SPECIAL COMMUNICATION

Sustainability of a digital health intervention within Pakistan's remote health system: learning from implementation research

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Abstract

Pakistan faces significant challenges in attaining the Sustainable Development Goals for maternal and child health by the 2030 target. Separate vertical programmes, governance challenges due to paper-based systems, and limited availability of data contribute to the health system's suboptimal functioning. An innovative mHealth tool, Hayat, was introduced in remote areas of Pakistan to digitalise record-keeping by frontline workers, provide evidence-based awareness content for dissemination, and track performance through transparency enhanced by geographical information system tracking. There has been a limited translation of mHealth evidence into policy change globally. Hayat is one of the few donor-funded programmes, and strengthens the health system in Pakistan. It secured matching funding from the government to sustain operations and for scale-up. The current paper was planned to describe the intrinsic and extrinsic factors that led to the intervention's adoption by the government, including the technological and programmatic approaches, challenges and mitigation strategies, and policy recommendations for the long-term sustainability of similar mHealth interventions in low- and middle-income countries.

Keywords: Child Health, Information Systems, Sustainable Development, Telemedicine, Health policy, Health system.

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Introduction

Many donor-sponsored programmes in low- and middle-income countries (LMICs) struggle with prolonging sustainability beyond the duration of the funding period.[1] In 2018, the Aga Khan University implemented an innovative multi-modular digital health solution, called Hayat. This represents a significant milestone wherein innovative digital health interventions have been formally adopted by the healthcare authorities in Gilgit-Baltistan (GB) and Khyber Pakhtunkhwa (KP) in Pakistan. Both governments have committed to absorbing the operational expenses of the project in the designated areas and have shown their dedication to expanding their reach throughout the region. The GB government has also committed to providing matching funding for the phased scale-up across multiple districts.

Pakistan's poor maternal, newborn and child health (MNCH) indicators, ranked among the world's highest, spurred the development of the Hayat programme.[2] Despite substantial investments aimed at enhancing both access and the quality of healthcare services, the intricate and comprehensive health system has demonstrated limited advancement over the years.[3,4] The challenges in primary healthcare, such as insufficient workforce (understaffing), limited capacity of healthcare personnel, financial constraints, ineffective monitoring and governance structures, lack of system transparency, and underperformance of community-based primary healthcare providers, exacerbate the situation, leading to unfavourable health outcomes.[5] The devastating floods of 2022 compounded the strain on the healthcare system, which was already grappling with the aftermath of the coronavirus disease-2019 (COVID-19) pandemic.[6] It is evident that there is an urgent requirement to introduce effective solutions to achieve the Sustainable Development Goal targets.[7]

Research has highlighted the contributions of digital health in enhancing the efficiency of healthcare professionals, expanding access to high-quality health services, and ultimately resulting in improved health outcomes.[8] This underscored the foundational Theory of Change for the Hayat project. Hayat helped revolutionise the delivery of services by introducing digital solutions for healthcare providers within the Expanded Programme on Immunization (EPI) and the National Programme for Family Planning and Primary Healthcare, which are overseen by provincial governments, often referred to as the lady health worker (LHW) programme. These

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programmes predominantly serve as the primary providers of preventive healthcare, health promotion services, and immunisation within the field of MNCH. Hayat also digitised the paper-based monitoring and accountability mechanisms in place. The reflections presented in the current report are based on feedback from primary and secondary sources of information, including policymakers, government programme staff, district-level administrators, health facility managers, frontline health workers, the research team, and baseline, midline, and end-line assessments.

The intervention's design and implementation approach was multi-pronged: a strong evidence base; an iterative approach working closely with end-users to ensure maximal adoption; and alignment with policy objectives to use innovation and technology to improve health for vulnerable populations.[9,10]

In KP, Hayat was piloted in 6 union councils (UCs) in the Chitral district and is now being scaled up across the entire district. In GB, Hayat was piloted in Ghizer district, and is now being scaled up across Hunza, Nagar, Astore, Skardu and Diamer districts through a phased approach.

Methods, results and discussion

The Delphi method was used to consolidate the opinions of experts involved in the project's implementation and integration. The respondents included 7 experts from the research project team, 2 experts from among the implementation partners, and 7 mid- and high-level officials representing the government health departments in GB and KP. The findings were consolidated and redistributed to all the stakeholders in the second round, and a consensus was reached.[9]

Achievements: Hayat stands as one of the initial digital health initiatives embraced by the health departments in GB and KP. Both provincial governments have committed to covering the operational expenses of the project in specified regions and have expressed a strong commitment to expanding its reach throughout the entire region. In 2021, the health secretary of GB stated that the government had made a strong commitment to enhancing vital MNCH indicators. He expressed hope that the Hayat app would function as the main instrument for collecting, storing and evaluating data on the health system's effectiveness. Additionally, he mentioned that the government was considering implementing the application in two more districts within GB.[11]

In Pakistan, programmes providing MNCH services at the primary care level function independently. Despite sharing similar goals between MNCH and immunisation initiatives, there was a notable absence of interoperability, coordination and data integration within the health information systems of these programmes. This gap was primarily attributed to the lack of a comprehensive, integrated digital system, and the continued dependence on outdated paper-based reporting methods.

