ORIGINAL ARTICLE

Impact of a Community-Based Intervention on Maternal and Neonatal Health in Flood-Affected Districts of Sindh, Pakistan: A Retrospective Pre- and Post-Intervention Study

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Abstract

Background: In 2022, catastrophic flooding in Sindh severely disrupted MNCH services. A community-based intervention was implemented to restore essential MNCH care and improve service utilization in flood-affected districts.

Objective: To assess the impact of Community-Based Intervention on MNCH service utilization in flood-affected districts of Dadu and Khairpur by comparing pre- and post-intervention healthcare.

Methods: A Retrospective pre- and post-intervention design evaluated how a community-based intervention affected maternal and neonatal health service use in the flood-affected districts of Dadu and Khairpur, Sindh, Pakistan, throughout November 2022 to August 2023. The intervention took place in flood-ravaged districts of Sindh.

Results: Post-intervention, MNCH service utilization increased significantly. OPD visits increased from 23,517 to 78,226, antenatal care visits from 7,905 to 34,317, and postnatal care visits from 1,115 to 3,261. Normal vaginal deliveries improved from 985 to 3,159, and full uptake of newborn and delivery kit utilization. Statistical analysis showed higher odds of utilizing MNCH OPD services (OR = 1.45, 95% CI: 1.43-1.49, p<0.001) and increased antenatal care visits (OR = 1.20, 95% CI: 1.17-1.24, p<0.001). Postnatal care utilization and hospital-based deliveries also improved (OR = 1.30, 95% CI: 1.22-1.39, p<0.001), (OR = 1.19, 95% CI: 1.10-1.27, p<0.001).

Conclusion: This study indicates that a community-based approach led to an increase in the number of visits to MNCH OPD for maternal and neonatal health, prenatal care, postnatal care, and hospital-based deliveries in areas affected by flooding.

Keywords: *Retrospective pre- and post-intervention study, community-based intervention, maternal neonatal and child health services, flood-affected areas, Pakistan.*

INTRODUCTION

Maternal health is one of the main public health concerns, deeply affecting the well-being of people and the complete growth of countries. Despite several policy initiatives and international partnerships, the rates of maternal and neonatal mortality are still alarmingly high in Pakistan. Catastrophic floods have destroyed huge areas of Pakistan. Among the millions of severely affected people are at least 650,000 pregnant women and girls, 73,000 of whom are expected to deliver in the next month. Many of these women lack access to the healthcare facilities and support they need to deliver their children safely [1, 2].

The 2022-23 floods in Pakistan displaced over 7.6 million people and left 650,000 pregnant women in urgent need of care, with 73,000 expected to deliver within a month. Such disasters have severely impacted maternal health in resource-limited settings like Bangladesh [3]. Damaged infrastructure and displacement have increased childbirth risks, prompting responses such as clean delivery kits and ANC PNC services [4].

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During the devastating floods in Sindh, the Indus Hospital & Health Network (IHHN), in partnership with UNICEF, played an essential role in strengthening maternal health services throughout the affected districts. Identifying the urgent requirement for healthcare access in the outcome of the floods, Indus rapidly prepared resources and employed support programs aimed at delivering antenatal care (ANC), postnatal care (PNC), formal deliveries, and neonatal care. The intervention included the provision of Clean Delivery Kits (CDKs), Newborn Baby Kits (NBKs), nutrition support, and important medicines. The initiatives bring a notable cutting edge in maternal and neonatal health outcomes as highlighted by pre- and post-intervention investigations that showed a rise in facility-based deliveries, ANC visits, and MNCH outpatient department (OPD) consultations [5-7].

The objective of achieving WHO guidelines regarding four or more ANC visits remains incomplete because only 51% of women succeed in this requirement [8, 9]. Postnatal care functions as a significant unmet need within the maternal health services system. Research shows that PNC care happens to less than half (41%) of women during their first two days post-partum period, even though this early stage directly affects their risk of developing postpartum complications [10]. Several factors like insufficient awareness, along with

social norms and distance challenges, serve as the main reasons behind the low PNC service utilization, particularly in rural communities [11, 12].

