth. Instances where experts' opinions diverge significantly or where achieving consensus proves challenging, may result in unambiguous conclusions or insights. Moreover, while the strength of the consensus-building approach lies in its incorporation of experts from varied disciplines, a potential response bias should be recognized.

We used detailed notes, memos, and reflexivity to scrutinize emerging concepts. During interviews, we posed clarifying questions to attain a deeper comprehension of concepts, thereby mitigating the likelihood of response bias. After interpreting interviews, surveys were administered to facilitate consensus-building, enabling participants to converge on emerging concepts from the interviews and curbing response bias. Our commitment to minimizing biases extended to coding analysis and interpretation. Two independent coders were engaged to ensure rigour, alongside peer debriefing sessions and consensus-building activities. This concerted effort reduced the influence of researcher bias, enhancing the credibility of our study's outcomes.

4. ***Changing landscape:*** The research focused on understanding fragility and its impact on health systems within the context of Afghanistan up to the point of the study's conclusion – quantitative data collection concluded in June 2020; some qualitative data collection and GDM surveys were collected afterwards. However, it is essential to acknowledge that contexts can evolve rapidly, especially in conflict-affected regions. The dynamic nature of Afghanistan's political, social, and economic landscape could mean that some of the findings might become outdated or less applicable in a relatively short time. This limitation could affect the long-term relevance and durability of the research's conclusions in a rapidly changing environment.

Specifically, the understanding of the fragility of health systems in Afghanistan may have been influenced by two realities, pre- and post-Taliban takeover in August of 2021, as our GDM KIIs were conducted before then and the following surveys afterwards. To mitigate this challenge and retain consistency of understanding, for the surveys, we encouraged participants to think about the fragility of health systems in Afghanistan prior to the Taliban takeover in August 2021.

Similarly, we recognize that the quantitative data were collected before August 2021, when the context was more complex with various armed groups in charge of different provinces. The sub-question exploring the impact of security on MNCH services was designed to mitigate the complexities of the security context in various provinces in Afghanistan.

5. ***Dealing with autocorrelation:*** Autocorrelation occurs when consecutive observations are more similar than those far apart; this often occurs in time series analysis, which violates the assumption of standard regression models that the observations are independent. To mitigate the effects of autocorrelation, we tested our time series models for autocorrelations and the final models were adjusted for autocorrelations.
6. ***Quantitative data constraints:*** There were limitations in the availability and quality of data, thereby constraining the selection of an appropriate control group. Consequently, non-intervention groups were utilized as a comparison against the intervention group, which was non-random in nature. Furthermore, certain outcome measures indicated a notably low baseline activity within the control groups, particularly in specific provinces. This suggests a limited level of initial activity in those regions, with subsequent increases observed over time. Such dynamics may have influenced the overall findings, thereby potentially impeding a comprehensive understanding of the impact associated with the

integration of midwives within MHTs. Additionally, some of the models indicating non-linearity can be further explored in the future using non-linear regression models.

5.4 Implications for the field and future recommendations

It is vital to underscore that healthcare policies should be context-specific, considering each location's unique nuances. Recognizing contextual disparities ensures that reforms are tailored to align with the local conditions, ultimately promoting the most effective and efficient healthcare practices in each setting. The insights derived from our exploration of the health systems fragility framework (as depicted in Figure 4.6) hold significant potential for shaping healthcare policy. Policymakers can use these findings to tailor their strategies to the specific context. For instance, prioritizing sustainability and efficiency in fragile health systems becomes paramount, involving carefully optimizing resource allocation and long-term planning to ensure stability and continuity. To mitigate unpredictability, implementing proactive risk management and emergency preparedness measures is essential for safeguarding healthcare systems against unforeseen disruptions.

Moreover, there is great value in fostering responsiveness and flexibility within healthcare systems. This approach enhances patient care and empowers the system to adapt swiftly to evolving circumstances, promoting resilience. Additionally, reducing fragmentation and encouraging integration and coordination among healthcare providers and institutions are critical factors in reinforcing the overall strength and effectiveness of the healthcare infrastructure.

The conceptual framework encompasses multiple levels of health systems and transcends geographical boundaries. While rooted in Afghanistan, the framework's principles can be extrapolated to similar conflict-affected regions or post-conflict settings. The underlying concepts of fragility and its relationship with resilient health systems are relevant across different sociopolitical contexts, enabling the framework to be valuable for global understanding of health system dynamics. This adaptability ensures that the insights drawn from our study can contribute to informed decision-making in Afghanistan and diverse regions facing similar challenges.

The study's distinctive contribution lies in the nuanced insights from analyzing provincial-level panel data. By focusing on the specific provinces within Afghanistan, we offer a microcosmic understanding of health system fragility dynamics, a facet that has been less explored in the literature. This localized perspective extends the scope of existing research and presents a more comprehensive picture of the challenges and opportunities. Collectively, this study enhances academic enrichment by advancing the theoretical and methodological landscape of health systems research in Afghanistan and lays a foundation for more intricate explorations in similar contexts globally. By delving into the conceptual understanding of the fragility of health systems and using a real-world example to mitigate this fragility, the research informs strategies for strengthening systems in conflict-affected areas. Health systems and service delivery practitioners can leverage the study's findings to design interventions to bolster health system capacities to withstand disruptions, improve responsiveness, and adapt to evolving challenges.

Future recommendations

We gained valuable insights from this academic discourse; here are some future recommendations so researchers can continue to build upon the foundation laid by our study, furthering the understanding of health system fragility and fostering resilient healthcare systems in conflict-affected regions. Collectively, these recommendations aim to bridge the gap between research insights and tangible policy implementation, fostering resilient health systems that effectively serve conflict-affected populations.

1. ***Continued exploration of the fragility of health systems framework:*** The exploration of the fragility of health systems framework presented in this study serves as a foundational step towards understanding the intricate interplay between its domains and sub-domains. Subsequent research endeavors could employ factor analysis as a means of validating the domains and sub-domains linked to the fragility of health systems. Such an approach would serve to bolster the robustness of the model, enabling a more nuanced understanding of the intricate associations underlying health system fragility. Given the complexity of this concept, further research is essential to delve deeper into the relationships between these domains, elucidate the connections among sub-domains within their respective domains, and uncover the synergies and interactions across different domains. Additionally, the

framework's versatility for understanding the fragility of health systems lies in its potential to be applied to various levels of health systems, including primary, secondary, and tertiary tiers. This adaptability allows us to gain insights into the specific support needed at different levels—offering a holistic overview of health system dynamics. This continued exploration will provide a more holistic and refined understanding of health system fragility, enabling the development of targeted interventions and policies that effectively address its multidimensional nature.

2. ***Conducting comparative analyses:*** Comparative analyses across different conflict-affected regions would offer valuable insights into the universality and context-specific nature of health system fragility. By examining similarities and differences, researchers can uncover patterns contributing to resilient health systems in diverse settings.
3. ***Conducting longitudinal studies:*** Building on the strengths of the Interrupted Time Series (ITS) design, future research could consider longitudinal studies that track health system and service-related variables over extended periods. This approach would allow a deeper understanding of how interventions' effects evolve and how health systems adapt to changing contexts.
4. ***Utilizing real-world data:*** A crucial recommendation for addressing the fragility of health systems is the continued utilization of real-world data to unearth practical solutions. Drawing from empirical evidence and insights gained through real-world scenarios, researchers and policymakers can refine strategies that directly target the challenges posed by health system fragility. By aligning interventions with the actual dynamics on the ground, informed decisions can be made to enhance the resilience, responsiveness, and effectiveness of healthcare systems in conflict-affected regions. This approach validates the relevance of research findings and ensures that interventions are tailored to the specific contexts and complexities that characterize health system fragility.
5. ***Gender, equity focus and local empowerment studies:*** Given the significance of female health workers in post-conflict health systems, future research could delve deeper into gender dynamics. This might involve exploring the impact of gender-inclusive policies and strategies on health system resilience, focusing on marginalized populations. Develop gender-inclusive policies that support female health workers and empower them to

contribute effectively to strengthening the health system. Expanding on the participatory approach, conducting studies that center on local empowerment and engagement can provide a comprehensive understanding of health system challenges and solutions from the community's perspective. This approach fosters ownership and tailor's interventions to specific needs.

6. ***Macro-micro linkages:*** Investigate the interplay between macro-level health policies and micro-level health service delivery. Understanding how national policies translate into tangible impacts at the local level can inform the design of effective interventions that bridge the gap between policy intentions and on-the-ground realities.
7. ***Evidence-based health programming:*** Utilize the insights garnered from this research to inform evidence-based health programming in conflict-affected areas. By tailoring interventions to address the specific challenges highlighted by our study, health programs can be designed to strengthen health systems. Considering the dynamic nature of health systems, post-intervention monitoring is crucial. Create robust monitoring and evaluation frameworks that assess health interventions' impact on health systems. These frameworks should incorporate quantitative metrics and qualitative feedback from the field to comprehensively understand program effectiveness. Follow-up studies could assess the sustainability of intervention effects and identify potential challenges or unintended consequences that emerge over time.

5.5 Conclusions

Health system fragility has garnered significant attention recently due to its intricate ties with contextual vulnerabilities, economic and political pressures, security challenges, and the pivotal role of governance and community trust. Our research delved into the core of this concept, revealing that fragile health systems are fundamentally incapable of adequately meeting the healthcare needs of their populations. These needs encompass basic healthcare requirements and expand to address elevated demands during adversity. To systematically address this issue, we formulated a comprehensive framework for health system fragility, delineating seven defining domains: unsustainability, inefficiency, uncertainty, unresponsiveness, inflexibility, fragmentation, and reactivity. An in-depth understanding of these domains becomes instrumental in fortifying health systems, ensuring successful transitions, bolstering resilience, promoting equity, enhancing accessibility, fostering capacity building, strengthening accountability, prioritizing effectively, and facilitating efficient healthcare delivery.

Applying this framework to Afghanistan's health system reveals complex challenges despite progress in maternal, infant, and child mortality rates and health indicators. The system's fragility stems from reactivity, donor reliance, security concerns, and gender insensitivity, compounded by rigidity, inefficiency, fragmentation, and unsustainability. Recent events, including the Taliban's takeover, highlight the need for international aid and urgent, sustainable strategies to fortify Afghanistan's health system. Our exploration illustrates the nuanced interplay between fragility dimensions, offering insights for informed interventions and policies to enhance resilience in the face of evolving health landscapes.

The practical implementation of the framework underscored the significance of culturally tailored interventions, like incorporating midwives into ARCS-MHTs, to strengthen health systems. This approach proves crucial in addressing fragility factors such as insecurity and enhancing overall system resilience. Our framework, outlining the characteristics of health system fragility, lays the foundation for further exploration and understanding.

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Appendices

Appendix 2.1: Overview of definitions of fragility

Organization	Definition	Concept
DfID (2005)	“the government that cannot or will not deliver core functions to the majority of its people, including the poor.” ⁴⁹	Perspective of an organization involved in Aid delivery and development.
OECD (2005)	“countries where there is a lack of political commitment and insufficient capacity to develop and implement pro-poor policies.” ²⁷⁵	OECD monitors development indicators based on the economic status of countries.
USAID (2005)	“unable or unwilling to adequately assure the provision of security and basic services to significant portions of their populations and where the legitimacy of the government is in question.” ⁵¹	The 2005 USAID report also introduced a ‘fragility framework based on the states’ political legitimacy and effectiveness in deriving and distributing resources.’ ⁵¹ Based on threats to security.
World Bank (2005)	i) “severely fragile” countries with lowest CPIA scores (less than or equal to 2.5) in need of increased international assistance in their development, ii) “core fragile” countries (CPIA scores of 2.5 to 3) with significant economic stress but some capacity for sustainability and iii) “marginal fragile” countries with the highest CPIA scores (between 3.1 and 3.2) and capacity for sustainable development. ²⁷⁶	The CPIA scores are based on each countries ‘quality’ of economic policy and institutional framework focusing on poverty reduction, sustainable growth and effective use of developmental support. ²⁷⁷ The CPIA rating scores: 1 (lowest) very weak performance to 6 (highest) very strong performance. ²⁷⁷ Low-Income Countries Under Stress (LICUS) with CPIA scores < 3.2
CIFP(2006)	“lack the functional authority to provide basic security within their borders, the institutional capacity to provide basic social needs for their populations, and/or the political legitimacy to effectively represent their citizens at home and abroad.” ⁵²	The CIFP provided a detailed examination of the transition of fragile states collapsing into failing and eventually failed states and introduced a concept of a continuum from fragility to failure.

