ISLAMIC RELIEF

ADELPHI UNIVERSITY

A RESEARCH STUDY ON

THE IMPACTS OF CLIMATE CATASTROPHE ON EXPECTANT AND LACTATING MOTHERS AND INFANTS IN FLOOD HIT AREAS OF SINDH AND KHYBER PAKHTUNKHWA

Credits

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Foreword

What are we doing to Mother Nature? This question started popping up in my head when climate emergencies became more deadly and frequent across the globe, especially in Pakistan. We waste water, put forests on fire, plant less trees and emit carbon throughout the year and in return we expect Mother Nature to be gentle to, and calm for us.

Amidst an escalating environmental crisis, women, especially pregnant and new mothers, are out at the forefront. They are part of those vulnerable groups under which infants, elderly and people with disability fall. The rising temperatures and erratic weather patterns are causing early and underweight births. Similarly, with poor air quality, the adverse outcomes during pregnancy are expected to rise.

In August 2022, Pakistan witnessed the worst flooding affecting roughly 33 million people among which a staggering 650,000 were expectant women. As water lashed villages, women gave births on roads, in tents and in vehicles with no access to basic health services. Both expecting and lactating mothers had to survive a calamity of a lifetime.

Besides all the groundwork, Islamic Relief has conducted valuable research in flood affected areas to broaden its emergency response and help the most in need. **'Impacts of Climate Catastrophe on Expectant and Lactating Mothers and Infants in Floods Hit areas of Sindh and Khyber Pakhtunkhwa'** unfolds the hidden and invisible impacts of climate induced disasters on the most vulnerable. It hints at the dire need to come up with urgent policy making and legislations to protect our very own in a dignified manner.

I hope this study will be a steppingstone for all stakeholders including humanitarian actors, policy makers, media, academia, think tanks and civil society to ensure that our women are well-protected and are at the heart of humanitarian and development efforts.

Asif Sherazi

Country Director,
Islamic Relief Pakistan

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Executive Summary

Pakistan ranks 10th among the most affected countries by climate disasters. Rural areas are more prone to adverse effects resulting from those disasters. The summer of 2022 was characterized as record-breaking in extreme climatic variations in Pakistan, where heatwaves were immediately followed by monsoon floods that submerged a third of the country, causing the loss of life of 1500 people. Overall, it impacted the livelihood of over 33 million people. Among all persons affected, there were approximately 650,000 pregnant women in urgent need of maternal services.

To support the urgent and long-term recovery of mothers and infants from floods, this study aimed to examine the impact of the monsoon flood of 2022 on the health of expecting and lactating mothers and their children and families and propose policies and program recommendation to strengthen safe delivery practices and long-term comprehensive care towards pregnant and lactating mothers and their children in flood relief camps.

This study utilized a mixed-method participatory approach, which includes three main parts: Group Model Building (GMB) workshops, case studies, and community surveys in most affected villages in Dera Ismail Khan(DI Khan) and Dadu districts of respectively Khyber Pakhtunkhwa and Sindh provinces of Pakistan.

Most families were still in a dire situation three months after the flood. Most families in DI Khan had moved back to their original residence, but families in Dadu still lived under tents. In some parts of Dadu, water had not fully retreated. Since their village was still submerged by flood water, families were not able to farm, missing on a fundamental source of income. Without a stable income, household food security suffered. Without nutritious food, mothers were not able to breastfeed children. Without sufficient income, purchasing formula milk became a huge burden. Mothers had to further sacrifice their health (do more work and eat less) to first ensure food for their children. GMB workshops showed the cycle of poverty that families were confronting after the flood. Many families had to use savings and assets in exchange of goods to survive.

In the community, access to safe and improved sanitary and hygiene facilities (WASH) was also a vast challenge after the flood and its absence was closely associated with poor maternal health. In all the workshops and case studies, participants mentioned that they got skin diseases due to being in contact with unclean water. Parents also mentioned the high cost of purchasing and transporting clean water. In addition, open defecation was common in the community in absence of improved sanitation, which further polluted sources of drinking water.

The quantitative data collected from 150 families in the considered areas provide details and a sense of the scale of the risks associated with maternal health mentioned by the communities during the GMB workshops and case studies. Among the 150 families we surveyed, there were 156 children under two years old; 64 (42.7%) of them were below two standard deviations from the height for age median of the World Health Organization (WHO) Child Growth Standards, considered as the reference for being stunted. Only three mothers did not report any delay in infant development. Breastmilk was key for children's optimal growth, but none of the mothers were able to practice exclusive breastfeeding for children under six months old as per WHO recommendations. The main reasons were lack of breastmilk and lack of privacy.

Parents health and mental health were also severely negatively impacted by the summer 2022 floods. More than half of the mothers and fathers reported weight loss and exhaustion. Around 40% of parents have been diagnosed with diarrhea and skin diseases or reported symptoms of diarrhea and skin diseases. As for mental health, 75.3% of mothers and 71.4% of fathers scored over the threshold of significant depressive symptoms.

Quantitative data also revealed changes in access to WASH and healthcare facilities before and after the flood. Even though most families did have access to a seemingly improved water source, families reported a change in the taste of the water collected from the well. As for sanitation, 71 (47.7%) had flush family toilets inside their house before the flood, and the rest of the families used pit latrines with ventilation. However, only 26 (17.4%) families still had flush toilets inside their house, and 67 (45%) families no longer had access to any toilets but had to go outside after the flood.

To address such challenges to the flood relief and recovery process, government and non-profit organizations were providing various services. Our researchers observed that various services were provided and infrastructures were operated by local organizations. Still, study participants reported that the services distributed by the government and nongovernmental organizations did not exist and sometimes were tainted by practices of corruption and therefore did not reach the most in need. In addition, some public assistance programs were disrupted after the flood, possibly due to a lack of funding from the government.

Findings of this study show that children and mothers were in urgent need of nutritional interventions in order not to miss key windows of optimal growth. Even though many governmental and non-governmental organizations were working on the distribution of ready-to-use therapeutic food or ration bag, there is a need for improved equity in this distribution of services, and for considering actual nutritional needs when planning the food distribution.

Second, mothers should be informed of the importance of exclusive breastfeeding for their newborn children and of keeping breastfeeding until the age of two years old. A community should also organize safe spaces for mothers to breastfeed. Breastfeeding is even more crucial in emergency, especially when the water sources are polluted.

In addition, facing the challenges of lack of income and jobs and of poor public infrastructure, a temporary cash-for-work program should be introduced. Families could be paid to assist in the community recovery process. Such an approach provides the opportunity for disaster survivors to regain dignity and self-esteem through their working contribution. It might also foster the local community's economic recovery and reconstruction process.

As for the long-term planning for building community resilience against future climate disasters, strengthening social safety nets constitutes a vital initiative to prevent poverty following disasters. Second, with the improvement of disaster relief knowledge and widespread social media outreach, disaster warning systems and basic disaster preparedness training should be established in every community. Third, improving infrastructures, especially water management systems, is crucial to preventing future flood disasters. With climate change worsening, an increased frequency of climate disasters is inevitable. To better protect people's life and well-being, governments need to implement strategies to promote the resilience of at-risk communities.

Background

Extreme weather phenomena increased by 46% between 2007 and 2017 and have become more intense with an increase in global average temperatures. This increased intensity of climate variations often induces humanitarian crises and affects the long-term well-being of populations, particularly the most vulnerable communities living in low-and middle-income countries (LMICs). Expectant and lactating mothers are among the most vulnerable groups faced with climate catastrophes that affect their individual health and the health of their children. The United Nations Population Fund (2015) reported that 61% of global estimates of maternal deaths (303,000) occur in areas of humanitarian crisis or fragile conditions.

Climate change has been found to directly impact maternal and perinatal health through individual, family, and community factors. The physical and mental health of mothers directly impacts the health of their children. The prolonged and intensified stresses from climate disasters increase the risks of preterm birth, premature rupture of membranes, low birth weight, and stillbirth. Children born to stressed mothers are more likely to be stunted and underweight, and slow in brain development . Extreme weather also increases the likelihood of postpartum depression and post-traumatic stress disorder, which in turn impacts the quality of caregiving of mothers toward their children. At the familial and community levels, extreme weather often results in the disruption of agricultural production, a primary source of income and food for rural families. Climate disasters also lead to a shortage of safe water and sanitation, which in turn increases the spread of infectious diseases such as diarrhea and cholera.

Pakistan ranks 10th among the most affected countries by climate disasters. Rural areas are more prone to adverse effects resulting from those disasters. The summer of 2022 was characterized by record-breaking extreme climatic variations in Pakistan, where heatwaves were immediately followed by monsoon floods that submerged a third of the country, causing the loss of life of 1500 people. Overall, it impacted the livelihood of over 33 million people. Among all persons affected, there were approximately 650,000 pregnant women in urgent need of maternal services (UNFPA, 2022).

Effective and expedient disaster response is crucial for saving mothers' and children's lives, in addition to building a foundation for a long-term recovery during and after floods. However, in September 2022, the United Nations Office for Coordination of Humanitarian Affairs (OCHA, 2022) reported that right after the flood, waterborne infectious diseases were prevalent in all the flood-affected areas of Sindh: 83% of key informants reported high prevalence of malaria and dengue, followed by cough, cold, and fever, as well as tropical/skin diseases. In addition to infectious diseases, 37 percent of key informants also reported that health facilities were still not functional and unable to respond to emergency health needs. In this context, expecting and lactating mothers are not able to complete regular prenatal visits and deliver safely in healthcare facilities. In addition, unsafe shelters, damaged roads, insufficient food, and poor access to clean water and sanitation represent many other health threats for mothers and infants. In October, OCHA reported that 1 in 9 children suffered from severe acute malnutrition.

After the 2022 floods, global communities and local NGOs worked together to rebuild communities. However, recovery and services delivery have not fully caught up with the lingering needs. OCHA reported that about 12-15% of affected populations only received relief assistance in October. A key priority is to ensure the safety of mothers and infants and reduce infant mortality by identifying the most vulnerable households and communities, assessing their unmet needs, existing communal resources, and the state of the services delivery system.

Study Aim

To support the urgent and long-term recovery of mothers and infants from floods, this study proposed the following three main aims:

1) Examine the impact of climate change, specifically the monsoon flooding of 2022, on the physical and mental health of expecting mothers, lactating mothers, their infants, and families.
2) Understand the coping mechanism, resources utilizations, and resilience of expecting and lactating mothers and their families facing a lack of access to food, clean water, and healthcare.
3)Evaluate community health workers practices, livelihoods, and nutrition practices, in response to the urgent and long-term needs identified during and after the floods, as well as their readiness to cope with other climate disasters.
4) Provide policy and program recommendations to strengthen safe delivery practices and long-term comprehensive care for expecting and lactating mothers and their children in flood relief camps. This is intended to further the transition back to normal life and strengthen programs and policy readiness for future climatic disasters.

Method

This study utilized a mix-methods design which consisted of three interconnected parts: participatory research consisting of Group Model Building (GMB) workshops, case studies, and a quantitative cross-sectional survey in the six most affected village areas of Dadu district of Sindh province and Dera Ismail Khan district of Khyber Pakhtunkhwa province.

GMB Workshop

GMB is a participatory method for involving communities in identifying the structural causes of complex local problems and building a common understanding of how social and natural systems interplay with each other and collectively affect the well-being of individuals, families, and communities. GMB generates action ideas from the perspective of the community to improve the system and promote short-term as well as more long-term and sustainable changes.

We conducted GMB workshops with three different groups of village stakeholders: healthcare workers, fathers, and mothers in Dadu and Dera Ismail Khan districts. Each workshop involved 8-15 participants who

voluntarily participated in the discussion. Each workshop was composed of three main sessions: 1. A focus group discussion (FGD), variables elicitation, and wall building; 2. A connection circle elaboration, and 3. Identification of action ideas. First, workshop facilitators introduced the goal of the study. Then, they conducted a FGD aimed at inquiring about difficulties participants were facing following the floods that struck their village and the type of help eventually provided to the village community. Facilitators then asked about factors influencing maternal health and newborn health and organized those variables according to themes in a short session of wall building.

The second session consisted of the elaboration of a connection circle, later formalized into a causal loop diagram (CLD) using Vensim® software. A causal loop diagram is a visual map of the system: It shows interactions existing between factors affecting maternal and newborn health in the wake of the floods. Building a connection circle then represented into a CLD is a way to develop a common picture of the complex local dynamics that characterize maternal and newborn health. It also allows us to elicit the community explanations behind those connections. Participants worked together on drawing the connection circle and diving deeply into the understanding of the structural issues characterizing maternal and newborn health following the floods.
The third session consisted in identifying leverage points in the system and possible action ideas to act upon them and improve the system. Action ideas can be implemented by relief organizations to improve the system. Workshops participants brainstormed together to determine how feasible the implementation of those action ideas were, considering the context as well as how much impact they might have on the system. They used a graphic representation with an x-axis indicating on a continuum between how easy to and how difficult to put in place each action idea is, and a y-axis indicating on a continuum how little to how large an impact each might have. This would determine the feasibility of each action idea. Participants then voted for the top three action ideas that they considered would have the highest impact while being feasible to put in place (i.e., not extremely difficult to implement).

Focused Ethnography Case Study

After we conducted GMB-focused group discussion, we conducted eight case studies in the two districts of Dadu and Dera Ismail Khan to collect individual testimonies of the events undergone as well as the individuals' situation in the aftermath of the floods. We purposefully chose two cases of families with pregnant mothers, together with one case of a family with a lactating mother in each district. These women's interviews offered critical insight into the understanding of mothers' daily coping mechanisms in the flood recovery process.

We interviewed both father and mother in each family. Interview questions were based on the information gained from focused group discussions, centered around three main dimensions of the families experience during and after the flood: families' journey, the eventual support they received following the flood events, and their perception of the structural issues that explain whether disaster preparedness was adequate and what was the ongoing consequences of the 2022 floods and possible other climate events from the past.