Multiple barriers obstruct the maternal health system of Pakistan through insufficient medical staff, combined with inadequate medical infrastructure, medication scarcity, and cultural traditions. Rural communities face greater pregnancy and childbirth risks since they do not have an adequate number of practicing obstetric and midwifery professionals in their locations [13]. Natural disasters like floods significantly disrupt maternal and neonatal health (MNH) services in low-resource settings. There is a lack of empirical evidence on post-disaster recovery efforts, especially community-based interventions, in Pakistan. Previous studies in LMICs have highlighted reductions in antenatal care, institutional deliveries, and postnatal follow-up after floods and earthquakes, but few have assessed intervention outcomes [14]. In Pakistan, existing literature has focused primarily on emergency relief or disease surveillance post-disaster, with limited research evaluating the impact of structured health service interventions on MNCH service utilization [15, 16]. This study fills this critical gap by examining how a coordinated, community-level intervention improved access to and uptake of MNCH services in two flood-affected districts. The study aims to evaluate the impact of a community-based intervention on maternal and neonatal health service utilization in flood-affected districts of Sindh, Pakistan.

METHODOLOGY

This was a retrospective pre- and post-intervention study conducted to evaluate the impact of a community-based intervention on maternal and neonatal health (MNCH) service utilization. The study was carried out in the flood-affected districts of Dadu and Khairpur in Sindh province, Pakistan. The intervention was implemented from November 2022 to August 2023 across the selected districts. Pre-intervention data were collected from January 2022 to October 2022. The study was conducted in four health facilities: Dadu District: THQ Johi and RHC Daigh Bala, and Khairpur District: RHC Thari Mirwah and RHC Chang Faiz Gunj.

This study was conducted using anonymized, routinely collected service utilization data without direct patient interaction. The data for this study were obtained from routine health service utilization records, specifically from hospital registers and monthly summary reports maintained by the District Surveillance Units (DSUs) in Khairpur and Dadu. These records included data from primary and secondary healthcare facilities located in Thari Mirwah, Faiz Ganj, Sohbo Dero, and Kot Diji Talukas of Khairpur District, and Johi Taluka of Dadu District. The information was extracted retrospectively from existing facility-based documentation systems. Therefore, individual informed consent was not required. The study protocol received ethical exemption from the Indus Hospital and Health Network Institutional Review Board (IHHN IRB) under reference number IHHN_IRB_2025_04_012. Inclusion criteria: Individuals utilizing maternal and neonatal health services (ANC visits, deliveries, PNC visits, newborn care services) during the study period at the identified health facilities and mobile camps. Exclusion criteria: Individuals accessing services unrelated to MNCH (such as adult OPD or chronic disease management). Duplicate or incomplete records, missing key demographic or service utilization data. The study included a total of 33,522 individuals during the pre-intervention phase and 126,692 individuals during the post-intervention phase. A retrospective review of service utilization records was conducted for the pre- and post-intervention periods. Data collection was performed through routine service documentation rather than a face-to-face survey. Healthcare providers documented patient service utilization during static and mobile health camps using standardized service registries.

Data collection focused on capturing antenatal care (ANC), delivery services, postnatal care (PNC), newborn care, treatment referrals, and health education sessions.

Collected data were verified routinely by Camp Focal Persons and District Health Officers (DHOs) for accuracy and completeness. District Coordinators conducted final reviews before uploading to the central database. The intervention included two major components:

Eight mobile teams were deployed to deliver essential maternal and newborn healthcare services, including treatment for pregnant women, newborn vaccinations, nutritional support, and health education. Transitional Maternal Health Units: Health facilities that had become non-functional due to floods were repurposed into transitional maternal health centers offering emergency and basic obstetric care. On average, each facility had 1-2 medical officers, 3-5 LHVs/nurses, and supported daily outpatient services, with extended hours during peak post-flood months."

Service delivery was coordinated through collaboration between District Health Department personnel and local partner organizations. Performance indicators, including the number of pregnant women screened and services utilized, were continuously monitored and evaluated during the intervention period to assess implementation reliability and effectiveness. The study utilized standardized service utilization registries developed by the Indus Hospital & Health Network for field documentation. These registries systematically captured: MNCH outpatient department (OPD) visits, Antenatal care (ANC) visits, Hospital-based deliveries, Postnatal care (PNC) visits, Utilization of newborn care kits (NBKs), and clean delivery kits (CDKs). All data entries were regularly cross-checked by supervisory teams to maintain data integrity.

