

# **Assessing Digital Health Readiness within Nepal's Health System**

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by

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# Table of Content

## Contents

|  |     |
|--|-----|
| Table of Content .....   | i   |
| Abbreviation .....   | iii |
| List of Figures and Tables.....                                | v   |
| List of Figures .....  | v   |
| List of Tables .....   | v   |
| Abstract.....  | vi  |
| CHAPTER I: Background .....                                    | 1   |
| 1.1. Background.....   | 1   |
| 1.2. Country Context.....                                      | 4   |
| CHAPTER II: Problem Statement Justification & Objectives ..... | 6   |
| 2.1. Problem Statement & Justification .....                   | 6   |
| 2.2. Study Objectives .....                                    | 9   |
| 2.1.1. General Objective .....                                 | 9   |
| 2.1.2. Specific Objectives .....                               | 9   |
| CHAPTER III: Methodology.....                                  | 10  |
| 3.1. Study Type.....   | 10  |
| 3.2. Study Area .....  | 10  |
| 3.3. Sampling and Selection of Participants .....              | 11  |
| 3.4. Data Collection Methods .....                             | 12  |
| 3.5. Data Processing and Analysis .....                        | 12  |
| 3.6. Ethical Consideration and Consent Form .....              | 13  |
| 3.7. Quality Assurance.....                                    | 13  |
| 3.8. Conceptual Framework.....                                 | 14  |
| CHAPTER IV: Results .....                                      | 16  |
| 4.1. Core readiness.....                                       | 17  |
| 4.1.1. Awareness on digital health service delivery.....       | 17  |
| 4.1.2. Need/demand of digital health services .....            | 17  |
| 4.1.3. Planning for digital health services.....               | 18  |
| 4.1.4. Determinants of digital health services.....            | 19  |
| 4.2. Engagement readiness.....                                 | 20  |
| 4.2.1. Acceptance of digital health services.....              | 20  |

|  |   |    |
|--|---|----|
| 4.2.2.                                       | Benefits of digital health services .....   | 20 |
| 4.3.   | Government readiness.....   | 21 |
| 4.3.1.                                       | Availability of policies and strategies and alignment of digital health interventions ..... | 21 |
| 4.3.2.                                       | Budget and funding availability in digital health services .....                            | 22 |
| 4.4.   | Infrastructure readiness .....  | 23 |
| 4.4.1.                                       | Affordability of digital health technologies .....  | 23 |
| 4.4.2.                                       | Availability of hardware and software for digital health service delivery .....             | 23 |
| 4.5.   | Health care provider readiness .....  | 24 |
| 4.5.1.                                       | Competency/IT literacy in digital health among health professionals .....                   | 24 |
| 4.6.   | Societal readiness.....   | 25 |
| 4.6.1.                                       | Collaboration between public and EDPs for digital health service delivery.....              | 25 |
| 4.6.2.                                       | Information data exchange.....  | 25 |
| CHAPTER V: Discussion.....                   |   | 26 |
| CHAPTER VI: Conclusion & Recommendation..... |   | 30 |
| References.....                              |   | 33 |
| Annexes .....                                |   | 38 |
| Annex 1: Interview Guide.....                |   | 38 |
| Annex 2: Research Table .....                |   | 40 |
| Annex 3: Ethical Approval .....              |   | 43 |
| Annex 4: Informed Consent.....               |   | 46 |
| Annex 5: Search Strategy.....                |   | 50 |

## Abbreviation

|        |  |
|--------|--|
| CHW    | Community Health Worker                                    |
| DoHS   | Department of Health Services                              |
| EDP    | External Development Partner                               |
| EHR    | Electronic Health Record                                   |
| EHRAF  | E-Health Readiness Assessment Framework                    |
| EMR    | Electronic Medical Record                                  |
| ELMIS  | Electronic Logistic Management Information System          |
| DHRAF  | Digital Health Readiness Assessment Framework              |
| FCHV   | Female Community Health Volunteer                          |
| GIZ    | Deutsche Gesellschaft für Internationale Zusammenarbeit    |
| GoN    | Government of Nepal  |
| HMIS   | Health Management Information System                       |
| ICT    | Information Communication Technology                       |
| IHMIS  | Integrated Health Management Information Section           |
| IMU    | Information Management Unit                                |
| JAR    | Joint Annual Review  |
| KII    | Key Informant Interview                                    |
| LMIC   | Low-Middle-Income-Countries                                |
| LMIS   | Logistic Management Information System                     |
| MICS   | Multiple Indicator Cluster Survey                          |
| MIDAS  | Medical Identity Protection Software                       |
| MoEST  | Ministry of Education and Science Technology               |
| MoF    | Ministry of Finance  |
| MoHP   | Ministry of Health and Population                          |
| MoICT  | Ministry of Information and Communication Technology       |
| NHEICC | National Health Education Information Communication Centre |

|        |  |
|--------|--|
| NHFS   | Nepal Health Facility Survey                       |
| NHRC   | Nepal Health Research Council                      |
| NHSS   | National Health Sector Strategy                    |
| NHTC   | National Health Training Centre                    |
| NMC    | Nepal Medical Council                              |
| NTC    | Nepal Telecom                                      |
| OPD    | Out-Patient Department                             |
| RA     | Research Assistant                                 |
| SBCC   | Social Behavioural Communication Change            |
| SDG    | Sustainable Development Goal                       |
| SHI    | Social Health Insurance                            |
| S2HSP  | Support to the Health Sector Programme             |
| TAM    | Technology Adoption Management                     |
| UHC    | Universal Health Coverage                          |
| UNICEF | United Nations Children's Fund                     |
| USAID  | United States Agency for International Development |
| WHO    | World Health Organization                          |

## List of Figures and Tables

### List of Figures

|   |    |
|---|----|
| Figure 1: Nepal’s Health System Organogram .....                                | 4  |
| Figure 2: Map of Nepal showing study sites.....                                 | 10 |
| Figure 3: Digital Health Readiness Assessment Framework adapted from EHRAF..... | 14 |
| Figure 4: Theme and Sub-themes from adapted DHRAF.....                          | 16 |
| Figure 5: KIT ethical waiver letter.....  | 43 |
| Figure 6: NHRC ethical approval letter .....                                    | 44 |

### List of Tables

|   |    |
|---|----|
| Table 1: KII participants category .....                  | 11 |
| Table 2: Definition of components in adapted DHRAF .....  | 15 |
| Table 4: Research table for KII.....                      | 40 |
| Table 3: Detailed chain of key words and combination..... | 50 |

## Abstract

**Introduction:** Digital health initiatives aims to mitigate the challenges of accessibility in health services. There is a greater need of understanding on how digital technologies can be used for delivering health services. Digital readiness is essential in defining the roadway for a successful digital healthcare era. This study aims to assess the digital health readiness within the Nepal's health system, to assist policy makers in improving the use of digital health technologies.

**Methodology:** Qualitative study using key informant interview with 21 health professionals was carried out at the three-tier system. To assess the digital health readiness, a deductive approach was used to analyse the findings based on adapted digital health readiness assessment framework.

**Findings:** The findings revealed participants to be aware on digital health initiatives, while some had concerns on the sustainability. All the participants have found that digital health has long-term benefits. Inadequate skilled human resources, lack of infrastructure and data interoperability were some of the major findings. Some participants emphasized the need of policies on coordination, between government and foreign agencies, for effective investment in digital health.

**Conclusion:** Prior to digital health implementation, assessment of digital health readiness is crucial for Nepal's health system. Lack of infrastructure such as continuous internet and electricity supplies, resulted in a decreased motivation among the health workers, to make optimal use of digital health, strong coordination is therefore required, among several ministries, to improve the utilization of digital health technologies.

Key words: Digital health, ehealth, LMIC, Health service delivery, Nepal

Word count: 12565



# CHAPTER I: Background

## 1.1. Background

The World Health Organization (WHO) defines digital health as “the field of knowledge and practice associated with the development and use of digital technologies to improve health” (1). The components of digital health include electronic records; telehealth comprised of telemedicine and mobile health; e-commerce through mobile or online fee payment and e-learning; and social media (2) and as well, public health surveillance, strategies used for health promotion, self-tracking wearable devices, medical imaging, genomics and information system (3). All these available digital health technologies, encourage health service providers, to use the data, information and knowledge in real time, to produce better health outcomes for the community within the decentralized health systems, through rigorous engagement with a citizen centric approach (4).

The 2030 agenda for the Sustainable Development Goal (SDG) has emphasized the advancement of digital technologies in enabling the global correspondence, bridging the digital divide and improving knowledge among the health professionals thereby escalating the country’s progress (1). Several public health literatures have shown significant contribution of digital health technologies in facilitating healthcare services. It has been beneficial in preventive medicine, health promotions, gathering quality data, for better medical outcome and disease patterns, thereby reducing the health care expenditure (5–7). Digital health technologies in particular have proven to provide opportunities in rural settings and developing countries, with inadequate healthcare provision, by mitigating geographical and socio-economic challenges to access healthcare services (8,9).

Digital health technologies are helping to meet the expectations of the medical practitioners and public health professionals by enabling them to share medical information, monitor people’s health-activities, identify illness and forming an effective network. It equally makes the lives of common people much more convenient, as they are able to determine the outbreak of infectious diseases in a particular geographical location, such as by checking websites (HealthMap) (10). In addition, telemedicine, a major wing of digital health, enabled to improve and widening the coverage of patient care services, with the approach of Technology Adoption Management (TAM) at the organization level. This deals with the decision of making the technology as the foundation of its organization and making them available to the service provider with the vision of accelerating their performance management (11). In the current pandemic scenario, digital health has proven to be a promising enabling agent for pandemic management, by aiding in rapid information sharing and transforming conventional care delivery (12).

In low-middle-income countries (LMIC) settings, the digital health initiatives foster to mitigate the challenges of accessibility, thereby improving the quality of healthcare delivery (13). Across different countries, health care facilities are not able to experience adequate, suitable and consistent digital health technologies. This poses challenges to the countries, where the health care setting is even more erratic, with scarce resources and a unique setup (14). For instance, LMIC country like Pakistan, has revealed the issues of digital health readiness associated with a lack of alignment of digital health initiatives with national strategies, inadequate digital health skills among the health

professional, insufficient technical infrastructures, such as poor internet connectivity and perceived usability from the provider's point of view (15).

Through the integration of health care provision and technology, digital health aims for quality, efficiency and safety, thereby mitigating the challenges faced by health institutions as one of its strategies (16). Digital health functions are making the healthcare delivery efficient by strengthening the interoperability. This makes information and health promotion activities readily available and enhances flexibility (17).

Recognizing the potential of digital health, the WHO global health strategy focused on developing a consistent digital health goal, aligned with the country's health needs. In this case, more than 120 member states, along with LMIC, have developed strategies and policies imbibing the same notion (1). Digital health has indeed added a significant value to the health care system, by allowing the use of mobile and various Information Communication Technology (ICT) in the field of public health, by expanding health practices (18). For instance, mobile health is used effectively for data collection and reporting from Community Health Workers (CHWs) to respective health facilities. This engages in direct patient care by sending messages and reminders on mobile phones, facilitating an improved health education and behaviour change communication (19).

