Digital Health in Nepal: A Perspective on Overcoming Challenges and Leveraging Opportunities

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ABSTRACT

Digital Health, which encompasses eHealth and mHealth, has revolutionized health care with input from information technology, computer science, and data. With the addition of client-centered content, digital health offers to low- and middle-income countries like Nepal the ability to gather, analyze and disseminate health information regardless of geographic and socioeconomic challenges. Nepal has enacted policies to improve the health system while overcoming the barriers of difficult terrain, internet capability, and low education. This paper will survey Nepal's health policy in telecommunication and digital health technology, outline successful interventions, note challenges and make recommendations for future activities.

KEY WORDS

Digital Health, Health system, Nepal

INTRODUCTION

With technological advancements and a growing number of users, electronic health (eHealth) and mobile health (mHealth), often collectively known as digital health, are becoming increasingly popular and indispensable components of modern healthcare.[1] The World Health Organization (WHO) defines eHealth as the cost-effective and secure utilization of information and communication technologies (ICT) in support of health and related fields and mHealth as the medical and public health practices supported by mobile devices by use of ICT in health and related domains in secure and cost-effective manner. Digital health involves the systematic application of information and communication technologies (ICT), computer science, and data to support informed decision-making by individuals, healthcare professionals, and health institutions.[2] This approach aims to enhance resilience against diseases and improve overall health and wellness.

Digital technologies can be broadly categorized into four main types: 1) Client-Oriented Technologies that include tools that provide compliance reminders for appointments and treatments, transmit health-event alerts, and facilitate payments or vouchers; 2) Health-Care Provider-Oriented Technologies that assist in client identification and registration, manage clients' health records, support communication and decision-making for healthcare providers, handle referrals, plan and schedule services, offer training, and manage laboratory tests, diagnostics, and imaging results; 3) Health Systems Manager-Oriented Technologies that include tools that support the management of human resources, supply chains, public health event notifications, civil registries and vital statistics, public and private-sector health funds, and healthcare facilities; and 4) Data Services-Oriented Technologies: These tools enable data collection, management, analytics, usage, data coding, location mapping, and data exchange and interoperability. These tools aims to enhances healthcare services, health surveillance, health literature, health education, knowledge, and research. These tools are an inseparable part of health systems, and when properly use they facilitate addressing changing health needs even in low- and middle- income countries (LMICs).

Digital technologies, such as mobile and wireless technologies, have the potential to revolutionize how populations interact with national health services. When properly used, they also facilitate improvement of the quality and coverage of care, increase access to health information, services and skills, as well as promote positive changes in health behaviours to prevent the onset of acute and chronic diseases, and efficient and secure data management systems.[3] In addition to health sector, other social and developmental sector can also benefit from digital health interventions. It facilitates education, health assessments, personalized health coaching, and access to digital health tools in workplaces, market places, health facilities, hospitals, and sports and recreation facilities.

Digital health interventions have been piloted and scaled up in various settings and countries to improve healthcare delivery, health systems and to promote healthy behaviors. These interventions have the potential to address public health challenges, improve coverage and quality of care and improve health outcomes.

DIGITAL HEALTH IN NEPAL

Digital health is gaining attention and support in health sector of Nepal. The government, academia and various development partners are actively working towards leveraging digital health technologies to strengthen healthcare delivery, particularly in rural areas. The Ministry of Health and Population has developed a national e-health strategy in 2017 to harness the potential of ICT technologies to improve health services, health governance and management. It has provided strategic directions to facilitate promotion of healthy life styles, protection from diseases, reducing risk behaviours; to deliver risk alerts for public health outbreaks and emergencies, to improved availability and access of general and specialized healthcare services; to increased compliance, adherence and satisfaction toward health services; to enable environment and capacity for the delivery of safe and effective health services; and to enhance access to data and information for effective planning, management, governance and evidence based decision making.