In addition to interviews, we also used participatory tools such as transit maps to collect information about community resources. We also interviewed local government officials and local healthcare workers to gather background information about the relief process. We would argue that these six in-depth case studies gave an in-depth first-hand understanding of the consequences of the recent floods on maternal health and were instrumental in elaborating recommendations to improve current remediation interventions and inform future preparedness programs and policies.

Survey

To establish some indicators of the flood impact on maternal and newborn health, we conducted a rapid, needs-based assessment in the two districts of Dadu and Dera Ismail Khan. The survey consisted of both closed and open-ended questions. We used surveyCTO, an online data collection platform, to collect and transfer data in the field.

We used the UNICEF framework on infant and maternal health (See Figure 1 below) to inform our choice of questions: We collected data on the immediate, underlying, and basic causes explaining the current situation of maternal and newborn health. In addition, we also collected information related to the influence of the 2022 flood on those causes. This survey investigated the complex impact of recent floods on individual, family, and community-level factors directly associated with maternal health.

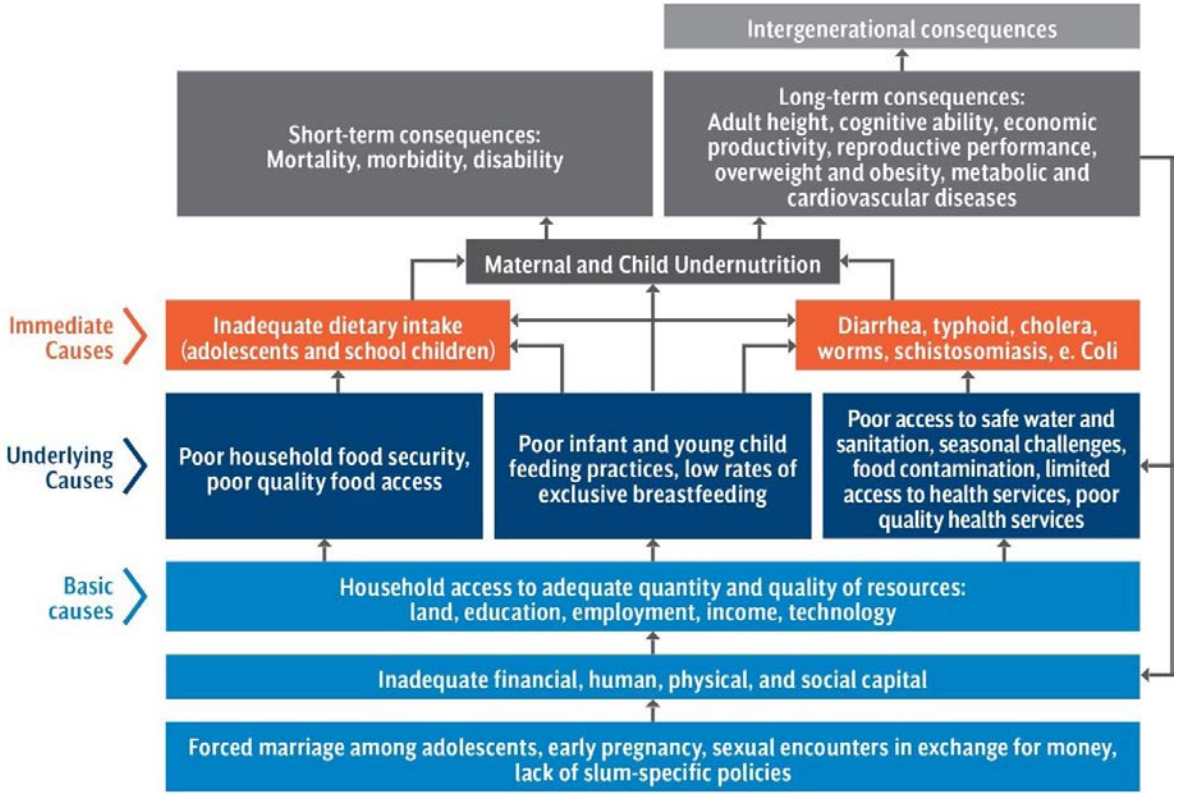


Figure 1. Framework to study the impact of climatic disasters on maternal and newborn health.

Overall, we collected anthropometric measures of infants, information about the feeding practices of mothers, family food security, and dietary diversity practices. We also used locally adapted scales to measure the depression and anxiety of mothers. To assess how the recent flood affected community, family, and individual level factors associated with maternal health, we collected information about the household environment, access to healthcare services, especially maternal and newborn care, disruptions in employment and other income sources. We also collected information about current services offered to pregnant and lactating women and their families.

1.3. Measures and data collection process

1.3.1. Outcomes

1.3.1.1. Nutritional status of children

Underweight and stunting are two key anthropometric measures of undernutrition. *Underweight* defined as weight for age z score (WAZ) is characterized by a score more than two standard deviations below the World Health Organization Child Growth Standard Median. Stunting, defined as height for age (HAZ) is characterized by a score more than two deviations below the WHO Child Growth Standard Median.

Trained and experienced female enumerators collected information about the weight and height of all children under two years old in selected families. They used a standard ruler to measure the length of the children. While taking newborn weight, enumerators were instructed to ensure that the child did not wear heavy clothes. Enumerators first measured the mother's weight and then measured the weight of the mother and her child together, and the difference (i.e., the child's weight) was automatically established by the software. We used the Anthro package in R to calculate the WAZ and scores .

1.3.1.2. Neurodevelopment

We used a home-based developmental screening questionnaire (DSQ) developed by Durkin et al. 1994 and Khan & Durkin 1995 for Bangladesh to identify children at risk of neurodevelopmental impairment. Based on children's age measured in months, different questions were asked to screen delays or difficulties in gross motor, fine motor, vision, hearing, cognition, socialization, behavior, and speech. Parents answered a set of yes or no response questions. The validity and reliability of this questionnaire had been established in a similar population of Bangladesh and Afghanistan. Enumerators collected information by observing children and interviewing mothers.

1.3.2. **Immediate causes.**

1.3.2.1. Exclusive breastfeeding

We used the Infant Young Child Feeding in Emergencies (IYCF-E) developed by the Infant Feeding in Emergencies (IFE) Core Group, a global collaboration of agencies and individuals that formed in 1999 to address policy guidance and training resource gaps hampering programming on infant and young child feeding support in emergencies. These agencies constitute the Global Thematic Working Group on Infant and Young Child Feeding in Emergencies. The IYCF-E measures the frequency of -and identify challenges- to breastfeeding among infant under 6 months of age.

1.3.2.2. Knowledge and attitude of exclusive breastfeeding

We asked open-ended questions about knowledge of exclusive breastfeeding and the challenges mothers face.

1.3.2.3. Complementary feeding

Complementary feeding questions were also gathered using the IYCF with mothers of children between 6 months and two years old. We asked whether mothers continued breastfeeding and what challenges they faced in doing so. We also asked about what other food they fed their children with.

1.3.2.4. Diseases

We developed a set of health screening questions based on the findings from the system dynamics workshops and the case study. We also consulted with a local physician to establish an accurate and locally sound list of the most frequently seen infectious diseases. We asked parents if they and their children had ever been diagnosed with diarrhea, skin diseases, and some other commonly seen diseases. We also asked about symptoms of diarrhea, skin rash, fever, headache, vomiting, stomach, coughing, or being bitten by animals.

1.3.3. **Underlying causes**

1.3.3.1. Household Food Security

The FCS is a measure of household-level food consumption. It provides the frequency of food groups consumed in the past seven days. The frequency of the seven food groups consumed was weighed and summed according to the World Food Program (WFP) weighting model (1996), in which energy dense food such as starch, beans, and flesh meat are weighted higher than foods in other groups. The FCS scores were coded into three categories: acceptable (FCS > 42), borderline (28.5–42), and poor (0–28).
The FCS assigns more weight to protein and calorie-dense food categories than to fruits and vegetables and does not provide specific

information on macro and micronutrients. To fill this gap, the WFP later developed the "Food consumption score nutrition quality analysis" (FCS-N), which aggregates the frequency of 15 food groups into protein-dense food (meat, poultry, fish, eggs, and milk), vitamin A-dense food (vegetables and fruits), and heme iron-dense food (meat, poultry, and fish).

1.3.3.2. WASH access

We asked about the families' access to water, types of bathrooms, and cooking fuel before and after the flood. For water sources, piped water, tank water, water carriers, and tanks, well water with cover as improved water sources, while rainwater, flowing water, and pool water was classified as uncleaned water. We categorized types of toilets into improved sanitation, a category that includes flush toilets, chemical toilets, and pit latrines with ventilation, and unimproved sanitation, which includes bucket toilets and pit latrines without ventilation and no toilet at all. As for the cooking fuel or energy, we categorized electricity, gas, paraffine, and solar energy as clean energy, while wood, coal, and animal dung were considered as unclean energy for the purpose of the current study following international standards.

1.3.3.3. Health of parents

Similarly, to investigate children's health survey, we asked parents if they visited a physician or health clinic after the flood and if children were diagnosed with any disease. We listed most of the diseases encountered following qualitative interviews conducted before the survey. In case parents did not visit any physician or health clinic, we asked them about symptoms of diarrhea, skin rash, fever, difficulty breathing, cough, being bitten by animals, stomachache, and vomiting.

1.3.3.4. Mental health of parents

We used the Center for Epidemiological Studies Depression Scales 10 items (CES-D-10) to assess the mental health of parents. The CES-D-10 is a 10-item Likert scale including three questions on depression, five on somatic symptoms, and two on positive mental wellbeing. The range of possible responses varies from "rarely or none of the time (less than 1 day)" (0) to "all of the time (5-7 days)" (3). The higher the score, the greater the depression symptoms. A cutting point of 10 indicates significant depressive symptoms.

1.3.4. **Basic causes**

1.3.4.1. Loss of Assets and Income

We asked about asset ownership before and after the 2022 flood. We asked about two types of assets. First, we asked about household items: the number of radios, mobile phones, cookers, refrigerators, generators, sewing machines, bicycles, motor bicycles, and cars a family owned before and after the flood. The second list of assets included the type of livestock owned, if any. We asked about the number of cows, horses, donkeys, sheep, and poultry owned by the household. In addition to assets, we also asked about changes in housing and in sources of income.

1.3.4.2. Disaster preparedness

We asked whether families heard about the 2022 flood and how they prepared for it. We included an open-ended question at the end of the interview asking what families eventually did and what measures they took after they heard about the flood to prepare for its upcoming.

1.4. **Samples**

We used a purposeful sampling method to select the three most affected villages in the two districts. In those villages, we relied on local leaders and healthcare workers to identify families with children under two years old.

Within the shared lists of identified families, we selected families based on their distance to the local water body as we wanted to include families living both close and away from the water body. We interviewed both father and mother of each family. We interviewed 75 families in each district for a total of 150 families.

1.5. **Data analysis**

The present report includes some descriptive statistics regarding the impact of the 2022 flood on the maternal and newborn health in Dadu district of Sindh province and Dera Ismail Khan district of Khyber Pakhtunkhwa province. We also conducted a binary analysis to show the associations between key factors identified during the CBSD workshops and maternal and newborn health.

Results

In the results section, we first present the findings from the GMB workshops during which healthcare workers, fathers, and mothers shared their opinions about which factors were associated with maternal health and how they interplayed with each other to collectively impact the well-being of families. Then we use the case studies to deepen our knowledge of individual families' experiences during and after the flood. Lastly, we present the quantitative data to demonstrate the scale of the issues impacting maternal health.

1. Group Model Building

1.1 Variable elicitation: Factors that impact maternal health after the flood

In the first part of the GMB workshops, participants listed factors that were associated with maternal health and voted on the top three most important factors. We describe here the factors that received the most votes from participants in the variables elicitation sessions.

Healthcare workers participants in Dera Ismail Khan district selected awareness, financial help, and good health as the most important factors that determined maternal health status.

> *Awareness: "Due to lack of awareness, people do not understand the value of maternal health...*
>
> *Financial help: "We need financial help from the government or any other organization which is able to provide easily to the needy peoples. In this way almost all our issues can be solved."*
>
> *Good Health: "Due to the flood, there is shortage of food. The health of mothers is badly affected in this village. We need proper food resources for this village."*

In Dadu district, healthcare workers selected water access, poverty, and aid as the most important factors that impact people's health.

> *Water access: "There should be access to safe drinking water to improve the health of mothers and children", "There is no sufficient water for agriculture lands", "waters is a basic need for everyone".*
> *Poverty "after the flood we had nothing to do and nothing to eat."*
> *Aid: "now we depend upon the aid".*

In fathers' group, In Dera Ismail Khan, fathers listed good occupation, education and healthcare facilities as key factors to improve maternal health:

> *Good occupation: "If government or any other organizations provide good way of earning then this will increase their income."*
> *Education: "If in this village education is good then people will know about the latest things or ways of earning a living"*
> *Health facilities: "The government would provide good health facilities with proper equipment's in BHU (basic health unit). Because in this facility we have no proper equipment and medication to treat maternal health problems".*

In Dadu, most of the fathers voted for "ration" (ration which expresses diversity of food with a choice of dishes), money and clean drinking water as the key factors influencing maternal health.

> *We are facing many problems regarding ration, every household is asking for ration, every time we need ration to feed all of us."*
> *Money "we need a lot of money, with money we can buy ration for ourselves and if our children are not well or suffering from any disease then money will make us able to get them to the hospital for treatment and we can build the houses to get safe from dangers of weather like rain, cold, heat."*
> *Clean drinking water "We don't have clean drinking water, after the flood, we realized we don't have access to clean drinking water and, due to this, diseases are increasing".*

As for the mothers' group, in Dera Ismail Khan district, the top variables they mentioned are shortage of clothes, sewage system, access to healthcare, and occupation.

