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# Optimizing Telehealth Interventions to Enhance Antenatal and Postnatal Care and Improve Outcomes for Pregnant Women in Flood-Affected Rural Sindh, A retrospective study

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**ABSTRACT**

**Background:** The 2022 Pakistan floods severely affected the provision of basic maternal healthcare services. Telehealth intervention was developed in the flood-stricken districts to fill in the gaps in maternal health services and continuity of care of the pregnant women.

**Objective:** The study aims to determine the effectiveness of the telehealth intervention to improve the antenatal and postnatal care and better maternal outcomes among pregnant women in rural Sindh, which is affected by floods.

**Methods:** A retrospective cross-sectional study was carried out with the help of program data obtained between June and December 2023. There was inclusion of all the recorded maternal health service utilized. Frequencies and proportions of doorstep consultations, antenatal and postnatal care visits, supervised deliveries and referral to secondary healthcare facilities were summarized using descriptive statistics.

**Results**: A total of 1,437 doorstep consultations were carried out, with 47.5 percent antenatal and postnatal care visits and 48.1 percent referrals to the secondary healthcare institutions where the management can be done. Approximately 730 births were supervised and 4.7 percent referrals to the secondary healthcare institutions were made at the Spoke site. Online consultations and community involvement, as well as organized referrals, enhanced maternal care accessibility, which guaranteed quality management of high-risk pregnancies and continuity.

**Conclusion:** The research suggested that, telehealth intervention improves maternal care by increasing the level of access to antenatal, postnatal and delivery service through teleconsultation and referral pathway, it strengthened continuity of care and timely management of high-risk pregnancies. These results highlight the need to consider the incorporation of telehealth into disaster-response health systems of crisis prone regions, as one of the sustainable options in improving maternal outcomes.

**Keywords:** telehealth, antenatal care, postnatal care, maternal health services, pregnant women, floods.

## BACKGROUND

Maternal and child health remains a burning issue in rural Sindh especially in flood hit areas where access to health was badly affected. As a signatory to the SDGs 3 (good health and wellbeing), Pakistan is committed to reduce maternal mortality to less than 70 per 100,000 live births remains an on-going challenge as every day twenty-seven mothers and six hundred and seventy-five babies under one month die and the health indicators are even more alarming in the rural areas where, people often travel long distances to reach out health facilities which increases the delay in getting healthcare services leading towards increasing the risks of complications for maternal and fetal health [1,2].

The most severe flooding in Pakistan's recent history occurred in September 2022 as a result of heavy monsoon rainfall. Flood water engulfed more than one-third of the nation, forcing 33 million people or 15% of Pakistan's total population to relocate and killing over 1500 people. The United Nations Population Fund (UNFPA) reports that damage to health facilities jeopardized the lives of women and girls, especially pregnant women, and interfered with the provision of basic health services. Over 650 000 pregnant women were thought to have limited or no access to health care, with 73 000 nearing the end of their pregnancy. Healthcare facilities of Dadu and Khairpur in Sindh were inaccessible due to damaged infrastructure, geographic isolation, and workforce shortages especially among the vulnerable cohort of women and children [3-5].

Digital health and telehealth technologies have been increasing exponentially to deliver remote healthcare in many specialties, and it has the potential to bridge this gap by improving antenatal care (ANC) and postnatal care (PNC) for pregnant women in underserved areas [6]. The telemedicine according to research can save or even increase the prenatal care visits particularly where time, money or distance constitute a barrier. This becomes especially critical in the low