Nepal has recognized opportunities and challenges in implementing digital health across various healthcare levels, from rural health centers to specialist hospitals. Developing infrastructure, such as reliable internet and electricity, remains a significant hurdle, especially in rural areas with low literacy and limited technology access. Despite these challenges, Nepal has rapidly adopted mobile technologies for social development, with smartphone subscriptions at 139 per 100 people in 2020 and 35% of the population having internet access.[4] This progress positions Nepal to potentially lead in digital health adoption. Given the modest budget allocation towards healthcare, leveraging innovative technologies can potentially maximize healthcare expenditure, efficiency, accessibility, and equity. Nepal faces challenges like rugged terrain, poor economic status, underresourced health sector that limit healthcare access, particularly in rural areas. With 83% of the population living in rural regions, the government aims to bridge healthcare gaps through the network of health facilities and community health workers and by harnessing digital solutions for effective service and information flow for clients.

This review is based on a desk-review of relevant policy documents and a comprehensive search of publications about digital tools used in the health system of Nepal. Digital health related policies, guidelines, reports and presentation available in the website of the Ministry of Health and Population and key development parters were downloaded for the review.

Nepal's health system has number of digital tools and systems this paper summarizes key policy documetns and their direction and information systems.

A. KEY MILESTONES AND POLICY GUIDELINES FOR DIGITAL HEALTH IN NEPAL

Nepal has made significant strides in leveraging telecommunication and digital health technologies to enhance its health systems. Key policy documents such as the Telecommunication Act of 1997 and the National Telecommunication Policy of 2004 have enabled the use of telecommunication devices in healthcare. Nepal transformed the traditional Health Management Information System (HMIS) into a modern software medium in 1993; HealthNet initiated affordable internet services for health professionals in 1995; the Logistic Management Information System was modernized in 1997; the first telemedicine initiative was piloted in 2004; HMIS data migrated to the DHIS2 platform in 2011; and the electronic health records system was piloted in 2014.

The 2002 Wireless Networking Project introduced ICT services in Myagdi, including internet, tele-teaching, and telemedicine is a cornerstone of digital health. It established a 2006 telemedicine link between Nangi health post and a Western Regional Hospital in Pokhara, later expanding to connect 10 remote health posts to Kathmandu Model Hospital, enhancing telemedicine in community and charitable hospitals.

The Government of Nepal enacted eHealth Strategy in 2017 and Digital Nepal Framework in 2019, Integrated Health Information Management System Roadmap 2021-2030 to govern, guide, and improve health information, monitoring systems, and digital health programs are the key milestones in digitalization of health sector in Nepal. The vision and mission of National Health Policy 2019, Nepal Health Sector Strategy 2015 – 2020 and Nepal Health Sector Strategic Plan 2023 – 2030 is to leverage modern technologies for better health information management, increased access to health services, better management of procurement and supply chain, and more effective and efficient construction of health facilities.[5] The high level committee at Prime