The COVID-19 pandemic has further augmented the use of digital health technologies and is considered vital for medical service delivery. For instance, Uganda established call-centres and online health during the pandemic, which has aided in disseminating health information to the general public and prioritized the callers for referral services. This enabled easy access to health service points (20). Digital technologies, ranging from telecare to mobile health apps and other technologies, offer massive opportunities in mitigating the pandemic-related issues (21).

In the context of Nepal since 1993, the use of digital health technologies, paved the way by transforming the traditional Health Management Information System (HMIS), Logistic Management Information System (LMIS) into a modern software medium (22). The escalating digital health actions have trickled down into numerous aspects of the health system functioning in Nepal, from service delivery to health service data to human resources for health, to health financing and quality of care (23). The digital Nepal initiatives in health purposes, to accelerate the virtual technologies - such as videoconferencing, e-learning, and mobile health - to mitigate the issues of accessibility, affordability, and quality of health care for Nepalese citizens (24). Including this, a telemedicine guideline, based on the Nepal Medical Council (NMC) Act 1964, is developed for setting standards and protocols on the use of telemedicine in the country. Whereby, the health professionals in Nepal follow this guideline in health education, setting up telemedicine infrastructure, management of data security and privacy (25).

Despite the ample progress, seen in various countries, the WHO states a lack of integrated national digital health strategies for effective execution of planned digital health interventions (1). There is still a requirement for standardization of technologies, for scaling up and engaging health workers, to include additional digital health initiatives in the context of LMIC (19,26). Regardless of the persistent demand for digital health interventions, with outstanding benefits and results for both developed and developing countries, inadequate and failure in implementation across the world is largely associated with a deficit in digital health readiness (27). In the current post-COVID-19

phase, the global readiness for digital health is imperative for intensive analysis of health outcomes for a deeper understanding of the progress and challenges associated with various digital health strategies (12).

In a limited resource setting, health workers remain, with outdated information on medical treatment, in such cases ICT has been found to be one of the major means to tackle the gap in information, using tablets in drug stock inventory and ordering (28). The low acceptance of health information technology among the health professionals has resulted in a delayed implementation of the health information system, leaving them behind, to achieve the overall health institution's goal and rigorous use of data management and exchange of information (29). Failures in implementing digital health intervention are associated with a lack of readiness at the providers and users' end (30). Additional determinants such as poor planning, lack of interoperability, cost, lack of mainstream within the existing systems, fragmented coordination and collaboration between the health professionals and patients are some of the indicators of disrupted digital health implementation (31).

There is already a slow adoption in the digital health service uptake and obstruction in socio-technical and organizational are further impeding the mainstreaming of digital health (32). There also remains an issue of information security and lack of software in digital health, especially in Nepal, as there is a disconnected information system with weak cyber security (33). In such circumstances, digital health readiness offers prolific solutions to gather, organize disseminate and manage ICT information (34). Actions related to the preparedness of health care organizations, communities, and individuals to deal with changes, brought by the ICT related program (30) and the country's ability to assist and bolster the development of ICT, is coined as e-health readiness (15). As stated by Hägglund M and et al, digital health and e-health can be used interchangeably, where e-health is also considered as the synonym for digital health (35). Likewise in this study, e-health will be referred to as digital health.

LMIC digital readiness is one of the crucial components in defining the roadway for a successful digital healthcare era (36). To assess the digital health readiness, several articles have been reviewed and the e-health readiness assessment framework is identified. This is comprised of eight components, which are most suitable for developing countries i.e., core readiness, engagement readiness, government readiness, health care provider readiness, infrastructural readiness, organizational readiness, public-patient readiness and societal readiness (30,37). In the LMIC setting, for digital health technologies to be influential, there is a greater need of understanding on how these technologies can be used for delivering health services in a comprehensive and timely manner, in both rural and urban populations.

## 1.2. Country Context

Nepal's constitution was promulgated in 2015, thereby replacing the unitary government with a federal government system with seven provinces and 753 local governments (293 urban and 460 rural municipalities commonly known as municipality). Each level has legislative, executive, and judicial functions and authority under exclusive and shared jurisdictions to make laws, policies, generate and utilise resources (38). As of 2020 Nepal has a total population of an estimated 29 million with an 1.8% annual population growth. The life expectancy of Nepalese citizens at birth is 71 years (39). The central government is responsible for expanding the network of primary healthcare all over the country (*Refer figure 1*) (40). Additionally, health resources are distributed across seven provinces and 753 local governments, for effective health planning budgeting and service provision to all these municipalities (41). The municipalities are responsible for over 4000 health facilities with the presence of community health workers (23). More than three-fourths (80%) of the health staff were positioned at the local level, because of the large number of health facilities that operated under the local governments (40).

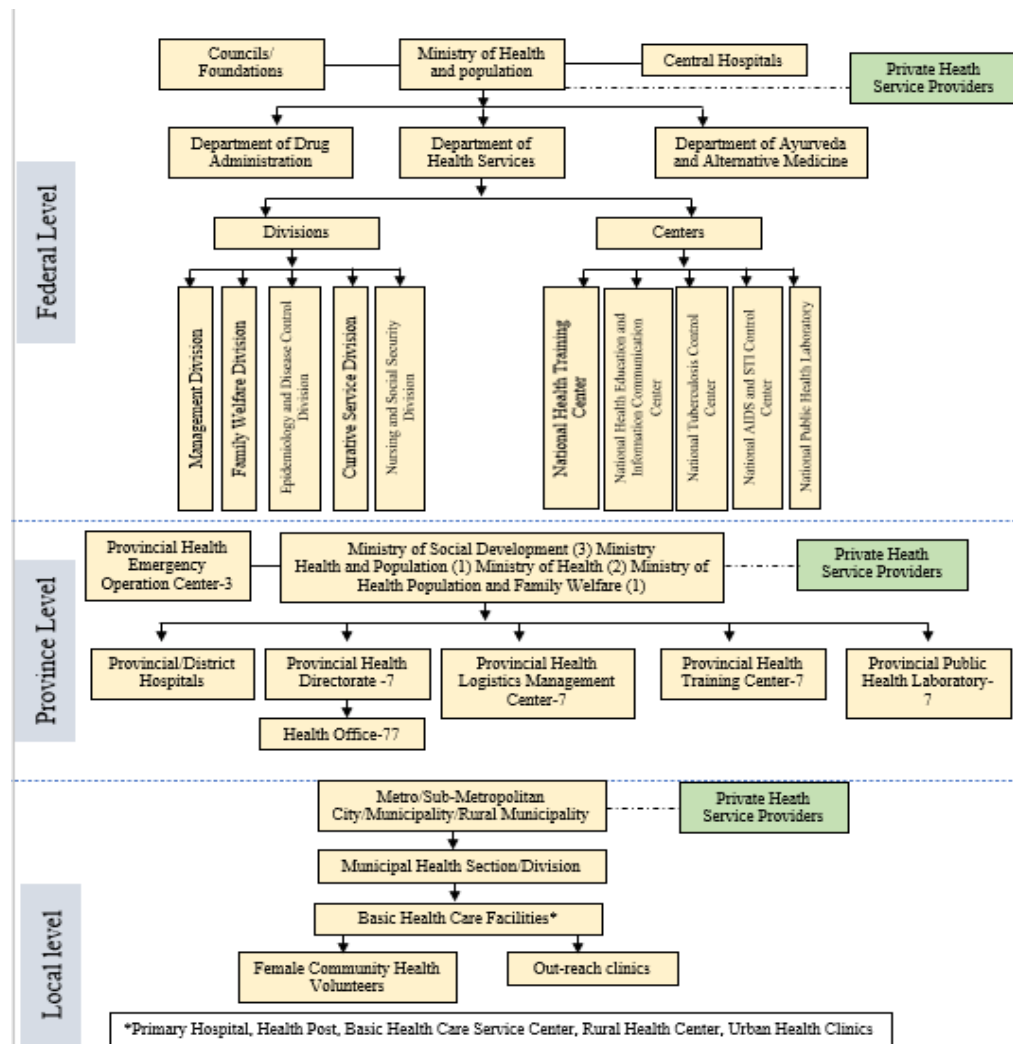


Figure 1: Nepal's Health System Organogram (40)

Over the last two decades, Nepal made significant progress in maternal, neonatal and child health services regardless of the constrained resources, political instability and lack of infrastructure (42). The success of this progress is linked to three of the six components mentioned in the WHO health system thinking framework. They are improvement in leadership and governance, service delivery and medical technologies(43). Additionally, the National Health Policy guides the activities, listed under National Health Sector Strategy 2016-2021(NHSS), which further highlights the pivotal role of the information system and modern ICTs assisting in evidence-informed planning (44).

Although there are disparities in the health services across the entire system, Nepal is persistent in mitigating these gaps by strengthening the ICT industry as an enabling factor for the country's development. In this case, Nepal has enjoyed incredible success in digital adoption, with mobile penetration exceeding 100% and internet penetration reaching 63% (33). In terms of digital development, 38% of the Nepalese population are using the internet, while 131 per 100 people have a mobile cellular subscription (39). The Nepal Multiple Indicator Cluster Survey (MICS) 2019, revealed the percentage of household ownership of ICT equipment and access to the internet at the national level, as 96.2%. Access to the internet at households in national, level as 51.1% (45). Whereas, by 2019, the internet service has been expanded to 2481 health institutions and 431 local levels, they are using mobile apps to establish a relationship with the general public (46). According to the Nepal Health Facility Survey (NHFS) 2021, the provision of regular electricity supply in the health setting in the national level is 78.1%. Similarly, the penetration of communication equipment at the national level is 25.7% (47).

Nepal's National Information and Communication Technology Policy has the vision of "Digital Nepal" by emphasizing the role of ICT, in increasing efficiency and bolstering the health system across the three-tier systems. This is envisioned by developing a strong inter-sectoral linkage and establishing interoperable ICT sector(48). At the same time, the Ministry of Information and Communication Technology (MoICT) has urged all the public, private and civil society organizations to collaborate and coordinate together in rolling out infrastructure for enabling internet access in remote areas. To facilitate an effective utilization of digital health technologies, the Government of Nepal (GoN) is committed in accelerating digital literacy and skills among the health professionals with much focus on making ICT infrastructure available in the government offices (23)

## CHAPTER II: Problem Statement Justification & Objectives

### 2.1. Problem Statement & Justification

The government of Nepal is determined to build digital interventions by expanding IT literacy, strengthening digital competencies, investing in digital infrastructures and collaborating with other organizations to build a conducive digital environment (23). To understand the current scenario of digital health in Nepal, a structured review of organizations working on different domains of health using ICT, were identified; Ama ko Maya (Mother's Love)<sup>1</sup>, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), Medic Mobile, Possible health, Public Health Concern Trust, United Nations Children's Fund Nepal (UNICEF) and WHO Nepal. These organizations are engaged in 15 e-health projects, working on monitoring and surveillance, electronic health records, HMIS, LMIS, inventory management system, and telemedicine (49).