Data analysis was performed using SPSS Version 26.0. Descriptive statistics were generated, including means and standard deviations (SD) for continuous variables and frequencies and percentages for categorical variables. Comparisons between pre- and post-intervention service utilization were conducted using the Chi-square test, which was considered statistically significant. Binary logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals to measure the strength of association between the intervention and each maternal and neonatal health service utilization outcome, with a p-value of ≤0.05

RESULTS

The intervention produced substantial service quality improvements for maternal and neonatal healthcare across the flood-affected areas of Khairpur and Dadu districts. Data shows an essential rise in access to healthcare services, which includes antenatal and postnatal care as well as institutional deliveries and essential maternal and newborn care kits distribution.

Table **1** outlines the population affected by the floods in Dadu and Khairpur districts, including the number of women of reproductive age and pregnant women. It highlights the expected live births, emphasizing the need for targeted maternal health interventions in these flood-impacted areas.

Table **2** shows the results of the intervention, which proved substantial improvements in maternal and neonatal health indicators. After the intervention, there was a marked increase in MNCH OPD visits, from 23,517 to 78,226. Antenatal care visits improved significantly from 7,905 to 34,317, whereas postnatal care visits and normal vaginal deliveries in hospitals also showed significant improvements. The consumption of newborn and clean delivery kits, which were absent in pre-intervention, increased to 3,269 and 4,460, showing enhanced access to essential care. These results suggested that the intervention effectively improved healthcare access in both districts.

Table 1: Impact of floods on maternal and neonatal health in Dadu and Khairpur Districts, Sindh.

Location	Tehsil	Total Population	No. of HH Damaged	No. of Population Affected	Total No. of Women of Reproductive Age	Total No. of Women of Reproductive Age Affected	Total No. of Current Pregnant Women
District Dadu	Tehsil Johi	294,389	31,541	220,792	73,579	55,198	40,403
District Khairpur	Tehsil Mirwah	352,491	12,506	87,542	88,122	21,881	1,746
	Tehsil Faiz Ganj	224,088	9,620	67,340	56,022	16,835	1,343

Table 2: Frequency table of pre- and post-intervention of maternal and neonatal health service utilization.

Indicators	Pre-Intervention						
	Khairpur					Dadu	Total
	Khairpur(City)	Thari Mirwah,	Faiz Ganj,	Sohbo Dero,	Kot Diji	District Johi	
MNCH OPD Visits	2788	4125	4894	5874	2874	2962	23517
Antenatal Care Visits	589	817	1606	1979	1425	1489	7905
Postnatal Care Visits	38	47	139	97	56	738	1115
Normal Vaginal Delivery Cases at Hospitals	27	13	115	75	20	735	985
Newborn Care Kit Utilization	0	0	0	0	0	0	0
Clean Delivery Kit Utilization	0	0	0	0	0	0	0
Indicators	**Post Intervention**						
	Khairpur					Dadu	Total
	Khairpur(City)	Thari Mirwah,	Faiz Ganj,	Sohbo Dero,	Kot Diji	District Johi	
MNCH OPD Visits	11681	7415	21478	17846	14789	5017	78226
Antenatal Care Visits	7678	4115	8975	6789	4759	2001	34317
Postnatal Care Visits	341	121	598	314	578	1309	3261
Normal Vaginal Delivery Cases at Hospitals	241	89	547	396	179	1707	3159
Newborn Care Kit Utilization	275	97	645	436	217	1599	3269
Clean Delivery Kit Utilization	378	128	874	687	578	1815	4460

Table 3: Improvement in maternal and neonatal health service utilization pre- and post-intervention.

Indicator	Pre-Intervention (n=33,522)	Post-Intervention (n=126,692)	Improvement (n)	Improvement (%)
MNCH OPD Visits	23,517	78,226	54,709	232.5
Antenatal Care Visits	7,905	34,317	26,412	333.1
Postnatal Care Visits	1,115	3,261	2,146	192.3
Normal Vaginal Delivery Cases at Hospitals	985	3,159	2,174	220.1
Newborn Care Kit Utilization	0	3,269	3,269	100
Clean Delivery Kit Utilization	0	4,460	4,460	100

Table 4: Odds ratios comparing pre- and post-intervention maternal and neonatal health service utilization.