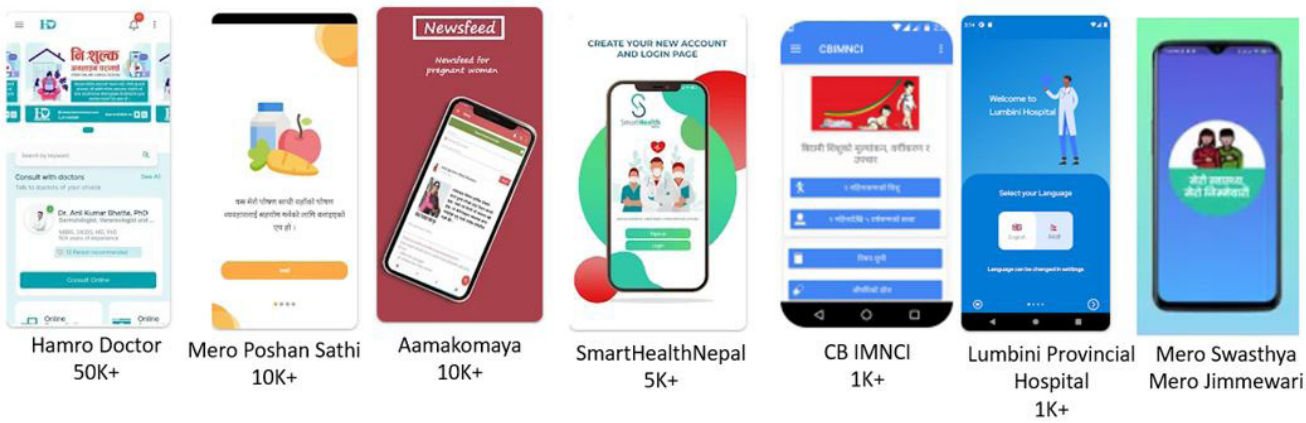

Figure 1. Some examples of mobile apps in Nepal and their download through Android playstore

Minister office is tailoring the master plan of an Integrated Health Information Management System Roadmap 2021 - 2030 to govern, guide, and improve health information, monitoring systems, and digital health programs.

Key framework documents to enable health best practices in digital in Nepal include the WHO Global Strategy on Digital Health (2020-2025), which emphasizes research and evaluation of digital health outcomes.[6] The WHO Country Cooperation Strategy for Nepal also highlights the importance of digital health for epidemic and pandemic response, and achieving health-related Sustainable Development Goals (SDGs). Digital health services for managing non-communicable diseases (NCDs) are tailored to primary healthcare needs. The Digital Nepal Framework (2019) guides health information and digital health programs, while the Integrated Health Information Management System Roadmap (2021 - 2030) improves health data management. These initiatives collectively aim to enhance health system efficiency and service delivery.

Currently, various divisions and centers are utilizing diverse digital solutions. For example, the National Health Education, Information and Communication Centre (NHEICC) uses cell phones to educate people on sexual and reproductive health. The National Centre for AIDS and STD Control (NCASC) employs digital tools for HIV surveillance, and the National Tuberculosis Centre (NTCC) uses eTB registers and AI-enabled X-rays for tuberculosis diagnosis.

B. DIGITALIZATION OF MANAGEMENT INFROMATION SYSTEMS

Use of digital recording, reporting and data visualization of different data sytem is one of the common area of use of digital solutions. In Nepal there are various information systems that uses digital recording and reporting, as listed below:

HMIS: health management information systems that collects data from health volunteers, health workers and health facilities and produce results

LMIS: logistics management information systems

PIS: pesonnel information systems

TIMS: training information management system

FMIS: financial management information system

PAMS: physical assets management system

DIN: drug information network

HFR: health facility registry

HWR: health workforce registry

FHP: Family health profile

PRTS: Pregnancy registration and tracking system

C. MOBILE APPS

There are various mobile apps developed to facilitate health care, either to be used by the clients/population (e.g. hamro doctor, aamakomaya) or by health care providers (e.g. CBIMNCI).

As social media continues to gain popularity, health workers and professionals are leveraging various platforms to create groups for effective communication and dissemination of health-related information and guidance. These groups also serve as forums for seeking advice on clinical, managerial, and administrative matters. While some groups are moderated and restricted for information sharing by authorized administrators, others are open for anyone to join and contribute. For instance, the Viber group “Swasthya Suchana by MoHP Nepal,” managed by the Ministry of Health and Population (MoHP), has nearly 350,000 members and is a key platform for sharing crucial information, decisions, and guidance. Additionally, many health workers within districts or provinces utilize Messenger groups to streamline communication and share updates within their teams.

E. EXAMPLES OF SUCCESSFUL DIGITAL HEALTH INTERVENTIONS IN NEPAL

With advancement and availability of various digital tools, Nepal has also initiated some of these in the diagnosis, case management and monitoring of health system. Below is the list of some of the examples:

• Phone-Based SMS Follow-Up: Utilized during COVID-19 to promote health, increase nutrition awareness, and ensure follow-up.