Hayat operates within the MNCH domain with its interoperable framework. This structure facilitates seamless information sharing, strengthens collaboration across different entities, prevents data duplication, and reduces the manual exchange of patient information. Hayat achieved effective data integration from each programme, improving inter-programme efficiency and health outcomes through the application of both horizontal and vertical scaling strategies. As a result, when a Community midwife (CMW) assists with childbirth, a notification is promptly transmitted to the designated LHW in the vicinity responsible for postnatal care, as well as the relevant vaccinator/LHW who makes sure the child promptly receives essential vaccinations.

The monitoring dashboard provides policymakers with the capability to access close-to-real-time data concerning crucial indicators, enabling them to tackle important issues within districts at the UC level and promote the equitable delivery of health services. Moreover, the digitisation of programme monitoring minimised the need for in-person field visits and resulted in cost savings.

Hayat actively involves a range of stakeholder groups responsible for making decisions related to MNCH to mitigate gender-based biases. Hayat features evidence-based audio-visual content covering a variety of MNCH topics in the local language. This innovation promotes the inclusion of male family members during home-based awareness sessions, challenging traditional socio-cultural norms that had previously restricted female health workers from verbally educating male family members on health topics during their house visits. Health workers express increased confidence while reporting to their supervisors about the inclusion of male family members in the awareness sessions and the accuracy of the information they were imparting.

Challenges

Infrastructure: Primarily, unstable internet connectivity was encountered as a key challenge in the field. As a solution, Hayat was improved with an 'offline mode', enabling end-users to input and synchronise data even in the absence of internet connectivity. This feature enables supervisors to retrieve user databases more effectively

when they return to urban areas from field visits upon gaining improved internet connectivity.[12]

Digital literacy: Considering the low rate of smartphone adoption among women in Pakistan, certain health workers had not previously been exposed to or utilised smartphones before the introduction of Hayat. Several training sessions were conducted to enhance their digital literacy as part of the programme. The utility of this approach became evident through its effective reduction of required clicks, utilisation of the local language, and digitisation of existing paper forms without altering their original format.

Healthcare workers' motivation: Health workers initially expressed apprehension about their overburdening workload, which involved data entry in both paper-based registers and Hayat. These concerns were addressed through two key strategies: providing assurance of the commitment made by the government to supplant paper-based registers with the application once evidence was generated of its significant impact on health outcomes, and incorporating features that alleviated their current workload through automatic identification of children who missed vaccinations and computation of monthly reports.

Integration between vertical programmes: It is difficult to validate data through paper-based systems, particularly when multiple health workers perform similar tasks. For example, LHWs and vaccinators both offer child vaccinations, and CMWs and LHWs both keep records of childbirths and deliveries. The introduction of Quick Response (QR) codes by the app effectively eliminated data duplication. This feature enables health workers to synchronise client data without redundancy, ultimately leading to more precise results in achieving set targets.

Resistance from supervisors: Due to logistical and administrative issues, lady health supervisors (LHSs) were not as involved in the design process as they should have been. Consequently, the acceptance of the app by LHWs was delayed, and resistance was faced from LHSs concerning the app's usability. The incorporation of a module for LHSs resulted in an increase in the regular utilisation of the platform and facilitated the digital transformation of both LHWs and LHSs within the LHW programme.

Clarity on programme indicators: Frequent turnover of critical political and programmatic roles, coupled with the lack of official documents containing programmatic, outcome, and output indicator descriptions, posed challenges in formalising formulas for key performance indicators (KPIs) for each dashboard. Consequently, there were delays in the development and numerous iterations of the dashboard. In response, the research team initiated regular meetings with government stakeholders, who designated appropriate points of contact. These contacts supplied all the necessary formulas and calculation methodologies for the KPIs, and actively engaged in user acceptance testing prior to the dashboard's launch.