> Shortage of clothes *"We do not have proper clothes for our children, so any organization or government need to give us financial help to buy clothes, or they need to give us clothes according to the weather"*
> *Sewage system: "There is no proper sewage system in this village, which is the cause of many diseases, so we want the government to improve the sewage system in our village."*
> *Health: "Due to not having proper healthy food the health status of villagers is very bad especially of mothers who are lactating or expecting; therefore, the government or any other organization need to make policies that will help us in providing healthy food for the mothers."*

In Dadu, mothers participating in the GMB workshop listed mosquitoes, malaria fever, health food, lack of access to healthcare and dirty water as the top reasons that impact maternal health.

> *Mosquitoes: "We don't have any safety net against mosquitoes that's why diseases are increasing a lot"*
> *Malaria fever:" Due to dirty water mosquitoes are increasing resulting in high number of malaria fever."*
> *Health food: "If mother will get the healthy food they need, then it will improve child's health. But after the flood there has been a shortage of food which increased deficiencies in maternal health"*
> *Need of doctor: "there is not any doctor in our village for medical purposes and for emergencies."*
> *Dirty water:" There is dirty water around our village after floods and due to this many unhygienic conditions are occurring".*

Findings from the variables' elicitation sessions show that the main factors discussed by the three groups centered around financial needs, healthcare access, and quality of food. These are the immediate needs that have not been fully met to date. In addition, people identified reasons why those needs are still unmet. In the fathers' group, there was a lot of discussion about jobs. Most of heads of household lost their jobs after the 2022-flood. They had to find daily jobs that are particularly precarious increasing the deepening of poverty. When they are not able to find a job, they remain without income to address the needs of their family. Without a stable and regular income, family needs for food, healthcare and medicine are also not met. Some of the people we interviewed were farmers, but their land was flooded. The source used to water their field was also polluted by the flood. They were not able to grow a crop anymore.

> *"We don't have any occupation to do and inflation is increasing a lot and we don't have any source of income. We usually cultivate but there is also the issue of water, we don't have pesticides and fertilizers."*

Because men did not have stable jobs after the 2022-flood, many women had also to go out to work "*We all here have to work.*"

However, when women went out to work, they did not have time to take care of themselves. As the healthcare workers group mentioned

> *"They [women] are doing hard work due to lack of resources at home for basic needs. Mothers suffer from malnutrition as majority of the women work. They don't have time for any selfcare."*

In addition to not having stable jobs to afford food, people mentioned that increased food prices including for infant formula made life

even harder. Some of the families had to sell their animals or take a loan to afford food and infant formula:

> *"What we got before or we saved like gold, rings, cattle like goats, cows, was sold to feed ourselves. Inflation has increased wheat flour, which is worth Rs. 140 per kg now. We don't have rashan now; there are many households who don't have flour to eat. We are going through very hard times.*
>
> *"Our child doesn't know that we are poor, we are taking loans to buy lactogen".*

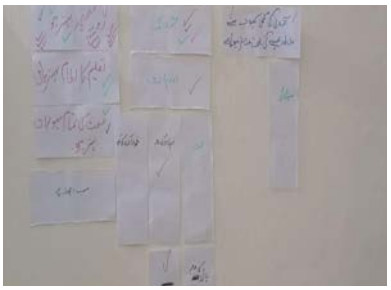
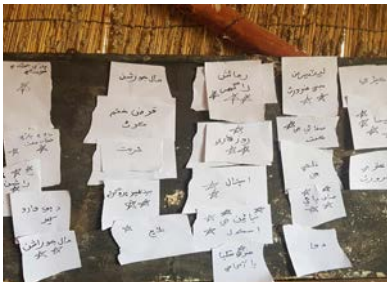
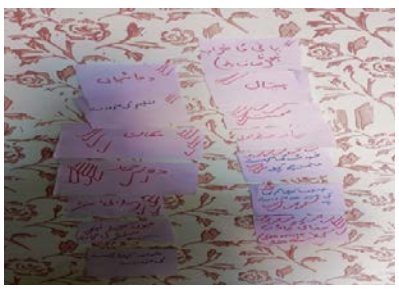
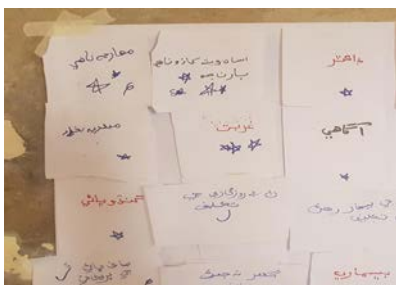
After the 2022-flood, clean water became a core issue damaging maternal and newborn health in both districts. Lack of clean water increased the cost of clean drinking water, threatening farming and causing diseases. Reasons mentioned to why people cannot access water vary. In Dera Ismail Khan, it seems that water is still drinkable, but the pump stop working. Nobody came to fix the pump

> *"The hand pumps stopped working. Thus, no drinking water is available anymore. Spread of diseases and allergies among mothers is prevalent."*

However, in Dadu, it seems that the underground water system was also polluted, so the water could not be used for human consumption.

> *"We don't have clean drinking water, we are drinking water, which is increasing the diseases among us, we should have clean drinking water".*

1.1.1.1. Figure 1. Variable elicitation activities

	DI Khan	Dadu
Health Care Workers		
Fathers		
Mothers		

1.2 Connection circle: the system behind climate change and maternal health

In the variables elicitation session (pictures are shown in Figure 2), participants started to discuss factors and potential connections between each factor. In the connection circle session, participants dived deeper into the relationships between different factors and identified the important connections as well as reinforcing and balancing causal loops that affect maternal health overtime.
Based on group discussions and the connection circles, we synthetized connections between all the different factors into a casual loop diagram (CLD) (Figure 3). The CLD in Figure 3 represents the interactions between factors affecting maternal and newborn health. It represents a shared understanding of the community of the complex local dynamics around maternal health and suggests some options for better intervention. Reinforcing feedback loops are represented in color and numbered R1 to R6. Connection circles represented by CLDs follow simple rules. Factors are variables that express quantities that change overtime. Arrows represent causal relationships between two factors; the direction of the causal relationship is symbolized by a plus sign when the two factors evolve in the same direction overtime and a minus sign when they evolve in opposite directions following an inverse relationship.
A reinforcing causal loop constitutes a series of cycles in which a change in any factor transmits its effect to the next factors through the loop and returns to reinforce the initial change. On the opposite, a balancing causal loop is a series of cycles overtime in which an initial modification in any factor transmits its effects through the loop to the other factors and return to reduce the initial change. The various reinforcing feedback loops show the multiple pathways that influence maternal and newborn health, some playing a role at the household level, other factors at the community level and finally some factors at the national level.

Reinforcing Causal Loop R1: Healthy food ▸ Maternal health ▸ Parents' time for care taking ▸ Income ▸ Healthy food

The reinforcing causal feedback loop R1 has been mentioned in all GMB sessions although in slightly different ways. Maternal health stands in the CLD for maternal, newborn and under 5 child health. R1 suggests that having healthy food will improve maternal, newborn and under 5 child health. If maternal, newborn and under 5 child health improves, then parents do not have to spend large amount of time to care for children as they can go for their activities (school, playing, helping with household chores…). They can then use the free time to work and secure more income that will allow to buy healthy food that in turns will contribute to better maternal, newborn and under 5 child health. But in the current context, most families are facing the opposite situation: Parents and children are not in good health, so the parents need to spend more time taking care of sick children. Then they have less available time to earn enough income to meet the family basic needs. As a result, they cannot buy healthier food which worsen the maternal, newborn and under 5 child health. As mentioned by fathers' participants in a Dadu district GMB workshop:

> *"If there is enough provision of healthy food for both mother and child, then they both will become strong and maternal health will also increase"*
> *(Fathers, Dadu).*

Influencing this loop is the possibility to access free and quality healthcare at a public healthcare facility such as a hospital:

> *"More visits to hospital will gave us better treatment so than we can get good health. By getting good health we can get good occupation which will improve our income. That's why we can get good food." (Mothers, DI Khan)*
>
> *"If the health of a person is in good state than he/she can get good occupation through which that person can earn more income and by earning more income that person will be able to get healthy food and his health will be good." (Mothers, DI Khan)*

Reinforcing Causal Loop R2: Housing ▸ Illness (prevention of diseases) ▸ Maternal health ▸ Income ▸ Housing

house ▸ privacy ▸ breastfeeding ▸ health
The reinforcing causal feedback loop R2 indicates that if housing improves, family members particularly children will have a better shelter to protect themselves against weather changes and exposure to diseases. This will improve maternal and child health and in turn will free time to work and earn an income that can be used to improve housing.
Discussions reveal that quite a few of our GMB participants lost their home and still lived in camps at the time of the study. Some of the other participants' house got damaged during the flood. Participants discussed the importance of having stable housing. Stable housing was perceived as providing needed security and shelter that could prevent children from getting sick because of the weather. When children are healthy, parents can earn more income and keep improving their housing.

> *"Weather effects will give rise to different diseases, and this will increase treatments which will results in more poverty; then unemployment also increases which is reducing number of houses built and due to decrease in well built houses weather effects increases threatening health" (Healthcare workers GMB workshop),*
>
> *"If we have money, we will be able to construct or buy good houses" (Fathers, DI Khan, GMB workshop)*
>
> *"If we have a roof, we can protect our children and ourselves from drastic weather changes i.e., during summer, winter, and monsoon. In our village we don't have proper residences due to flood, so we faced more weather effects like (cold, rainy weather and coming effects of summer season) which is directly affecting mothers and children health and our income. (Mothers, DI Khan, GMB workshop)*

Reinforcing Causal Loop R3: Good education ▸ Health awareness ▸ Reduced birth rates or underaged birth rates ▸ Mother and children's health ▸ Income ▸ Good education.
Participants identified that a good education make people aware of health issues linked to early pregnancy, which postpones the age of marriage and the age at which women have their first child. Participants argued that young girls were often victim of adverse pregnancy outcomes. Healthy mothers can contribute to the household income while healthy children do not incur out of pocket health expenditure. Without extra burden from diseases, the household income will increase. With better income, families will be able to provide good education to their children which will improve health awareness. The impact of good education, and good occupation have been mentioned many times in the discussions. Participants are aware of the short- and longer-term benefits of education. Good education can increase parents' awareness in maternal health which will contribute to improve the health of the children. In long run, good education can reduce birth rates, especially among underaged girls. This will lead to overall better maternal health.

> *"If people of this village are educated, then they will be more aware of family planning in that way we can get good effects on maternal health" (Mothers DI Kan)*
>
> *"If our village has a school for girls then our girls will be able to get education and face the modern world's problems and issues.... And girls will get awareness how to deal with daily routine and will make their own decisions in life and they will become self-dependent, and girls will have many paths to start a professional life then occupation for girls will also increase" (Fathers, Dadu)*

Reinforcing Causal Loop R4: Access to clean drinking water ▸ Maternal health ▸ Income ▸ Poverty ▸ Access to clean drinking water

Better access to water improves maternal and child health and leads to reduced healthcare expenses. This increases the possibility to work. Therefore income will increase and poverty will deacrease. When the communities have more income, access to clean drinking water will also increase. The importance of clean drinking water has been frequently mentioned during the discussions. Absence of access to clean drinking water also impacted

household expenses. When families do not have access to clean drinking water, they have to purchase water, which affects their income. This decreases income and creates more poverty.

> *"Clean drinking water will reduce the risk of acquiring water borne illness and will protect our children from various diseases. With less diseases we will spend less on medication, and we will be able to save more money for other things. That money can be utilized for other essentials needed to improve our own and child health." (Mothers, DI Kan)*

> *"Because of poverty, we can't afford clean water... Because in our village there isn't easy access to clean water and we need the money to access clean water and all this is affecting our health". (Mothers, Dadu)*

Reinforcing Causal Loop R5: Healthcare quality in public hospitals ▸ Visits to public hospitals ▸ Good medical treatment ▸ Maternal health ▸ Jobs ▸ Income ▸ Number of doctors in public hospitals ▸ Healthcare quality in public hospitals.

If healthcare quality in public hospitals would improve, people would go more often to get good medical treatment which would improve maternal and child health allowing people. Good health status will allow parents to work more, increase their income which makes possible to pay more for treatment. The increased income of hospital might potentially increase the number of qualified doctors, and in turn improve healthcare quality in public hospitals.
The lack of affordable care adds stress for families after the 2022-floods. Participants reported that public hospitals do not have enough doctors and medicines and are far away from their villages. They could not go to the hospital when they or their children were sick; or if they could go to the hospital, they did not get good treatment. Lack of affordable quality healthcare directly impacts their health. Some participants even reported observing rising prices in governmental hospitals.
To get medicine or good care, they must go to private hospitals which are more expensive. This directly impacts their already limited income.

> *"First, we go to government hospital, but if the situation gets worse, we go to a private hospital."*
> *At first, we use household methods to get them well but if they don't then we go to the*

hospital. We prefer government hospitals but then we go for private.

we are poor that's why we use our household methods to get them cured... because we can't afford thousands of hospitals." (Mothers, Dadu)

"Hospital nearby is not providing proper cure. Most of the time the staff is also not present. We must go to Private hospital takes about Rs, 50,000 – 60,000 per visit especially for the delivery of a baby. We rather want a hospital here that could provide us help 24/7. That would be a big relief for us." (Fathers, DI Khan)

Reinforcing Causal Loop R6: Unequal or poor-quality provision of services by non- profit organizations ▸ Poverty ▸ Corruption. Participants argued that poor and unequal distribution of services increased poverty that in turn increased generalized corruption and reduce the access to goods. After the 2022-flood, a lot of non-profit organizations came to the flooded areas. Participants in GMB workshops reported that most of the non-profit organizations provided short term services. The distribution of tents, food rations or money did not reach to people in needs.

"NGO's like yours come and go, they vaccinate us and then they leave after their work is done and don't give anything to poor people or provide relief during their visit" (Fathers, DI Khan".