Variable	Pre-Intervention n(%)	Post-Intervention n(%)	Odds ratio	95% CI (Lower-Upper)	p-value
MNCH OPD					
Utilized	23,517 (70.1)	78,226 (61.8)	1.45	1.43-1.49	<0.001
Not Utilized	10,005 (29.9)	48,466 (38.2)	Reference category		
Antenatal Care Visits					
Visited	7,905 (23.6)	34,317 (27.1)	1.20	1.17-1.24	<0.001
Not Visited	25,617 (76.4)	92,375 (72.9)	Reference category		
Postnatal Care Visits					
Visited	1,115 (3.3)	3,261 (2.6)	1.30	1.22-1.39	<0.001
Not Visited	32,407 (96.7)	123,431 (97.4)	Reference category		
Normal Vaginal Delivery Cases					
Hospital Births	985 (2.9)	3,159 (2.5)	1.19	1.10-1.27	<0.001
Non-Hospital Births	32,537 (97.1)	123,533 (97.5)	Reference category		

Table **3** shows a substantial improvement in key maternal and neonatal health indicators following the intervention. MNCH OPD visits increased by 232.5%, from 23,517 to 78,226. Antenatal care visits showed a significant rise of 333.1%, from 7,905 to 34,317. Postnatal care visits improved by 192.3%, increased by 3,261, up from 1,115. The number of normal vaginal deliveries in hospitals increased by 220.1%, from 985 to 3,159. Moreover, the utilization of newborn and clean delivery kits, which was zero in pre-intervention, increased by 3,269 and 4,460, respectively, showing a 100% improvement. These results show a significant improvement in healthcare access.

Service utilization before and after the intervention showed significant changes in maternal and neonatal health, as shown in Table **4**.

The odds of attending MNCH OPD services after the intervention were more likely (OR = 1.45, 95% CI: 1.43-1.49, p<0.001) as compared to the pre-intervention period. Since the OR is more than 1, it indicates that individuals were more likely to utilize MNCH OPD services post-intervention, demonstrating a significant improvement in service utilization. The odds of attending antenatal care visits after the intervention were more likely (OR = 1.20, 95% CI: 1.17-1.24, p<0.001) as compared to the pre-intervention period. Since the OR is greater than 1, it indicates that individuals were more likely to utilize antenatal care services post-intervention, demonstrating a significant improvement in maternal healthcare utilization. The odds of attending postnatal care services after the intervention were more likely (OR = 1.30, 95% CI: 1.22-1.39, p<0.001) as compared to the pre-intervention period. Since the OR was more than 1, it indicates that women were more likely to utilize postnatal care services post-intervention. The healthcare intervention led to women becoming more active in seeking postnatal care services. The odds of having hospital birth deliveries after the intervention were more likely (OR = 1.19, 95% CI: 1.10-1.27, p<0.001) as compared to the pre-intervention period. Since the OR is more than 1, it indicates that women were more likely to give hospital birth deliveries post-intervention, demonstrating a significant improvement in hospital-based deliveries. The implementation of the intervention resulted in greater use of MNCH OPD facilities and antenatal care services, together with postnatal care services and hospital-based deliveries. The program led to the greatest progress in antenatal care utilization, although postnatal care utilization and hospital birth rates showed moderate improvement.

DISCUSSION

The study estimated the impact of a community-based intervention on maternal and neonatal health service utilization in flood-prone districts of Dadu and Khairpur, Pakistan. The results emphasized improvements and barriers in service utilization, mainly in MNCH outpatient visits, antenatal care (ANC), postnatal care (PNC), and hospital-based deliveries. Although complete service utilization improved in the post-intervention period.

An intervention carried out within the community established an assessment for its impact on maternal and neonatal healthcare service utilization all over Dadu and Khairpur districts that were impacted by floods of 2022 and 2023 in Pakistan. The data highlight that maternal and neonatal health service utilization showed positive outcomes after the intervention, mainly about MNCH outpatient visits, ANC, PNC visits, and Hospital-based deliveries. The odds of using the MNCH OPD facilities after the intervention were more likely (OR = 1.45, 95% CI: 1.43-1.49, p < 0.001). This suggests that there is a greater improvement in OPD visits than expected. This also suggests that the intervention helped increase OPD maternal and child health services in offshore disaster situations where the health system is always fragile [17]. A study conducted in Bangladesh showed similar results: mobile health clinics set up in flood-affected communities increased outpatient service utilization [18, 19]. Similarly, a study on maternal health interventions in Nepal emphasized the need to resume services after natural calamities to sustain MNCH service continuity [20].