Despite the continuous effort, digital health interventions are not yet integrated within the national health system (22). The HMIS in Nepal faces challenges in inaccurate and inconsistent reporting. As a result of this, the quality of data remains questionable, hindering effective planning, budgeting and decision making at the policy level (50). There is significant inequality in access and utilization of health care services in the country where 79.42% of people living in rural areas, face financial, socio-cultural, geographic, and organizational barriers in accessing health services (33). There is poor preparedness in gathering health information in Nepal; allocating infrastructure; exchanging and using of information thereby lagging the country behind in capacitating the health workers in executing digital health intervention (22).

To stimulate the engagement and understanding the digital health among health professionals, the problem also remains in the ability to engage the end-users, in the design process and the lack of communication in conveying the complexity of digital health work in health care setting (51). Health professionals in Nepal have echoed information about the lack of clarity in roles and responsibilities within and between the level of government across three tiers. This is also reflected in the lack of effective leadership under the federal system for effective health service delivery (52).

The challenge of poor ICT in Nepal is coupled with geographical diversity, poor human capital and security issues, leaving the country's e-government readiness index ranked at 132 and e-government participation index ranking at 137 in the year 2020 (46). At the human resource level, a study on assessing e-readiness, during COVID-19 pandemic, disclosed the challenges experienced by them in the realm of utilizing and adapting digital health. Some of them were a lack of appropriate training, supervision, and technical support on using digital services like telemedicine and smartphone for tracking and tracing COVID-19 cases and virtual training, which contributed to a lack of confidence among the health workers (53). Another study on developing community-based care, using mobile technology for mental health in a rural setting of Nepal, revealed that most health workers, despite their willingness to try advancing technologies, were facing technical issues, internet disruption due to poor network tower set-up in the region, limited

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<sup>1</sup> Ama ko Maya (Mother's Love) is the Social Behavioural Communication Change (SBCC) strategy through web-application approach to support pregnant women and protect the life of a newborn baby. Cite URL: (<https://www.amakomaya.com/en/about>)

capacity of the health workers because of basic computing skills and mobile technology familiarity and other associated costs of digital health (54).

Another significant issue in Nepal's health system is a shortage of health workers, the ratio of doctors to population is 0.17 per 1000 only. This problem is heightened when the position of the health workers at the health facilities are not fulfilled, thereby limiting the access of health services in the communities of Nepal, especially in rural setting (55). There have been initiatives by the National Mental Health Policy, who has highlighted integration of mental health services, from primary health care delivery. But this faces the challenges of absence of digital records and the lack of information exchange mechanism in place (40). These modern technologies fail to realize the potential of digital health, in terms of exchanging data, which arises due to the gap in synergy between various organizations with its own digital systems, thus posing risk of duplication of efforts made in the health care (23). The problem in digital health readiness is exacerbated due to impoverished infrastructures and limited funding from external agencies, thereby restricting the growth of the ICT sector (33). A review of digital health initiatives in Nepal has added engagement of health workers, electricity and network challenges in rural areas, geographical feasibility, inadequate implementation of digital health, lack of coherent and effective health policy and governance, as some of the crucial bottlenecks around digital health (49).

Several challenges pertaining digital health readiness in the country is highlighted in the above problem statement. Despite the challenges, digital health technologies have a promising impact on LMIC. Not only to deal with disease responses but also to bolster the health care system at the periphery level of a country (36). The digital initiative in Nepal is escalating, thereby increasing IT literacy among the health professionals. Increasing investment in digital infrastructure through public and private health sectors has enabled to create a favourable digital ambiance in Nepal (23). The United Nation report also suggest that the capacity of utilizing digital technology called as e-readiness, seems to improve significantly in Nepal and reached the world ranking of 117 from 135 in the year 2018 indicating that the use of digital health technologies is improving gradually (46). During the time of the COVID-19 pandemic, the MoHP established the Information Management Unit (IMU) for strengthening and operationalizing integrated information across three tiers, for effective monitoring and responses to health interventions (40).

Both public and private health sectors in Nepal are coordinating to build an effective Electronic Medical Record (EMR) system, by simplifying it for the physicians and mid-level providers and has aimed to improve the government reporting. They use the EMR information for research purposes and for further public health surveillance system (56). The use of digital health technology, such as the mobile phone, has proven to be effective in a limited resources setting. Health intervention was found to be accepted by the people in rural settings in Nepal, it as well improved the service coverage and quality of health and nutrition service utilization in the area (57). In Nepal the digital health tools used in diagnostic services improved clinical service management. Included, the web-based digital dashboard, introduced by Nepal, Ministry of Health and Population (MoHP), has allowed the health workers to monitor the health indicators related to NHSS and SDG for a timely update (40). The Government of Nepal has allotted a budget for scaling up numerous digital health programs, related to interoperability, DHIS2 (electronic reporting) including digital software as iMIS pertaining to Social Health Insurance (SHI). The study also suggests that digitalization in Nepal's health sector has led to better transparency and

accountability, empowering decision-makers (23). Included the Digital Nepal Framework has committed in allocating at least 10% of its central health budget to digital health programs with an attempt in making the country inclusive, equitable and thriving by 2030 (33).

Since the level of readiness relies on the health workers' preparedness on using digital technologies, infrastructure availability, effective governance and policies in place, that either result in successful or failure of digital health interventions. Assessment of digital health readiness before executing digital health interventions could indeed promote change among health professionals and the government, to accept digital interventions, that could ultimately prevent setbacks (15). In the case of Nepal, there lies lack in research of assessing digital health readiness within Nepal's health system (49).

In spite of the limited research, the Digital Nepal Framework has highlighted the importance of readiness among the stakeholders in using the digital health service platforms. It has emphasized conducting digital health readiness assessment among the health professionals within the health care system (33). Additionally, the e-health strategy, National and Provincial Health policy of Nepal have acknowledged the investment in digital technologies in health and social protection, to protect and promote well-being and ultimately aid in Universal Health Coverage (UHC) (58,59). Based on the available information on the gap in digital health readiness and its promising way forward, as reflected in various policies and strategic documents, this study aims to explore the current readiness of digital health within the health system of Nepal and provide viable recommendations to the policy makers for smooth implementation of digital health intervention in days to come.



## 2.2. Study Objectives

### 2.1.1. General Objective

To explore the digital health readiness within the health system of Nepal and to provide recommendations to policy makers in improving the use of digital health technologies in health service delivery.

### 2.1.2. Specific Objectives

1. To map the current digital health initiatives in health service delivery in Nepal
2. To explore the barriers and enabling factors in implementation of digital health initiatives in health service delivery in Nepal
3. To analyse the alignment of digital health initiatives with the national strategies
4. To provide recommendations to policy makers in improving the existing digital health implementation in health service delivery in Nepal

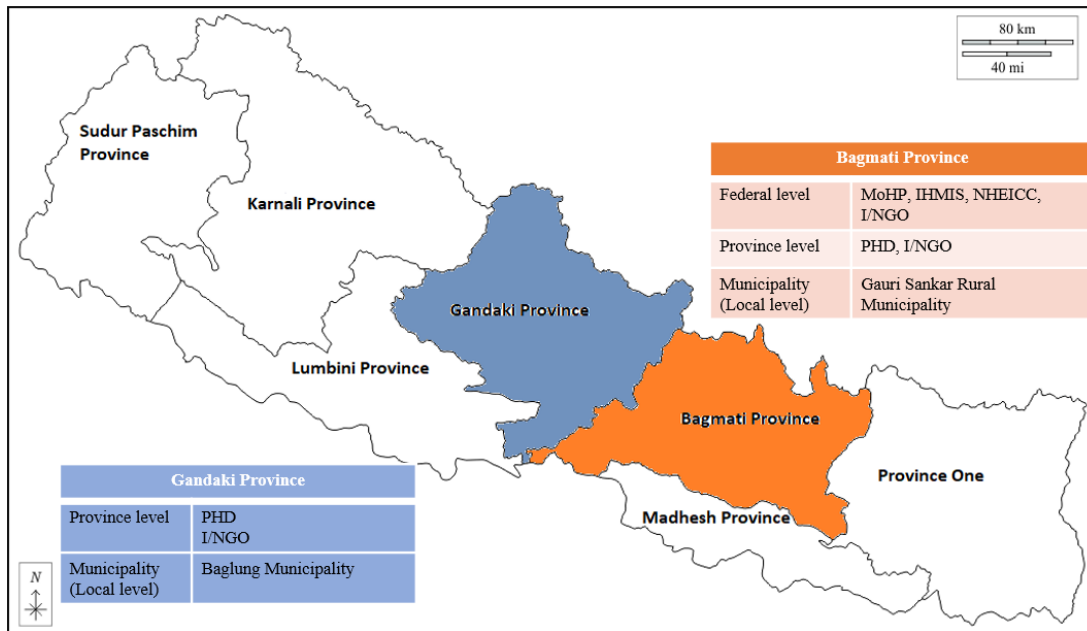
## CHAPTER III: Methodology

### 3.1. Study Type

An exploratory qualitative study was carried to assess the digital health readiness within Nepal’s Health System. This study type is effective for short duration research and is helpful in getting insights into a problem obtained from study participants’ perspectives (60).

### 3.2. Study Area

This study was conducted at the three-tier system of Nepal i.e., federal, province, and local level<sup>2</sup> of the country. The reason behind selecting the study sites (*Refer figure 2*), is that since the MoHP is at the federal level, and various External Development Partners (EDP) working in digital health are based in Kathmandu. Interviewing the major stakeholders from here provided a holistic picture of how digital health intervention are being coordinated, implemented, and supported from top to bottom level. Bagmati and Gandaki provinces have several digital health projects that are currently being implemented at Baglung district (Gandaki province) and Dolakaha district (Bagmati province). Two municipalities, providing the urban and rural context i.e., Baglung municipality<sup>2</sup> and Gaurishankar rural municipality<sup>2</sup> were selected from the respective districts. Selected areas provided information on factors leading to the successful implementation, potential barriers and enabling factors, which aided in gathering recommendation for the policy makers, for smooth implementation of digital health interventions.



Source: d-maps.com ([https://d-maps.com/carte.php?num\\_car=26987&lang=en](https://d-maps.com/carte.php?num_car=26987&lang=en))

Figure 2: Map of Nepal showing study sites

<sup>2</sup> Local Government (local level) according to the constitution of Nepal means rural municipality or municipality. Rural municipality is a less populated area while municipality consist of dense population and have local administration government (73)

### 3.3. Sampling and Selection of Participants

The sample size has been selected to gain a range of views from each level of the system (Federal; Provincial; and Municipal) without overburdening staff at one time. The participants of the study (*Refer table 1*) were recruited through purposive and snowballing sampling. As little is known about digital health readiness within Nepal’s health system, the purposive sampling assisted in identifying study participants that had expertise in digital health service delivery from limited study population of interest (60). Additionally snowballing sampling aided in using the network of researcher’s existing contacts with public health professional in Nepal for identify the study participants. At the federal level total of seven representatives involved in designing, budgeting, planning, government coordination and supervision were recruited. Eight participants from two provinces, involved in digital health implementation, budgeting, coordination, engagement and monitoring, were recruited. At the local level six participants were recruited from two municipalities, who provided information on digital health readiness at the grassroots level as the frontline implementers.