"The reason is because of political influences... The distribution of relief is not equal. So, 20% people are unable to get relief. Many NGOs approach feudal lord or political parties and involve them in the efforts to provide relief to flood / disaster victims but then it is not equally distributed. That must change." (Healthcare workers, DI Khan)

"Influential and favorite persons got the tents and camps in Johi city. They live in the city, their houses are well built they don't need the tents or camps/ That's why they came and said you all are in need and we have tents and camps, give us some money and buy it. (Fathers, DI Khan)

Other important connections

Damages to public infrastructures were a structural issue frequently mentioned by participants. When the water pump is destroyed people cannot access drinking water. When roads are damaged, it increases the difficulties to go to hospital, to reach the market or to fetch water.
Participants also mentioned that in absence of sewage system, the water source got polluted after the flood.
Participants mentioned that the flood had also negative consequences on public interventions such as the disruption of existing social safety nets which could have offered important support to people during such tough times. For example, people in Dadu district mentioned that they have not received payment from the Benazir Income Support System (BISP) program since the flood. The BISP program was designed to provide monetary support to women in need.

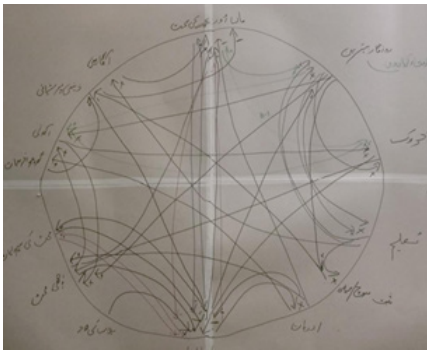
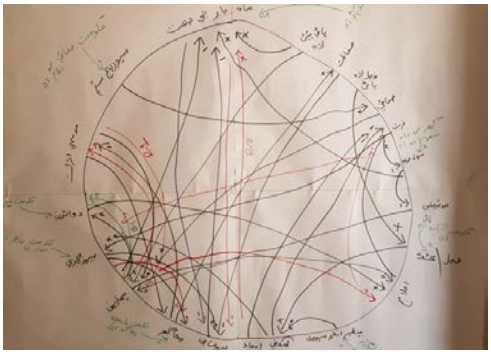
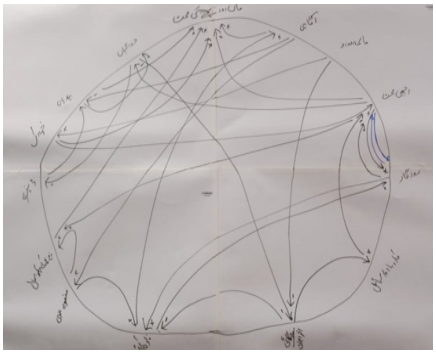
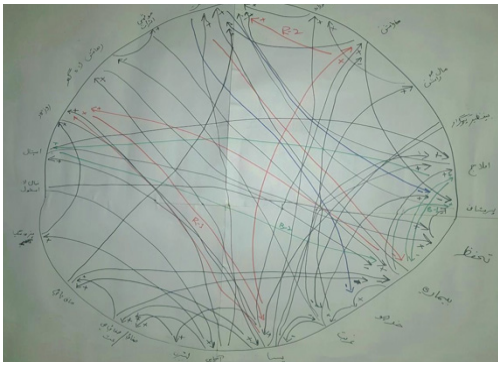
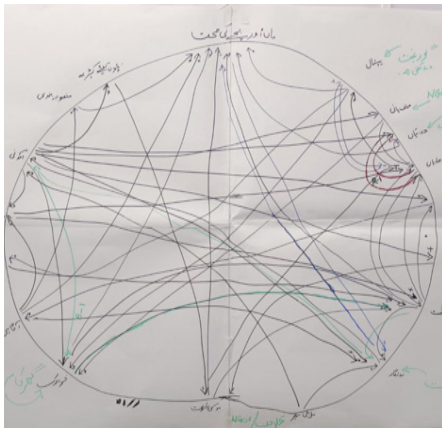
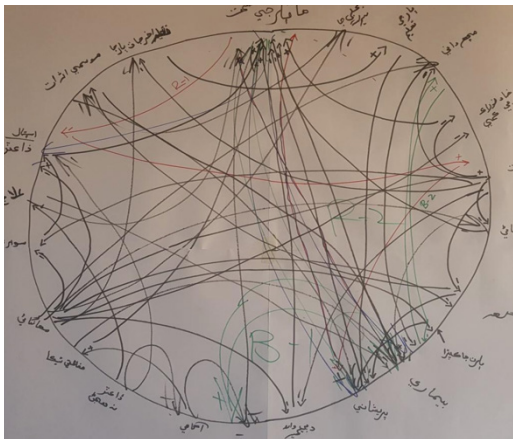
"Benazir Income Support Program BISP is a source of income for us... it is an aid program from the provincial government... if we can get money from the BISP then we can buy things of need" (Fathers, Dadu)

"Some government relief did provide help in the form of cash which is about Rs 400,000 per household. But not everyone received it." (Fathers DI Khan)

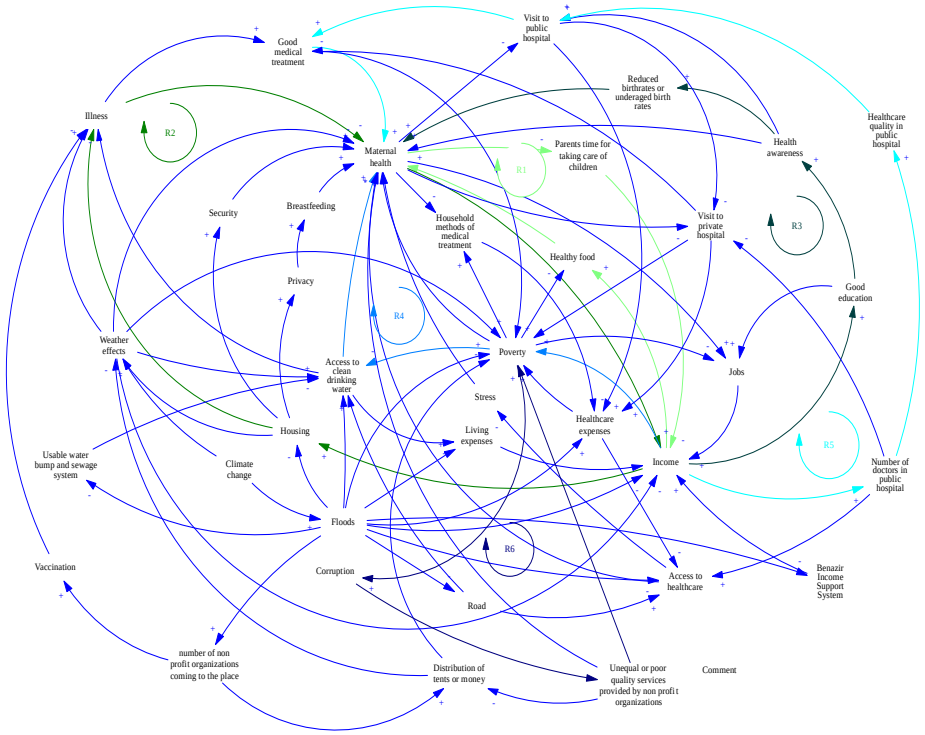
Corruption was also a factor mentioned by people which worsen many factors related to maternal health. For instance, a father in Dadu draw our attention to the tent where is family was sheltered: *"look at that tent, I have bought it 4 thousand rupies. NGOs and others have given the tents to influential persons and those were selling the tents to us" (Fathers, Dadu)*

"Government did help some people with housing for those people who were displaced, or houses affected. But elite people bulldozed their houses down and remade their houses, taking away the resources provided by the government for poor people." (Fathers, DI Khan)

1.5.4.1. Figure 2. Connection cycle sessions

	DI Khan	Dadu
Health Care Workers		
Fathers		
Mothers		

1.5.4.2. Figure 3. Causal loop Diagram of factors influencing maternal health following 2022- floods



1.3 **Actions ideas**

In the third part of the GMB session, participants engaged in a discussion regarding action ideas aimed at improving maternal and child health. The majority of the proposed action ideas revolved around the implementation of more effective government aid programs for the community. To address immediate needs, participants emphasized the importance of distributing nutritious food, medicine, and financial assistance based on the true needs of people. They suggested that needs assessments should be followed by an intervention addressing those needs. In the recent period, many participants noticed that they received visits from outsiders they believe were NGO staff with whom they shared their concerns and needs (as they did with us). Yet, they complained that it was not followed by any program, and they did not receive any support.

Participants also emphasized the necessity of establishing or restarting the safety net programs. Additionally, they requested that both government and non-profit organizations offer stable employment opportunities to enhance their economic situation. In the long term, participants called for support in areas such as housing, sewage systems, clean water, and agriculture.

As the participants expressed, their current circumstances are dire, making it challenging for them to break free from the cycle of poverty after the flood. Therefore, these short, mid, and long-term measures are crucial for their recovery, and the realization of these action ideas relies on support from both governmental and non-governmental organizations.

1.1.1.1. Summary of GMB findings

Participants identified the key factors influencing maternal and child health, recognizing the intricate connections between them. They particularly highlighted the presence of reinforcing causal feedback loops which will further intensify and exacerbate their situation if without effective intervention immediately. Currently, it appears that families find themselves trapped in a destructive cycle of limited access to food, income, and healthcare, all of which significantly impact maternal and child health.

While participants attempted to propose actionable ideas within their individual capacities, they acknowledged that most of the solutions required collaborative efforts from both governmental and non-governmental organizations. Participants acknowledged the support provided by these entities but expressed concerns regarding the inefficient and inequitable distribution of aid relief.

Overall, participants stressed the importance of addressing the interconnected factors affecting maternal and child health and called for coordinated efforts between various stakeholders to implement effective and fair solutions.

2 Case study

The GMB workshop generated essential factors influencing maternal health and how these different factors work together to impact maternal health. Case studies presented experience of families illustrating the poverty cycle presented in the GMB workshops, and listed details about the different coping strategies families adopted in the aftermath of the flood. Our aim was to gain a deeper understanding of the parents' experiences during and after the 2022 flood, including the challenges they faced and their coping mechanisms. Additionally, we sought to identify families' needs and any existing gaps in services.

We conducted case studies with four families with children under 2 years old in each district. We included two families where delivery occurred during the flood. Enumerators observed the living space of each family. They interviewed the father and the mother separately about their experience during and after the 2022-flood, the challenges they faced and their needs.

Summary of six case studies

1.1.1. Dera Ismail Khan

Dera Ismail Khan (DI Khan) is in Khyber Pakhtunkhwa province. Within the district, we focused on one of the most severely affected villages. During the flood, a majority of the families from the village sought refuge in the mosque situated atop a nearby hill. They were able to return to their homes within a week once the floodwaters receded. During their stay at the mosque, simple food provisions were provided to the affected families.

However, even after the floodwaters subsided, most families faced significant challenges in accessing food, finding source of incomes, and accessing to healthcare and other essentianl services.

Family 1

Family 1 has been residing in Dera Ismail Khan for generations, and their living situation involves a single-room house with a spacious boundary wall. Their house sustained minimal damage during the flood. In this single room house, the family performs their daily activities such as sleeping and cooking. The family's daughter often spends time playing in the courtyard. Along with parents, there also are two brothers, and two sisters also residing with them.

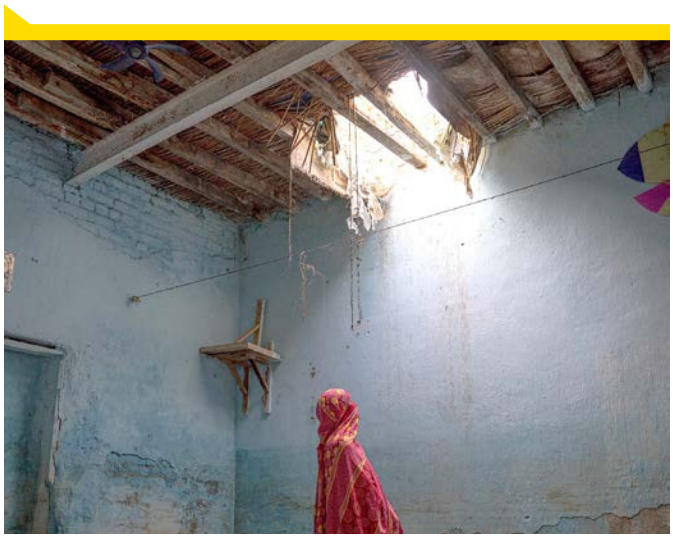


Figure 1. Housing conditions of family 1.

As a financially struggling family, they are unable to afford expensive food items. Consequently, they rely on simple meals available at the local shop or those cultivated in the adjacent fields. To save costs, they obtain fresh vegetables from their own field. Other necessary items like oil, sugar, and spices are purchased from local vendors within the village.

Following the flood, their house sustained less damage compared to neighboring houses, resulting in many of their relatives seeking shelter with them. Unfortunately, they were unable to provide beds for their relatives, who had to sleep on the floor with simple beddings.

1.5.4.3. Family 2

Family 2 lives in Jabbar Wala, a part of the Dera Ismail Khan district. The family includes grandparents, siblings and two sons aged 3 and 1 year. Their house has four rooms and a small kitchen. The house was affected by the flood, causing cracks in the walls and rooms.

Figure 2. Housing conditions of family 2.

The flood also destroyed their crops and other sources of income leaving them without enough food. Personal hygiene is also a huge challenge in the areas due to the consequences of flood. Ms. Maryam was expecting a child when the flood struck their village. The flood destroyed their house, leaving them with only one room to live in. The absence of a proper kitchen and bathroom, coupled with limited space, posed significant challenges for the family. As a result, Figure 2. Housing conditions of family 2.
they resorted to eating primarily bread, which adversely affected their nutritional status and overall health. The children played outside the house due to lack of space inside and poor living conditions.