middle and income countries (LMICs), where the access to care is already affected unevenly by the frequency of climate disasters such as floods, as well as maternal health institutions, which are already underfunded [7]. According to the results of a recent study, potential advantages of the virtual follow-up visit include the need to improve the continuity of care during the postpartum period, eliminate the barriers to delivering care in person due to transportation challenges, and overcome time constraints related to work and childcare responsibilities [8]. Additionally, flexible postpartum care models that support a patient-centered approach might boost patient satisfaction and uptake by offering virtual visits, Participation in the continuum of care increased by 300%, according to another study. Telehealth interventions have the potential to offer life-saving consultations, remote consultations, and health education. Nevertheless, to optimize the use of telehealth interventions in resource limited and disaster-prone regions, it is important to deal with infrastructural, cultural, and other factors like lack of internet connectivity, low digital literacy, and cultural resistance to virtual care disrupt the usefulness of telehealth interventions. In terms of maternal care, a review of 71 studies shows that, digital health has helped shape perinatal care in several ways, that includes screening for postnatal depression, web-based cognitive behavioral therapy, apps to suggest healthier lifestyle practices, and monitoring fetal monitoring at home [9,10].

This study focuses on a tele-health intervention which was carried by the telehealth program at community health directorate - Indus Hospital and Health Network (IHHN), in the flood affected districts to overcome the challenges faced by the pregnant women. With the approach of improving maternal and child health outcomes, aligning with the sustainable developmental goals. Through assessment of effectiveness of Telehealth intervention, the study seeks to know how telehealth can be optimized to suit rural, disaster prone region to help in ensuring that the pregnant women get the care they require, and to measure how well the telehealth intervention

(tele-midwifery services) is used and how the intervention affects the uptake of antenatal and postnatal care and access to services among the pregnant women in the flood affected districts of the rural Sindh region.

## METHODOLOGY

### Study design and setting

This cross-sectional study utilized a retrospective data, to assess the efficacy of telehealth intervention implemented as part of the routine healthcare service delivery by telehealth program - community Health Directorate (CHD) of the Indus Hospital & Health Network. The aim of the intervention was to improve maternal healthcare outcomes, especially enhancing access for ANC and PNC services in the flood-affected districts of Dadu (tehsil Dadu) and Khairpur (tehsil Kot Diji) Sindh, Pakistan.

### Study Duration

June 2023 and December 2023.

### Study population and sampling

A purposive sampling approach was utilized to include all the eligible women of reproductive age (15–49 years), who were mapped and assessed by the midwives and, who received maternal healthcare services (ANC and PNC) through the telehealth intervention.

**Inclusion criteria:** Women aged 15 to 49 years, residing in the flood affected areas of Khairpur and Dadu, who received telehealth supported online medical consultations through IHHN's telehealth intervention.

**Exclusion criteria:** No eligible participants were excluded all women who met the inclusion criteria during the study period were included to ensure comprehensive representation of the program's reach, however during data extraction the incomplete and duplicated data was excluded.

## Data collection technique

The data for this retrospective study is obtained from the program database while ensuring the anonymity of the participants. The data extraction for the relevant variables is carried out under the supervision of the telehealth program team and there was no direct contact with the participants.

## Ethics approval and consent to participate

The protocol of the study received ethical exemption from IRB-IHHN under reference number IHHN_ IRB_2025_06_020 on June 19, 2025, and under exemption category 4. The telehealth intervention was implemented as part of the routine healthcare service delivery to address maternal health challenges during flood, and there was no recruitment of participants for research purpose. The study utilized existing data (retrospective analysis), in which no direct contact with the participants was required and no patient information used in the analysis was identifiable. Therefore, IRB waived the need for informed consent from all the participants including legal guardians and parents of the participants who were under 16.

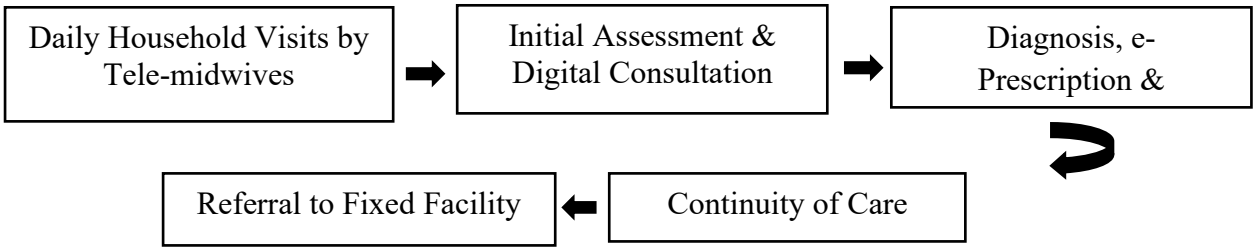
## Statistical analysis

SPSS Version 26.0 was used to examine all program data. The analysis concentrated on descriptive statistics because every variable was categorical. Key metrics such as doorstep consultations, ANC and PNC visits, referrals to higher-level facilities and tele-midwifery sites, supervised births, and maternal problems were all counted and percentage was calculated, to demonstrate the use of telehealth services and the results of maternal care in rural Sindh affected by floods.