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Organization	Definition	Concept
Brooking’s Institute definition of the weakness of states. (2008)	“countries lacking the capacity and/or will to foster an environment conducive to sustainable and equitable economic growth; to establish and maintain legitimate, transparent, and accountable political institutions; to secure their populations from violent conflict and to control their territory, and to meet the basic human needs of their population.” ⁵⁰	The Brooking’s Institution in the United States also looked at the processes that make countries susceptible to breakdowns within their systems. Instead of describing the states as weak, fragile and collapsing, the Brooking Institute report in 2008, focused on the concept of weakness representing fragility, where weakness. Based on threats to security
CRISE (2009)	“states that are failing, or at risk of failing, concerning authority, comprehensive service entitlements or legitimacy.” ²⁷⁸	Authority failures are when the state lacks the authority to protects citizens from political violence, resulting in civil wars Service failures occur when the citizens do not have access to basic education, health services, water, housing, infrastructure for transport and energy. ²⁷⁸ Legitimacy failures stem from limited support from the citizens, typically in non-democratic situations where often the military is directly or indirectly supporting governments. ²⁷⁸
7plus (2013)	“a state that can be understood as a period during nationhood when sustainable socio-economic development requires a greater emphasis on complementary peacebuilding and state-building activities such as building inclusive political settlements, security, justice, jobs, good management of resources, and accountable and fair service delivery.” ²⁷⁹	
ECD (2016)	“characterized as the combination of exposure to risk and insufficient coping capacity of state, system and/or communities to manage, absorb or mitigate those risks. Fragility can lead to negative outcomes including violence, the breakdown of institutions, displacement, humanitarian crises or other emergencies.” ³	
BTI	Bertelsmann Stiftung’s Transformation Index The indices examine the state of political transformation impacting the economic infrastructure within a country by measuring indicators such as abuse of power, corruption, monopoly of the state on administrative structures	
The Fragile State Index	Takes into account indicators related to security, economic vulnerabilities, political instabilities and demographic changes such as internal displacements to create lists of fragile countries across the globe.	
Global Fund for Peace	Analyzes economic factors associated with peace and monitors global trends of peacefulness across the globe.	

Appendix 2.2: Key Health Systems related frameworks

Health system framework (Year)	Definition (Underlying theory)	Structure	Category	Operational concept			Health systems framework objectives	
				HS	HS PA	M&E	Intermediate goals	Final goals
Behavioral Healthcare (1998) ⁶³	“A continuum of services aimed at promoting physical, mental and social well-being through thoughtful and respectful intervention in human behavior, behavioral antecedents and behavioral consequences.” ^{62,63} (Health behavioural model) ^a	The behavioral model is cyclical and helps and determines the best strategy for their needs.	Analytic	✓	✓		i. Effectiveness: the production of health benefits. ii. Efficiency: the cost-effectiveness of producing health benefits. iii. Equity: the distribution of health benefits and costs across the groups	Health and Well-being
Integrated Performance Model for the Health Care System (EGIPSS) (1998) ^{64, 65}	“Organized systems of action with four functional dimensions: goal attainment; environmental adaptation; production; culture and value maintenance, plus the interchanges taking place between each of these functions and the others.” ^{62,64} (Parson’s social theory) ^b	Four interlinked functional dimensions: Two internal functions: i. Maintaining values and producing meaning ii. Integrating and stabilizing processes for production. Two external functions: iii. Interacting with the environment to acquire the necessary resources and adapting iv. Attaining the valued goals of the system.	Analytic		✓		i. Productivity ii. Volume of care and services iii. Quality of care and services	i. Health improvement ii. Effectiveness iii. Efficiency iv. Equity

Continued next page ...

Health system framework (Year)	Definition (Underlying theory)	Structure	Category	Operational concept			Health systems framework objectives	
				HS	HS PA	M&E	Intermediate goals	Final goals
WHO (2000) ⁵⁶	The resources, actors and institutions related to the financing, regulation and provision of health actions, where health actions are any set of activities whose primary intention is to improve or maintain health. (Health actions) ^c	Stewardship (governance), creating resources (investment and training), service delivery, financing (collecting, pooling, and purchasing)	Analytic	✓	✓		i. Access ii. Coverage iii. Quality iv. Safety	i. Level and distribution of health ii. Level and distribution of responsiveness iii. Fairness in financing iv. Efficiency
OECD (2001) ⁶⁶	The health care system, not including public health activities or other wider issues. (Health care system)	Focused mostly on equity of access.	Analytic	✓	✓			i. Level and distribution of health ii. Level and distribution of responsiveness and access iii. Equity iv. Macroeconomic and microeconomic efficiency
Control Knobs (2003) ⁶⁷	A set of relationships where the structural components (means) and their interactions are associated and connected to the goals the system desires to achieve (ends). (Health system)	Financing, payment, organization, regulation, behaviour.	Deterministic	✓	✓		i. Efficiency ii. Quality iii. Access	i. Health status ii. Consumer satisfaction iii. Risk protection

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Health system framework (Year)	Definition (Underlying theory)	Structure	Category	Operational concept			Health systems framework objectives	
				HS	HS PA	M &E	Intermediate goals	Final goals
Common Wealth Fund (2006) ⁶⁸	The way in which health care services are financed, organized and delivered to meet societal goals for health. It includes the people, institutions and organizations that interact to meet the goals, as well as the processes and structures, that guide these interactions. (Health care services)	Finance, coordination and organization	Analytic	✓	✓		i. High-quality care ii. Efficient care iii. Access iv. System and workforce innovation and improvement	Long, healthy and productive lives
OECD-HCQI (2006) ²⁸⁰	A health system includes all activities and structures whose primary purpose is to influence health in its broadest sense (in keeping with WHO's definition). Health care refers to the combined functioning of public health and personal health care services. ^{62, 280} (Health system, health care)	Effectiveness Safety Patient/Responsiveness Accessibility Cost/expenditure	Analytic	✓	✓			i. Improving health ii. Macroeconomic efficiency/ sustainability and microeconomic efficiency/ value for money iv. Equity
WHO (2007) ⁵⁷	Framework for Action, with the aim of "clarifying and strengthening WHO's role in health systems in a changing world." (Health system)	Leadership/governance, health work force, information, medical products/vaccines/technology, financing, service delivery.	Analytic	✓	✓		i. Access ii. Coverage iii. Quality iv. Safety	i. Level and distribution of health ii. Level and distribution of responsiveness iii. Fairness in financing iv. Efficiency

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Health system framework (Year)	Definition (Underlying theory)	Structure	Category	Operational concept			Health systems framework objectives	
				HS	HS PA	M &E	Intermediate goals	Final goals
International Health Partnership and related initiatives IHP + (2008) ²⁸¹	WHO and World Bank collaboration to introduce a common framework to evaluate the performance of international initiatives and partnerships, while maintaining country relevance. (Health system)	Maps the monitoring and evaluation actions to the framework.	Deterministic		✓	✓	i. Coverage ii. Responsiveness	Improved health
Systems thinking (2008) ⁶⁹	A health system is made up of elements that interact together to form a complex system, the sum of which is greater than its parts. The interactions of these elements affect the achievement of health system goals. Although these goals may vary in different countries, essentially many are similar. (Health system)	Interlinkages and coordination, external and internal factors	Deterministic	✓	✓		i. Equity ii. Choice iii. Efficiency iv. Effectiveness	i. Health ii. Financial risk protection iii. Consumer satisfaction

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Health system framework (Year)	Definition (Underlying theory)	Structure	Category	Operational concept			Health systems framework objectives	
				HS	HS PA	M &E	Intermediate goals	Final goals
International Futures model IF (2011) ⁸	Predicated on the primary considerations of human development, social fairness, security and environmental sustainability, health in this model is considered to be a component dynamically connected to all other systems in a country or region. (rooted in the theory of several disciplines: politics, environment, economics and health)	Considers ten domains including health, environment, economic and political landscape linked to each other in a way that fluctuation in one or more components would affect others	Deterministic		✓			Improving global health
Public health information system in Crisis (2017) ²⁸²	Framework to assess health service delivery in emergency and crises situations based on risk factor assessment during crises. (public health system)	Crisis and disaster response and coordination	Deterministic		✓	✓	Improving service delivery in emergencies	Averting population mortality

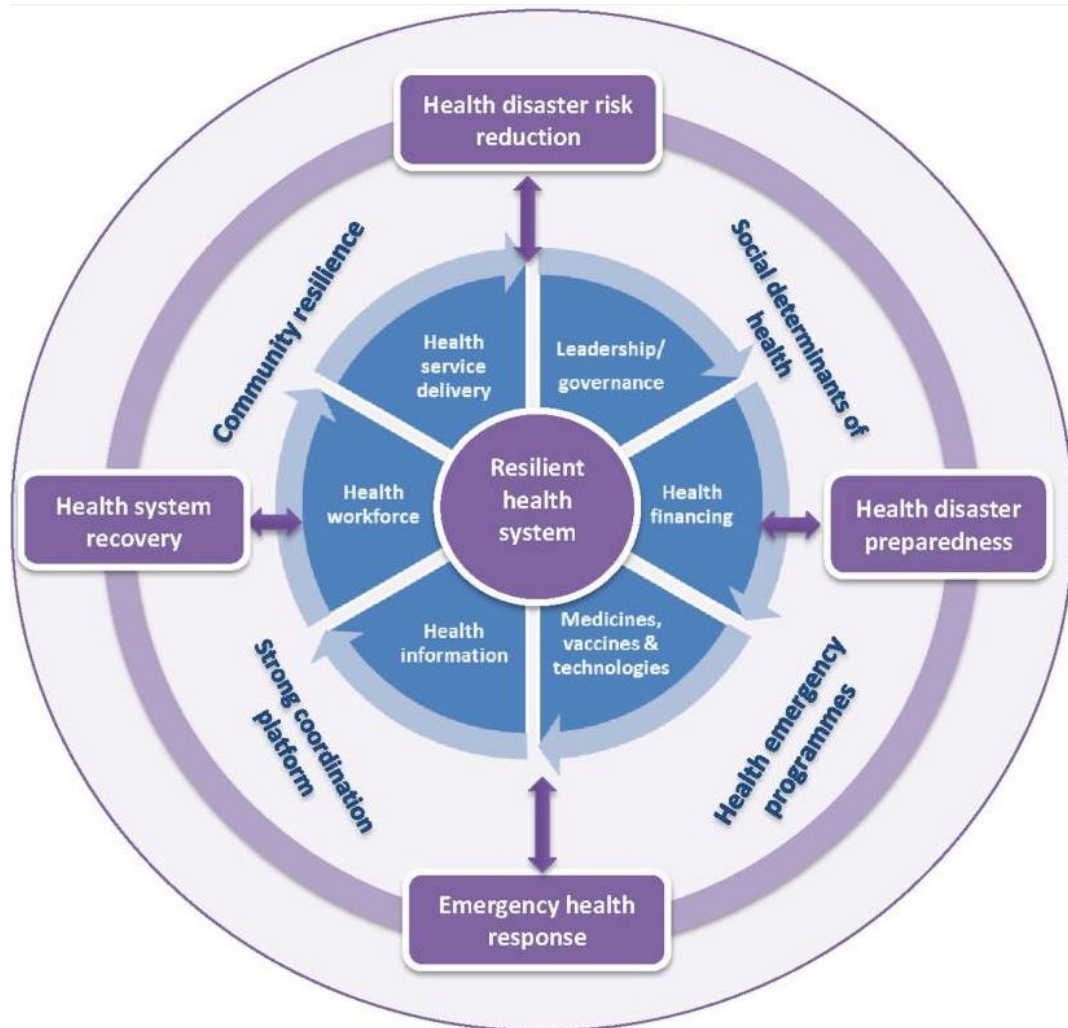
Note: HS: Health Systems, PA: Performance Assessment, M&E:Monitoring and Evaluation.

^a Health Behavior model- Based on the structure, process and outcome. Structure: physical, social and economic environment. Process: transaction of healthcare. Outcome: the enhanced health of individuals and communities.

^b Parson's social theory states that four functions are necessary for the survival of an organization: attainment of goals, production of services, culture and value maintenance, and adaptation to external environment.

^c A health action is defined to be any set of activities whose primary intent is to improve or maintain health.

Appendix 2.3: Health systems framework with building blocks and resilience



Copied from: Olu O. Resilient Health System as Conceptual Framework for Strengthening Public Health Disaster Risk Management: An African Viewpoint. *Front Public Heal.* 2017;5(September):1-6. doi:10.3389/fpubh.2017.00263

Appendix 3.1: Key informant interview guide for GDM study

Before the start of each interview, the topic was introduced with the purpose of the study and consent was sought; details are presented in the letter of information within the Ethics review document REB full protocol 115184, appendix 3.5.

Theme I: Exploring the concept of fragility of health systems

Suggested questions:

1. How do you define fragility of health systems? [Probe conceptual understanding of fragility as it relates to health systems, how its defined]
2. How does the concept of fragility relate to health systems in Afghanistan?

Theme II: Exploring domains of fragility of health systems

Suggested questions:

1. Which factors contribute to fragility of health system in Afghanistan? [Explore system level factors which enable or disable health systems]
2. How do these factors contribute to the fragility of health systems? [Probe mechanisms]
3. How do these factors contribute to fragility of health systems in Afghanistan?
4. Which indicators identify fragility of health systems in Afghanistan?
5. How would those indicators identify the fragility of health systems?