During the flood, Ms. Maryam experienced a miscarriage. The physically demanding tasks of moving heavy objects and caring for her children during pregnancy likely contributed to this unfortunate outcome of her pregnancy. The unavailability of healthcare in the vicinity exacerbated the situation, as Ms. Maryam had no access to medical assistance during her pregnancy. She relied on the help of an experienced neighbor throughout this difficult period, but her physical and mental health conditions declined. Additionally, one of her children was diagnosed with anemia, creating and additional health challenge for the family.

The flood's aftermath brought additional hardships for Ms. Maryam and her family. With their house destroyed, they had to rebuild their lives from scratch. The lack of employment opportunities further compounded their difficulties, as Ms. Maryam's husband lost his job after the flood. Daily survival became a significant concern, as the family struggled to provide adequate food and clothing for themselves.

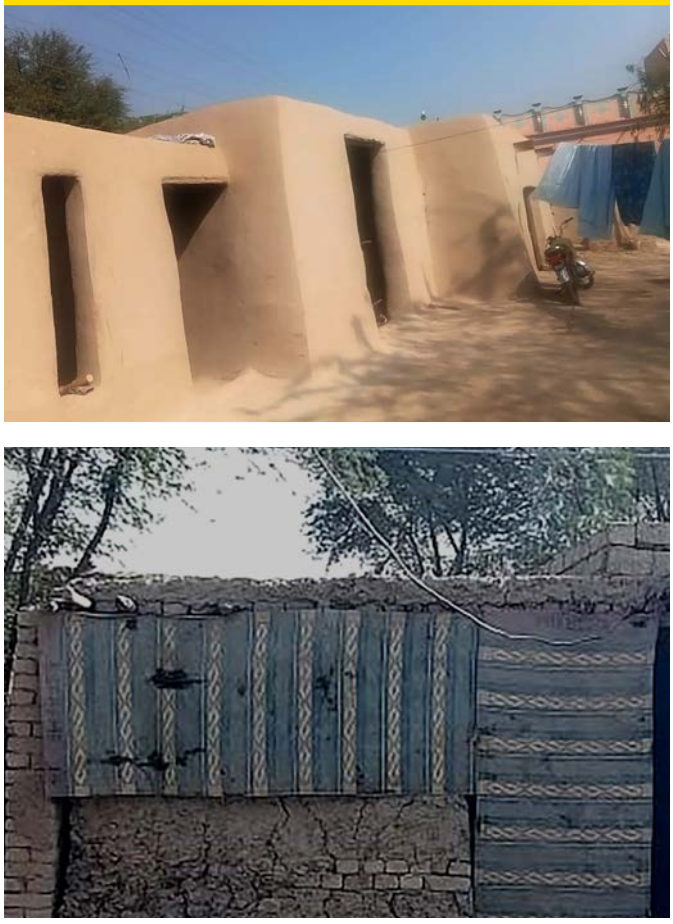


Figure 3. The condition of the housing of family 2. Picture A Overall housing condition. Picture B rooms damaged during the flood.

The case of Ms. Maryam and her family provides a stark illustration of the devastating impact of floods on vulnerable communities. The lack of proper infrastructure, limited access to healthcare, and the loss of livelihoods have significantly affected their overall well-being.

Urgent support is needed to provide them with safe and stable housing, nutritious food, and means of income generation to rebuild their lives. Additionally, implementing effective disaster management strategies, including early warning systems, can help mitigate the impact of future floods and protect vulnerable populations like Ms. Maryam and her family.

1.5.4.4. Family 3

Family 3 resides in village Jabbar Wala in DI Khan, They have four sons and two daughters. Prior to the flood, they lived in their two-room house but now they are only able to use one room. They built an extra tent for cooking and sleeping. The other room suffered severe damage during the flood, with the walls almost completely collapsing.

Figure 3. The condition of the housing of family3.

The flood washed away all their belongings, leaving the family with very few possessions. They have limited sources of income and have attempted to grow vegetables and potatoes to sustain themselves. The family appears fragile, and the children lack clean clothes to wear indicating the challenges in maintaining basic living.

1.5.4.5. Family 4

Family 4 ‘s house was also damaged during the flood. They managed to rebuild one room using mud due to limited fundings from the mother. However, the house sustained significant damage which required more fundings to be fully repaired. Not only were they not able to afford better material to rebuild the house, but little saving was left to purchase food after they rebuilt their house. Due to the stress resulted from the flood, the mother also experienced a miscarriage.

Figure 4. The condition of the housing of family 3. Picture A current living conditions and picture B destruction by the flood.

2.1.2. Dadu

Dadu District is in the interior part of Sindh province, situated along the bank of the Indus River. On the other side of the river, stood the Kirther Range mountains. Unfortunatly, the district experienced severe damage due to the torrential floods. The rainfall was exceptionally heavy, causing the water to overflow from the mountains, particularly in Taluka Johi, which resulted in widespread flooding across the entire region.

As a consequence of the flood, many villages in Dadu District were still grappling with its aftermath during our study. Stagnant water remained present in numerous areas, and people continued to live in camps or were forced to reside amidst the debris of their damaged houses. The long-lasting impact of the flood has led to ongoing displacement and challenges for the affected communities in the district.

1.5.4.6. Family 1

Family 1 resides in Goth Allah Bachayo, a village located in Taluka Johi of Dadu district. Unfortunately, their house was completely destroyed during the flood. As a temporary solution, they lived in a tent situated at the top of the MNA Drain for a period. At the time of the survey, they had returned to their own village.

Upon their return, the family managed to construct a roof for their living space, but they were still lacking stable walls. The village was surrounded by water during the interview, and a strong and unpleasant odor emanated from the stagnant water, pervading the entire area.

The families, along with other villagers, are suffering from various health issues. Malaria, stomachaches, and other ailments were prevalent among them, likely due to the unsanitary conditions caused by the flood and the presence of stagnant water in the village. The lack of proper infrastructure and access to healthcare services further exacerbated their health challenges.

1.5.4.7. Family 2

Parween, a resident of the village Allah Bachayo in Taluka Johi, District Dadu, has been severely impacted by the summer 2022 flood. Her house, which had rooms, a kitchen, and a toilet, was destroyed during this disaster. She now lives with her husband and two young children, aged 3 years and 6 months, in a makeshift shelter. The family lacks proper cooking facilities, resorting to using bricks as a kitchen hob and cooking on the dirt ground with wood fire. Hygiene conditions are poor, and the children are suffering from rashes, fever, malaria, and persistent cough since the flood.

The flood has had a devastating impact on Parween and her community. Parween shares her harrowing experience of being pregnant during the flood, facing immense challenges in finding transport to reach a hospital. She witnessed other women losing their babies and some even losing their lives. The flood has left the entire village in ruins, causing fear, trauma, and a sense of helplessness among the residents.

Parween states," they did not receive any support or assistance from the local government during or after the flood. But they received a one-time supply of rations, medicines, and a water purification machine. However, despite purifying the floodwater, it remained undrinkable.

Due to the widespread devastation caused by the flood, Parween's family and friends were also facing their own challenges and were unable to provide much assistance to each other. The community has various needs, including concerns about food and future employment opportunities for their children. The flood has left Parween feeling unsafe in her own village. Various communities, including strangers, have taken refuge in the village, making it difficult for women to access washroom facilities. Parween expresses the need for a permanent solution to safeguard their village from future floods.
Parween argued for support that we can summarize as follows:

a. Immediate Needs:

- Provision of adequate healthcare and medical support, especially for the children's ailments.
- Access to clean drinking water to prevent waterborne diseases.
- Improved hygiene conditions, including sanitary facilities and washrooms.
- Temporary shelters to protect families from extreme weather conditions.

b. Long-term Needs:

- Development of flood-resistant housing and infrastructure in the village.
- Implementation of early warning systems and evacuation plans to ensure the safety of residents.
- Access to livelihood opportunities and skill development programs for sustainable income generation.

Parween also made some suggestions for the different actors involved in the relief effort:

a. Government:

- Provide immediate relief aid, including food, clean water, and medical assistance, to the flood-affected families.
- Invest in long-term solutions to prevent future floods and ensure the safety of vulnerable communities.
- Establish a comprehensive disaster management framework and early warning systems.

b. Non-profit Organizations:

- Extend continuous support by providing regular rations, medicines, and medical camps.
- Collaborate with local authorities and community members to implement sustainable development projects.

c. Community Support:

- Encourage local community members to come together and support each other during times of crisis.
- Create awareness about the importance of hygiene practices and disease prevention.

The story of Parween and her family highlights the urgent need for immediate relief and long-term solutions to address the aftermath of the devastating flood. Collaboration between the government, non-profit organizations, and community members is crucial to provide assistance, improve living conditions, and develop resilient infrastructure that can withstand future disasters. By addressing these needs, Parween's community and others like it can regain their sense of security, health, and hope for a better future.

Figure 6. The family camp on the top of camp at top of the MNA Drain.

1.5.4.8. Family 3

Prior to the flood, family 3 resided in a house consisting of two rooms, a toilet, and a kitchen. However, their house was severely damaged, leaving only two walls standing. To cope with their situation, the family built a shelter on the same site where their house once stood. The shelter, made using inexpensive materials such as wood, mud, and plastic sheets, serves as their temporary living space.

Cooking is done outdoors, on the ground, as they lack a proper kitchen facility. In terms of sanitation, the village received a shared toilet facility provided by NGOs. Due to the limited availability of water, maintaining proper hygiene becomes a significant challenge for the family.

The mother gave birth to her baby during the flood, which has added further difficulties in terms of health, food, and safety for her and the family. The combination of these factors poses significant hardships for the family's overall well-being and quality of life.

1.5.4.9. Family 4

Family 4 is a female-headed household, where the mother single-handedly raises her three boys. At the time of visit, the father of the children was away earning money to support the family. Prior to the flood, they had a house with four rooms and a kitchen. Unfortunately, the flood completely destroyed their home, leaving them with nothing.

Currently, the mother and her children reside in a tent situated in the same location where their house once stood. However, the tent does not have a proper kitchen or bathroom facility, which further adds to the challenges they face in their daily lives. To sustain themselves, they rely on the support provided by the father-in-law's family.

This female-headed household endures significant hardship, as the mother shoulders the responsibility of raising the children and managing the household in the absence of the father. The loss of their home and the lack of basic amenities poses considerable challenges for their overall well-being and stability.

2.2. Individual stories during the flood

The devastating floods brought about a traumatic experience for all eight families, particularly the mothers who gave birth amidst the chaos. In the following paragraph, we present the experience of eight families with a particular focused on young mothers who gave birth during the disaster. The stories of these families paint a vivid picture of the gaps and shortcomings in the current services, systems, and flood preparedness measures.

1.5.4.10. "Flood came unexpectedly"

In DI Khan, none of the families have heard about the governmental warning signs before the 2022-flood came in. Most were informed by friends and relatives about 3 days before the flood hit. This limited timeframe left them with little opportunity to safeguard their homes and belongings. However, while the flood caused severe damage to the houses in the area, only one family experienced a complete loss of their house. The remaining families faced varying degrees of damage, highlighting the widespread impact of the flood on the infrastructure in DI Khan.

> *"I don't know about that and we didn't get any warning before the flood. We got the information from friend or family but it's not authentic." (family 4, DI Khan)*
>
> *"I don't know about warning, and we didn't get any warning before the flood from the government. We got the information from friend or family about 3 days before". (Family 2, DI Khan)*

In Dadu district, only family 1 mentioned that they heard the news from the government.

> *"During the rain, officials just came on vehicles and said concerned notice will be issued tomorrow; some vehicles were equipped with heavy loudspeakers and were announcing that peoples from these areas should leave their houses within a day because flood was coming so" just leave the village go where you want to go and save yourselves", some of us believed them and some don't. After two-day water was on us."*

The remaining two families in Dadu did not receive any news or warnings about the impending flood. They waited until the they saw the flood gradually inundating their village. These families had to quickly find a way to leave their homes and seek safety. Unfortunately, due to the suddenness of the flood, some families were unable to gather necessary supplies, including food, before evacuating.

" It rained almost three months and we don't have electricity during this, we haven't heard any news regarding this, we heard from other villages that may be flood will come. When rain stopped, there was water everywhere; there was no any transport for us to get us outside from village. Water level was increasing then we realized it is flood and now we should leave the village. We just took our children and some good on boat and left our houses." (family 4, Dadu)
"During Flood, everyone one was getting ill and was in fever. My baby was about a month and not getting the safety vaccination and for that we were very much worried, and it was raining a lot and there was no any transportation, we hardly managed to shift at the top of the Drain to safe ourselves. We were worried that how we will manage and where will we live during flood. Water was getting high in our village and children were shouting in fear. Houses were become weak and cracked; we grabbed a boat which shifted some of our goods and us to the top. Boatman was asking a lot of fare for shifting but somehow, we managed". (family 4 Dadu)

Some people believe that without disaster warning system or government does not want to warm people is because of corruption.

There is no any system to manage disaster situations. Through social media it came to know that water is coming flood is coming because it was raining a lot and we also know that water is about to come. Officials wanted flood to come that's why they didn't warn us and why would they. Local politicians want us to suffer so that they got aid so they can do corruption.

1.5.4.11. During the Flood

With no prior readiness measures in place, families were left with little choice but to seek shelter in the closest available locations when the flood arrived. However, as the floodwaters persisted, families grappled with the pressing issues of inadequate food and insufficient shelter. The prolonged duration of the flood meant that families had to endure these challenges for an extended period of time, exacerbating their already vulnerable situation. The lack of proper sustenance and shelter posed significant hardships for these families, underscoring the urgent need for effective disaster preparedness and response measures to mitigate such challenges in future flood events.