• Telemedicine: Conducted in remote villages, telemedicine provides specialized services and technical support for health workers in isolated areas.

• Computer-Aided or Robotic Surgery: Nepal's medical community is piloting computer-aided and robotic surgeries, revolutionizing surgical procedures and enhancing patient care.

• AI-Assisted Diagnosis and Treatment: Nepal is piloting AI tools, such as portable AI-assisted X-rays for tuberculosis diagnosis, reflecting advancements in technology.

• Mobile Apps to Connect Clients to Health Systems: Variou apps, such as Aamako Maya, Mero Poshan Sathi, and Khulduli, help connect users to the health system and disseminate targeted health information, particularly among digitally literate adolescents and young adults.

• Digital Appointment Systems: Web-based and app-based systems (e.g., Mero Doctor and Cogent) enable appointment booking, diagnostic services, and fee payments via online wallets.

• Digital Platforms for Health Records: Establishing digital platforms for healthcare records and reporting ensures secure data management and facilitates timely, quality reporting and two-way feedback mechanisms.

• Data Collection and Analysis: Large surveys like the Demographic and Health Survey, Health Facility Survey, and Integrated Bio Behavioral Surveillance use Computer-Assisted Personal Interviewing (CAPI) for enhanced data collection via mobile phones, tablets, or personal computers.

These examples illustrate the emergence of digital technologies in Nepal's health sector, demonstrating promise in improving healthcare delivery and addressing public health issues. However, infrastructure limitations and technology access remain challenges, particularly in rural areas. Continued efforts are essential to overcome these barriers and expand the reach of digital health interventions.

F. OPPORTUNITIES AND CHALLENGES IN DIGITALIZATION IN HEALTH SYSTEM

Nepal has significant opportunities to enhance public health through digital health interventions, especially with continued investment in infrastructure and the support of an appropriate legal framework. Various small-scale pilots are operational and effective on a limited scale, but they often face interoperability issues and sustainability concerns. The Government of Nepal, at the federal, provincial, local, and health facility levels, has allocated budgets for piloting and developing some systems. National-scale interoperable initiatives will streamline systems and apps, ensuring interconnectedness and interoperability. Over the past decade, digital health initiatives have expanded to support multiple health system functions, including service delivery, data management, human resources, and health financing. These efforts aim to enhance healthcare quality, coverage, and overall system efficiency through principles such as methodological planning, security, network development, and open-source systems.[4,7] The utilization of digital health resources such as review of recent development in international journals has reported to improve doctor-patient communication, fostering clearer and more effective interactions.[8] These tools enable streamlined information exchange, better accessibility to medical records, improved data quality and enhanced patient engagement, ultimately strengthening the quality and efficiency of communication within the healthcare experience.[9] The digital transformation of Nepal's health sector is fostering greater transparency and accountability while empowering decision-makers. Access to reliable and timely data, combined with the growth of digital capabilities, is unlocking new insights and analytical opportunities.[10]

Despite the promise of digital health, its implementation in Nepal faces numerous challenges, particularly in rural areas with limited infrastructure and technology access, as well as resistance to change among healthcare workers. During the COVID-19 pandemic, mHealth emerged as a vital tool, facilitating efficient data collection, health communication, and decision support.[11-13] However, the broader adoption of mHealth has been slower than expected due to barriers such as low technological skills among health professionals and limited applicability in rural contexts.[4,11] Addressing these challenges is crucial for advancing digital health to support in achieving health-related Sustainable Development Goals (SDGs) and ensuring equitable healthcare delivery. Effective strategies must consider stakeholder needs, including healthcare workers and the general population, to maximize the potential of digital health interventions.

Challenges in implementing digital health interventions in rural areas of Nepal include inadequate infrastructure, internet connectivity, and an aging health workforce.[4] Limited access to ICT, electricity, and proficient health workers capable of analyzing digital data may impede the effective utilization of digital health technologies.[9] Furthermore, the government's limited funding and oversight of health services could jeopardize the sustainability of such interventions if this trend persists.