## Description of the telehealth-intervention

The telehealth intervention illustrated in figure **1**, was designed to connect a gynecologist from the "HUB" based in Karachi with two labor Rooms (non-functional initially) in government health facilities one in each district, Khairpur (Union council; Naseer Fakir Jalalani) and Dadu (Union council; Y.M Kalhoro), which were refurbished and operationalized to provide maternal health services to the flood affected communities, by serving as fixed "Spoke" site, connected virtually to specialist and gynecologist at the telehealth-HUB. Meanwhile, five main trained midwives were deployed in these areas to carry out community-based maternal care and digital health facilitation (online consultation) with the doctor daily during the post-peak flood months. The midwives conducted the initial assessments and digital consultations during their household visits and performed virtual consultations with the specialists for the diagnosis and mediation prescription. The women were referred to the fixed facility and maternal services were provided while ensuring their continuity of care.

**Figure 1: Telehealth hub and spoke model of service delivery in Sindh rural areas.**




## RESULTS

The telehealth intervention that was carried out in the flood-impacted underserved districts showed significant service usage throughout the study. As shown in Table **1**, a total of 5,764 patients were managed through telehealth platforms across District Dadu (Tehsil Dadu) and District Khairpur (Tehsil Kot-Diji) during the peak flood times, generating 5989 tele-consultations with the central hub located in Karachi. Out of these, 5,049 of women had

telehealth consultations, and about 730 pregnant women received the services of antenatal and postnatal maternal care The data shows essential increase in access to tele-health services. It also included number of women and their spouses who were given awareness regarding important maternal and child health and related topics such as nutrition, continuity of care, vaccinations, postpartum care, family planning and significance of ANC and PNC visits.

**Table 1: Telehealth reach and consultation volume on a district-by-district basis.**

| Location | Tehsil | Number of tele-calls to Hub | Overall patients seen via telehealth | Number of women received tele health consultations | Pregnant women who received telehealth maternal care |
|---|---|---|---|---|---|
| **District - Dadu** | Tehsil Dadu | 2713 | 2581 | 2112 | 183 |
| **District - Khairpur** | Tehsil Kot-Diji | 3276 | 3183 | 2937 | 547 |
| **Total** | --- | 5989 | 5764 | 5049 | 730 |

Table **2** outlines utilization of maternal services through the telehealth intervention at the community (doorstep) and at the spoke site in the flood-affected districts. Approximately, one thousand four hundred and thirty-seven doorstep consultations were carried out during the study period (1,437) out of which 682 (47.5) were postnatal and antenatal visits. Among all the doorstep consultations carried out by the midwives, about 692 women (48.1) were referred at the spoke site for further assessment and care. At the spoke site, 730 consultations were conducted however, women who directly accessed the spoke site for maternal services (un-booked) were included as well, to maintain complete data tracking, 182 supervised deliveries (24.9%) were performed, while 34 women (4.7%) were identified requiring referral to secondary healthcare facilities for further management of the complication. This shows the

impact of the telehealth intervention on providing structured maternal care to guarantee safe delivery care and effective referral even in flood-stricken rural areas.