*Table 1: KII participants category*

| Location  | Participants   | Number    |
|---|--|-----------|
| Kathmandu (Federal level)   | Focal person on Integrated Health Management Information System (IHMIS) from MoHP and Department of Health Services (DoHS) | 2         |
|   | Focal person on digital health at IMU in MoHP  | 1         |
|   | Section head from National Health Education Information Communication Centre (NHEICC)                                      | 1         |
|   | Representative from EDPs working in digital health   | 3         |
| Gandaki and Bagmati provinces (From Provincial Health Directorate)  | Health Directorate   | 2         |
|   | Focal person for digital health  | 2         |
|   | Representative from I/NGO  | 4         |
| Local level (Two Municipalities) (Gandaki Province, District: Baglung)<br>Baglung Municipality (Bagmati Province, District: Dolakha)<br>Gaurishankar Rural Municipality | Chief of Municipal Health Section (Health Coordinator)   | 2         |
|   | Health Facility in-charge  | 2         |
|   | Female Community Health Volunteer (FCHV)   | 2         |
| <b>Total</b>  |  | <b>21</b> |

The inclusion criteria were set because of the limited time availability for this study. In which case, health professional involved in the public and private health sector with at least five years of

experience, working in digital health interventions with GoN and or EDPs were the inclusion criteria set for federal and province level. At local level with two years of experience working in digital health interventions with GoN and or EDPs were listed as the inclusion criteria. While those working in other provinces, districts and municipalities than the above-stated study sites and health professionals with less than above mentioned work experiences, were excluded.

### 3.4. Data Collection Methods

The data were collected through Key Informant Interviews (KII) using an interview guide (*Refer annex 1*). Prior to the interview, participants were provided with an information sheet developed in Nepalese language which included the information regarding the purpose of the study, why they had been invited to participate, confidentiality, and the voluntary nature of their participation. Out of 21 KIIs, 15 KIIs were conducted face to face in a private location to maintain confidentiality, the location was chosen according to the participants' preference (either at their workplace or at community centres). Remaining six KIIs were also conducted through online platforms (zoom and Microsoft teams). All the face-to-face interviews were conducted by two of the Research Assistants (RAs) who had prior work experience in qualitative health system and policy research in Nepal. In the study, prior data collection, two RAs were provided with training on the interview guide and consent form for face-to-face interviews. The RAs coordinated with the selected participants for fixing the appropriate time for virtual interview.

The interviews were recorded using mobile devices of the RAs and the recordings in RAs phone were deleted once they were sent to the researcher. Whereas, online interviews were recorded using voice recorder, available in online meeting platforms. The interview guide was prepared, corresponding to the proposed framework of this study (37). Interviews primarily focused on awareness on current digital health readiness, assessing information on digital health interventions' alignment with government strategies and policies, financial investment related to the digital health technologies. Interviews at the local government emphasized on factors affecting the implementation of digital health interventions and also provided information on current collaborations within public and private health sector. The participants were probed using the research table when required (*Refer annex 2*).

### 3.5. Data Processing and Analysis

All the interviews were conducted in Nepalese language and were audio recorded and subsequently transcribed into English. All the interviews were shared with the principal investigator (researcher) of this study through Google drive. Upon receiving the recording, the researcher of this study transcribed the recorded information into Nepali and later translated these Nepali transcripts into English. Themes were generated from the adapted digital health readiness assessment framework of this study. The process involves systematically categorising and coding the data, and the data saturation was achieved when no new codes or themes emerged from the data. These themes were coded using the computer software Nvivo (61) and these themes were analysed using deductive approach.

### 3.6. Ethical Consideration and Consent Form

The researcher of this study obtained ethical approval from the Nepal Health Research Council (NHRC) (Ref. No. 4062) and also a letter from the KIT research ethics committee (*Refer annex 3*). Consent from all 21 participants was obtained prior to the survey and interview; no personal identifiers were recorded in the electronic dataset to maintain anonymity. The confidentiality was maintained by keeping their designation and names anonymous. The study information will be archived up to only five years in a password protected folder.

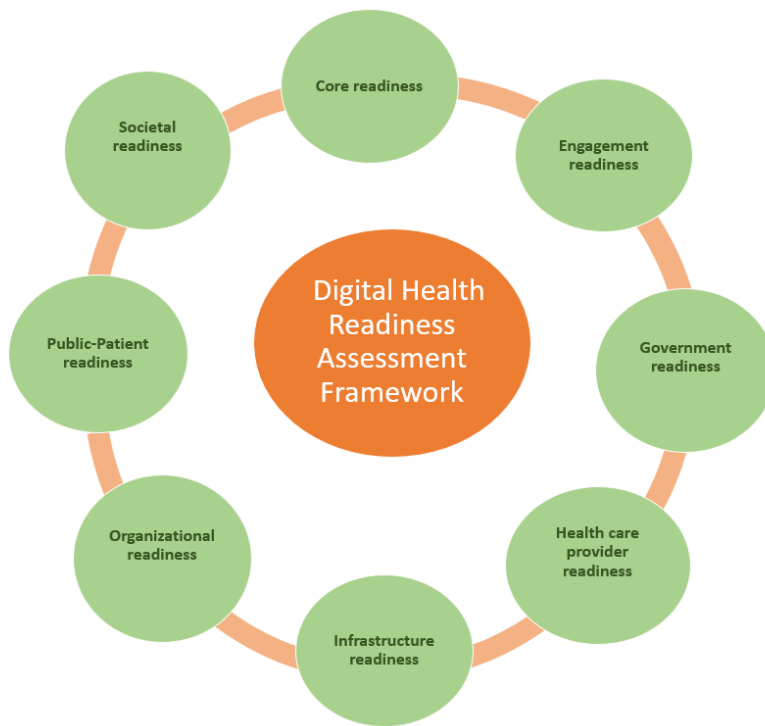
### 3.7. Quality Assurance

The interview guide (*Refer annex 1*) and consent form (*Refer annex 4*) were initially developed in English and translated into the Nepali language, which was also pre-tested before actual data collection, to ensure reliability of the tools. The interview guide was designed using the digital health readiness assessment framework. The RAs in this study were trained in data collection tools, prior to pre-testing who were responsible for conducting a pre-test out of the study site. The assigned RA was mobilized to finalize meetings and conducting KIIs. Triangulation of the study tools was based on information collected during KIIs and findings presented in literature review using search strategy (*Refer annex 5*). The information generated from the study was critically reviewed and checked by the thesis and academic advisors, to ensure the tools used in the study captured relevant and appropriate information. In addition, responses from all the participants validated the information obtained under each objective of this study. Every day after interviews, both RAs field work experiences, participant recruitment process and interview probing were thoroughly reviewed and provided feedback for the quality of interviews.

### 3.8. Conceptual Framework

The proposed e-health readiness assessment framework (EHRAF) is designed for developing countries and have distinct assessment criteria that illustrates the underlying role of digital readiness within the health care delivery system of a country. This EHRAF consists of eight readiness components i.e., core, engagement, government, healthcare professional, infrastructural, societal, organisational, public patient and societal. All these components help to analyse the initial setting of the country, for better implementation of health interventions using technologies (37). As digital health and e-health can be used interchangeably (35), in this study, e-health will be referred to as digital health. Hence the conceptual framework for this study is adapted as digital health readiness assessment framework (DHRAF) (*Refer figure 3*).

Other developing countries using EHRAF have found this framework useful in addressing major determinants and have assisted policy makers in planning for digital health programs on a contextual basis (62). The framework could also assist in avoiding failures in program implementation, that uses ICT in provision of healthcare services (63).



*Figure 3: Digital Health Readiness Assessment Framework adapted from EHRAF (36)*

Considering these reasonings, the proposed framework is suitable for analysing the current status and exploring determinants that are either enabling or are barriers in implementing digital health intervention in Nepal. It so provides the stakeholders of the country with the current readiness of digital health technology within Nepal's health system. Out of eight original components, the study focused on seven components excluding public-patient readiness which are listed in the table below (*Refer table 2*). Due to limitation in study time, the researcher was unable to collect first-hand information from the community level, which happens to be one of the limitations of this study.

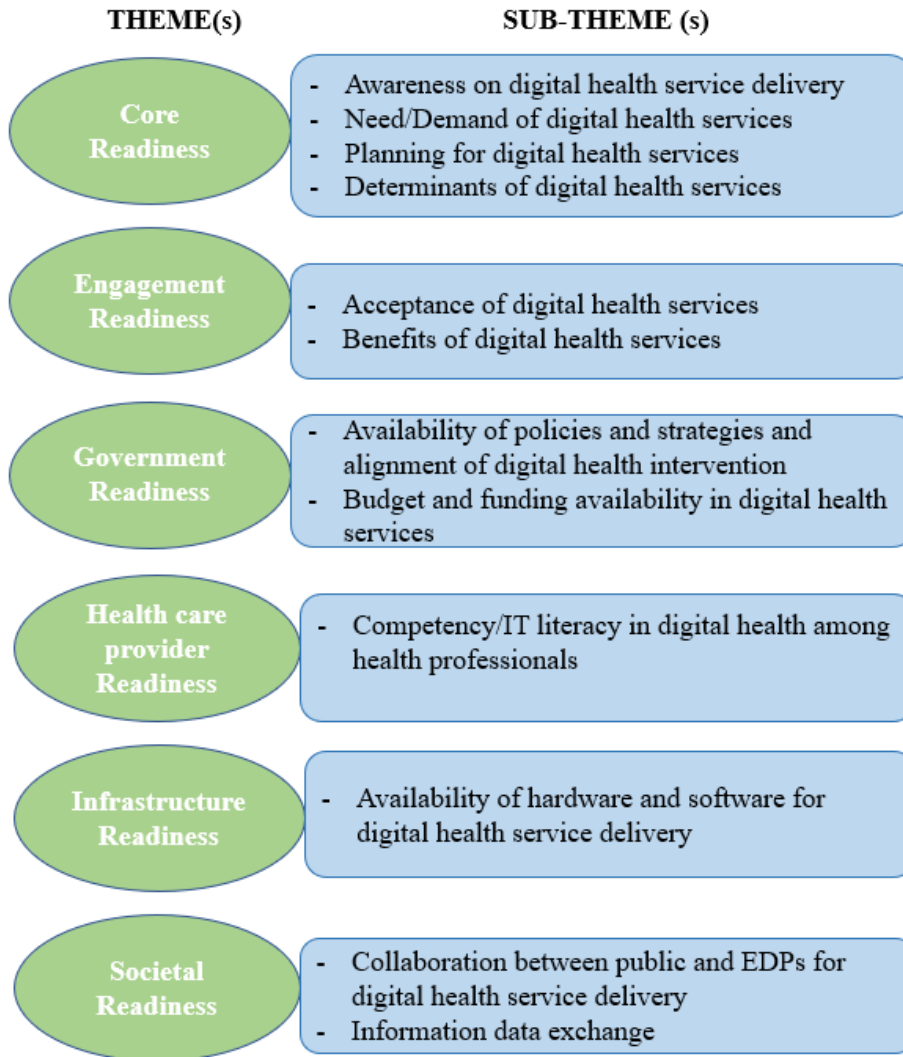
*Table 2: Definition of components in adapted DHRAF (36)*

| <b>Digital health readiness component</b> | <b>Definition</b>  |
|---|--|
| <b>Core readiness</b>                     | Focused on addressing the factors associated to planning, providers' satisfaction and willingness in digital health implementation, challenges identified during digital health interventions  |
| <b>Engagement readiness</b>               | Recognizing the benefits, potential negative impacts, e-health education of communities from healthcare provider's perspectives.   |
| <b>Government readiness</b>               | Analysing the availability of policies and strategies to promote and manage the use of digital health technologies, funding availability and support from government in implementing various digital health interventions in the country |
| <b>Health care provider readiness</b>     | Focuses on deriving information from healthcare workers based on their experience, perception and acceptance in using the digital health.  |
| <b>Infrastructure readiness</b>           | Assessing the availability and affordability of ICT, availability of skilled human resources, power/network coverage.  |
| <b>Organizational readiness</b>           | Focused on assessing the current institutional set-up, implementation, promoting awareness and use of digital health intervention.   |
| <b>Public- Patient readiness</b>          | Assessing the awareness of patients and their affordability towards digital health services. Identifying perspectives on the influential factor for using digital health services.   |
| <b>Societal readiness</b>                 | Inspecting the collaboration and interaction within and between public and private healthcare institutions.  |

The above definitions on the components of digital health readiness have assisted in analysing the results which are presented in the next chapter of this study.