Moreover, the use of digital health interventions involves the collection and storage of large volume of personal health data such as date of birth, national identify number, health conditions raising significant concerns regarding privacy and data security.[14] Ensuring the confidentiality of this data is crucial to maintaining trust and safeguarding

individuals' sensitive information. Additionally, the implementation of digital health interventions may exacerbate the digital divide, particularly in rural areas with minimal access to technology and limited digital literacy. This disparity could further marginalize certain populations, hindering their ability to access and benefit from digital health interventions.

DISCUSSION

Given the extensive reliance on paper-based processes and limited access to healthcare facilities in remote areas of Nepal, there is significant potential to leverage digital health solutions. Digital health can help achieve the objectives outlined in the National Health Policy 2014 and the Nepal Health Sector Strategic Plan 2023-2030 by utilizing modern technologies for improved health information management, increased access to health services, enhanced procurement and supply chain management, and more efficient construction of health facilities. Some of the digital solutions such as rural telemedicine program delivers notable benefits in context of Nepal, but its implementation faces significant obstacles such as inadequate infrastructure, a shortage of skilled human resources, insufficient technical competence, and limited financial and policy support.[15,16] Addressing these barriers is essential to unlocking the potential of digital solutions and ensuring its sustainability and impact in underserved areas.

Various organizations have implemented numerous digital health pilots and initiatives across different settings in Nepal. However, these initiatives often operate in isolation, with limited sharing of activities, skills, and lessons learned. Additionally, there is a lack of comprehensive policy to guide digital health initiatives in Nepal, hindering efficient implementation and leading to duplication of efforts.[16] Mainstreaming and harmonizing these projects would enable health officers and stakeholders to better understand the current digital health landscape and accelerate future initiatives. Though digital health has huge potential, it is not a magic bullet every problem, and thus should be carefully planned and implemented considering country context.[17] Digital tools present a transformative opportunity to enhance access to healthcare, improve the quality of services, and ensure better adherence to care in remote and resource-constrained settings globally.[7] However, scaling these interventions effectively poses significant complexities and challenges, requiring strategic planning, robust infrastructure, and tailored solutions to achieve sustainable impact. This paper provides an overview of current digital health initiatives in Nepal and identifies opportunities and challenges to improve the digital health ecosystem. Many digital health initiatives struggle to progress beyond the pilot phase, highlighting the critical need for strategic investments to bridge this gap.[18] Ensuring the transition from pilot projects to scalable, sustainable digital health solutions requires robust planning, adequate funding, and comprehensive stakeholder engagement. By focusing on scalability and long-term viability, these initiatives can deliver transformative benefits to health systems and populations.

CONCLUSIONS

Digital health holds immense potential to enhance health systems by expediting and refining data collection, facilitating training and access to reference materials, promoting communication among health workers, providing job aids and decision support, supervising health workers, and encouraging healthy behaviors within the population. The successful implementation of digital health initiatives in rural Nepal hinges on several factors, such as the availability of infrastructure, internet connectivity, digital literacy, community engagement, healthcare personnel capability, governmental support, integration with existing healthcare infrastructure, and a focus on human-centered design. Addressing these elements can greatly enhance the adoption of digital health technologies and ultimately improve healthcare services in rural areas.

There is ongoing work in Nepal that has identified opportunities and challenges in rural digital health, ranging from community healthcare centers to specialist tertiary hospitals. These initiatives, often pilot projects addressing specific health issues, are crucial in the context of Nepal's federalization, where responsibilities for budgeting and planning health service delivery are devolving to the local level, making them more affordable. Digital health holds immense potential to overcome geographical barriers, reach marginalized populations, enhance program efficiency, and deliver better care and quality services. However, successful implementation requires robust infrastructure, stakeholder collaboration, and sustained investment in technology-enabled healthcare solutions. Embracing digital health represents a transformative step towards achieving equitable healthcare access and improving health outcomes for all Nepali citizens.

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