**Table 2: Telehealth services at doorstep and at the Spoke site.**

| Telehealth Interventions | Variable | Frequency (n) | (%) of doorstep consultations |
|---|---|---|---|
| **Tele-Midwifery at Doorstep** | Total doorstep consultations | 1,437 | 100% |
| | ANC + PNC visits | 682 | 47.5% |
| | Referred to tele midwifery site | 692 | 48.1% |
| **At Tele-midwifery at Spoke Site** | Total site consultations | 730 | 100% |
| | Deliveries at site | 182 | 24.9% |
| | Referred to civil sites | 34 | 4.7% |

Table **3** presents the distribution of maternal complications identified at tele-midwifery sites and referred to the nearest civil hospital on the same day to treat the complications timely. Out of 34 women who needed to be referred (4.7% of consultations in the site), high pregnancy risk (n = 12; 35.3%) and threatened miscarriage (n = 7; 20.6%) were the most frequent complications. Other complications and co-morbidities included, subfertility (n = 3; 8.8%), hepatitis (n = 3; 8.8%), at-term pregnancies requiring referral (n = 2; 5.9%), and single cases of complete miscarriage, hypertension, in-subfertility, malaria, pre-eclampsia, snake bite, and un-booked threatened miscarriage (each n = 1; 2.9%). This data demonstrates that the telehealth and tele-midwifery initiative effectively identified high-risk and complicated cases, enabling timely referral and continued maternal care in flood-affected rural communities for timely management of the serious cases to reduce the chances of maternal mortality.

**Table 3: Maternal Complications Referred to Higher-Level Facilities**

| Type of Complication | Frequency (n) | % of Complication Cases n (34) |
|---|---|---|
| High-risk pregnancy | 12 | 35.3% |
| Threatened miscarriage (including un-booked) | 8 | 23.5% |
| Hepatitis | 3 | 8.8% |
| Subfertility-related concerns | 4 | 11.8% |
| Hypertension (HTN + pre-eclampsia) | 2 | 5.9% |
| Complete miscarriage | 1 | 2.9% |
| Malarial infection | 1 | 2.9% |
| At-term pregnancy requiring referral | 2 | 5.9% |
| Snake bite during pregnancy | 1 | 2.9% |
| Total | 34 | 100% |

The intervention effectively increased access to care, and enabled timely identification of maternal complications while providing timely referrals, which shows its potential to enhance maternal health in disaster-prone rural areas.

## DISCUSSION

The study showed the impact of Telehealth Intervention to Enhance Antenatal and Postnatal Care while Improving access to maternal care for Pregnant Women in Flood-Affected Rural Sindh, Pakistan. It estimates that, in the areas where conventional health care access is not possible the telehealth initiative can be a huge source of support for the people especially pregnant women. Furthermore, in low middle income countries community health workers can play a huge role in terms of overcoming the shortages of healthcare professionals, in fact the

lack of qualified healthcare workers continues to be a significant factor in determining the health outcomes for mothers and newborns. According to the 2006 World Health Report, nations with less than 2.28 doctors, nurses, and midwives per 1,000 people find it difficult to provide adequate coverage of critical mother and child health services, such as competent delivery attendance. In addition to that, the data highlights a direct association between mother and child survival and healthcare professionals' destiny, showing the deterioration in the results if the availability of workforce is further reduced [11].

This void was bridged by the concept of a hybrid telehealth and tele-midwifery, which virtually offers specialization to the community-level midwives in flood-affected rural Sindh, where the lack of manpower and the damage cause by infrastructure add to the access barriers. The intervention enhanced coverage of the services and optimized limited human resources through linking doorstep care with remote gynecological consultation and structured referral routes. This also shows how digital health integration can help reduce partially the workforce stress in depressed and disaster-prone areas, and is aligned with other multisectoral policies aimed at protecting and improving the health of women.

The results from this study highlight tele health services that were utilized by the pregnant women of Dadu and Khairpur district where 730 pregnant women who sought maternity care services through skilled midwives and hub-based clinical assistance were among the thousands of teleconsultations that the program provided over the study period. 48.1% of community-level consultations were escalated to the spoke site, where high-risk conditions were appropriately diagnosed and sent to secondary healthcare facilities, and deliveries were overseen which reflects the operational optimization of maternal healthcare delivery in a disaster-prone environment.