Enablers

Involvement and collaboration with health system stakeholders: The comprehensive stakeholder engagement plan for Hayat incorporated continuous early engagement with the three tiers of the healthcare system, which consisted of the provincial-level policymakers involved in health policy planning, mid-level management and programmatic staff responsible for programme implementation, government priorities, and action plans aligned with health policies, and, foremost, the frontline health workers overseeing execution of the project on-field. The research team secured support at various levels within these tiers, which helped maintain project functionality even in the face of rapid turnover in key political positions.

Agreement on the design, content, and scope: The dashboard design was collaboratively agreed upon by administrative and managerial staff, along with input from policymakers. Distinct dashboards were created for the EPI and LHW programmes, tailored to the unique priorities of each programme. These dashboards featured digital versions of paper-based reports with the attendance modules and provided close-to-real-time data on crucial health indicators specific to each programme.

Focus on usability and training: The project emphasised enhancing the digital literacy of healthcare workers through a series of comprehensive training sessions. The goal was to create a user-friendly system design that closely resembled traditional registers, thereby promoting the adoption of the application.

Clear communication channels: Informative feedback holds the potential to be a strong contributor to the project's success.[13] The team established transparent and efficient communication channels with three kinds of health system stakeholders. Furthermore, a qualitative mid-period assessment was conducted to assess the tool's functionality, utility and task-technology fit of the tool, offering valuable feedback to refine its design during implementation.

Adaptability: The Hayat architecture has been designed with modularity to ensure adaptability in its structure and

an agile response to emerging situations.[14] This approach facilitated a smooth transition to address the project's expansion into intermediaries and other health priorities, including non-communicable diseases.

Comprehensive approach to strengthening the health system: To effectively manage, COVID-19 necessitated government coordination with important stakeholders to promote engagement from multiple sectors and encourage proactive community participation. These efforts aimed at improving community understanding and awareness of issues exacerbated by the pandemic.[15,16] The implementation of Hayat facilitated the improvement of digital literacy among frontline health workers, empowering them to deliver services virtually within communities and disseminate evidence-based health education content.

Constraints

Quick turnover of key political and programme positions at the decision-making level, natural disasters, poor infrastructure, and geographical inaccessibility of the regions were the challenges that arose during project implementation.

Mitigating challenges and leveraging enablers for improved services in the Hayat project: The Hayat project successfully addressed various challenges by adapting its approach. Unstable internet connectivity was tackled with offline functionality. Low digital literacy was countered through training focussed on user-friendliness and translating the app into the local language. Apprehension from health workers was reduced by highlighting workload reduction features and future transition into a paperless system. Data duplication was eliminated through the use of QR codes. Supervisor resistance was overcome by incorporating dedicated modules for supervisors to reduce their workload and improve efficiency. Ambiguous programme indicators were clarified through stakeholder meetings.

Hayat's success stemmed from strong enablers. Stakeholder engagement at all levels ensured project continuity despite turnover. Collaborative design created programme-specific dashboards with familiar functionalities. Training prioritised usability, and clear communication channels facilitated feedback. The modular architecture allowed for adaptation to new health priorities. Overall, Hayat demonstrated how addressing challenges and leveraging enablers could significantly improve healthcare service delivery.

Limitations

The recommendations generated based on experiences may be tailored to the specific contexts of GB and KP. The uniqueness of these regions may limit the broader applicability of the policy recommendations to more diverse settings, where health infrastructure, cultural norms and technological readiness might differ significantly. Moreover, the policy recommendations assume a certain level of technological infrastructure readiness in GB and Chitral. However, challenges related to connectivity, access to devices, and digital literacy among frontline health workers and communities might not have been thoroughly addressed. This assumption could lead to policy recommendations that are difficult to implement in regions where the necessary technological foundations are not uniformly established.

Conclusion

Sustainability poses a significant challenge for mHealth initiatives in LMICs. It is imperative for those undertaking these projects to collaborate closely with government agencies in order to explore hybrid financial strategies and secure long-term funding beyond project completion. During the planning phase, it is essential to prioritise two important factors: ensuring that the project provides value to each end-user, and understanding how it contributes to achieving the desired outcomes. By developing district-level solutions that incorporate feedback from field personnel, policymakers, and the communities they serve, and by promptly addressing challenges and threats, enduring sustainability of similar mHealth interventions in LMICs can be promoted. Digital health interventions often rely on mobile phones and internet access, making them more readily adopted in high-resource settings. Strengthening governance in low-resource environments can be achieved by ensuring comprehensive mobile data coverage, utilising automated applications, and providing devices with offline capabilities, all without compromising the implementation of technology-driven solutions. Health leaders need to acknowledge the array of motivations, challenges and resistance to disrupting the status quo that can influence the successful implementation, and potentially reduce its impact on society.

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MJM, MS and **FR**: Discussion writing
ZS: Provided mentorship throughout the project.
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