## CHAPTER IV: Results

A total seven interactive themes with 12 sub-themes were identified (*Refer figure 4*) and findings from 21 KIIs are presented in this section. Out of the seven themes from the framework, the content on the organizational readiness had to be discontinued in this study as the content were reflected in other thematic readiness.



*Figure 4: Theme and Sub-themes from adapted DHRAF (36)*

The overall findings under each readiness are explained in relation to themes and their sub-themes in this section below:



## 4.1. Core readiness

Core readiness assesses the participants' level of awareness on utilization of digital health technology ; current need for planning on digital health and various determinants hindering the accessibility on the use of digital health technology as follows:

### 4.1.1. Awareness on digital health service delivery

All the participants were aware about the utilization of digital technology in health service delivery in various part of Nepal. At the federal level, the MoHP developed e-health roadmap and is in the process of digitization. In terms of the information system, participants knew about various health information management systems, such as DHIS2, health dashboard, electronic health record (EHR), EMR and other digital technologies, such as mobile health and telemedicine. While the FCHVs only knew about the mobile as the digital tool for health service delivery, as they have been using the mobile to disseminate health related messages to the community people and receive messages from health facilities in their respective social media group. To which the health directorate from one of the provinces, referred mobile-health and social media as a social mobilization tool, to engage the community and further questioned on the sustainability of such a program once it is over in this area.

At the local level, a health-facility in-charge shared that, despite having an idea of digital health and knowledge of various hospitals and organizations implementing paperless systems, didn't have a digital system implemented at the working site, where they still practice writing on an Out-Patient Department (OPD) card for the patient. Participants at the province level highlighted that people are not aware of how the digital system functions and seem not to recognize the importance of digital health

*“Some health professionals at the municipality level don't know where the data comes from, and what could be done through this data for planning level... and they don't know what infrastructure and resources are required, that is why awareness is important and that is lacking.”- EDP representative, Gandaki Province*

Provincial and federal level participants also concordant that EMR system has also been piloted in phase wise. As the participants mentioned hospitals in Bagmati province and federal level have piloted EMR system. However, some participants had concern in the piloting of EMR system, as digital health in Nepal is being implemented in an unsystematic manner and is in nascent stage.

*“In Nepal the era of digital health is not actually started. In private hospital, who are using technologies at the maximum level, there the patients still must bring their referral books and doctor's report in their hands. And this is not digital health... Digital health in our country is in a premature state.”- IMU, MoHP, Federal level*

### 4.1.2. Need/demand of digital health services

Almost all the participants expressed the need and demand for digital health technologies. At the municipality level, participants emphasized the communities demand for more viable tools to improve their access and use of health services and highlighted the need for an integrated tool in health service management. Equally the need of telemedicine is emphasized for higher level

services for the auxiliary nurse mid-wife or paramedics, to provide consultation through telemedicine, in cases where the services users were in doubt.

One of the participants from Gandaki province, highlighted that to generate demand for digital health at the community level, there had to be an information awareness campaign. FCHV at the local level expressed that the mobile is essential for everyone in the community, as people in the community staying at home didn't seem to know everything. Participants at the province and federal level, emphasized, that for the community to express their need and demand, the government had to first create a favourable environment through provision of policies, strategies, and skilled human resources. The participants seem to find the digital health as the need of the hour and have considered it as the lifeline at the community level, for aiding in increasing awareness on health-related information.

*“I was at the meeting for this health dashboard where other provinces were also demanding for such dashboard. I can't say there is no demand at all but, the demand will arise if we are able to make the community understand about its importance and the consequences of the system in place otherwise there will not be much demand.”- IHMIS, MoHP, Federal level*

#### 4.1.3. Planning for digital health services

The majority of the participants, confirmed about budget allocation plan for digital health services at the province level. Some of the participants shared that due to availability of data the planning for health services had become easier. While at the province level, Electronic Logistic Management Information System (ELMIS) significantly assisted in planning, forecasting, and quantifying the medicines, and vaccines to make their work efficient. Participants at the federal level shared that the NHEICC team is in the verse of developing a concept note, where the information generated at the federal level, could be reached at all three tiers. For which the team are also proposing to have an admin, from federal level at the province level and at the local level so that everyone could have access to one unified health platform. Gandaki province had planned to convert all the hospitals into the EMR system and have confirmed the availability of budget from MoHP, which has also been reflected in the government action book called “Redbook.” At the local level, there has been a greater discussion in adapting digital tools for service management. All of this seem to be a good enabling factor for effective digital health implementation. Despite the great initiatives at the planning level, participants shared the gap of planning at the human resource level for effective implementation of digital health interventions

*“Human resource allocation is another task; we don't have planning of this level. Planning has only been at the level of budget; they may purchase the technology and try it at one or two health institutions.... The main problem is how you will develop an implementation plan and how you will coordinate. Developing an implementation plan is a big deal”- EDP representative, Federal level*

Many participants thought there should be plan for advocacy in buying software for the optimal use to digital health technologies in accessing health services.

*“My work is to lobby and advocate about the digital health, and during my presentation in meetings, I try to make the stakeholders understand about its importance in terms of planning and increasing the efficiency of human resources.” - Health Directorate, Province level*

Overall, many participants stressed on advocating for globally proven tools for the government to easily adapt and standardize, based on the country’s context.

#### 4.1.4. Determinants of digital health services

All the participants identified electricity, internet, lack of computers, geographical complexity, lack of trained human resources, as the major determinants on accessing digital health technologies. At the province level, the focal person on digital health identified a lack of technical support in launching and maintaining digital technologies as hindering factors for continuous access to digital health. At the municipality, the health facility in-charge, associated availability of infrastructure with the motivation of staff to use the digital health tool. In the absence of internet, electricity, those who are keen to learn and improve the capacity seems to affect the personal motivation of the health workers

*“As you know we have geographical challenges in our country, and electricity services is not stable in our municipality. If it’s raining or there is thunderstorm our electricity will be gone for a few hours up to 10 days sometimes. If we are planning to use digital technologies, we must make sure that electricity and internet services are stable and working properly.” - Health-facility-in-charge, Local level*

While participants at local level found individual motivation, enthusiasm, and one’s habit in playing a significant role in accessing the digital health tools, where health professionals without motivation and practice were less likely to use the available digital tools. In case of telemedicine, there seems to be a lack of trust from the community, limiting the use of such digital technology. Some of the participants, found confidentiality, data leakage as one of the major negative effects of digital health implementation. Participants highlighted, that lack of robust data security, back-up systems as a probable cause to loss of data, misinterpretation, hacking and data theft. There also seems to be a lack of consistent teams while working in the government, where the core working group for digital health were found to be volatile within huge gap in developing a robust system for data security, anti-theft, security, and data interoperability

*“People have their own illness, such as HIV and if our system becomes weak then this information can get leaked or stolen, then one will lose their confidentiality, and in any work sector this is one of the biggest negative impacts of online system.” - Health facility in-charge, Local level*

At the federal level participants identified health workers’ transfer due to adjustment from one district to another as a prime reason for not having a trained health worker on the site at the time-of-service delivery. Thereby, duplicating the efforts in trainings. Lack of authority and commitment among health workers was also identified as a significant determinant in utilization of digital health services by all the participants.

## 4.2. Engagement readiness

This section discusses two major sub-themes namely, acceptance and benefits of using digital health technologies as follows

### 4.2.1. Acceptance of digital health services

The study participants had mixed responses on the acceptability of digital technologies. Participants at the federal level shared a good acceptance of EMR among the health workers in their implementing sites. This was linked to the previous technology culture, where this staff, since the beginning of their job enrolment, used the digital system to enter their travel and leave information. As a result, they had a high acceptance of current digital technologies. Likewise, at the province level, the health professional seems to make good use of data and technologies in procuring medicines and forecasting them, resulting in reduction of expired medicines in stocks. Participants at the federal level revealed good acceptance of digital system among the private sectors, like hospitals and insurance companies. Private hospitals were found to modify the system as per their need, such as their own billing system. Similarly, acceptance was related to an initial thrill of using the digital technology, whereby people tend to have a high acceptance at the beginning due to their excitement, but as gradually the work started to get added, acceptability started to diminish. At the local level, the young health workers, despite being IT friendly, were reluctant to use the technology, due to a gap in training which leaves them to perceive it as a far-fetched dream. During digitalizing TB programs as e-TB, provision of training led the health professional to accept the technology

*“Initially there was a complain of burden on entering data through manually written recording tool to electronic records, but now it’s been one year, and we have trained two-three staffs at the local level, now they perceive this electronic system as beneficial and have high acceptance.”- Digital health focal person, Province level*

Participants at the federal level highlighted not much of groundwork has been done to assess the acceptance of the digital health technology in Nepal’s health system.

*“There are many factors from providers’ part such as technology acceptance. There is this Technology Acceptance Model, which is not worked out properly. We don’t know yet, by doing what there will be technology acceptance.”- EDP representative, Federal level*

While the health directorate at the province level noted, that if the digital system was not simplified, then people tend to not accept it readily.

### 4.2.2. Benefits of digital health services

All participants have found the digital system beneficial for the health service delivery, thereby improving the quality of services in Nepal. At the local level, FCHV associated the use of the mobile phone in expanding service coverage, where they were able to reach vulnerable women and raise awareness among them. To which the participant at the province level also shared that the digital system would help in achieving UHC. Additionally, participants mentioned the improvement in demand and supply of medicine through digitization, as the health workers can check the expired medicines in stock and demand medicines in required amounts. The system was also termed as economical and timely as the health workers were able to access data of remote

areas instantly. Participants found digital technology improving quality services, as the health workers could access the updated guideline and apply them in their clinical practices. Participants have associated the use of digital technology with evidence-informed planning, quick communication between the service providers and users and had found the system very beneficial during the time of emergency.