A study in New York shows that, telehealth in maternal care is feasible and beneficial, in crisis situations. Approximately 1,352 prenatal visits (31.8%) out of 4,248 prenatal visits over a 5-week period were performed via telehealth during the COVID-19 epidemic in New York City. Positive feedback about providers showed that special care is required to optimize the opportunities. Although it is demonstrated that telemedicine has the potential in high-resource urban areas [12]. Our findings can be extended to rural Sindh affected by flooding where 5,764 patients with 730 pregnant women among them utilized the telehealth platform where small numbers were not admitted un-booked without prior admission and prenatal checkups. This mixed system demonstrated that telehealth and community midwifery can enhance access to maternal care and continuity as well as facilitate a timely referral of complications in resource-constrained, disaster-prone or any emergency situation. It achieved this by providing 682 ANC and PNC visits with 1,437 doorstep visits, 182 supervised deliveries in tele-midwifery centers and 34 high-risk cases referred to the secondary healthcare facilities.

**Study limitations**

This study has some contextual and methodological limitations that may affect the generalizability of its findings, even though it offers insightful information about the use of telehealth and tele-midwifery services in rural Sindh devastated by flooding. First, the absence of certainty that the telehealth intervention was the only reason for the observed improvements in maternity care since the retrospective design restricts causal inference. Second, the study mostly relied on referral and service utilization data and did not explicitly examine specific clinical outcomes, such as maternal or neonatal morbidity and mortality. Lastly, because there was a lack of long-term follow-up data, it is unknown whether the study had a lasting effect on maternal and neonatal outcomes. Despite these drawbacks, the study offers a useful assessment of the telehealth intervention in a difficult humanitarian setting and produced significant data

to guide policy and scale-up such programs in comparable low-resource, disaster-prone environments.

## CONCLUSION

This study shows that in flood-affected rural Sindh, access to maternal health services was supported and greatly enhanced using the telehealth intervention. The biggest improvements were shown in ANC and PNC visits and doorstep consultations. The referrals on time and births at the Spoke site shows the improvement in terms of patient safety and continuity of care offered by the intervention. The findings highlight that women in rural areas face societal, geographical and infrastructural limits to access health facilities as the utilization of secondary healthcare facilities is comparatively very low and, under such conditions the telehealth intervention can be a potential solution to improve the access for maternal healthcare services.

The results underscore the necessity of long-term maternal tele-health interventions by incorporating digital health resources in order to improve maternal outcomes in disaster prone areas. Expanding telehealth initiatives and interventions to improve timely access to ANC and PNC; integrating telehealth services with facility-based care for supervised deliveries and managing high-risk cases; investing in digital infrastructure and mobile connectivity in rural, flood-prone areas, offering midwives and community health workers ongoing clinical training and support for digital literacy and involving them in ongoing maternal initiatives for better outcomes, strengthen polices by prioritizing maternal health via telehealth to integrate digital ANC and PNC and tele-midwifery services into disaster rehabilitation plans, yet increasing funding to expand remote maternal care programs in crisis-affected areas, are some of the actionable steps recommended by the findings.

## AUTHOR'S CONTRIBUTION

NA and MT conceptualized the study, JN has extracted the data, BN drafted the manuscript, SAR and STA supported through data analysis. The manuscript is edited, reviewed, and approved by all the authors.

**FUNDING**

None

**DATA AVAILABITITY**

The corresponding author may provide the data set upon a reasonable request.

**DECLARATIONS**

**Ethical approval**

Ethical approval is obtained from IRB-IHHN under reference number IHHN_ IRB_2025_06_020 on June 19, 2025.

**Consent to participate**

Not applicable

**Consent for publication**

Not applicable

**Conflict of interest**

None

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**ABBREVIATIONS**

**PNC:** Postnatal care

**ANC:** Antenatal care

**LMICs:** Low middle and income countries

**COVID-19:** Coronavirus disease 2019

**UNFPA:** The United Nations Population Fund

**CHD:** Community health directorate

**IHHN:** The Indus Hospital and Health Network

**IRB:** Institutional review board

**DHO:** District health officer

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