The odds of attending antenatal care visits post-intervention were more likely (OR = 1.20, 95% CI: 1.17-1.24, p < 0.001), indicating a positive association between the intervention and ANC utilization. This

suggests that increased awareness, service availability, and healthcare outreach efforts encouraged more pregnant women to seek antenatal care. Similar results were observed in other low-resource settings where ANC visits improved by following community-based interventions, mobile clinics, and incentives for pregnant women [21, 22]. However, despite these initiatives, barriers such as delayed ANC visits and incomplete follow-up visits persist, as reported in previous studies from rural Pakistan [23]. Ensuring the continuity of ANC services through sustained awareness campaigns and mobile healthcare programs remains essential.

The odds of utilizing PNC services post-intervention were more likely (OR = 1.30, 95% CI: 1.22-1.39, $p < 0.001$), representing improved PNC visits. Postnatal care exists as a critical unmet need in maternal health. The studies conducted in South Asia emphasized socio-economic barriers, cultural constraints, and inadequate awareness as main restrictions to PNC engagement [24, 25]. A study that was conducted in India identified that postnatal home visits by trained midwives suggestively improved maternal and neonatal outcomes, strengthening the requirement for home-based PNC models in Pakistan [26]. Progressive midwifery-driven community programs and implementing postnatal care services into routine maternal healthcare visits might improve service utilization.

The odds of having hospital birth deliveries after the intervention were more likely (OR = 1.19, 95% CI: 1.10-1.27, $p < 0.001$) as compared to the pre-intervention period. But even with the upgrading in delivery situations, home deliveries are still the norm, due to cultural partialities, lack of financial support, and inadequate transportation access. In Sub-Saharan Africa, resulting in community health interventions, facility-based deliveries were identified to have improved access, whereas home births persisted as common due to traditional beliefs [27]. Transport incentives, community advocacy, and expert birth attendance programs can upsurge institutional delivery rates even, according to a systematic review of birth preparedness programs in developing countries [28]. Structuring referral systems and minimizing financial barriers can drive more women to choose hospital-based deliveries in Pakistan.

This study has several methodological and contextual limitations that may influence the interpretation and generalizability of its findings. The absence of a control or comparison group limits the ability to directly attribute the observed improvements in maternal and neonatal health service utilization to the intervention. Although the pre- and post-intervention design offers valuable insights into service trends over time, it does not account for the potential influence of external factors or confounders. In addition, certain indicators—particularly those related to postnatal care—relied partly on self-reported information, which may be affected by recall bias and result in inaccurate reporting. The generalizability of the findings is restricted, as the intervention was conducted in selected flood-affected Talukas of Dadu and Khairpur, where health infrastructure, access, and community response may differ from other regions. The use of retrospective data from routine health facility records also poses a risk of incomplete or inconsistent documentation, particularly during the flood emergency when recordkeeping may have been disrupted. Despite these limitations, the study provides timely and policy-relevant evidence on the utility of community-based interventions in strengthening MNCH service delivery in disaster-affected, resource-constrained settings.

CONCLUSION

This study demonstrates that a community-driven approach significantly improved utilization of MNCH outpatient services, antenatal care, postnatal care, and hospital-based deliveries in flood-affected areas. The largest gains were seen in OPD, ANC, and PNC visits, indicating that awareness efforts and expanded service access positively influenced care-seeking behaviors. However, the relatively smaller increase in institutional deliveries suggests persistent barriers such as limited knowledge, poverty, and sociocultural constraints. These findings highlight the need for sustained maternal health programs, the integration of digital health tools, and midwifery-led community models to strengthen maternal and neonatal outcomes in disaster-prone, low-resource settings.

RECOMMENDATIONS

Reinforce the primary health network by increasing mobile health services and midwifery-driven home visits. Improve ease of access and economic feasibility by providing transport support and financial incentives for hospital-based deliveries. Influence digital health solutions such as telemedicine, telehealth, mobile applications, and Message-based notifications for ANC and PNC follow-up visits. Improve policy-based interventions by prioritizing maternal health in crisis rehabilitation plans and demand an increase in funding for Maternal Newborn and Child Health programs.

ETHICS APPROVAL

The study protocol received ethical exemption from the Indus Hospital and Health Network Institutional Review Board (IHHN IRB) under reference number IHHN_IRB_2025_04_012. All procedures performed in studies involving human participants were following the ethical standards of the institutional and/ or national research committee and the Helsinki Declaration.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA

The data set may be acquired from the corresponding author upon a reasonable request.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHOR'S CONTRIBUTION

MT: Developed, designed, and analyzed the data for the manuscript.

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