Theme III: Exploring the difference between fragility and resilience of health systems

Suggested questions:

1. What makes health systems resilient? [Explore definition, factors, indicators]
2. Are there any factors, indicators that lead to resilience of health systems in Afghanistan?
3. Is the concept of fragility of health systems similar to lack of resilience of health system? [If yes, Probe how, if no, probe why. Explore differences and similarities between both concepts]

Appendix 3.2: Survey questionnaire 1: Concept prioritization and ranking

GDM Survey 1-Concept prioritization

Introduction:

Thank you for your participation and insights into my research project focusing on exploring the concept of fragility of health systems. As part of the study, we informed you that we would conduct interviews followed by two surveys. This is the first of the two surveys. In the first phase of this study, we were able to interview 18 experts. Our preliminary analysis identified 7 domains mapping on to the concept of fragility of health systems broadly. In this second phase of our study, we want to get your inputs in selecting the domains you think are most relevant to the concept of fragility of health systems. This concept prioritization survey will consist of two parts. The first part will focus on selecting the domains you think are most relevant to the overall concept of fragility of health systems. The second part pertains to the concepts as they relate to Afghanistan. We understand that the global and contextual factors have changed drastically since the interviews were first conducted. Please review the concepts from a wholistic perspective, with an understanding that with the passage of time some views may have shifted. We invite you to deliberate on the concept of fragility as it was discussed in its original understanding, which was in the backdrop of protracted conflict and development work prior to the takeover by the Taliban in August of 2021. There will be the option to add your comments and additional thoughts. Thank you again for taking the time for this survey. It should not take more than 10 - 15 mins of your time. Kindly fill and return this survey within two weeks of receiving this. I will send a reminder at the end of one week. Please note that your participation remains voluntary, and feel free to reach me at ----- if you have any questions, comments or need any clarifications.

Section 1:

This section of the survey has 9 questions.

Q1-8 will ask you to rank the domains and sub-domains as you think they relate to the concept of fragility. Q9 will be optional for any additional comments that you may have regarding the concept of fragility of health systems.

Q1- Inefficient

'Health systems are fragile when they are inefficient'

Identified sub-domains for inefficiency include:

- Inability of the systems to meet the needs of its population (are under-resourced, deliver poor quality services, are inequitable, gender unresponsive, have a weak primary healthcare system)
- Uncoordinated systems (unregulated systems, with misutilization and poor planning)
- Poor financing (donor dependency, lack of government investment, unaffordable due to out of pocket expenses)
- Poor quality of education and training of health workers
- Poor quality of services
- Systems which are unable to absorb shocks
- Unable to maintain a functioning system based on the WHO building blocks.

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

Not critical Maybe critical Somewhat critical Critical Absolutely critical
 0 10 20 30 40 50 60 70 80 90 100

Systems that are unable to meet the needs of its population	
Systems that are uncoordinated	
Systems with poor financing	
Systems with poor quality education and training for its healthcare providers	
Systems with poor quality services and service delivery	
Systems that are unable to absorb shocks	
Systems that are unable to maintain a functioning system based on the WHO building blocks	
Systems that are unable to meet the needs of its population	
Systems that are uncoordinated	
Systems with poor financing	
Systems with poor quality education and training for its healthcare providers	
Systems with poor quality services and service delivery	
Systems that are unable to absorb shocks	
Systems that are unable to maintain a functioning system based on the WHO building blocks	

Q2- Reactive

'Health systems are fragile when they are reactive'

Identified sub-domains of reactivity as related to fragility of health systems include:

- Lack long term planning (systems focus on quick fixes, example of lack of human resource planning or infrastructure planning)
- Lack of priority setting (systems are reactive).

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

	Not critical	Maybe critical	Somewhat critical	Critical	Absolutely critical						
	0	10	20	30	40	50	60	70	80	90	100
Lack long term planning											
Lack of priority setting											

Q3- Fragmented

'Health systems are fragile when they are fragmented.'

Identified sub-domains of fragmentation related to fragility of health systems include:

- Lack of standardization (lack of standardization in operating procedures, licensing, regulations or procedures)
- Lack of oversight
- Lack of linkages (lack of linkages within the system and lack of coordination and linkages with related systems outside of health systems)
- Informal systems (traditional practitioners, unregulated practitioners to fill the gaps left by the government)
- Political diversity (diversity in political control impacting health systems, differences between state and regional policies).

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

	Not critical	Maybe critical	Somewhat critical	Critical	Absolutely critical						
	0	10	20	30	40	50	60	70	80	90	100
Lack of standardization											
Lack of oversight											
Lack of linkages											
Political diversity											
Informal systems											

Q4- Unresponsive

'Health systems are fragile when they are unresponsive'

Identified sub-domains of unresponsiveness related to fragility of health systems include:

- Unmet needs (systems are not people centered, gender unresponsive, cannot meet routine needs and struggle to meet the demands of its people)
- Lack of resources (including health work force)
- Unprepared (unable to deal with threats)
- Sociocultural irrelevance (not culturally relevant, reliant on aid)

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

	Not critical	Maybe critical	Somewhat critical	Critical	Absolutely critical						
	0	10	20	30	40	50	60	70	80	90	100
Unmet needs											
Lack of resources											
Unprepared											
Sociocultural irrelevance											

Q5- Unsustainable

'Health systems are fragile when they are unsustainable'

Identified sub-domains of unsustainability as related to fragility of health systems include:

- Lack of localization (donor driven, local agenda ignored) - Lack of resources (financial resources, human resources)
- Disruptive (disruption or trust, continuation of care)
- Unstable partnerships (mismanaged public and private partnerships)
- Lack of ownership (there are gaps between planning and implementation, lack of formal health systems, lack of government ownership)

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

	Not critical	Maybe critical	Somewhat critical	Critical	Absolutely critical						
	0	10	20	30	40	50	60	70	80	90	100
Lack of localization											
Lack of resources											
Disruptive											
Unstable partnerships											
Lack of ownership											

Q6- Inflexible

'Health systems are fragile when they are Inflexible'

Identified sub-domains of inflexibility related to the concept of fragility of health systems include:

- Unable to anticipate (systems without capacity to anticipate the changes in health needs)
- Unable to adapt (systems not adapting to change especially in the face of stressors)
- Unable to learn (system that does not learn from how it is adapting from shocks)

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

Not Maybe Somewhat Critical Absolutely
 critical critical critical critical
 0 10 20 30 40 50 60 70 80 90 100

Unable to anticipate	
Unable to adapt	
Unable to learn	

Q7- Uncertain

'Health systems are fragile when they are uncertain'

Identified sub-domains of uncertainty as related to fragility of health systems include:

- Donor dependency (health expenditure covered by donors, donor priorities, staff hiring based on donor requirements)
- Gender unresponsive (unmet needs, gender imbalance in health workforce needs)
- Uncertainty related to systems codependent with health systems (other systems such as education, infrastructure)
- Security issues (conflict, sudden closures, instability)
- Natural disasters (cyclical disasters leading to continuous threat and sudden disasters)
- Weak governance (lack of accountability, policy, finances, stewardship and when systems are unregulated, corrupt, there is nepotism and political instability)
- Easily collapsible (closely linked with political instability and can easily collapse)

Reflecting on your understanding of fragility of health systems please drag the bar to indicate how critical you think the sub-domain is under the domain of inefficiency. Scale of 1(Not critical) -100 (Absolutely critical).

Not Maybe Somewhat Critical Absolutely
 critical critical critical critical
 0 10 20 30 40 50 60 70 80 90 100

Donor dependency	
Gender unresponsive	
Uncertainty related to systems codependent with health systems	
Security issues	
Natural disasters	
Weak governance	
Easily collapsible	

Q8- Overall concept

After reviewing the concepts linked to the seven identified domains for fragility of health systems, can you reflect on how critical each domain is as it relates to fragility of health systems.

Please drag the bar to how critical you think the domain is in relation to fragility of health systems, on a scale of 1(Not critical) -100 (Absolutely critical)

Not critical Maybe critical Somewhat critical Critical Absolutely critical
 0 10 20 30 40 50 60 70 80 90 100

Inefficient	
Reactive	
Fragmented	
Unresponsive	
Unsustainable	
Inflexible	
Uncertain	

Q9- Comments Please add any additional comments regarding domains and sub-domains of fragility of health systems.

Section 2- Fragility of health systems in Afghanistan

Analysis summary Based on our preliminary analysis we identified 7 domains which map on to the concept of fragility of health systems. Our initial analysis shows that 5 of these domains were more relevant with fragility of health systems in Afghanistan. In this section you will reflect and prioritize the domains in relation to the concept of fragility in Afghanistan. This section will have 3 questions.

Q1. After reviewing the seven identified domains for fragility of health systems, can you rank them from most to least as they relate to fragility of health systems in Afghanistan. The list below is ranked in random order.

Please drag and drop based on most related (1) to least related (7) to the fragility of health systems in Afghanistan.

- Inefficient
- Reactive
- Fragmented
- Unresponsive
- Unsustainable
- Inflexible
- Uncertain

Q2. After reviewing the 33 sub-domains for fragility of health systems, can you group these as not critical, somewhat critical, or absolutely critical in terms of leading to fragility of health systems in Afghanistan.

Please drag and drop it on the relevant box.

Sub-domains	Not critical	Somewhat critical	Absolutely critical
Systems that are unable to meet the needs of its population			
Systems that are uncoordinated			
Systems with poor financing			
Systems with poor quality education and training for its healthcare providers			
Systems with poor quality services			
Systems that are unable to absorb shocks			
Systems that are unable to maintain a functioning system based on the WHO building blocks			
Lack long term planning			
Lack of priority setting			
Lack of standardization			
Lack of oversight			
Lack of linkages			
Political diversity			
Informal systems			
Unmet needs			
Lack of resources			
Unprepared			

Sociocultural irrelevance

Lack of localization

Lack of resources

Disruptive

Unstable partnerships

Lack of ownership

Unable to anticipate

Unable to adapt

Unable to learn

Donor dependency

Gender unresponsive

Uncertainty related to systems codependent with health systems

Security issues

Natural disasters

Weak governance

Easily collapsible

Q3- Comments . Please add any additional comments regarding domains and sub-domains of fragility of health systems in Afghanistan

Appendix 3.3: Survey questionnaire 2: Concept agreement

GDM Survey 2- Concept agreement

Introduction:

Thank you for your participation and insights into my research project focusing on exploring the concept of fragility of health systems. As part of the study, we informed you that we would conduct interviews followed by two surveys. This is the last of the two surveys. Please find the letter of information for the study attached for your review.

- In the first phase of this study, we were able to interview 18 experts. Our preliminary analysis identified 7 domains mapping on to the concept of fragility of health systems broadly.

- In the second phase of our study (concept prioritization survey sent out in October 2022), you provided your inputs in ranking the domains you felt were the most relevant to the concept of fragility of health systems. The data have now been ranked.

- In this last phase of the study, we are asking your agreement/ disagreement for the ranked domains and sub-domains based.

This concept agreement survey will consist of two blocks:

- In the first and second sections, we will list the concepts related to fragility of health systems in general and in Afghanistan and ask if you agree with the ranking.

- In the third section of the survey, we will ask for your agreement with the exploration of similarities and differences between the concepts of fragility and resilience of health systems.

Thank you again for taking the time for this survey. It should not take more than 10 - 15 mins of your time. Kindly fill and return this survey within two weeks of receiving this. I will send a reminder at the end of one week. Please note that your participation remains voluntary, and feel free to reach me at -----if you have any questions, comments or need any clarifications.

Section 1: Domains and sub-domains related to concept of fragility of health systems

We ranked the domains and sub-domains according to your interpretation of how relevant these were in relation to fragility of health systems. From top to bottom the domains were ranked as: unsustainable, inefficient, unresponsive, uncertain, inflexible, fragmented and reactive. This section of the survey has 10 questions. Q1-8 will ask you to agree or disagree with the ranking of the sub-domains and domains. Q9 will ask you to agree or disagree with the ranking of domains as they relate to concept of fragility of health systems in Afghanistan. Q10 will be optional for any additional comments that you may have regarding the concept of fragility of health systems in general and in Afghanistan.

Q1- Unsustainable

The top ranked domain was unsustainable, contributing most to the fragility of health systems. Sub- domains for unsustainability as they related to the concept of fragility of health systems are ranked and presented below in order of ranking. Please choose if you agree or disagree with the ranking:

	Disagree	Neutral	Agree
1. Lack of ownership	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Lack of resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Lack of localization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Unstable partnerships	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Disruptive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2 - Inefficient

The second ranked domain was inefficient, contributing to the fragility of health systems. Sub- domains for inefficient as they related to the concept of fragility of health systems are ranked and presented below in order of ranking. Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Systems that are unable to meet the needs of their population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Systems with poor financing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Systems that are uncoordinated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Systems that are unable to maintain a functioning system based on the WHO building blocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Systems with poor quality services and service delivery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Systems that are unable to absorb shocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Systems with poor quality education and training for its healthcare providers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3 - Uncertain

The third ranked domain was uncertain, contributing to the fragility of health systems. Sub- domains for uncertain, as they related to the concept of fragility of health systems are ranked and presented below in order of ranking. Please agree are neutral or disagree with the ranking

	Disagree	Neutral	Agree
1. Weak governance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Donor dependency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Easily collapsible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Security issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Uncertainty related to systems codependent with health systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Gender unresponsive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Natural disasters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4- Unresponsive

The fourth ranked domain was unresponsive, contributing to the fragility of health systems. Sub- domains for unresponsive, as they related to the concept of fragility of health systems are ranked and presented below in order of ranking.

Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Lack of resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Unmet needs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Unprepared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Sociocultural irrelevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q 5- Inflexible

The fifth ranked domain was inflexible, contributing to the fragility of health systems. Sub- domains for inflexible, as they related to the concept of fragility of health systems are ranked and presented below in order of ranking. Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Unable to adapt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Unable to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Unable to anticipate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6 - Fragmented

The sixth ranked domain was fragmented, contributing to the fragility of health systems. Sub- domains for fragmented, as they related to the concept of fragility of health systems are ranked and presented below in order of ranking. Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Lack of oversight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Lack of standardization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Lack of linkages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Informal systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Political diversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7- Reactive

The seventh ranked domain was reactive, contributing to the fragility of health systems. Sub- domains for reactive, as they related to the concept of fragility of health systems are ranked and presented below in order of ranking. Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Lack long term planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Lack of priority setting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8 - Domains ranked in relation to the overall concept of fragility of health systems are presented in the order of ranking below.

Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Unsustainable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Inefficient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Uncertain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Unresponsive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Inflexible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Fragmented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Reactive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 2: Fragility of health systems in Afghanistan

Q 9. Our analysis showed that domain ranking for fragility of health systems in Afghanistan was different from the overall ranking (highlighting contextual differences impact fragility of health systems). Domains ranked in relation to the concept of fragility of health systems in Afghanistan are presented in the order of ranking below.

Please choose if you agree are neutral or disagree with the ranking:

	Disagree	Neutral	Agree
1. Reactive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Uncertain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Inflexible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Unresponsive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Fragmented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Inefficient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Unsustainable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10 - Comments. Please add any additional comments regarding the ranking of domains and sub-domains of fragility of health systems in general and in Afghanistan

Section 3: Relationship fragility and resilience

As part of the study, we also explored the relationship between the concepts of fragility and resilience of health systems.

Five themes (one overarching and four connected themes) and 12 sub-themes regarding the relationship between fragility and resilience of health systems were identified through preliminary analysis.

Key statements regarding themes are presented in this section. This section will have 6 questions with statements. You will be asked to agree or disagree with the statements Q1-5. Q.6 will be optional to add your additional comments regarding the relationship between fragility and resilience of health systems.

Q 1 - An overarching theme that emerged from the interviews was that many of the health systems have elements of fragility and that there is no health system that is completely resilient.

Please review the statement and choose if you agree or disagree:

	Agree	Disagree
	<input type="radio"/>	<input type="radio"/>

Q 2. Differences-Three sub-themes emerged when exploring the relationship, specifically under the theme of differences between fragility and resilience of health system.

- Crisis vs. long-term:** Resilience is linked to crisis response while fragility is more linked to the long-term functionality of the health systems
- Response vs. efficiency:** Resilience is a function of response of health system (mostly to crisis) while fragility is a function of efficiency of health systems (how health systems operate when there is no crisis)
- Equity perspectives:** Equity related issues contribute to the fragility of health systems and emerge as outcomes when we look at resilience of health systems

Based on the differences, please review the statements and choose if you agree or disagree:

	Crisis vs. Long-term		Response vs. Efficiency		Equity perspective	
	Resilience is linked to crisis response (1)	Fragility is linked to long-term functionality of health system (2)	Resilience is a function of response (1)	Fragility is a function of efficiency (2)	Equity related issues emerge as outcomes measured as part of resilience of health systems (1)	Equity related issues contribute to fragility of health systems (2)

Agree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Neutral	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3. Similarities- Another theme which emerged from the analysis was that 'fragile health systems can sometimes also be resilient.' There were three specific contexts are instances identified, presented in the statements below. Please review the statements and choose if you agree or disagree. This is a text entry so please add letter Y under one of the three scale points to register your response. (you can also enter text in your response to these statements if you wish to add to it)

	Disagree	Neither agree nor disagree	Agree
There are resilient sub-systems within fragile health systems (example, some countries with protracted war have advanced trauma support capacities)			
Systems within fragile health systems can temporarily become resilient with external support during a crisis (disaster response, vaccination support etc.)			
When communities under protracted threat are innately resilient, they to contribute to strengthen the system through their innate resilience and ability to withstand pressures.			

Q 4: Spectrum -Another theme that emerged was the fragility and resilience of the health systems on a spectrum
Please review the statements and choose if you agree or disagree:

	Completely disagree with the statement	Neither agree nor disagree	Completely agree with the statement								
	0	10	20	30	40	50	60	70	80	90	100
Fragility and resilience of health systems are not on the same spectrum- these are difference concepts with their own spectrums											
Both fragility and resilience are affected by the same factors											
Fragility and resilience of health systems overlap in a matrix											
Fragility and resilience of health systems have an inverse relationship											

Q5 – Opposite -Two subthemes emerged as potentially at the opposite end of fragility spectrum:

Stability of health systems: A learning stable health systems is at the opposite end of fragility of health systems

Anti-fragility: When systems can build back better and can remain stable, that is when the systems are anti-fragile and are at the opposite end of fragility.

Q5A Stability: Please move the dot (it goes up and down) to indicate if you agree with the concept of stability being at the opposite end of spectrum of fragility. Higher the number of horizontal bars, more agreement with the concept.



- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 (7)

Q5B Anti-fragility: Please move the dot (it goes up and down) to indicate if you agree with the concept of anti-fragility being at the opposite end of spectrum of fragility. Higher the number of horizontal bars, more agreement with the concept.



- 1 (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 (7)

Q 6 –Please add any additional comments regarding the relationship between fragility and resilience of health systems

Appendix 3.4: Key informant Interview guide

Themes and suggesting questions

Before the start of each interview, the topic was introduced with the purpose of the study and consent was sought; details are presented in the letter of information within the Ethics review document REB full protocol 115185, appendix 3.5.

These are themes and suggestions for the questions for the focus group discussion and were not asked in a particular order. The questions guide the discussion based on the aims and objectives of the study.

Theme I: Delivery of basic (primary) healthcare services by MHTs Suggested questions:


1. What do you think about the MHTs operations in Afghanistan? [Explore reasons]
2. Do you think these MHTs are successful in delivering health services to the most vulnerable in the community? (Explore more the reasons why yes or no)
3. What are the challenges you have faced while delivering health services through MHTs? [Explore challenges in delivery in armed conflict, other barriers to access and how to overcome these challenges]
4. What are factors that help you delivery of health services to the communities [Explore issues including trust and preparedness]
5. How have the MHTs impacted health service delivery in your communities? What else can be done to improve MHT services? [explore readiness, capacity, sustainability]

Theme II: Inclusion of female midwives in the MHTs Suggested questions:


1. How have things changed in terms of delivery of health services since the introduction of midwives?
2. How do communities respond when they see female midwives?
3. Probe if not already responded: Do you think there are more women and children who access services?
4. Are there any challenges to recruit and retain female midwives in MHTs? [Explore what and probe possible solutions? Questions specifically for midwives:
6. What made you decide to be part of MHTs?
7. How has your experience been like?
8. How do communities respond to your presence in the MHTs? What kind of cases do you see? [Probe: types and community need vs. available services]
9. What are some of the challenges? [Probe: trainings, medicines, infrastructure etc.] What are some of your key needs in delivery of health services?

Appendix 3.5: Ethics approval documents

1-Western University Research Ethics Board- initial approval for the Study ‘Exploration of the concept and dimensions of the fragility of health systems in Afghanistan’ (renewed annually).

 Western Research	
Date: 8 April 2020	
To: Dr. Amardeep Thind	
Project ID: 115184	
Study Title: Exploration of the concept and dimensions of fragility of health systems in Afghanistan	
Short Title: Fragility of health systems in Afghanistan	
Application Type: NMREB Initial Application	
Review Type: Full Board	
Meeting Date: 07/Feb/2020 12:00	
Date Approval Issued: 08/Apr/2020 17:26	
REB Approval Expiry Date: 08/Apr/2021	
<hr/>	
Dear Dr. Amardeep Thind	
The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.	
This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.	

2-Western University Research Ethics Board- initial approval for the Study ‘Exploration of Red Cross and Red Crescent (RCRC) movement supported Maternal, Neonatal and Child Healthcare (MNCH) services delivered by Mobile Health Teams (MHT) in Afghanistan’ - (renewed annually).



Date: 9 April 2020

To: Dr. Amardeep Thind

Project ID: 115185

Study Title: Exploration of Red Cross and Red Crescent (RCRC) movement supported Maternal, Neonatal and Child Healthcare (MNCH) services delivered by Mobile Health Teams (MHT) in Afghanistan

Short Title: Impact of Red Cross supported mobile health teams in Afghanistan

Application Type: NMREB Initial Application

Review Type: Delegated

Meeting Date: 07/Feb/2020 12:00

Date Approval Issued: 09/Apr/2020 08:27

REB Approval Expiry Date: 09/Apr/2021

Dear Dr. Amardeep Thind

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

3- The ARCS letter of support



Afghan Red Crescent Society

Health Department Directorate

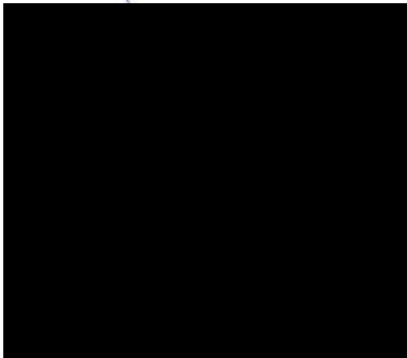
Subject: Letter of Consent to utilize project data and collecting data for research purposes

TO WHOM IT MAY CONCERN,

This is to certify that the Afghan Red Crescent Society (ARCS) is aware and supportive of Canadian Red Cross (CRC) utilizing the monitoring and administrative data from the implementation of Mobile Health Teams for research purposes. The project was implemented by the ARCS and funded by the CRC. The CRC is allowed to use this data for further analyses, profiling and publishing to conduct the research “Exploration of Red Cross and Red Crescent (RCRC) movement supported Maternal, Neonatal and Child Healthcare (MNCH) services delivered by Mobile Health Teams (MHT) in Afghanistan”.

Please feel free to contact should you require further information on the project.

Sincerely,



افغانستان، کابل، پتخمه ناحیه، د شهید استاد برهان الدین رباني واک، د افغاني سړي مياشتي ټولني مرکزي دفتر



4 - The Institutional Review Board of the Ministry of Public Health in Afghanistan- letter of approval



Islamic Republic of Afghanistan
Ministry of Public Health
Afghanistan National Public
Health Institute
Institutional Review Board



د افغانستان اسلامي جمهوریت
د عامې روغتیا وزارت
د افغانستان د عامې روغتیا ملي انسټیټوټ
د اخلاقیات بررسیو بورډ



Date: March 6, 2020

IRB Code No: A.0320.0169

To: Dr. Faiza Rab
Doctoral candidate
Epidemiology and Biostatistics/Wester University

Subject: Approval for proposal entitled, “**Exploration of Red Cross and Red Crescent (RCRC) movement supported Maternal, Neonatal and Child Healthcare (MNCH) services delivered by Mobile Health Teams (MHT) in Afghanistan**”.

Dear Dr. Rab,

Institutional Review Board, Ministry of Public Health has examined and reviewed your proposal entitled, “**Exploration of Red Cross and Red Crescent (RCRC) movement supported Maternal, Neonatal and Child Healthcare (MNCH) services delivered by Mobile Health Teams (MHT) in Afghanistan**”.

We are pleased to note satisfactory response therefore; your study is approved. However, we reserve the rights to monitor and audit your study and any violation of ethical norms during the course of study shall lead to withdrawal of given approval.

The duration of approval for a study to begin the research project is valid for one year and the implementation plan and monitoring plan should be shared to IRB secretary ([REDACTED]).

You are bound to share the result of your study with MoPH prior any dissemination plan.