In DI Khan, even though two families could shelter in their own home, they did not have enough food: *By the grace of Allah, we were safe from flood due to the fact that our house is on a hill. But due to flood water surrounded the village, we were stuck in the house for 3 to 4 days and we faced food shortage as we normally, we kept the food items for 2 to 3 days food for our family. As we had some relatives as guests, the food supplies were consumed in a few days. After 4 or 5 days, we received some food items like rice and boiled potatoes from the community elders, but they were not enough for us. The main problem was for the child that we could not get the milk which is necessary item for the child and elders as well. (family 4 DI Khan)*

In DI Khan, most families had to relocate to safer places during the flood. In these temporary shelters, they faced significant challenges in accessing food. The lack of

resources and disrupted supply chains meant that families had limited means to obtain nutritious food, particularly for mothers and children.
Yet, some community members and organizations later stepped in to provide food to the affected families which primarily consisted of rice and other grains. This food helped alleviate immediate hunger. However, the lack of access to a variety of nutritious food options remained a persistent issue, especially for lactating mothers.

> *"Due to flood, we could not do anything as flood water remained standing in our area for 15 to 16 days. No help from the Govt. department but some people came with food on the days when we were stuck in the mosque due to flood water and some people provided boiled rice and potatoes." (family 3, DI Khan)*

In Dadu district, the situation during the flood was significantly more dire. Families were compelled to swiftly relocate to the top of the MNA Drain, where they remained for months. Even during our visit, some families were still residing there, unable to return to their original homes. The flood had devastating consequences, resulting in the loss of houses and assets for most families in the area. These families found themselves in a precarious situation, struggling to sustain themselves and meet their basic needs.

In Dadu district, the situation was much worse. Families had to suddenly move to the top of the MNA Drain and waited there for months. During our visit, some families were still living there. Most of the families lost their house and assets in the flood. They have no means to support themselves.

Amidst these challenging circumstances, mothers who gave birth during the flood faced immense stress and uncertainty. Unable to find local midwives or suitable birthing facilities in their immediate surroundings, their only option for ensuring their safety and of their babies was to seek urgent medical care at hospitals. This further added to the burden faced by these mothers, as they had to bear the financial expenses associated with childbirth during the flood.

> *During my delivery, there was not any mid-wife near to us that's why we went to hospital; no one was there in hospital when we reached because it was emergency in late hours. I got panic attacks due to pain and I was out of my senses, at last I delivered a baby, doctor stitched me and sent me to the Sehwan city hospital, I was there for 3 days and got treated there. After five days my daughter became ill and his skin color changed, we took her to hospital then doctor told us she has hepatitis, now she is fine. We suffered a lot due to floods. (Family 2, Dadu.)*

Opting for hospital deliveries during floods was considered a safer choice for the well-being of both mother and child, as it provided access to timely medical treatment and assistance. However, the financial implications of this decision were significant, particularly for families who had to rely on private hospitals. The high costs associated with hospital deliveries and subsequent medical expenses depleted the limited savings of these families, adding a heavy financial burden to their already challenging circumstances.

> *"We were on MNA Drain living in camps when my wife was about to deliver a baby, we don't have any transportation to go to hospital of Dadu city, we hardly manage to grab a Rickshaw (public transport using motor bike) and took my wife to city's private hospital because there was no any proper healthcare services in government hospital." (family 3, Dadu)*
> *"During Flood, I delivered a baby boy, I suffered a lot, we are poor it was very hard to afford in already devastating situations, I delivered a baby in hospital and came back to camps and we spend almost 10k during delivery." (family 3, Dadu)*

The urgency of the situation and the limited time for preparations during the flood placed immense physical and mental stress on the mothers. The sudden evacuation and displacement added to their already challenging circumstances. Tragically, one of the mothers we encountered experienced a miscarriage during the flood, and were till enduring the trauma from it.

> *I faced miscarriage of 2.5 months pregnancy due to flood, due to hard work during and after flood days with my husband. We made the arrangements for our family to construct the house and we built it with mud with own efforts of me and my husband. This miscarriage caused many maternal health issues, which I'm still facing. (Family 4 DI Khan)*

1.5.4.12. Life after the flood in March

March was the month when we conducted the present cases study. Among our 8 families, only 3 families had managed to rebuild their house, while the remaining families were still living in temporary housing conditions. The challenges faced by these families revolved shelter, food, income, and health.

To navigate these challenges, families employed various coping strategies. Some families resorted to selling their livestock or assets to generate income for immediate expenses. Others relied on the support of extended family members or assistance from local organizations. However, these coping mechanisms were often short-term solutions and did not address the underlying structural issues or provide long-term stability.

One family has to sell their livestock in exchange for food.

> *"After the flood, we had nothing to do and no way to earn. So I sold my animal (Buffalo) for household expenses and after that I sold 1 more for more expenses to run my family. Now we have two (buffalo) if the situation remains same then maybe I will sell it." (Family 2 DI Khan)*

In Dadu, most families lost their land in the flood, which deprived them of their primary source of income. They were left without means to sustain themselves and ended up with reduced food supply and income. The disruption caused by the flood to local markets and supply chains contributed to a rise in prices for essential goods and services. This inflationary pressure further compounded the challenges faced by the affected families.
In their struggle to cope with food scarcity, families relied on wild vegetation that grew in the fields around March as an alternative source. However, as the summer approached, this vegetation would no longer be available, posing additional challenges to food security.

> *"Inflation is increased a lot; we cook vegetables a lot because we can't afford things now."(Family 2 Dadu).*

Facing this dire situation, governmental and nongovernmental organizations did provide support. However, just like what has been discussed during the GMB workshops, families also expressed, during the case study, concerns about the inconsistency and unequal distribution of aid. Most families had no ideas when and where they could get those aids.

In addition, while some organizations focused on maternal health support and provided ready-to-use therapeutic food (RUTF) for mothers, there were instances where families were unfamiliar with how to properly utilize these resources. Some mothers reported that family members fell ill after consuming the RUTF, highlighting the importance of proper education and guidance in utilizing aid effectively and safely.

> *We received 01 blanket from Hussani Foundation. We received 2 times ration beg from Political Influencers with the support of Community elders(during the past six month)" (Family 2 DI Khan)*
>
> *"We got some relief from NGOs, NGOs helped us by giving ration food, two NGOs came and gave 15 and 25 thousands to each family but those amounts were not enough we lost everything" (Family 1 Dadu)*
>
> *"NGOs came and helped us by giving rashan and food, some gave us soaps, some gave us water for drinking. And when we came back to our village, they provide us tank with water and after some time they took it back. World Food NGO came and gave us flour, oil and other food items and provide us toilet." (Family 3. Dadu)*

"NGOs came and gave things in our village, they came and give aid to our Father in law and then he shared it with all his sons. Due to this it wasn't enough to full needs. We got tents and RDF helped a lot and they also gave us kitchen utensils and gave us blankets and other goods for living." (family 4, Dadu)

2.3. Demands about change

The families from the different case studies strongly believed that their experience during the flood was not solely the result of a natural disaster but also stemmed from underlying structural issues. They expressed a desire for immediate needs to be met while emphasizing the importance of developing long term policies towards sustainable changes to prevent or mitigate the impact of future disasters.

Disaster preparedness was a key concern for the families we interviewed, with a strong call for the establishment of a warning system that would provide them with sufficient time to prepare and take the necessary steps if they need to flee. They also highlighted the need for improved water management, such as deepening the MNA drains, and the construction of flood boundary walls to minimize the frequency and severity of floods.

During the flood, the families we interviewed expressed their expectations towards the government to address their basic needs and provide the necessary support. They stressed the importance of timely and effective response from the government in providing immediate relief and assistance.

In the aftermath of the flood, families requested that the government expedite the drainage of floodwater to facilitate a quicker recovery process. They emphasized the critical role of efficient water drainage in helping them rebuild their lives and communities.

Without these structural changes and improvements, families expressed concern that similar disasters in the future would have a comparable impact on their livelihoods. They highlighted the need for sustained efforts and proactive measures to ensure the long-term resilience and well-being of communities in the face of natural disasters.

One family specifically mentioned that they had not fully recovered from the 2010 flood when they were struck by the current flood. This highlights the prolonged and enduring challenges faced by families in recovering from disasters and the urgent need for comprehensive support and structural changes to prevent a recurring cycle of devastation.

"The better way to deal with this type of disaster, they should aware the peoples and convey the message to the communities to protect themselves. To handle the situation during flood, Government should provide us the crane to make way to divert the flow of flood water in open areas."(Family 4 DI Khan)

"We hope the Govt. should arrange for better system to deal with the flood situation, the government and other non-profit NGOs should provide us with proper drainage system and divert the flow of flood water to open areas. They should also provide the basic needs of the people like food and drink and shelter to deal with this flood. (Family 3 DI Kan)

We haven't recovered from 2010's flood, we worked hard to get our houses back but after 10 years this flood again destroyed everything, during last flood NGOs gave us rooms we were not able build that too. (Family 1 Dadu)

"MNA drain is near to our village, we want them to dig it deeper and strengthen its boundaries, we are at lower area and we can't move ourselves anywhere. (Family 2 Dadu)

"Government should give way to water to divert the flow of flood water in open areas away from populations and they should make the people aware and convey the message to the communities to protect them. (Family 2 Dadu)

"Government should provide flood barrier to our village so water should stop outside the village and we remain safe in our village and our husbands can go through water on boats if we need something. We just want to live safely in our houses. Every time flood comes, and our houses got destroyed and we remain displaced." (Family 4 Dadu)

2.4 Summary of information from the Case studies

The case studies conducted in Dera Ismail Khan and Dadu district shed light on the experiences and challenges faced by families affected by devastating floods. Family members shared their story, highlighting the traumatic events they endured before, during, and after the floods, particularly the struggles faced by mothers who gave birth during the crisis. These different cases revealed significant gaps in existing services, systems, and disaster preparedness arrangements.

The case studies highlighted the urgency for comprehensive and sustainable solutions to address the immediate and long-term needs of flood-affected families. It emphasized the importance of equitable aid distribution, improved disaster preparedness measures, and structural changes to mitigate the impact of future disasters. By addressing these issues, communities can rebuild their lives, enhance their resilience, and create a safer and more secure future.

3. Quantitative Study

While the qualitative data from the GMB workshops and case studies provided valuable insights into the challenges faced by mothers regarding maternal health during and after the flood, quantitative data can complement this information by providing concrete numbers to reveal the scope of the issues in the two selected geographic areas.

We presented data according to the UNICEF framework. We first presented the severity of the infant development issues in the flood-affected areas. The data provides the prevalence of infants who are stunned or underweighted, or experienced delays or difficulties in key developmental milestones, such as motor skills, cognitive abilities, language acquisition, and social-emotional development. Second, we presented the immediate, underlying, and basic factors that were associated with infant and maternal health, showing how those factors were impacted by the flood. Third, we presented data on policies and programs gaps. We reported unmet needs at the individual, family, and community levels where current interventions fall short.

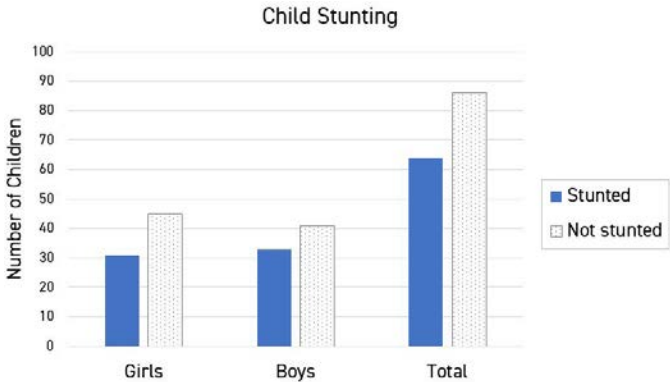
1.1 Sample Description

We interviewed fathers and mothers from 150 families. The average household size is 5.7 (SD=2.1) people. The average age of father is 33.1 (SD=10) and the average age for mothers is 28.8 (SD=8.6). The average children a family has is 3.2(SD=1.9). Most families have one children under 2 years old and six families have two.

1.2 Outcomes

Newborn and child nutritional status

Among the 156 children, 64 (42.67%) were identified as stunted, meaning their height-for-age z-score was below 2 standard deviations from the WHO Child Growth Standards median. The gender distribution of stunting showed no significant difference, with 33 boys (44%) and 31 girls (40.79%) experiencing stunting.



Furthermore, 38 (25.33%) of all children were classified as underweight or low weight-for-age, with their weight-for-age z-score falling below 2 standard deviations from the WHO Child Growth Standards median. Notably, there was a significant difference in the prevalence of underweight between boys and girls. Among the underweight children, 14 boys (18%) and 24 girls (31.6%) were identified as underweight, with girls showing a higher prevalence.

Among the children who were stunted, 49 (76.6%) were residing in Dadu district. Similarly, among the underweight children, 20 (52.6%) were from Dadu district.

Infant development

141 out of 150 mothers completed the Developmental Screening Questionnaire (DSQ) for their children, which provided insights into the developmental delays experienced by children under the age of 2 in the selected flood-affected areas.

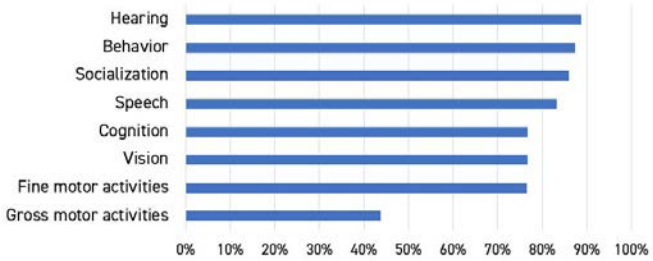


Figure 1. Percent of children under the age of two with delays in eight developmental domains assed by the DSQ.

Only a small percentage of 4.5% of mothers reported no delays in their children. A significant number of 88 mothers (62.4%) reported delays in seven out of eight developmental domains assessed by the DSQ. The highest proportions of delays were observed in gross motor activities (43.8%), fine

motor skills (76.6%), vision (76.7%), hearing (88.7%), cognition (76.7%), socialization (86.0%), behavior (87.3%), and speech (83.3%). Notably, there were no significant differences in the prevalence of delays between boys and girls or between the two districts.

Additionally, an association was identified between stunting (indicating chronic malnutrition) and the risk of low vision (p=0.002). This highlights the potential long-term consequences of stunting on visual development and underscores the importance of addressing malnutrition and its effects on child development.