*“In case of emergency, it helps us manage emergency smoothly by enabling us to coordinate with our higher authorities, by reporting the status through DHIS2 and ELMIS which is later used for planning as required.” Health-facility-in-charge, Local level*

Participants highlighted lack of centralized system in improving the healthcare system of Nepal. While a participant, working in EHR sector, highlighted, through unified health dashboard hospitals could get the report at one place thereby, aiding the health professionals in making accurate decisions on diagnosis and treatment and also help the patient party to get the information in their mobile.

*“I have 10 hospital cards but now slowly as the system is being digitalized, I can check my record from any of the health care provider due to which, data control is with me and I can also opt out for other opinions while seeking health services.”- EDP representative, Federal level*

At the province level, participants emphasized the EMR system, to improve the services at the hospital, due to availability of patients’ information at one portal, thereby enabling to get the real-time data ultimately improving, accuracy, interpretation, planning, monitoring, and evaluation.

### 4.3. Government readiness

This component focuses on the sub-theme such as policies/strategies availability and alignment of digital intervention with national strategies. Findings also revealed the budget availability for digital health intervention implementation as follows:

#### 4.3.1. Availability of policies and strategies and alignment of digital health interventions

The participants across three tiers shared the availability of policies and strategies such as e-health roadmap, e-health strategy, Digital Nepal framework, Nepal Health policy mentioning digitalization of health services and e-logistic management. The availability of protocol on EMR developed by MoHP for uniform implementation and encouraged the idea of having a separate digital health strategy at each level for contextual implementation. A few of the participants shared that the government allocated the budget adhering with the policies, however it lacked successful implementation at the grassroots level.

Almost all participants have considered existing policies to have assisted significantly in moving towards digitalization from a paper-based system. A few participants however, involved in policy making, found the current policies lacking clear directions regarding the modality of moving towards digitalization and felt the need from the government to define the roles of each stakeholder. Additionally, a participant shared the concern of MoHP in developing relevant strategy, based on the Nepal digital framework, developed by government of Nepal to guide the province and local health entity. And a similar view was presented by other participants at the federal level who found the framework an incomplete document as it lacked vision and guidance

in a clear manner. To which another participant shared that the framework consisted of 8 domains and 88 sub domains and relates with the good foundation being set-up, but again agrees with the former participants that its interlinkage with rest of the components seem to be lacking.

*“The framework is incomplete, and we need to do homework for this. Without involving stakeholder, private sectors and beneficiaries of digital health how will the digital health be implemented? Private sectors are to be informed regarding the digital health policies. This kind of work must be initiated by the government thus we are lacking essence.”- EDP representative, Federal level*

Most of the participants repeatedly stated that the government has failed to develop policies on privacy, connectivity, health protocol regarding the exchange of data, protocols on data exchange, investment policies for private sectors to invest openly. Participants were often found disappointed with lack of regulations in digital health implementation.

#### 4.3.2. Budget and funding availability in digital health services

Participants at the municipality level revealed there is not separate heading for digital health, but the budget is being allocated under repair, maintenance, and capacity building headings. While for the system, such as HMIS participants shared, that the government has spent enough budget in recording and reporting the indicators on health. It was found that the national level budget, for institutionalization of digital health, is not available. Some participants shared that the government has an inadequate budget for digital health and were taking financial support from donor agencies such as U.S. Agency for International Development (USAID) and WHO.

*“In terms of budget in digital health Nepal government alone cannot afford it, USAID is supporting it”- EDP representative, Province level*

Participants at the province level revealed that although Nepal’s federalised health system is still in infancy stage where the province level hasn’t been fully functioning and allocating sufficient budget for planning for digitalization but some plans for advocating and buying software seem to be in the piloting phase. The majority of the participants confirmed the budget availability at the local level. On the contrary, other participants had a slightly different view on the availability of budget at the local level, mentioning that the local level budget is only sufficient for minor utility problems such as internet, laptop and not for developing infrastructure such as servers.

*“Most of the resources are at local government if the local government is able to realize the importance of data and perceive digitalization as beneficial then within one corer (USD 10 million) budget including training, equipment, software purchase, the local level can implement digital health it is not a big deal for them.”- Health Directorate, Province level*

Participants from three-tiers stated the lack of funds for the digitalised health system despite the envision of e-health strategy and national and provincial health policies and mentioned about the lack of financial management within the government system to invest the budget in a right way for the right thing.

#### 4.4. Infrastructure readiness

This component talks about affordability of digital health and availability of infrastructure such as hardware and software in place as discussed below:

##### 4.4.1. Affordability of digital health technologies

All the participants termed digital health as an investment and not an expenditure. Participants compared the initial cost with long-term benefits, such as an efficient system, improved quality in health services where they all found it to be affordable.

*“If we analyse the cost for manual reporting of data, cost for paper, financial loss due to low data accuracy, error in transferring data compare to these, initial cost for digitalization is actually not a huge cost....and thinking that the initial cost is high and not investing in digital health in fact will be a foolish decision.”- Health Directorate, Province level*

The majority of the participants felt rather than the question of being affordable or not? It was in fact necessary and shared that in a recent budget speech, it was announced to implement EMR in all federal hospitals.

##### 4.4.2. Availability of hardware and software for digital health service delivery

Many participants internalized the importance of having software and hardware in the country for effective data exchange process and highlighted its linkage with a developing protocol for data exchange using the software. Most of the participants highlighted that the country needed to improve hardware and software systems and focused on merging multiple software in making a centralized system to ensure the reliability of the system. Participants associated software with gaining public trust for instance, by developing software for telemedicine such as for visualization, real time conversation and uploading digital reports to gain public trust.

*“This province started telemedicine combining four to five hospitals from this fiscal year, but the problem is the trust of the public. Because they seek physical touch by doctors and they don't tend to trust advises given from far away.”- Health Directorate, Province level*

Participants revealed the that handling of software is done through outsourcing companies and had concerns on the sustainability of the software, due to lack of human resources to manage and produce software.

*“If the same process continues for long time and people from outside are handling the software then it may eventually lead to the demolition of the whole system in Nepal.”- Digital health focal person, Province level*

Private IT company seem to be working on developing open-source technology that could be used freely and seem to challenge the software companies that needed to be paid. Participant related the use of software with generating more money for the software companies.

*“In regard to the software part there are free and some which you need to pay. In terms of government, they always select the one which has bigger commercial value which needs to be paid, if a paid product is launched it gains bigger commercial value as it reaches to every health institution. It receives money from each patient, the software companies receive money per patient,*

*and it is implemented all over Nepal then the software companies will make more money.”- EDP representative, Federal level*

Participants further revealed that in HMIS, the recording is done manually, while for reporting DHIS 2 is used, to which another participant added that having software for recording and reporting would not only make the work efficient but also prevent the problem of hacking.

#### 4.5. Health care provider readiness

Under this readiness the competency of the current public and private health professionals, in utilization of digital health service delivery is assessed and the findings are presented in below sub-theme:

##### 4.5.1. Competency/IT literacy in digital health among health professionals

Community health workers at the local level were found capable of using mobile phones for disseminating and providing health related services through social media apps such as Facebook. However, the participants from the health facilities further noted that the health workers from rural setting seem to be not competent enough to handle the digitalise health services, in some case, not even aware about digital health technologies. Many participants shared that the older health workforce required additional time in learning new tools and seemed to be not that attracted towards the digital component compared to the young health professional who were found quite motivated and enthusiastic.

Overall, for a low IT literacy among the health workers, participants at federal and province level highlighted lack of digital health and EMR education in the school curriculum thus contributing to low acceptance of digital health technologies among the health workers in Nepal.

*“At least 2 credit courses on m-health and EMR should be available for public health and medical students for achieving health workers readiness in digital health... We are in fact pushing and some medical institutions are also positive, and we have started some training, however this should come in alignment from medical academics.”- EDP representative, Federal level*

Many participants emphasized on the provision of trainings to improve the capacity of health workers to operate the digital system smoothly. In which case, FCHVs are provided with training on using the mobile to provide maternal and child health services from organizations such as medic mobile.

*“Last time in e-health when we were providing DHIS2 training, most of them didn't even know in DHIS2 one has to click in URL”- EDP representative, Province level*

From most of the participants' observation and work experience it was found that the health workers were competent on using the android mobile phone and seemed to easily use social media such as Facebook and highlighted that the slow progression of the Nepal health system into digitization could be creating a higher knowledge gap.



## 4.6. Societal readiness

This section discussed two major sub-themes identified such as collaboration and information exchange between the organization, while using digital technologies for health service delivery which area as follows:

### 4.6.1. Collaboration between public and EDPs for digital health service delivery

Health facilities at the local level seemed to be coordinating with EDPs for seeking support on training such as DHIS2, eLMIS. There is a collaboration with EDP agencies at federal level such as SUAHARA, Medic Mobile, Nyaya Health, Chemonics, USAID, WHO in implementing digital health programs using technology such as the mobile phone and e-health information at the local (municipality) level. Some participants further started about the coordination with local NGOs in Nepal, who are involved in developing software such as Medical Identity Protection Software (MIDAS) and supporting on electronic recording at the health facilities level.

*“Through collaboration with EDPs during this COVID phase we initiated IMU. In the beginning WHO introduced this and then the government of Nepal approved it.”- Digital health focal person, Province Level*

The majority of participants highlighted the need of coordination and collaboration with public and private health sectors, while developing policies on digital health for the private health sectors to invest openly.

### 4.6.2. Information data exchange

While exchanging information within the organizations and across three tiers of the government, many participants urged on having one single digital platform for disseminating health information across the tiers of the government. Only a few participants mentioned using data interoperability in their organization for disease control programs. Talking about data exchange, some of the participants highlighted the need of having a data exchange policy in place for efficient access to digital information from one hospital to another.

*“X hospital had recorded data of all the patients and what if the patient is referred to Bir hospital? Does that patient go to Bir Hospital with all his document ... patient history is required and the data from one hospital to another should be exchangeable, thus policy is also required on the same.”- EDP representative, Federal level*

While Some participants flagged the concern in data exchange process in the scenario where both public and private health organization have their own coding mechanism due to fear of data manipulation and lack of standardized data reporting system.

*“If everyone had national identity card, there would be unique number and from that unique number data exchange would be possible. But there is no readiness for quickly generating that unique code in Nepal.”- EDP representative, Federal level*

Overall, participants reported the use of technologies such as IHMIS, EHR and DHIS2, for recording and reporting health information within public and private health organizations while community health workers at the local level were found to use the mobile for record and reporting information at the health facilities.