Sincerely,

[REDACTED]

Director General
Afghanistan National Public Health Institute (ANPHI) &
Chairman, Institutional Review Board (IRB)
Ministry of Public Health

Appendix 4.1: Participant demographics using Knowledge Resource Nomination worksheet

#	Sex	Worked in Afghanistan	Discipline			
			Health systems	Health services	Humanitarian Response sector	Health in Emergencies
1	M	✓	✓	✓	✓	
2	M		✓	✓	✓	✓
3	F		✓	✓	✓	✓
4	M		✓	✓	✓	✓
5	M		✓	✓	✓	✓
6	F		✓	✓	✓	✓
7	M		✓	✓	✓	✓
8	M	✓	✓	✓	✓	✓
9	M	✓	✓	✓	✓	✓
10	M	✓	✓	✓	✓	✓
11	M	✓	✓	✓	✓	✓
12	M	✓	✓	✓	✓	✓
13	F		✓	✓	✓	✓
14	M		✓	✓	✓	✓
15	F	✓	✓	✓	✓	
16	M	✓	✓	✓		
17	M	✓	✓	✓		
18	M	✓	✓	✓		

#	Organization						Publication
	UN system - WHO/UNFP A/UNICEF	Red Cross movement	International NGO's other than Red Cross - MSF/USAID/AKF	Government	Academic	Clinician	
1			✓			✓	✓
2		✓	✓		✓		✓
3		✓					
4		✓					✓
5		✓				✓	✓
6		✓	✓				
7			✓		✓		✓
8	✓			✓	✓		✓
9	✓				✓		✓
10		✓	✓			✓	
11	✓				✓		✓
12	✓			✓	✓		✓
13					✓		✓
14			✓		✓		✓
15	✓				✓		✓
16	✓					✓	✓
17	✓					✓	✓
18			✓				

Appendix 4.2: Scores domains and sub-domains critical to the concept of fragility of health systems

		N	Mean	SD	Median	Min	Max
Inefficient	Main domain score	16	84	20	91	22	100
	Sub-domain scores						
	Unable to meet the needs of its population	15	81	22	85	20	100
	Uncoordinated	16	77	23	81	20	100
	Poor financing	16	77	26	87	23	100
	Poor education and training for healthcare providers	16	70	23	70	30	100
	Poor quality services and service delivery	16	74	15	77	34	100
	unable to absorb shocks	16	73	21	78	31	100
	unable to maintain a functioning system based on WHO building blocks	16	76	20	80	35	100
Reactive	Main domain score	16	71	19	71	29	100
	Sub-domain scores						
	Lack of long-term planning	16	74	22	82	42	100
	Lack of priority-setting	16	73	23	81	25	100
Fragmented	Main domain score	16	76	20	79	30	100
	Sub-domain scores						
	Lack of standardization	16	71	21	71	9	98
	Lack of oversight	16	74	21	81	12	99
	Lack of linkages	16	70	18	72	25	100
	Political diversity	16	65	20	70	11	86
	Informal systems	16	66	21	67	21	100
Unresponsive	Main domain score	16	80	19	88	37	100
	Sub-domain scores						
	Unmet needs	16	81	17	87	38	100
	Lack of resources	16	85	14	90	57	100
	Unprepared	16	76	18	82	31	100
	Sociocultural irrelevance	16	71	22	77	18	100

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		N	Mean	SD	Median	Min	Max
Unsustainable	Main domain score	16	85	18	93	40	100
	Sub-domain scores						
	Lack of localization	16	87	10	88	70	100
	Lack of resources	16	87	14	91	50	100
	Disruptive	16	77	11	79	50	91
	Unstable partnerships	16	78	17	83	40	100
	Lack of ownership	16	90	17	95	31	100
Inflexible	Main domain score	16	79	16	79	47	100
	Sub-domain scores						
	Unable to anticipate	16	77	20	80	22	100
	Unable to adapt	16	85	18	88	31	100
	Unable to learn	16	82	20	86	21	100
Uncertain	Main domain score	16	87	11	89	66	100
	Sub-domain scores						
	Donor dependency	16	89	12	90	64	100
	Gender unresponsiveness	16	70	25	76	19	100
	Codependent systems	16	72	18	78	39	100
	Security issues	16	81	17	85	41	100
	Natural disasters	16	70	21	75	31	100
	Weak governance	16	91	17	96	29	100
	Easily collapsible	16	88	17	94	46	100

N: Number of participants

*Scores of 0-100: The scores represent how critical the domains are to the concept of fragility of health systems. 0- Not critical at all and 100 absolutely critical.

Note: There is little difference between mean and median. The Median was used to analyze and interpret all the domains and subdomains.

Appendix 4.3: Percentage of participants agreeing, neutral or disagreeing with the rankings of domains and sub-domains critical to the fragility of health systems

		Disagree (%)	Neutral(%)	Agree(%)
Domains critical to the fragility of health systems	Unsustainable	0	8	92
	Inefficient	23	8	62
	Unresponsive	8	15	77
	Uncertain	8	23	69
	Inflexible	8	0	85
	Fragmented	15	15	69
	Reactive	8	8	85
Unsustainable	Lack of ownership	15	23	62
	Lack of resources	8	23	69
	Lack of localization	8	38	54
	Unstable partnerships	8	23	69
	Disruptive	0	15	85
Inefficient	Systems unable to meet the needs of their population	15	0	85
	Systems with poor financing	0	0	100
	Uncoordinated systems	8	0	92
	Systems unable to maintain a functioning system (based on the WHO building blocks)	8	38	54
	Systems with poor quality services and service delivery	15	0	85
	Systems that are unable to absorb shocks	8	15	77
	Systems with poor quality education and training for its healthcare providers	8	15	77

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		Disagree (%)	Neutral(%)	Agree(%)
Unresponsive	Lack of resources	8	23	69
	Unmet needs	0	8	92
	Unprepared	0	8	92
	Sociocultural irrelevance	0	23	69
Uncertain	Weak governance	8	0	92
	Donor dependency	15	23	62
	Easily collapsible	8	8	77
	Security issues	15	8	69
	Uncertainty related to systems codependent with health systems	8	38	54
	Gender unresponsive	0	38	54
	Natural disasters	0	38	54
Inflexible	Unable to adapt	8	0	85
	Unable to learn	15	8	77
	Unable to anticipate	8	0	92
Fragmented	Lack of oversight	15	8	77
	Lack of standardization	15	15	69
	Lack of linkages	15	23	54
	Informal systems	8	31	54
	Political diversity	0	31	62
Reactive	Lack long term planning	8	0	92
	Lack of priority setting	15	0	85

Appendix 4.4: Cumby-Huizinga test for autocorrelation – RQ 2.1

Childhood vaccinations

2016-Right-side panel of the output table shows that autocorrelation is present up to lag 14 but not higher lag orders (up to 20 lags tested). The final model was re-estimated using lag (14)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	68.790	1	0.0000	1	68.790	1	0.0000
1 - 2	71.081	2	0.0000	2	24.162	1	0.0000
1 - 3	71.130	3	0.0000	3	13.555	1	0.0002
1 - 4	71.213	4	0.0000	4	9.392	1	0.0022
1 - 5	71.637	5	0.0000	5	8.244	1	0.0041
1 - 6	77.352	6	0.0000	6	7.675	1	0.0056
1 - 7	80.071	7	0.0000	7	6.410	1	0.0114
1 - 8	88.423	8	0.0000	8	5.452	1	0.0195
1 - 9	97.355	9	0.0000	9	4.530	1	0.0333
1 - 10	97.593	10	0.0000	10	4.117	1	0.0425
1 - 11	104.991	11	0.0000	11	4.046	1	0.0443
1 - 12	108.116	12	0.0000	12	3.723	1	0.0537
1 - 13	113.464	13	0.0000	13	4.197	1	0.0405
1 - 14	113.927	14	0.0000	14	3.845	1	0.0499
1 - 15	113.984	15	0.0000	15	2.978	1	0.0844
1 - 16	114.014	16	0.0000	16	1.860	1	0.1727
1 - 17	117.693	17	0.0000	17	2.291	1	0.1301
1 - 18	118.119	18	0.0000	18	1.838	1	0.1751
1 - 19	118.592	19	0.0000	19	0.978	1	0.3228
1 - 20	118.713	20	0.0000	20	0.331	1	0.5653

Test robust to heteroskedasticity

2017-Right-side panel of the output table shows that autocorrelation is present up to lag 11 but not higher lag orders (up to 20 lags tested). The final model was re-estimated using lag (11)

Cumby-Huizinga test for autocorrelation

H0: disturbance is MA process up to order q

HA: serial correlation present at specified lags >q

H0: q=0 (serially uncorrelated) HA: s.c. present at range specified				H0: q=specified lag-1 HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	12.282	1	0.0005	1	12.282	1	0.0005
1 - 2	13.553	2	0.0011	2	6.615	1	0.0101
1 - 3	27.627	3	0.0000	3	12.292	1	0.0005
1 - 4	33.516	4	0.0000	4	9.855	1	0.0017
1 - 5	35.574	5	0.0000	5	8.763	1	0.0031
1 - 6	37.770	6	0.0000	6	6.256	1	0.0124
1 - 7	37.858	7	0.0000	7	3.931	1	0.0474
1 - 8	37.893	8	0.0000	8	3.222	1	0.0727
1 - 9	44.455	9	0.0000	9	3.536	1	0.0600
1 - 10	47.265	10	0.0000	10	4.261	1	0.0390
1 - 11	47.338	11	0.0000	11	4.776	1	0.0289
1 - 12	48.796	12	0.0000	12	3.335	1	0.0678
1 - 13	50.272	13	0.0000	13	2.652	1	0.1034
1 - 14	52.616	14	0.0000	14	2.563	1	0.1094
1 - 15	54.713	15	0.0000	15	2.352	1	0.1251
1 - 16	56.312	16	0.0000	16	2.523	1	0.1122
1 - 17	56.539	17	0.0000	17	2.270	1	0.1319
1 - 18	59.206	18	0.0000	18	2.318	1	0.1279
1 - 19	61.402	19	0.0000	19	2.062	1	0.1510
1 - 20	62.127	20	0.0000	20	1.977	1	0.1597

Test robust to heteroskedasticity

2018-Autocorrelation not found, therefore unadjusted model finalized

Cumby-Huizinga test for autocorrelation
H0: disturbance is MA process up to order q
HA: serial correlation present at specified lags >q

H0: q=0 (serially uncorrelated) HA: s.c. present at range specified				H0: q=specified lag-1 HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	3.841	1	0.0500	1	3.841	1	0.0500
1 - 2	5.655	2	0.0591	2	2.281	1	0.1310
1 - 3	5.786	3	0.1225	3	1.710	1	0.1909
1 - 4	5.787	4	0.2157	4	1.704	1	0.1918
1 - 5	7.015	5	0.2195	5	2.900	1	0.0886
1 - 6	7.227	6	0.3004	6	20.711	1*	0.0000
1 - 7	7.406	7	0.3879	7	0.091	1	0.7634
1 - 8	7.406	8	0.4935	8	0.010	1	0.9205
1 - 9	7.541	9	0.5810	9	0.066	1	0.7972
1 - 10	7.676	10	0.6605	10	0.059	1	0.8079
1 - 11	7.714	11	0.7387	11	0.076	1	0.7834
1 - 12	8.165	12	0.7721	12	0.206	1	0.6501

Test robust to heteroskedasticity
* Eigenvalues adjusted to make matrix positive semidefinite

Tetanus toxoid vaccinations

2016- Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (12)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	43.636	1	0.0000	1	43.636	1	0.0000
1 - 2	51.587	2	0.0000	2	23.416	1	0.0000
1 - 3	51.968	3	0.0000	3	14.655	1	0.0001
1 - 4	51.983	4	0.0000	4	10.347	1	0.0013
1 - 5	52.925	5	0.0000	5	7.819	1	0.0052
1 - 6	53.223	6	0.0000	6	5.386	1	0.0203
1 - 7	54.374	7	0.0000	7	4.957	1	0.0260
1 - 8	55.150	8	0.0000	8	4.590	1	0.0322
1 - 9	56.781	9	0.0000	9	3.434	1	0.0639
1 - 10	56.934	10	0.0000	10	3.777	1	0.0520
1 - 11	56.935	11	0.0000	11	3.070	1	0.0797
1 - 12	56.935	12	0.0000	12	2.789	1	0.0949