1.3 **Immediate causes**

Breastfeeding

In our sample, 47 out of 150 mothers had children below 6-months of age, which is considered by the WHO as the exclusive breastfeeding period of life (See Figure). However, none of the mothers interviewed adhered the WHO recommended practice of exclusive breastfeeding and all of them substitute breastmilk with cow milk.

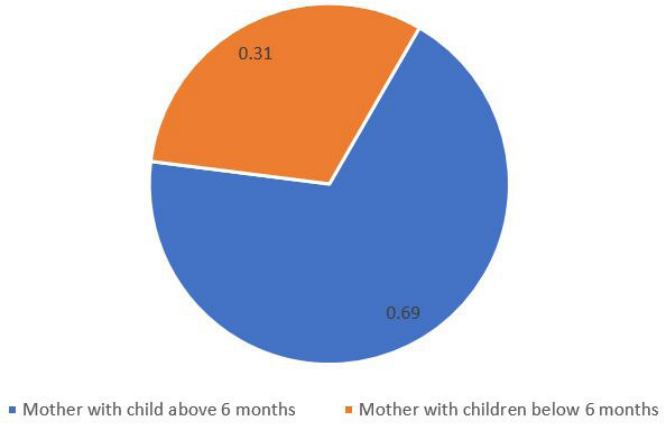


Figure 1: Proportion of mothers according to age of their children

As for the reasons of not doing exclusive breastfeeding, 12 mothers mentioned that they did not have enough milk, and one mother mentioned lack of privacy as the main reason.

Knowledge of and attitudes towards breastfeeding

Among the 47 mothers whose children were in the exclusive breastfeeding period, it is concerning to note that only 7 of them had heard about exclusive breastfeeding. This suggests a lack of awareness and knowledge regarding this recommended practice. Furthermore, a majority of 31 mothers (67.39%) were uncertain about the duration for which babies should exclusively receive breastmilk, showing their lack of awareness of the WHO recommendations.
Figure 1. Of the 47 mothers with children under the age of six and therefore in the exclusive breastfeeding period, only 15% of them had accurate knowledge of exclusive breastfeeding.

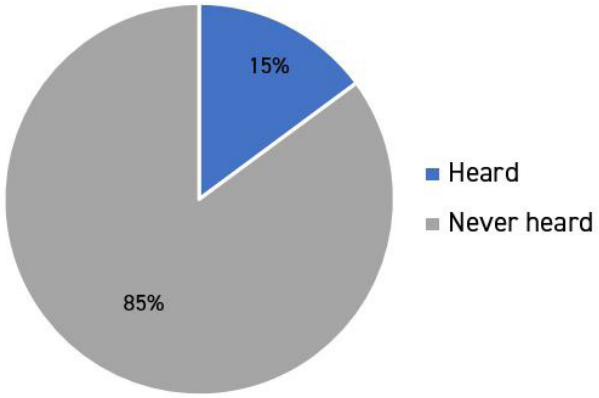


Figure 2: Knowledge of Exclusive Breastfeeding for Mothers with Children under 6 Months

Although all mothers acknowledged that exclusive breastfeeding was beneficial, there was also a common belief among them that children should be introduced to diverse foods within the first six months of their life. This highlights a misconception regarding the appropriate timing for introducing complementary foods, as exclusive breastfeeding is recommended until six months of age.

It is worth noting that 40 mothers expressed difficulty in continuing breastfeeding their child beyond six months, with the main reason being a perceived lack of breastmilk. This perception could be a result of insufficient knowledge about lactation dynamics or a concern about their own health.

Food intake during the complementary feeding period

Among the 112 mothers who had children over 6 months old, 110 of them were still

breastfeeding their child. However, 20% of those families were not able to provide children with any nutrient dense food, 57% of these families were only able to provide 1-2 types of food in the past week and only once or twice.

Children health status

Among all 150 mothers, 119 (79.3%) of them reported their child got sick after the 2022-flood. 115 (76.6%) of all mothers were able to take their child to see a physician. The other 35 mothers could not take their child to see a physician because of their incapacity to pay out-of-pocket fees. most of them (31) of them lived in DI Khan.

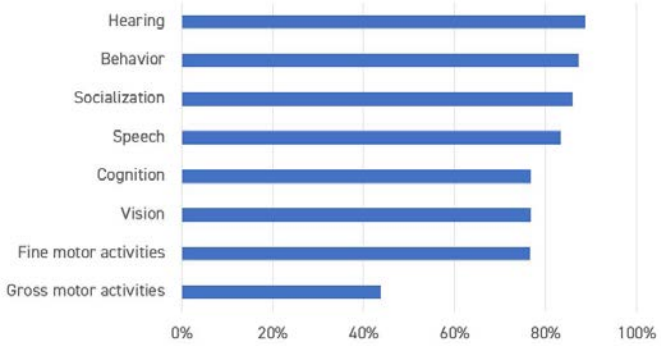


Figure 3: Proportion of children under 2 years old with delays

Among current diseases listed, 51 (34%) mothers reported that children had diseases caused by unclean water, 44 (29.3%) reported diseases caused by food; 23 (15.3%) reported that their children vomited during the past month following the flood, 44 (29.3%) reported they vomited blood, 40 (26.7%) reported their child had fever, 59 (40%) reported they had skin issues or skin rash, 27 (18%) reported they had an episode of malaria, and about 10% reported they suffered from a respiratory disease. These health concerns indicate the range of illnesses experienced by children in the aftermath of the flood, likely resulting from exposure to unsanitary conditions and compromised living environments.
Beyond disease, we also identified important delays in development among children below 2 years old. Over 80% of children below 2 were delayed for speech, socialization, behavior, 76% for cognition, vision and fine motor activities and 43% for gross motor activities.

1.4 **Underlaying causes**

Household food insecurity

Among the 150 families interviewed, 103 (70.1%) belong to the acceptable food consumption categories, though none of the families were able to have heme-iron dense food, which posed a severe risk of iron deficiency, particularly for mothers and children. Iron deficiency can have detrimental effects on child development, including impaired cognitive function, decreased attention span, and delayed motor skills. Iron deficiency in mothers can have several negative effects on their health. It can lead to fatigue, weakness, and decreased energy levels, making it challenging to cope with the demands of motherhood. Additionally, iron deficiency in mothers can affect their ability to produce breastmilk which also impacts the growth and development of their children.

The average consumption of meat, poultry, and fishes were less than one time a week. The main source of proteins were milk and beans, but their average frequency consumption was 3-4 times a day.

In terms of vitamin A intake, the consumption of vegetables, which are rich in vitamin A, was reported to be on average 2.37 times a week. This suggests that the frequency of consuming vitamin A-dense foods was relatively low among the surveyed families, posing a potential risk of vitamin A deficiency.

Most of the families had to purchase their food, with around 5% of all families receiving some types of food as gift.

1.5.4.13. Water, Sanitation and Hygiene (WASH) conditions before and after the flood

There was not major change of water source and energy before and after flood. Most families (143, 95%) had access to improved water at the time of interview. Their main sources of water cited were water from public tab/hand pump (n=41, 27.5%), borehole on site (n=62, 41.6%) or off site at communal place (n=40, 26.8%).

However, in both areas, families reported a change in the taste of the water collected from the well, which may indicate possible contamination or alterations in water quality due to the flood.
All families had access to electricity, but for a limited time. Due to this limitation in accessing clean energy, their main cooking and heating sources were wood (n=93) and animal dung (n=14) or a combination of both (n=39). Using wood and animal dung for cooking and heating purposes can contribute to indoor air pollution and have negative health effects,

The major change observed was with the access to toilet. Before the flood, 71 (47.7%) had flush families toilet inside their house, and the rest of the families used pit latrine with ventilation. However, only 26 (17.4%) families still had flush toilet inside the household and 67 (45%) families did not have toilet at all anymore. They have to go outside. The rest 42 (28%) families were using pit latrine or backet toilet. Lack of adequate toilet facilities can pose health risks and contribute to the spread of diseases.

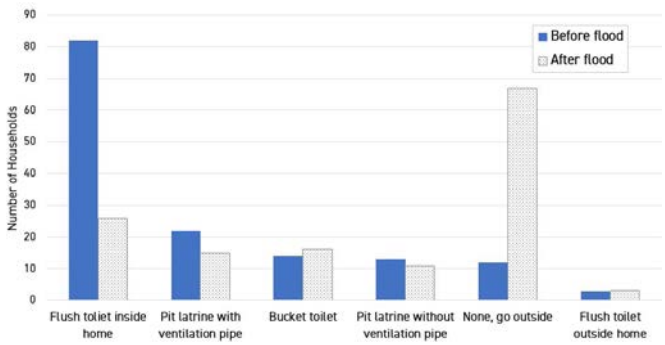


Figure 3. How access to toilets and what type of toilet households had access to before and after the floods.

Access to healthcare and health status of parents

Findings show that not all parents were able to visit the closest healthcare facility when they were not feeling well. Among 150 families, 68 (45.6%) lived in a village with a hospital. However, according to our enumerator's observation, the hospital located in the villages were often basic health units (BHU) staffed with one doctor and some paramedical personnel. The rest of the sample was on average one hour away from the closest hospital by motorcycle.

114 (67.9%) mothers and 102 (68.5%) fathers reported weight loss after the 2022-flood. 108 (64.3%) women and 46 (30.9 %) fathers reported feeling exhausted. 68 (40.5%) mothers and 87 (58.4%) fathers visited a healthcare clinic after the 2022-flood. Among those mothers who had a health professional examination, 14 (8.3%) mothers were diagnosed with diarrhea, 9 (5.4%) with skin disease, 29 (17.3%) with hypertension. Among the fathers who had a health professional examination, 63 (42.3%) were diagnosed with diarrhea, 60 (46.3%) with skin disease, and 151(0.1%) with hypertension.

Among those who did not go for a healthcare visit, 59 (34.7%) mothers and 65(43.6%) fathers reported symptom of diarrhea during the past six months, 38 (25.3%) mothers and 103 (69.1%) fathers reported symptoms of skin rash, 135 (90%) mothers and 135 (90.6%) fathers reported fever, 48 (32%) mothers and 18 (12.1%) fathers reported difficulty breathing, 110 (73.3%) mothers and 103 (69.1%) fathers reported coughing, 29 (19.3%) mothers and 19 (12.8%) fathers reported stomachache, and 48 (32.0%) and 6 (4%) fathers reported vomiting.

Prenatal check and neonatal health

Among 150 mothers, 53 (43.44%) had a child less than one year old, which indicates that they delivered their babies right before or during the 2022-flood episode.

Table 1 (in appendix) shows that antenatal care remained acceptable after the 2022-flood. A large majority of women (88.5%), similar to the number observed before the 2022-flood (81.5%) were able to visit a healthcare facility during pregnancy for the recommended number of four antenatal visits (the mean number of visits observed was 4.5 before the flood and 4.87 after). Few did not go for a single visit and probably delivered their baby at home. A large majority of pregnant women were treated by a midwife (respectively 66.7% and 86.5% before and after the 2022-flood). Interestingly, a larger number of pregnant women underwent at least one ultrasound after (82.7%) compared to before (66.7%) the 2022-flood.

Qualitative interviews showed that family members were available to accompany the pregnant woman for their antenatal visit. Most delivery were spontaneous after the 2022-flood (86.5%) while a few more were C-section before (33.3%). A small minority delivered their baby at home before (22.2%) and after (15.4% and probably more like 25% if one includes those who never went for an antenatal visit). Most of the women delivered in a healthcare facility assisted either by a doctor (55.6% and 61.5% before or after the 2022-flood) or by either a nurse or a midwife (7.4% before and 17.3% after).

The fact that a majority of women delivered in a facility with the assistance of a professional attendant is a very positive point considering that a non negligeable proportion of the deliveries had some complication (55.6% before and 40.4% after the 2022-flood) including: delay in first cry (22.9% and 53.8% before and after the 2022-flood respectively), baby turned blue (29.6% and 17.3% respectively), baby fever (29.6% and 7.7% respectively), birth injury (11.1% and none after), jaundice (25.9% and 7.7% respectively).

Parental mental health

The average depression score measured by CES-D-10 was 13.9 (SD=4.8) for mothers and 11.7 (SD=2.7) for fathers. 113 (75.33%) mothers and 106 (71.4%) fathers scored over the threshold of 10 which corresponds to significant depressive symptoms.

1.5 **Basic causes**

Loss of assets and Income

Most people lost assets during the 2022-flood. 93 (62%) families reported the loss of or a damage to their house during the 2022-flood. The average income loss was PKR15100 (SD=8950) per household per month.

Disaster preparedness

89 families (60%) first heard about the 2022-flood news from their from friends, relatives and neighbors, 27 (18.12%) from social media, 16 (10.74%) from TV or radio news, but only 5 (3.36%) heard about it from government officials. After families heard that a flood was announced in the very near future, most of them decided to leave as a family, taking along important property and something to eat to seek cover and a safer place.

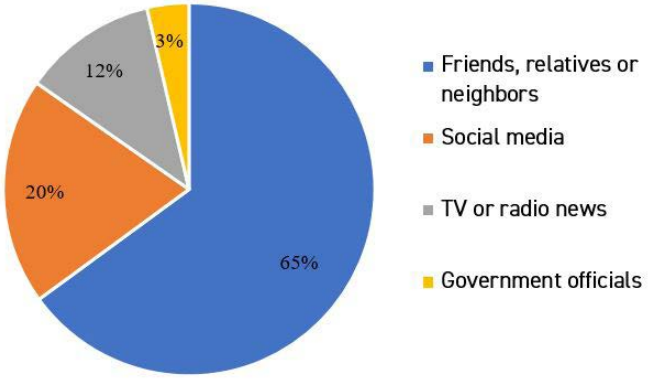


Figure 4. How and where people first heard about the floods.