## CHAPTER V: Discussion

The prime objective of this study was to assess the readiness of digital health technologies within the health system of Nepal. This study focused on outlining the current digital health initiatives, exploring barriers and enabling factors for implementing digital health interventions and assessing their alignment with the available policies and strategies. In this quest, the study has identified five key findings namely, awareness on digital health initiatives and importance of stakeholders' engagement in increasing awareness; major barriers pertaining to digital health intervention; funding and collaboration for digital health infrastructure, lack of data interoperability and possible solutions in the country and lastly affordability in digital health initiatives. Details of the findings are discussed in the following paragraphs.

The study found all the participants to be aware on the digital health tools, except for the CHW (FCHV in Nepal) who were only aware about the mobile health technologies used in digital health interventions. Some participants also flagged that older generation and health workers, working in rural setting, are unaware of digital health technologies. Similar findings in Africa also revealed to have low awareness on digital health among the politicians and health professional from the older generation but the young generation were interested (64).

Most of the participants in this study seem to be aware of the current strategies such as e-health roadmap, e-health strategies, and Nepal digital health framework. They have underlined the importance of involvement of stakeholders, from public and private sectors, while developing framework and strategies so that all the eminent actors are aware of the documents from the onset of digital health implementation. This finding is supported by a study focused on developing countries and has highlighted the importance of involvement of stakeholders during the course of designing e-health framework, which could significantly contribute in promoting awareness and readiness of technologies among the stakeholders (30).

Additionally, in Malawi, mobile phones were used by the CHWs in providing services that resulted in increased service coverage and improved efficiency in one of the mobile health interventions piloted in the rural based mission hospitals (65). Similar to Malawi's context, in Nepal, various mobile health intervention programs implemented by the private sectors such as Medic Mobile have also resulted in wide service coverage on maternal/child health and other disease control programs. There remains a concern on the continuous use of mobile health by FCHVs, once these programs come to an end. Due to such circumstances as well, the participants in this study have urged the need for the government of taking the ownership of the programs on digital health to ensure the sustainability of digital health technologies at the community level.

One of the major determinant factors for the optimum utilization of digital health technologies in this study was associated to inadequate skilled human resources, as a result of which the country is not able to take ownership in developing in-house software. This is supported by the findings in Pakistan where inadequate availability of skilled human resources was hindering the implementation and scale up of technology-based interventions (66). As suggested by the participants, in such scenario trainings were considered as pivotal steps in achieving skilled human resources. Whereby a study to examine digital health contribution, in achieving UHC in Sub-Saharan Africa, has also emphasized the provision of training to health workers on managing and

maintaining digital health technologies, through academic institutions (67). Likewise, participants in this study also emphasized inclusion of EHR/EMR courses in the curriculum of public health and medical professional as a two-credit course, so that these health workers are prepared for the ICT infrastructure from early on, which perhaps could accelerate the readiness of digital health in Nepal.

Another interesting finding is that, despite the internet penetration reaching 63% and mobile penetration exceeding 100% in Nepal (45) study participants reported that there is lack of internet availability in rural settings, and it is a major determinant hindering access to digital health technologies in those health facilities, despite of the envision of the national and provincial health policies as a result has also demotivated the enthusiastic health workers in accepting digital health technologies. This finding is in contrast with the literature available in Sub-Saharan Africa where, despite the internet penetration being only 21.8% (68) and mobile phone availability 64% (69), there is still a sufficient stage to scale up digital health on the continent. As to accelerate the implementation of digital health devices, they are up to establishing a new intergovernmental arrangement between Ministries of health and ICT (70).

Regarding the funding for the digital health technologies, findings indicated that various EDPs have supported providing infrastructure such as software and assisting technically or financially in implementing digital health interventions in Nepal. This is supported by another finding in LMIC, as in Nigeria, where various foreign agencies seem to be involved in funding e-health projects. A study revealed significant findings where lack of political will and an unfavourable environment, such as poor working conditions, could result in low eagerness among funding agencies to implement in e-health projects in developing countries (71).

In such scenarios mandates on effective collaboration could spark interest among the donor agencies to fund digital health interventions in developing countries. The participants in this study also have highlighted the inclusion of protocols on coordination between government and EDPs sectors in the policy for creating a favourable environment for the donor agencies. In addition, an experience of Rwanda for achieving success in digital health care is directed through robust actions and strategic partnership, whereby the government has also created a favourable environment such as reliable ICT infrastructure and strengthened partnership with external agencies such as Baby I to scale the telehealth initiatives (36).

Findings of this study reveals that, interoperability was used only for the disease control program in Gandaki province. This finding is similar to the literature available in Pakistan, where only one project was connected to a national database, where the stakeholders involved in digital health have highlighted the ministry of health and ministry of information technology and telecommunication to collaborate effectively in implementing policies for regulating ICT (66). Likewise, the participants in this study have accentuated for a robust data exchange policy in place for efficient access to digital information from one place to another. Nepal's National ICT policy and e-health strategy has also clearly stated effective and efficient interoperable digital health solutions and applications (23).

The digital health implementation in the country doesn't seem to align with what the national strategies have enlisted, as the participants in this study are still struggling with data exchange process, where both public and private sectors have their own coding mechanisms. They have urged to merge the multiple reporting system into one for not only making the work efficient but also to prevent the problem of hacking. On a positive note, to strengthen data interoperability, a program called Support to the Health Sector Programme (S2HSP) in Nepal, through collaboration with GIZ and Global fund, have introduced an e-reporting system using existing open-source software DHIS2 for interoperability (23).

In India, to boost the foundation of interoperability and for reliable ICT infrastructure, the country has prioritized establishing a national digital healthcare ecosystem whereby, as of 2020 \$63.6 million is allocated in budget by private sector led companies (36). Similarly, a Joint Annual Review (JAR) report in Nepal has outlined that the Ministry of Finance (MoF) has circulated protocols for efficient and effective public expenditure on the use of digital technology. Whereby, the protocol also states to conduct an audit of the implementation status by the concerned entity (72).

In terms of digital health technologies being affordable, findings revealed that this as a one-time investment having long-term benefits. Several studies done in LMICs, have also concluded digital technologies to have a reduced cost, with the potential to expand affordable health services in all settings (64). Findings also indicated about the affordability of the software, that are handled by outsourcing companies and are associated with high cost. While the software companies also seem to be interested in generating money to gain commercial space in the market. Findings also emphasized in developing software at the country level, on the contrary, Pakistan's experience tells otherwise, where the trend of developing custom-made software at the country level has resulted in lack of creativity and limited value for money (66).

*Reflection on the Conceptual Framework:* The digital health readiness framework adopted in this study is most suitable for developing countries. Out of the eight original readiness components, one readiness i.e., public-patient readiness, was omitted from this study, since the targeted participants were only health professionals. This framework was used for designing the interview guide for conducting KIIs. Additionally, the readiness components were used as the theme whereby, the study findings were analysed under those themes as a deductive approach.

During the process of analysis, one of the themes i.e., organizational readiness was discarded since the information on institutional set-up, support from organization and use of digital health technology in the organization happen to be repetitive in other themes such as Infrastructure readiness and Government readiness.

*Strengths and Limitation of the study:* In terms of strengths of this study, it had a good coverage of participants as they were selected from all three tier thereby, having wide range of perspectives from policy makers, health professional, community health workers, and EDPs. This is the first qualitative study to assess digital health readiness in Nepal using the adapted digital health readiness assessment framework. The participants in this study had a good acceptance on this

framework. They were providing information based on the themes generated from the conceptual framework.

As this study was carried out as a part of the academic thesis within limited time-period, it was not possible to have a sample from the entire country. Therefore, the findings presented from two provinces could be different in other provinces. The findings also suggest that the digital health is still in a premature stage in Nepal, and the literature review on the readiness of digital health is also available in minuscule amount. The study consists of perspectives from public and private health workers, due to which there could be chances of social desirability biases. To prevent this, the researcher and RAs used probing guided by the themes of the conceptual framework.

*Researcher Reflexivity:* The interviews were taken by the researchers and by two RAs and in order to maintain the uniformity in questioning the participants, the researcher conducted thorough online training on interview guide and consent form for similar interpretation of the questions. The participants in this study included experts working in digital health intervention, and to minimize the information bias, the researcher in this study, hired RAs from mid-level background i.e., student pursuing bachelor's degree in public health so that they don't override the information provided by the participants. Including this, once the recordings were received, the researcher kept notes on the way interviews were conducted and later provided both RAs with feedback for ensuring the objective of the study are met. The preliminary finding of the study was shared to the thesis advisor based on which the areas that were overlooked were given attention while finalizing the findings of the study.

## CHAPTER VI: Conclusion & Recommendation

This qualitative study assesses the readiness of digital health within the health system of Nepal. The study was conducted interviewing 21 key participants involved in providing health services using digital health technologies across federal, province and local level. The sampling of the participants was done using purposive and snowballing technique. The interviews were analysed using thematic analysis based on DHRAF, within six major themes and 12 sub-themes. The conceptual framework was useful in mapping current digital health initiatives among public and private health professional through already established themes. It also enabled the researcher to identify barriers and facilitating factors that could ultimately influence the digital health readiness within Nepal's health system.

The study found all the participants to be aware on the utilization of digital technology in health service delivery. Participants reported various information management system in place, HMIS, DHIS2, EHR and EMR. However, CHWs only knew of the mobile phone as the digital tool since they used it for disseminating health related messages in the community. While the end users at the community level in the rural setting seem to unaware about digital health. The participants informed digital health to be in the nascent stage and highlighted importance of engagement of stakeholders involved in digital health to ensure sustainability of digital health initiatives in the country.

Infrastructure such as, electricity, internet, lack of computers, geographical complexity, lack of trained human resources, were identified as the major determinants on accessing digital health technologies. Participants also revealed that health workers without motivation and from older generation were less likely to use digital technologies during service delivery. In terms of low IT literacy among the health workers, participants at federal and province level highlighted lack of digital health and EMR education in the school curriculum thus contributing to low acceptance of digital health technologies among the health workers in Nepal. Participants informed that lack of robust data security and back-up systems, could lead to loss of data, misinterpretation, hacking and data theft. Along with lack of inadequate coordination, participants highlighted lack of consistent team present in digital health initiatives.

There seemed to be collaboration with several international agencies for technical and financial support in developing digital health infrastructure (software, hardware, and maintenance). A few of the participants shared that the government allocated the budget adhering with the policies, however it lacked successful implementation at the grassroots level. This could be due to lack of financial management across the nation. Participants revealed that handling of software is done through outsourcing companies and had concerns on the sustainability of the software, due to lack of human resources to manage and produce software.

Only a few participants mentioned using data interoperability in their organization for disease control programs. Some of the participants highlighted the need of having a data exchange policy in place for efficient access to digital information from one hospital to another. Many participants internalized the importance of having software and hardware in the country for effective data exchange process and highlighted its linkage with a developing protocol for data exchange using the software. The fact that participants felt the need and demanded for integrated tools to improve

the access for health services could be demonstrated as an enabling factor. Including this, the availability of information system such as EMR, DHIS2 had enabled the health workers to plan better for health service provision at the working sites. But there seemed to be lack of planning at the human resources level. MoHP were found to invest in HMIS, while the national level budget for institutionalization of digital health was not available in the country but found digital health as a one-time investment and not an expenditure due to its long-term benefits.