Test robust to heteroskedasticity

2017- Right-side panel of the output table shows that autocorrelation is present up to lag 46 but not higher lag orders (up to 50 lags tested). The final model was re-estimated using lag

lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	38.146	1	0.0000	1	38.146	1	0.0000
1 - 2	44.753	2	0.0000	2	19.152	1	0.0000
1 - 3	45.262	3	0.0000	3	10.276	1	0.0013
1 - 4	47.448	4	0.0000	4	8.027	1	0.0046
1 - 5	47.500	5	0.0000	5	11.403	1	0.0007
1 - 6	47.734	6	0.0000	6	17.112	1	0.0000
1 - 7	67.953	7	0.0000	7	8.223	1	0.0041
1 - 8	68.017	8	0.0000	8	5.391	1	0.0202
1 - 9	69.272	9	0.0000	9	5.224	1	0.0223
1 - 10	69.335	10	0.0000	10	4.724	1	0.0298
1 - 11	71.848	11	0.0000	11	6.694	1	0.0097
1 - 12	73.239	12	0.0000	12	5.746	1	0.0165
1 - 13	73.541	13	0.0000	13	5.686	1	0.0171
1 - 14	78.696	14	0.0000	14	5.399	1	0.0201
1 - 15	83.279	15	0.0000	15	5.498	1	0.0190
1 - 16	85.971	16	0.0000	16	5.606	1	0.0179
1 - 17	95.612	17	0.0000	17	4.982	1	0.0256
1 - 18	98.994	18	0.0000	18	5.365	1	0.0205
1 - 19	99.709	19	0.0000	19	5.464	1	0.0194
1 - 20	101.762	20	0.0000	20	5.517	1	0.0188
1 - 21	101.956	21	0.0000	21	4.125	1	0.0422
1 - 22	104.303	22	0.0000	22	4.573	1	0.0325
1 - 23	104.782	23	0.0000	23	3.587	1	0.0582
1 - 24	107.624	24	0.0000	24	4.258	1	0.0391
1 - 25	110.575	25	0.0000	25	4.474	1	0.0344
1 - 26	113.231	26	0.0000	26	4.119	1	0.0424
1 - 27	119.290	27	0.0000	27	4.810	1	0.0283
1 - 28	120.823	28	0.0000	28	5.326	1	0.0210
1 - 29	122.115	29	0.0000	29	5.091	1	0.0241
1 - 30	123.385	30	0.0000	30	5.046	1	0.0247
1 - 31	127.780	31	0.0000	31	5.484	1	0.0192
1 - 32	130.372	32	0.0000	32	5.672	1	0.0172
1 - 33	134.816	33	0.0000	33	7.117	1	0.0076
1 - 34	136.074	34	0.0000	34	7.070	1	0.0078
1 - 35	139.813	35	0.0000	35	7.320	1	0.0068
1 - 36	143.507	36	0.0000	36	8.231	1	0.0041
1 - 37	146.322	37	0.0000	37	7.395	1	0.0065
1 - 38	146.588	38	0.0000	38	6.497	1	0.0108
1 - 39	146.766	39	0.0000	39	5.606	1	0.0179
1 - 40	151.954	40	0.0000	40	6.700	1	0.0096
1 - 41	154.512	41	0.0000	41	7.442	1	0.0064
1 - 42	155.372	42	0.0000	42	6.890	1	0.0087
1 - 43	159.447	43	0.0000	43	6.557	1	0.0104
1 - 44	161.525	44	0.0000	44	6.512	1	0.0107
1 - 45	162.857	45	0.0000	45	5.204	1	0.0225
1 - 46	163.224	46	0.0000	46	4.346	1	0.0371
1 - 47	163.224	47	0.0000	47	3.605	1	0.0576
1 - 48	164.310	48	0.0000	48	2.871	1	0.0902
1 - 49	165.196	49	0.0000	49	3.787	1	0.0516
1 - 50	165.755	50	0.0000	50	2.563	1	0.1094

2018- Right-side panel of the output table shows that autocorrelation is present up to lag 12 but not higher lag orders (up to 20 lags tested). The final model was re-estimated using lag (12)

Cumby-Huizinga test for autocorrelation
H0: disturbance is MA process up to order q
HA: serial correlation present at specified lags >q

H0: q=0 (serially uncorrelated) HA: s.c. present at range specified				H0: q=specified lag-1 HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	19.336	1	0.0000	1	19.336	1	0.0000
1 - 2	29.266	2	0.0000	2	13.779	1	0.0002
1 - 3	31.422	3	0.0000	3	11.949	1	0.0005
1 - 4	42.799	4	0.0000	4	11.940	1	0.0005
1 - 5	43.977	5	0.0000	5	10.194	1	0.0014
1 - 6	56.341	6	0.0000	6	15.185	1	0.0001
1 - 7	68.392	7	0.0000	7	9.779	1	0.0018
1 - 8	69.442	8	0.0000	8	6.877	1	0.0087
1 - 9	70.235	9	0.0000	9	4.398	1	0.0360
1 - 10	74.076	10	0.0000	10	3.753	1	0.0527
1 - 11	75.853	11	0.0000	11	4.853	1	0.0276
1 - 12	79.516	12	0.0000	12	4.580	1	0.0323
1 - 13	79.541	13	0.0000	13	3.534	1	0.0601
1 - 14	79.551	14	0.0000	14	3.406	1	0.0650
1 - 15	82.284	15	0.0000	15	3.648	1	0.0562
1 - 16	83.643	16	0.0000	16	2.464	1	0.1164
1 - 17	91.957	17	0.0000	17	2.052	1	0.1520
1 - 18	93.562	18	0.0000	18	2.118	1	0.1456
1 - 19	95.459	19	0.0000	19	2.231	1	0.1353
1 - 20	98.335	20	0.0000	20	2.526	1	0.1120

Test robust to heteroskedasticity

Antenatal care services

2016-Right-side panel of the output table shows that autocorrelation is present up to lag 14 but not higher lag orders (up to 20 lags tested). The final model was re-estimated using lag (14)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	64.096	1	0.0000	1	64.096	1	0.0000
1 - 2	66.690	2	0.0000	2	25.095	1	0.0000
1 - 3	70.271	3	0.0000	3	17.006	1	0.0000
1 - 4	70.320	4	0.0000	4	13.784	1	0.0002
1 - 5	70.820	5	0.0000	5	11.339	1	0.0008
1 - 6	71.803	6	0.0000	6	8.310	1	0.0039
1 - 7	74.819	7	0.0000	7	4.542	1	0.0331
1 - 8	78.834	8	0.0000	8	4.220	1	0.0399
1 - 9	84.634	9	0.0000	9	5.355	1	0.0207
1 - 10	84.990	10	0.0000	10	3.989	1	0.0458
1 - 11	86.466	11	0.0000	11	4.332	1	0.0374
1 - 12	88.179	12	0.0000	12	4.382	1	0.0363
1 - 13	88.322	13	0.0000	13	4.423	1	0.0354
1 - 14	88.329	14	0.0000	14	4.183	1	0.0408
1 - 15	88.730	15	0.0000	15	2.964	1	0.0851
1 - 16	88.860	16	0.0000	16	1.345	1	0.2461
1 - 17	90.048	17	0.0000	17	1.767	1	0.1837
1 - 18	90.067	18	0.0000	18	0.886	1	0.3465
1 - 19	90.149	19	0.0000	19	0.388	1	0.5333
1 - 20	90.415	20	0.0000	20	0.332	1	0.5644

Test robust to heteroskedasticity

2017-Right-side panel of the output table shows that autocorrelation is present up to lag 21 but not higher lag orders (up to 30 lags tested). The final model was re-estimated using lag (21)

Cumby-Huizinga test for autocorrelation

H0: disturbance is MA process up to order q

HA: serial correlation present at specified lags >q

H0: q=0 (serially uncorrelated) HA: s.c. present at range specified				H0: q=specified lag-1 HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	63.332	1	0.0000	1	63.332	1	0.0000
1 - 2	74.003	2	0.0000	2	34.181	1	0.0000
1 - 3	83.919	3	0.0000	3	26.546	1	0.0000
1 - 4	84.903	4	0.0000	4	17.851	1	0.0000
1 - 5	84.943	5	0.0000	5	9.150	1	0.0025
1 - 6	84.945	6	0.0000	6	9.296	1	0.0023
1 - 7	84.946	7	0.0000	7	11.922	1	0.0006
1 - 8	86.737	8	0.0000	8	7.383	1	0.0066
1 - 9	89.069	9	0.0000	9	7.537	1	0.0060
1 - 10	89.319	10	0.0000	10	6.802	1	0.0091
1 - 11	89.421	11	0.0000	11	5.485	1	0.0192
1 - 12	89.859	12	0.0000	12	4.004	1	0.0454
1 - 13	91.187	13	0.0000	13	3.068	1	0.0798
1 - 14	93.714	14	0.0000	14	3.635	1	0.0566
1 - 15	99.250	15	0.0000	15	3.210	1	0.0732
1 - 16	99.740	16	0.0000	16	2.818	1	0.0932
1 - 17	100.173	17	0.0000	17	2.902	1	0.0885
1 - 18	100.268	18	0.0000	18	3.530	1	0.0603
1 - 19	100.279	19	0.0000	19	5.011	1	0.0252
1 - 20	100.935	20	0.0000	20	5.350	1	0.0207
1 - 21	100.939	21	0.0000	21	5.384	1	0.0203
1 - 22	101.425	22	0.0000	22	2.964	1	0.0852
1 - 23	101.635	23	0.0000	23	3.005	1	0.0830
1 - 24	106.574	24	0.0000	24	2.018	1	0.1555
1 - 25	107.576	25	0.0000	25	1.335	1	0.2479
1 - 26	111.166	26	0.0000	26	1.902	1	0.1678
1 - 27	111.438	27	0.0000	27	1.704	1	0.1917
1 - 28	111.904	28	0.0000	28	1.977	1	0.1597
1 - 29	113.321	29	0.0000	29	2.859	1	0.0909
1 - 30	114.215	30	0.0000	30	2.469	1	0.1161

Test robust to heteroskedasticity

2018-Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (8)

Cumby-Huizinga test for autocorrelation

H0: disturbance is MA process up to order q

HA: serial correlation present at specified lags >q

H0: q=0 (serially uncorrelated) HA: s.c. present at range specified				H0: q=specified lag-1 HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	20.842	1	0.0000	1	20.842	1	0.0000
1 - 2	23.780	2	0.0000	2	8.226	1	0.0041
1 - 3	24.236	3	0.0000	3	4.665	1	0.0308
1 - 4	25.193	4	0.0000	4	3.589	1	0.0582
1 - 5	25.714	5	0.0001	5	2.009	1	0.1564
1 - 6	26.928	6	0.0001	6	6.136	1	0.0132
1 - 7	30.148	7	0.0001	7	8.173	1	0.0043
1 - 8	30.392	8	0.0002	8	4.315	1	0.0378
1 - 9	30.757	9	0.0003	9	2.339	1	0.1261
1 - 10	30.763	10	0.0006	10	2.055	1	0.1517
1 - 11	30.772	11	0.0012	11	1.146	1	0.2844
1 - 12	30.969	12	0.0020	12	2.344	1	0.1258

Test robust to heteroskedasticity

Postnatal care services

2016- Right-side panel of the output table shows that autocorrelation is present up to lag 6 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (6)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	30.552	1	0.0000	1	30.552	1	0.0000
1 - 2	33.893	2	0.0000	2	13.014	1	0.0003
1 - 3	34.809	3	0.0000	3	8.693	1	0.0032
1 - 4	34.834	4	0.0000	4	7.209	1	0.0073
1 - 5	35.044	5	0.0000	5	6.706	1	0.0096
1 - 6	35.582	6	0.0000	6	4.976	1	0.0257
1 - 7	38.023	7	0.0000	7	2.820	1	0.0931
1 - 8	44.605	8	0.0000	8	2.893	1	0.0889
1 - 9	47.301	9	0.0000	9	2.277	1	0.1313
1 - 10	48.618	10	0.0000	10	2.142	1	0.1433
1 - 11	49.000	11	0.0000	11	1.563	1	0.2113
1 - 12	49.184	12	0.0000	12	1.510	1	0.2192

Test robust to heteroskedasticity

2017- Right-side panel of the output table shows that autocorrelation is present up to lag 16 but not higher lag orders (up to 20 lags tested). The final model was re-estimated using lag (16)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	26.033	1	0.0000	1	26.033	1	0.0000
1 - 2	39.871	2	0.0000	2	16.244	1	0.0001
1 - 3	45.115	3	0.0000	3	14.328	1	0.0002
1 - 4	46.749	4	0.0000	4	10.563	1	0.0012
1 - 5	46.807	5	0.0000	5	6.241	1	0.0125
1 - 6	64.084	6	0.0000	6	6.523	1	0.0107
1 - 7	68.503	7	0.0000	7	6.960	1	0.0083
1 - 8	68.510	8	0.0000	8	5.654	1	0.0174
1 - 9	68.511	9	0.0000	9	5.199	1	0.0226
1 - 10	69.432	10	0.0000	10	4.911	1	0.0267
1 - 11	76.440	11	0.0000	11	7.183	1	0.0074
1 - 12	76.693	12	0.0000	12	4.549	1	0.0329
1 - 13	78.331	13	0.0000	13	4.251	1	0.0392
1 - 14	81.637	14	0.0000	14	4.041	1	0.0444
1 - 15	82.071	15	0.0000	15	5.489	1	0.0191
1 - 16	82.083	16	0.0000	16	3.907	1	0.0481
1 - 17	82.282	17	0.0000	17	3.252	1	0.0713
1 - 18	82.830	18	0.0000	18	2.959	1	0.0854
1 - 19	89.432	19	0.0000	19	2.390	1	0.1221
1 - 20	92.098	20	0.0000	20	2.880	1	0.0897

Test robust to heteroskedasticity

2018- Right-side panel of the output table shows that autocorrelation is present up to lag 10 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (10)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	24.832	1	0.0000	1	24.832	1	0.0000
1 - 2	25.019	2	0.0000	2	7.880	1	0.0050
1 - 3	25.114	3	0.0000	3	5.815	1	0.0159
1 - 4	25.198	4	0.0000	4	4.996	1	0.0254
1 - 5	25.310	5	0.0001	5	4.179	1	0.0409
1 - 6	25.329	6	0.0003	6	3.277	1	0.0703
1 - 7	26.544	7	0.0004	7	3.746	1	0.0529
1 - 8	27.097	8	0.0007	8	3.853	1	0.0496
1 - 9	27.288	9	0.0013	9	5.406	1	0.0201
1 - 10	28.435	10	0.0015	10	4.735	1	0.0296
1 - 11	29.782	11	0.0017	11	2.883	1	0.0895
1 - 12	31.289	12	0.0018	12	2.848	1	0.0915