Summary of the Quantitative Findings

The quantitative data presented above revealed the severity of infant development and maternal health issues, and the systematic impact of the flood. The findings reveal a high prevalence of stunting and underweight children, indicating the detrimental effects of the flood on nutritional status. Additionally, a significant number of children were reported to have experienced delays in key developmental milestones. Furthermore, a substantial proportion of children experienced various health issues following the flood, including water and foodborne diseases, vomiting, fever, and respiratory illnesses.

Regarding maternal health, the data showed a concerning level of food insecurity, health and mental health among the parents. Especially for mothers, lack of sufficient nutritional intake such as heme-iron and vitamin A rich food had adverse effects on mothers and children. The study also highlighted challenges in breastfeeding practices, with a lack of exclusive breastfeeding during the recommended period.

Policies and Program Recommendation

The immediate needs of mother and children

Our findings show that six months after the 2022-flood most families face nutritional and health difficulties regarding healthcare access. These difficulties were not particularly linked to antenatal maternal care that seems to be continuously delivered rather well after the 2022-flood, continuing existing relatively good practice. Yet, we don't know if during ANC visits women received the required nutrient complements (particularly iron and folic acid) and other essential components of the ANC visit, that are not always accessible in Pakistan. Yet, we observed important delays in meeting developmental milestones among newborn and infants in all streams of development: expressive and receptive language, including social communication, visual problem, motor development, neurobehavioral development, and social-emotional development. Environmental factors, such as poor nutrition early in life and infections influence early child development with negative consequences for brain development and lifelong wellbeing. In particular, the first two years are a critical window for growth and nutrition in infants and children with potential irreversible consequences. In particular, stunted growth results in increased mortality and morbidity, slower physical and intellectual development and loss of learning capacity. Additionally, consequences of poor early nutrition are associated with a higher risk of chronic diseases and infections as well as other health consequences later in life that can affect working capacity and maternal reproductive outcomes.

Informing families and particularly mothers about the importance of exclusive breastfeeding for their newborn children and breastfeeding until children are two years old while providing them with essential nutrients is essential to avoid such irreversible negative impacts. Breastfeeding is a crucial method of infant and child feeding in emergency situations, especially when the water sources are polluted. Studies have shown that breastfeeding exclusively in emergency situations is key to reduce dehydration.

In our study, mothers discussed the challenges of breastfeeding children in a flood camp. Poor maternal nutrition and lack of privacy were the two factors frequently mentioned by mothers. Both of these challenges present serious barriers to a mother's ability to continue to provide nutrition at the breast. Mother and child nutrition were interconnected and needed the support from the wider community. This is especially true in breastfeeding where there is a symbiotic relationship that goes beyond traditional interconnectedness. Given the research which clearly demonstrates the superior benefits of exclusive breastfeeding in early infancy, and supplemental breastfeeding through age 2, the authors recommend that emergency planners are specifically trained in three areas: Firstly, how to evaluate and ensure adequate maternal nutrition; secondly, how to create private spaces conducive to breastfeeding in mass congregate emergency sheltering situations; and finally, how to ensure that families receive adequate support to start, continue, or re-lactate in such emergency settings.

Another essential intervention would be to ensure children affected by undernutrition are identified early on through community outreach health workers visits trained to weight and measure newborn and children under 2 years of age, and if possible, up to 5 years of age, to identify situations acute or chronic undernutrition that might have been extant even before birth during gestation. Because reduced access to clean water and safe sanitation contribute to the risk of undernutrition among newborn and under two children. health workers should be equipped with the knowledge and skills to deliver sensitization messages about nutrition, but also about also about

WASH. Health workers should also be trained in delivering standard treatment regimens with highly fortified foods.

The intermediate needs of families:

healthcare and livelihoods access

This study confirms earlier findings that communities' vulnerability such as socioeconomic status, gender, maternal status or being a woman with a newborn or small children largely explains the severity of the negative consequences of a disaster, beyond the actual hazard itself .Women particularly are at risk of higher rate of mortality and poverty in case of disaster.

Our findings show that after the 2022-flood, most families in our sample were deprived of a livelihood as the main breadwinner lost their job or the possibility to farm was considerably reduced by the pollution of the water source for irrigation as well as the coverage of the family field. This put maternal and child health at increased risk because of the impact of reduced income on access to a diversity diet as well as healthcare.

Such a dire situation justifies relief intervention to improve free and quality access to healthcare as well as ways to secure quality food and other basic needs at least until people recover and can provide for themselves again, thus ensuring basic human rights to disaster impacted populations. Most maternal deaths are avoidable, as the health-care solutions to prevent or manage complications are well known. All women need access to antenatal care in pregnancy, skilled care during childbirth, and care and support in the weeks after childbirth. It is particularly important that all births are attended by skilled health professionals, as timely management and treatment can make the difference between life and death. Securing access to free quality antenatal and postnatal healthcare is a priority.

Implementing a cash-for-work program can be a highly effective approach to address the challenges faced by flood-affected communities. By providing temporary employment opportunities, families can earn cash to meet their immediate needs and gain greater control over their resources, including accessing healthcare services. Engaging the affected families in the design and implementation of the program is crucial to ensure it aligns with their specific needs and empowers them in their own recovery. This participatory approach fosters a sense of ownership, dignity, and self-esteem as families actively contribute to the community's recovery efforts. Moreover, the cash-for-work program can stimulate the local economy by injecting money into the community, fostering economic recovery and reconstruction. By combining immediate relief with economic empowerment, this approach not only addresses immediate needs but also promotes long-term resilience and self-sufficiency, providing individuals and communities with the means to rebuild their lives and regain hope in the aftermath of the disaster.

The sustainable change in building

climate resilience community

Once immediate needs are addressed, it is crucial for the government and NGOs involved in relief efforts to focus on long-term disaster recovery and resilience. This includes developing disaster preparedness plans in collaboration with local communities. Community engagement in disaster preparedness, disaster risk reduction, and the reconstruction process can play a critical role in minimizing the negative impact of natural disasters such as floods, droughts, or landslides. By involving local communities, recovery efforts can be more efficient and effective, especially in areas that are often cut off by disasters.

Our studies have highlighted the lack of disaster preparedness as a key factor impacting the well-being of families. Participants reported a lack of warning systems from the government, leaving them with only a few days to prepare for the sudden emergency. Moreover, the government's ability to provide shelter and food after the flood was insufficient, and many areas were inaccessible due to inundation, further hindering post-flood support. Therefore,

building capacity in fortifying resilient communities through adequate disaster mitigation, emergency preparedness, response, and recovery planning is essential.

Building capacity in fortifying resilient communities to combat future climate disasters through adequate disaster mitigation as well as emergency preparedness, response and recovery planning has been shown to be far less costly than the overall cost of the disaster response in absence of planning. More and more communities in developed countries are starting to work on strengthening the resilience of infrastructures and services to increase their preparedness to climate emergency. However, limited studies have been conducted on climate change mitigation and disasters preparedness in rural communities in LMICs. These few studies advocate for the importance of community knowledge by identifying predictors of floods, including early scientific warning and tracking systems of typhoons to help and mitigate the damages in rural communities. With improvement of science and widespread social media outreach, disaster warning systems along with basic disaster preparedness training should be established.

Second, a lot of participants called for the improvement of infrastructures, especially water management systems. With worsening climate change, increased frequency of climate disasters is inevitable. To better protect people's life and well-being, governments need to put in place strategies to promote the resilience of at-risk communities.

Third, Participants in our studies also emphasized the need for improved distribution of services and goods. Clear criteria for aid relief and monitoring processes should be implemented, drawing on prior work in supply chain management and logistics in post-flood or disaster-affected areas. Governmental and nongovernmental organizations should collect more detail data using participatory methods to build an effective supply chain and logistic system prior to the next disaster in collaboration with communities. Studies have shown that local people can accurately identify those families most in needs. A participator process for the distribution of the relief aid will increase satisfaction of local communities and reduce their hardship. Most non-profit organizations are aware of participatory methods, but it is important for non-profit organizations to commit to consistent engagement and participatory approaches to better serve local communities.

Fourth, it is essential to establish and strengthen long-term social safety nets to support communities in the aftermath of major disasters. The disruption of social welfare programs, as mentioned by women in Dadu district, highlights the need for reliable and sustainable support mechanisms. This can be achieved through robust government policies that prioritize disaster-affected communities and allocate adequate funding for post-disaster recovery. Additionally, exploring the possibility of flood insurances provided by private entities can offer an alternative means of financial support for affected individuals and families.

Conclusion

In conclusion, this study has highlighted several important areas that require attention to enhance disaster preparedness, response, and recovery. Maternal and child nutrition practices, including promoting exclusive breastfeeding and addressing nutrient deficiencies, need to be prioritized. Privacy for breastfeeding mothers should be ensured to support their breastfeeding nneds. Additionally, strategies must be implemented to prevent maternal exhaustion and mitigate the additional burden imposed by disasters on mothers and families.

To prevent the entrenchment of poverty due to livelihood disruptions, measures should be taken to support families and ensure their financial stability in the aftermath of a disaster. This could include increasing the efficiency and equality in distribution of aids, providing cash to work program, and strengthening social safety nets

Access to clean water and sanitation is crucial for temporary shelter areas to prevent water-borne diseases and protect the health of affected families. Efforts should also be taken in further increasing access to WASH in the recovery process.

Furthermore, long-term perspectives and sustainable changes are needed to promote resilient building practices and strengthen supply chains in disaster-prone areas. This involves equipping communities with the necessary tools, knowledge, and education to recover quickly and effectively from future climate disasters.

By addressing these areas of concern and implementing proactive measures, communities can enhance their resilience, reduce the negative impact of disasters, and promote a more sustainable and effective response and recovery process.

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Appendix

Table 1

	Delivery baby in 2022 (N=78)	Delivery baby before 2022 (N=61)	P-value
Maternal check-up			
Yes	66 (84.6%)	47 (77.0%)	0.36
No	12 (15.4%)	14 (23.0%)	
How many times of check-ups			
Mean (SD)	4.32 (3.25)	4.89 (3.06)	0.339
Median [Min, Max]	3.00 [1.00, 20.0]	4.00 [2.00, 15.0]	
Who did checkup			
Doctoral	5 (6.4%)	3 (4.9%)	0.114
Nurse	0 (0%)	3 (4.9%)	
Midwife	61 (78.2%)	41 (67.2%)	
Ultrason			
Yes	58 (74.4%)	38 (62.3%)	0.94
No	3 (3.8%)	3 (4.9%)	
Duration of Labor			
Less than 12 hours	58 (74.4%)		
Between 12-20 hours	14 (17.9%)		
Greater than 20 hours	1 (1.3%)		
Delivery methods			
Spontaneous	67 (85.9%)		
Cesarean Section (c-section)	10 (12.8%)		
Delivery place			
Home	13 (16.7%)		
Hospital	62 (79.5%)		
Who assists in labor			
Doctor	53 (67.9%)		
Nurse	10 (12.8%)		
Midwife	14 (17.9%)		
Complication in delivery			
No	44 (56.4%)		
Yes	33 (42.3%)		
Missing	1 (1.3%)		
Delayed of the first cry			
Yes	34 (43.6%)		
No	43 (55.1%)		
Baby turns blue after birth(cyanosis)			
Yes	16 (20.5%)		1
No	61 (78.2%)		
Baby has fever			
Yes	12 (15.4%)		1
No	65 (83.3%)		
Baby surfer from birth injury			
Yes	3 (3.8%)		1
No	74 (94.9%)		
Missing	1 (1.3%)		
Jaundice (yellow eyes)			
Yes	12 (15.4%)		0.391
No	65 (83.3%)		

Table 2

	Mothers with Baby 6-1-year-old (Deliver around flood time) (N=27)	Baby under 6 months old (After flood) (N=52)	P-value
Maternal check-up			
Yes	22 (81.5%)	46 (88.5%)	0.612
No	5 (18.5%)	6 (11.5%)	
How many times of check-ups			
Mean (SD)	4.50 (3.53)	4.87 (3.66)	0.692
Median [Min, Max]	3.00 [1.00, 16.0]	4.00 [1.00, 20.0]	
Who did checkup			
Doctoral	4 (14.8%)	1 (1.9%)	0.0616
Midwife	18 (66.7%)	45 (86.5%)	
Ultrason			
Yes	16 (59.3%)	43 (82.7%)	0.683
No	2 (7.4%)	2 (3.8%)	
Duration of Labor			
Less than 12 hours	18 (66.7%)	37 (71.2%)	0.697
Between 12-20 hours	4 (14.8%)	8 (15.4%)	
Greater than 20 hours	3 (11.1%)	3 (5.8%)	
Delivery methods			
Spontaneous	16 (59.3%)	45 (86.5%)	0.00348
Cesarean Section (c-section)	9 (33.3%)	3 (5.8%)	
Delivery place			
Home	6 (22.2%)	8 (15.4%)	
Hospital	18 (66.7%)	39 (75.0%)	0.65
Who assists in labor			
Doctor	15 (55.6%)	32 (61.5%)	
Nurse	2 (3.7%)	9 (17.3%)	
Midwife	8 (29.6%)	7 (13.5%)	0.132
Complication in delivery			
No	15 (55.6%)	21 (40.4%)	
Yes	10 (37.0%)	27 (51.9%)	
Delayed of the first cry			
Yes	8 (29.6%)	28 (53.8%)	0.284
No	17 (63.0%)	20 (38.5%)	
Baby turns blue after birth(cyanosis)			
Yes	8 (29.6%)	9 (17.3%)	
No	17 (63.0%)	39 (75.0%)	0.0589
Baby has fever			
Yes	8 (29.6%)	4 (7.7%)	
No	17 (63.0%)	44 (84.6%)	0.327
Baby surfer from birth injury			
Yes	3 (11.1%)	0 (0%)	
No	22 (81.5%)	48 (92.3%)	0.0241
Missing			
Jaundice (yellow eyes)	7 (25.9%)	4 (7.7%)	
Yes	18 (66.7%)	44 (84.6%)	0.0673
No			

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