Test robust to heteroskedasticity

Appendix 4.5: Demographic distribution of KII and document details for DR

<i>Type of data</i>	<i>Participant role</i>	<i>Gender</i>	<i>Education</i>	<i>Years of experience</i>	<i>Years with MHTs</i>
<i>KII</i>	Program director (ARCS)	Male	Physician/MPH	> 10 years	10 years in current capacity
<i>KII</i>	Regional Health Officer (ARCS)	Male	Physician		
<i>KII</i>	Midwife	Female	Graduate	> 10 years	3 years in current capacity
<i>KII</i>	MHT doctor	Male	Physician	5 years	3 years in current capacity
<i>KII</i>	Operations manager for all MHTs (ARCS)	Male	Physician	> 10 years	> 5 years
<i>KII</i>	Health in Emergency Officer (ARC)	Male	Physician		
<i>KII</i>	Program manager (CRCS-local)	Male	Program management		> 4 years
<i>KII</i>	Midwife	Female	Graduate	> 5 years	3 years in current capacity
<i>KII</i>	MHT doctor	Male	Physician		
	Document Type	Title	Authors	Organization	Year
<i>DR</i>	Internal evaluation and review	Afghanistan: Review ARCS Health and Care Program 2011-2015. Basic Health program sub-report	Nuran Higgins	Norwegian Red Cross and Afghanistan Red Crescent	2015
<i>DR</i>	Internal evaluation and review	Afghanistan: Review ARCS Health and Care Program 2011-2015. Mobile Health Team (MHT program review sub-report)	Nuran Higgins	Norwegian Red Cross and Afghanistan Red Crescent	2017
<i>DR</i>	Internal midterm evaluation and review	Strengthening Emergency Relief and Disaster Response Capacity of the Afghan Red Crescent Society	Hani Dajani	Canadian Red Cross	2018
<i>DR</i>	Project management final report	Swedish RC project/program management report Final report	Hani Dajani	Swedish Red Cross	2018
<i>DR</i>	Final evaluation and review	Strengthening Emergency Relief and Disaster Response Capacity of the Afghan Red Crescent Society (2013 - 2019)	Hani Dajani	Canadian Red Cross	2019

KII: Key Informant Interviews

DR: Document Review

Appendix 4.6: Qualitative data organization and code description

Themes	Sub-themes	Categories	Files	References	Examples/Description
Need for MHT operations	<i>Service gaps</i>	Services for hard-to-reach areas	10	25	Isolated regions, mountainous regions, conflict-affected, natural disaster-affected, for internally displaced and areas where health facilities or health services are not available.
		Lack of trained staff in remote areas	2	5	Trained staff to deliver health services is not available in remote areas, so they rely on MHTs
	<i>Access needs</i>	Improving access for the most vulnerable	3	8	Bringing services to the communities is helpful to the most vulnerable
		Reducing financial burdens	2	2	The MHT bring services to the communities, decreasing travel-related and other costs for the communities.
	<i>Community ownership and satisfaction</i>	Service ownership	5	10	People in the communities take ownership of the team and services provided
		Community satisfaction	2	5	People in the communities are happy to see MHTs
Strengthening primary healthcare systems	<i>Community engagement</i>	Community engagement	4	8	The work requires building trust with the community and keeping them engaged.
	<i>Referral pathways</i>	Referral pathways	2	3	The doctors, nurses and midwives in the MHTs are able to identify cases that need additional health services and are able to provide referral pathways.
	<i>Sustainability</i>	Sustainability	5	9	Centralized systems with financial sustainability and continued acceptance by the community are important for sustainability.
Barriers to MHT operations	<i>Barriers to service delivery and access</i>	Cultural barriers	8	14	Cultural practices impact women's access to services delivered and midwives' delivery of those services.
		Language barriers	1	2	Multinational, multiethnic country, issues arise when local staff is not hired - there are language issues.
		Long distances to cover	4	4	Termed as 'high coverage area'- there are long distances as remote areas are far away, the villages to be covered even in one district are spread over a long distance.
		High workload	2	2	High volume of patients
		Inadequate training	4	12	There wasn't enough training for the staff to update their skill and deliver quality services.
		Lack of equipment and resources	7	16	Lack of funding and resources, including medicines and necessary equipment for midwives, were sometimes insufficient or unavailable.
		Insecurity	9	13	Armed conflict and general insecurity in the country affected access to and delivery of healthcare services.

Continued on next page...

Themes	Sub-themes	Categories	Files	References	Examples/Description
Barriers to MHT operations	<i>Barriers to Staff Retention</i>	Need for Mahram	4	8	The need to hire a male family member posed difficulty in hiring and retaining midwives and drove the costs up.
		Inadequate pay	6	8	Late payments and salaries are inadequate for the risk taken to deliver the services.
		Competing priorities	3	3	Staff, especially women, have competing family-related priorities that force them to leave.
MHT strengths	<i>Community acceptability of services</i>	Cultural acceptance	7	13	Respecting local culture and traditions increased trust among communities and the acceptability of MHTs
		Midwives acceptability	8	14	The presence of midwives and their Marham increased the acceptability of services.
	<i>Coordination</i>	Communication and coordination	7	12	Coordinating with the Ministry of Public Health for the delivery of services
	<i>Contribution of ARCS</i>	Movement principles	1	1	The RCRC movement principles contributed to improved service delivery
		Red crescent volunteers in communities	7	11	Thousands of ARCS community volunteers support MHT operations and facilitate delivery
<i>Advantages of having midwives in MHTs</i>	Difference after midwives inclusion	8	19	The type of services available and accessible for women in the communities increased.	

Appendix 4.7: Provincial distribution of population proportionate distribution of outcome variables based on level of insecurity

Level of insecurity	Provinces	Childhood vaccinations (%)	Tetanus toxoid vaccinations (%)	ANC (%)	PNC (%)
Least insecure	Parwan	1.3	1.8	1.4	1.2
	Samangan	0.7	1.1	0.7	0.6
	Nimroz	1.6	3.5	2.4	0.3
	Daykundi	1.4	3.8	0.6	0.3
	Khost	0.9	3.2	1.8	1.1
	Kapisa	1.9	5.8	1.1	0.4
	Laghman	0.3	0.6	0.8	0.1
Moderately insecure	Kabul	3.1	2.5	1.5	1.1
	Ghor	0.6	1.4	0.4	0.1
	Kunar	0.2	0.3	2.2	1.3
	Sarepol	0.1	0.5	1.0	0.4
	Takhar	0.3	0.4	1.8	0.6
	Badakhshan	0.2	0.5	2.7	0.8
	Jawzjan	0.1	0.3	0.4	0.1
	Paktika	1.4	1.1	0.4	0.3
	Herat	0.5	0.8	0.9	0.4
	Balkh	0.4	0.5	1.1	0.3
	Badghis	2.4	4.9	2.6	3.0
	Baghlan	0.2	1.9	0.7	0.3
	Logar	0.2	0.3	1.8	1.0
	Paktia	8.6	6.0	0.7	0.6
Most insecure	Faryab	0.3	0.9	0.5	0.1
	Farah	0.7	2.2	3.5	0.0
	Kunduz	1.0	4.2	1.7	0.0
	Kandahar	1.1	1.3	1.3	1.2
	Nangarhar	0.9	0.9	1.1	0.5
	Helmand	2.0	1.8	0.9	0.6

Appendix 4.8: Cumby-Huizinga test for autocorrelation – RQ 2.2

Childhood vaccination

Moderate vs. Least insecure-
Right-side panel of the output table shows that autocorrelation is present up to lag 6 but not higher lag orders (up to 12 lags)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	14.152	1	0.0002	1	14.152	1	0.0002
1 - 2	17.054	2	0.0002	2	8.082	1	0.0045
1 - 3	23.337	3	0.0000	3	8.764	1	0.0031
1 - 4	27.207	4	0.0000	4	9.810	1	0.0017
1 - 5	30.934	5	0.0000	5	8.004	1	0.0047
1 - 6	32.296	6	0.0000	6	5.488	1	0.0191
1 - 7	33.675	7	0.0000	7	3.238	1	0.0719
1 - 8	33.742	8	0.0000	8	2.597	1	0.1071
1 - 9	36.017	9	0.0000	9	2.502	1	0.1137
1 - 10	38.868	10	0.0000	10	2.648	1	0.1037
1 - 11	39.806	11	0.0000	11	2.828	1	0.0926
1 - 12	40.268	12	0.0001	12	2.228	1	0.1355

Test robust to heteroskedasticity

Most vs Least insecure-Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (8)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	50.901	1	0.0000	1	50.901	1	0.0000
1 - 2	56.852	2	0.0000	2	22.549	1	0.0000
1 - 3	57.570	3	0.0000	3	12.952	1	0.0003
1 - 4	58.040	4	0.0000	4	10.858	1	0.0010
1 - 5	58.479	5	0.0000	5	9.565	1	0.0020
1 - 6	60.492	6	0.0000	6	9.775	1	0.0018
1 - 7	60.524	7	0.0000	7	5.816	1	0.0159
1 - 8	60.559	8	0.0000	8	3.626	1	0.0569
1 - 9	60.710	9	0.0000	9	3.109	1	0.0779
1 - 10	61.446	10	0.0000	10	2.858	1	0.0909
1 - 11	61.633	11	0.0000	11	3.560	1	0.0592
1 - 12	61.695	12	0.0000	12	2.422	1	0.1196

Test robust to heteroskedasticity

Tetanus toxoid vaccination

Moderate vs. Least Insecure-
Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (8)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	29.921	1	0.0000	1	29.921	1	0.0000
1 - 2	40.760	2	0.0000	2	18.681	1	0.0000
1 - 3	41.333	3	0.0000	3	11.098	1	0.0009
1 - 4	43.136	4	0.0000	4	8.331	1	0.0039
1 - 5	43.258	5	0.0000	5	10.719	1	0.0011
1 - 6	43.611	6	0.0000	6	14.176	1	0.0002
1 - 7	58.008	7	0.0000	7	6.490	1	0.0108
1 - 8	58.146	8	0.0000	8	4.199	1	0.0404
1 - 9	58.218	9	0.0000	9	3.671	1	0.0554
1 - 10	59.119	10	0.0000	10	3.431	1	0.0640
1 - 11	60.797	11	0.0000	11	4.372	1	0.0365
1 - 12	62.004	12	0.0000	12	3.642	1	0.0563

Test robust to heteroskedasticity

Most vs. Least Insecure-Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (8)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	31.292	1	0.0000	1	31.292	1	0.0000
1 - 2	36.481	2	0.0000	2	14.877	1	0.0001
1 - 3	36.495	3	0.0000	3	7.323	1	0.0068
1 - 4	36.835	4	0.0000	4	5.452	1	0.0195
1 - 5	40.822	5	0.0000	5	6.187	1	0.0129
1 - 6	45.993	6	0.0000	6	6.303	1	0.0121
1 - 7	46.424	7	0.0000	7	5.938	1	0.0148
1 - 8	46.455	8	0.0000	8	2.938	1	0.0865
1 - 9	47.023	9	0.0000	9	2.091	1	0.1482
1 - 10	48.305	10	0.0000	10	1.461	1	0.2268
1 - 11	48.546	11	0.0000	11	2.304	1	0.1291
1 - 12	48.773	12	0.0000	12	2.539	1	0.1111

Test robust to heteroskedasticity

ANC services

Moderate vs. Least insecure- Right-side panel of the output table shows that autocorrelation is present up to lag 14 but not higher lag orders (up to 18 lags tested). The final model was re-estimated using lag (14)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	81.504	1	0.0000	1	81.504	1	0.0000
1 - 2	83.602	2	0.0000	2	29.398	1	0.0000
1 - 3	90.512	3	0.0000	3	19.822	1	0.0000
1 - 4	90.617	4	0.0000	4	15.227	1	0.0001
1 - 5	90.634	5	0.0000	5	10.797	1	0.0010
1 - 6	90.944	6	0.0000	6	10.011	1	0.0016
1 - 7	92.425	7	0.0000	7	10.393	1	0.0013
1 - 8	95.648	8	0.0000	8	8.967	1	0.0027
1 - 9	101.575	9	0.0000	9	9.632	1	0.0019
1 - 10	102.866	10	0.0000	10	8.524	1	0.0035
1 - 11	103.877	11	0.0000	11	6.207	1	0.0127
1 - 12	103.974	12	0.0000	12	5.489	1	0.0191
1 - 13	104.299	13	0.0000	13	4.766	1	0.0290
1 - 14	104.812	14	0.0000	14	5.222	1	0.0223
1 - 15	104.819	15	0.0000	15	3.020	1	0.0823
1 - 16	106.395	16	0.0000	16	2.356	1	0.1248
1 - 17	107.992	17	0.0000	17	2.388	1	0.1223
1 - 18	108.343	18	0.0000	18	2.700	1	0.1004

Test robust to heteroskedasticity

Most vs. Least insecure- Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (8)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	8.917	1	0.0028	1	8.917	1	0.0028
1 - 2	9.268	2	0.0097	2	1.530	1	0.2161
1 - 3	10.134	3	0.0175	3	1.840	1	0.1750
1 - 4	10.512	4	0.0326	4	1.593	1	0.2069
1 - 5	10.586	5	0.0602	5	0.589	1	0.4427
1 - 6	10.588	6	0.1020	6	10.241	1*	0.0014
1 - 7	12.057	7	0.0987	7	4.997	1*	0.0254
1 - 8	13.778	8	0.0877	8	2.001	1*	0.1572
1 - 9	14.492	9	0.1059	9	0.300	1	0.5837
1 - 10	16.278	10	0.0919	10	1.447	1	0.2289
1 - 11	16.808	11	0.1137	11	0.007	1	0.9320
1 - 12	18.681	12	0.0965	12	0.056	1	0.8133

Test robust to heteroskedasticity
* Eigenvalues adjusted to make matrix positive semidefinite

PNC services

Moderate vs. Least insecure-
Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 12 lags tested). The final model was re-estimated using lag (8)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	36.024	1	0.0000	1	36.024	1	0.0000
1 - 2	42.216	2	0.0000	2	15.765	1	0.0001
1 - 3	45.248	3	0.0000	3	12.093	1	0.0005
1 - 4	45.522	4	0.0000	4	10.733	1	0.0011
1 - 5	45.594	5	0.0000	5	8.626	1	0.0033
1 - 6	50.578	6	0.0000	6	7.737	1	0.0054
1 - 7	54.786	7	0.0000	7	5.984	1	0.0144
1 - 8	54.879	8	0.0000	8	4.113	1	0.0426
1 - 9	55.637	9	0.0000	9	3.073	1	0.0796
1 - 10	55.749	10	0.0000	10	2.553	1	0.1101
1 - 11	58.069	11	0.0000	11	1.630	1	0.2017
1 - 12	58.581	12	0.0000	12	1.059	1	0.3034

Test robust to heteroskedasticity

Most vs. Least insecure-
Right-side panel of the output table shows that autocorrelation is present up to lag 8 but not higher lag orders (up to 15 lags tested). The final model was re-estimated using lag (12)

Cumby-Huizinga test for autocorrelation							
H0: disturbance is MA process up to order q							
HA: serial correlation present at specified lags >q							
H0: q=0 (serially uncorrelated)				H0: q=specified lag-1			
HA: s.c. present at range specified				HA: s.c. present at lag specified			
lags	chi2	df	p-val	lag	chi2	df	p-val
1 - 1	26.653	1	0.0000	1	26.653	1	0.0000
1 - 2	36.272	2	0.0000	2	16.116	1	0.0001
1 - 3	36.391	3	0.0000	3	10.097	1	0.0015
1 - 4	39.934	4	0.0000	4	8.413	1	0.0037
1 - 5	41.850	5	0.0000	5	7.559	1	0.0060
1 - 6	41.872	6	0.0000	6	5.731	1	0.0167
1 - 7	42.051	7	0.0000	7	4.551	1	0.0329
1 - 8	47.435	8	0.0000	8	7.039	1	0.0080
1 - 9	47.542	9	0.0000	9	5.038	1	0.0248
1 - 10	51.553	10	0.0000	10	6.506	1	0.0108
1 - 11	52.019	11	0.0000	11	4.731	1	0.0296
1 - 12	54.028	12	0.0000	12	3.551	1	0.0595
1 - 13	54.041	13	0.0000	13	3.551	1	0.0595
1 - 14	54.058	14	0.0000	14	1.867	1	0.1718
1 - 15	54.670	15	0.0000	15	2.379	1	0.1229

Test robust to heteroskedasticity

Curriculum Vitae

Name: Faiza Rab

Post-Secondary Education and Degrees: University of Western Ontario
London, Ontario, Canada
2012 Masters of Science in Epidemiology and Biostatistics
Thesis: Impact of perceived social support on health-related quality of life in women with breast cancer among women with low socioeconomic status.

University of Toronto
Toronto, Ontario, Canada
2008 Masters of Health Sciences in Bioethics

Allama Iqbal Medical College
Lahore, Pakistan
2003 Bachelor of Medicine and Bachelor of Surgery (M.B.B.S)

Honours and Awards: Mitacs Accelerate Fellowship
Grant: Optimizing COVID-19 response capacity at CRC through technical and evidence-based operational support to CRC's Global Health Unit (Health in Emergencies)
2020 - 2021

Mitacs Accelerate Fellowship
Grant: Evidence-based delivery of effective packages of health services in humanitarian, fragile and conflict-affected areas
2019 - 2020

Honours and Awards (continued):	Canadian Institute of Health Research (CIHR)- Health System Impact Fellowship (HSIF) Grant: Efficient Disaster Response and Integration of Health Services: Supporting the Canadian Red Cross RMNCAH (Reproductive Maternal Neonatal and Child Health) 2018 – 2019
	Western Graduate Research Scholarship 2016 - 2018
Related Work Experience:	Senior Manager Health in International Long-term Programming- Health in Emergencies Canadian Red Cross, Canada 2022 – Present
	Senior Manager Health Intelligence, Research and Development- Health in Emergencies Canadian Red Cross, Canada 2021 – 2022
	Graduate Student Co-Supervisor (MPH, Master of Science students from the University of Western Ontario, University of Alberta, Simon Frasier University, McGill University, McMaster University, University of Ottawa and Public Health Agency of Canada) Canadian Red Cross, Canada 2018 - Present
	Graduate Teaching and Research Assistant University of Western Ontario 2016 - 2018

**Relevant
Publications:**

Rab, F., Razavi, D., KONE, M. *et al.* Implementing community-based health program in conflict settings: documenting experiences from the Central African Republic and South Sudan. *BMC Health Serv Res* **23**, 738 (2023). <https://doi.org/10.1186/s12913-023-09733-9>

Khalid, A.F., Grimshaw, J.M., Parakh, N.D, Charide, R., **Rab, F.**, Sohani, Salim. Decision-makers' experiences with rapid evidence summaries to support real-time evidence informed decision-making in crises: a mixed methods study. *BMC Health Serv Res* **23**, 282 (2023). <https://doi.org/10.1186/s12913-023-09302-0>

Lyles, E., Diaz, M., Ververs, M., Sohani, S., Michaud, S., **Rab, F.**, Spiegel, P. Emergency health surge support: Lessons learned from a review of Red Cross responses, 2015-2019. *Journal of Emergency Management* 21, 1 (2023). DOI: [10.5055/jem.0722](https://doi.org/10.5055/jem.0722)

Jafari, M., Jafari, F., **Rab, F.**, Ormel, I. The health burden of the Afghan Woman: Navigating challenges amidst calamity. News Security Beat, the blog of the Environmental Change and Security Program, Wilson Center (2023). Available at: [The Health Burden of the Afghan Woman: Navigating Challenges Amidst Calamity \(newsecuritybeat.org\)](https://www.wilsoncenter.org/blog-post/the-health-burden-of-the-afghan-woman-navigating-challenges-amidst-calamity). Last accessed: November 2023.

Relevant Publications: Wheeler, D., Ormel I., Assefa M., **Rab F.**, Angelakis M., Yaya Sanni., Sohani S. Engaging Community Health Workers (CHWs) in Africa: lessons from the Canadian Red Cross supported programs. PLOS Global Public Health 4(1): e0002799. <https://doi.org/10.1371/journal.pgph.0002799>

Relevant Conference Participation: Canadian Conference on Global Health
Ottawa, Canada - 2023
Abstracts accepted:

1. Oral: Supporting Pakistan Red Crescent in Rapid health systems assessments after the 2022 floods in Pakistan. Role: Author and Presenter
2. Oral: Role of Mobile Health Units in delivery of primary health care services after the 2022 floods in Pakistan. Role: Co-author
3. Symposium: Empowering Community Health Workers in Africa to delivery community health services
Role: Co-author and Panelist

Canadian Conference on Global Health
Ottawa, Canada & Virtual - 2021
Abstracts accepted:

4. Oral: Rethinking health research partnerships: innovative approaches for health research in acute conflict settings
Role: Author and Presenter
5. Oral: Linking data to strengthen pandemic response: spatial analysis of the Canadian red cross service delivery
Role: Co-author

**Relevant
Conference
Participation
(continued):**

6. Oral: Engaging global partners to overcome inequities in delivery of essential health services to reduce childhood mortality in LMICs
Role: Co-author
7. e-Poster: Role of partnerships in operationalizing Reproductive, Maternal, Neonatal, Child, and Adolescent Health service delivery in conflict settings
Role: Author and Presenter

World Congress of Epidemiology
Sydney, Australia & Virtual - 2021

Abstract accepted:

8. Oral: Evaluating the impact of engaging female health workers in conflict-affected areas in Afghanistan
Role: Author and Presenter
9. Oral: Strengthening of health systems through the empowerment of female health workers in Pakistan
Role: Author and Presenter

Sixth Global Symposium on Health Systems Research
Dubai, U.A.E & Virtual - 2021

Abstract accepted:

10. Symposium: Deploying evidence to inform decisions and build accountability: Re-imagining health systems in the era of increased humanitarian crises
Role: Co-author and Panelist

Relevant Conference Participation (continued):

Canadian Conference on Global Health
Virtual - 2020
Abstracts accepted:

11. Workshop: Challenges and strategies for adapting to COVID-19 realities while supporting ongoing Red Cross Red Crescent health projects in Low- and Middle-Income Countries (LMIC) (Lessons learned/implication for climate action)
Role: Co-author and Co-Host
12. Oral: Strengthening COVID-19 response through synergies between Canadian Red Cross and Canadian Government agencies
Role: Co-author
13. e-Poster: Optimizing knowledge management and utilization to facilitate rapid surge in Canadian Red Cross's COVID-19 response.
Role: Author and Presenter
14. e-Poster: Challenges in delivering basic health services to Rohingya refugees in Cox's bazaar, Bangladesh: adapting services to COVID-19 realities.
Role: Co-author

World Public Health Congress
Rome, Italy & Virtual - 2020
Abstracts accepted:

15. Oral: Building trust and enhancing localization to improve access to women's health services in Afghanistan
Role: Author and Presenter

Relevant Conference Participation (continued): Canadian Conference on Global Health
Ottawa, Canada - 2019
Abstracts accepted:

16. Symposium: Governance of health systems during disaster relief: Integration of International humanitarian aid workers in local health facilities for more effective collaboration
Role: Co-author
17. Oral: Ensuring Equity and Sustainability of Data in Global Health Research
Role: Co-author
18. Poster: Bridging health inequities, improve health coverage and provide stable governance of healthcare systems in Afghanistan
Role: Author
19. Poster: Bridging the health inequity gaps in governance of health systems through the engagement of female health workers in the delivery of essential health care needs in Pakistan
Role: Author and Presenter
20. Poster: Solar-Powered Water pumps, a simple solution to a complex health problem- experiences from Pakistan
Role: Co-author

Relevant Conference Participation (continued):

Student Health Research Forum

Canadian Health Sciences Graduate Student Association and University of Manitoba

Winnipeg, Manitoba - 2019

Nominated by the Department to be one of the representatives from the University of Western Ontario

21. Poster: Effectiveness and Sustainability of Mobile Health Teams in Delivering Reproductive, Maternal, Neonatal and Child health care in Afghanistan

Role: Author and Presenter

National Conference of Canadian Society of Epidemiology and Biostatistics

Ottawa, Ontario - 2019

Abstracts accepted:

22. Poster: Impact of female health workers in the delivery of essential healthcare needs in Pakistan

Role: Author and Presenter

23. Poster: Impact of Mobile Health Teams in Delivering Reproductive, Maternal, Neonatal and Child health care in Afghanistan

Role: Author and Presenter

24. Poster: Impact of Solar Waterpower pumps in improving health outcomes in drought-affected areas in the south of Pakistan

Role: Author and Presenter

Relevant Conference Participation (continued):

Canadian Conference on Global Health
Toronto, Ontario - 2018
Abstract accepted:
25. Oral: Strategies to improve childhood vaccinations in fragile settings
Role: Author and Presenter

Fifth Global Symposium on Health Systems Research
Liverpool, United Kingdom - 2018
Abstract accepted:
26. Oral: Effective strategies for implementing childhood immunizations in fragile contexts: Identification and review of community-based strategies
Role: Author and Presenter

Canadian Society of Epidemiology and Biostatistics – National Student Conference
Thunder Bay, Ontario - 2018
Abstract accepted:
27. Oral: Systematic review and meta-analysis for effective vaccination strategies in fragile contexts
Role: Author and Presenter