## **RECOMMENDATIONS**

Prior to any digital health implementation, it is effective to assess the readiness of digital health in all aspects of Nepal's health system. Following are the recommendations of this study in three major domains for policy makers and stakeholders involved in health sector for smooth implementation of digital health interventions in days to come.

### **Policy/Strategy level**

- MoHP should take a leadership in developing a separate digital health strategy across three-tier system. Those strategies on digital health should be aligned with Digital Nepal Framework and National Health Policy to guide the province and local government for effective health service delivery.
- There should be advocacy in purchasing globally proven software and tools for the optimal use of digital health technologies at the federal and province level through technical committee formed for digital health.
- The NHRC should focus on conducting more research on assessing digital health readiness, covering the entire country, for generating evidence informed decision and planning, regarding digital health interventions in Nepal.

### **Efforts in Coordination**

- A technical committee with consistent team members for digital health should be formed at MoHP and at province health directorate including EDPs for mainstreaming digital health into Nepal's health system.
- The MoHP should collaborate with MoICT to develop nationwide policies on privacy, data connectivity and protocols related to data exchange for establishing stringent regulations in place. This would ensure effective management between public and private health sectors who then could invest willingly.
- MoHP and Ministry of Finance (MoF) should establish a monitoring mechanism to ensure effective financial management for digital health interventions across three tier system.
- As lack of infrastructure resulted in decreased motivation among the health workers, to make optimal use of digital health, the MoHP should coordinate with MoICT for continuous internet and electricity supply in the complex geographical setting.
- MoHP in coordination with provincial health directorate and NHRC should immediately conduct ground level assessment using approaches such as technology adaption management for assessing the acceptability of digital health technologies within Nepal's health system.

### **Initiation in increasing awareness and capacity building**

- MoHP and Ministry of Education and Science Technology (MoEST) should coordinate effectively in developing course curriculum in digital health, mobile health and EMR for creating foundation of digital health among the health professional from early on.
- MoHP in coordination with National Health Training Centre (NHTC) and EDPs, should focus on strengthening the capacity of health workers in utilization of digital health technologies.
- MoHP should implement EMR and EHR in all health facilities of Nepal by ensuring adequate budget to get real-time data for strengthening health service delivery, as stated in National e-health strategy.
- The NHEICC in coordination with Nepal Telecom (NTC) involved in disseminating messages to the general public, should plan awareness related activities on digital health for health service delivery, especially in rural settings. Including this an awareness campaign at the community level should be organized by the local government to generate demand for digital health among end users.



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## Annexes

### Annex 1: Interview Guide

English version

1. How aware are you about the use of digital health technologies for health service delivery? What are they?
2. What are the current digital health collaborations within public and private health sector?
3. What do you think are the current perceived need for digital health services in the community level during your work tenure?
4. How affordable are digital health technologies for the Nepalese health system for service uptake?
5. What do you think are the constrains in digital health service delivery?
6. What are perceived negative effects for digital health service delivery?
7. What is current IT literacy and how competent do you think are current health care workers in utilization of digital health technology during health service delivery?
8. What are the perceived benefits of digital health technology?
9. How is your experience of using digital health technology in your job setting?
10. How do you perceive the alignment of digital health implementation with current government strategies and policies?
11. At the governance level what do you think is the readiness of regulations, guidelines, monitoring and supporting mechanism for digital health initiatives?
12. What is the financial consideration for the investment, operational and maintenance cost related to digital health technology that are in use?

## Nepali translated interview guide

१. नेपालको स्वास्थ्य सेवा प्रवाहमा डिजिटल हेल्थ टेक्नोलोजिको प्रयोगबारे तपाईं कतिको सचेत हुनुहुन्छ ? र ति के के हुन्?
२. हाल डिजिटल स्वास्थ्यमा सार्वजनिक र निजी स्वास्थ्य क्षेत्रको सहकार्य कस्तो छ?
३. तपाईंको सेवाकालमा सामुदायिक स्तरमा डिजिटल स्वास्थ्य सेवाहरूको लागि महसुस वर्तमान आवश्यकता के हो जस्तो लाग्छ?
४. नेपाली स्वास्थ्य प्रणालीका लागि डिजिटल स्वास्थ्य प्रविधिहरू कतिको किफायती छन्?
५. तपाईंको विचारमा डिजिटल स्वास्थ्य सेवा प्रवाहका बाधाहरू के के हुन्?
६. तपाईंको विचारमा डिजिटल स्वास्थ्य सेवा प्रवाह नकारात्मक असरहरू के के होला?
७. तपाईंको विचारमा हाल कार्यरत स्वास्थ्यकर्मीहरू डिजिटल स्वास्थ्य प्रविधिको प्रयोगमा कतिको शिक्षित र सक्षम हुनुहुन्छ ?
८. डिजिटल स्वास्थ्य प्रविधिको फाइदाहरू के के हुन सक्छन्?
९. तपाईंको कार्य क्षेत्रमा (office) डिजिटल स्वास्थ्य प्रविधिको प्रयोगको अनुभव कस्तो छ?
१०. तपाईंको विचारमा डिजिटल स्वास्थ्य कार्यक्रमहरू सरकारको वर्तमान नीति र रणनीतिहरूको आधारमा कार्यान्वयन भईरहेका छन् ?
११. सरकारी स्तर वा नितीगत तहमा तपाईंलाई डिजिटल स्वास्थ्यको पहलका लागि नियम, निर्देशिका, अनुगमन र सहयोगी संयन्त्रको तयारी कस्तो लाग्छ ?
१२. प्रयोगमा रहेका डिजिटल स्वास्थ्य प्रविधिको लगानी, सञ्चालन र मर्मतसम्भार का लागि वित्तीय व्यवस्थापन कस्तो छ ?

## Annex 2: Research Table

Table 3: Research table for KII

English version

| S.N. | Specific Objectives   | Issues   | Methods | Respondents  |
|------|---|--|---------|--|
| 1.   | To map the current digital health initiatives in health service delivery                                  | <ul style="list-style-type: none"> <li>• Aware about digital health program/intervention</li> <li>• Public Private partnership</li> <li>• GoN programs</li> <li>• I/NGO programs</li> <li>• Funding</li> </ul>   | KII     | <ul style="list-style-type: none"> <li>• Chief of IHMIS</li> <li>• Section head from NHEICC</li> <li>• EDPs representative working in digital health</li> <li>• Health Directorate</li> <li>• Focal person ICT</li> <li>• Chief of Municipal Health Section</li> <li>• Health Facility in-charge</li> </ul>                      |
| 2.   | To discuss dimensions affecting the use of digital health in health service delivery                      | <ul style="list-style-type: none"> <li>• Education</li> <li>• Network/signal coverage</li> <li>• Geographical feasibility</li> <li>• ICT adoption</li> <li>• IT literacy</li> <li>• Affordability/Cost</li> <li>• Accessibility</li> <li>• Awareness</li> <li>• Perceived benefits</li> <li>• Acceptance</li> <li>• Health service need</li> <li>• Skills/Experience</li> <li>• Collaboration</li> <li>• Data interoperability</li> <li>• Infrastructures</li> </ul> | KII     | <ul style="list-style-type: none"> <li>• Chief of IHMIS</li> <li>• Section head from NHEICC</li> <li>• Representative from INGO working in digital health</li> <li>• Health Directorate</li> <li>• Focal person ICT</li> <li>• Chief of Municipal Health Section</li> <li>• Health Facility in-charge</li> <li>• FCHV</li> </ul> |
| 3.   | To assess the enabling factors in implementation of digital health initiatives in health service delivery | <ul style="list-style-type: none"> <li>• Network/coverage</li> <li>• Technology penetration (mobile phone)</li> <li>• Coordination/collaboration</li> <li>• Information communication technology</li> <li>• Capacity building/training</li> </ul>  | KII     | <ul style="list-style-type: none"> <li>• Chief of IHMIS</li> <li>• Section head from NHEICC</li> <li>• Representative from INGO working in digital health</li> </ul>   |



|    |   |  |     |   |
|----|---|--|-----|---|
|    |   | <ul style="list-style-type: none"> <li>• Funding</li> <li>• IT literacy</li> <li>• Governance</li> <li>• Coherent Policies</li> </ul>  |     | <ul style="list-style-type: none"> <li>• Health Directorate</li> <li>• Focal person ICT</li> <li>• Chief of Municipal Health Section</li> <li>• Health Facility in-charge</li> <li>• FCHV</li> </ul>  |
| 4. | To analyze the alignment of digital health initiatives with the national strategies | <ul style="list-style-type: none"> <li>• Strategy/policy/regulations</li> <li>• Mainstreaming</li> <li>• Integration</li> <li>• Research</li> <li>• Planning</li> <li>• Health management information system</li> <li>• Coordination /Collaboration</li> </ul> | KII | <ul style="list-style-type: none"> <li>• Strategies/policies availability</li> <li>• Digital Nepal Framework</li> <li>• E-Health strategy</li> <li>• Nepal Health policy</li> <li>• Nepal Health Sector Strategy</li> <li>• Interviews: <ul style="list-style-type: none"> <li>• Chief of IHMIS</li> <li>• Section head from NHEICC</li> </ul> </li> <li>• EDPs representative working in digital health</li> <li>• Health Directorate</li> <li>• Focal person ICT</li> <li>• Chief of Municipal Health Section</li> <li>• Health Facility in-charge</li> </ul> |

Research table Nepali version

| क्र.स. | विशिष्ट उद्देश्य  | समस्या  | विधिहरू   | उत्तरदाताहरू  |
|--------|---|---|---|---|
| १.     | स्वास्थ्य सेवा वितरणमा हालको डिजिटल स्वास्थ्य पहलहरू नक्सा गर्ने                                  | <ul style="list-style-type: none"> <li>डिजिटल स्वास्थ्य कार्यक्रमहरू बारे सचेत</li> <li>सार्वजनिक निजी साझेदारी</li> <li>सरकारी कार्यक्रमहरू</li> <li>अन्तर्राष्ट्रिय र राष्ट्रिय गैर-लाभकारी संस्थाका कार्यक्रमहरू</li> <li>कोष</li> </ul>   | प्रमुख<br>जानकार<br>अन्तर्वाता  | <ul style="list-style-type: none"> <li>IHMIS को प्रमुख</li> <li>NHEICC विभाग प्रमुख</li> <li>डिजिटल स्वास्थ्यमा काम गर्दै आई.एन.जीओ.का प्रतिनिधि</li> <li>स्वास्थ्य निर्देशनालय</li> <li>ICT फोकल व्यक्ति</li> <li>नगरपालिका स्वास्थ्य शाखा प्रमुख/स्वास्थ्य संस्थाको इन्चार्ज</li> </ul>   |
| २.     | स्वास्थ्य सेवा वितरणमा डिजिटल स्वास्थ्यको प्रयोगलाई असर गर्ने आयामहरू छलफल गर्ने                  | <ul style="list-style-type: none"> <li>शिक्षा</li> <li>नेटवर्क/सिग्नल कभरेज</li> <li>भौगोलिक सम्भाव्यता</li> <li>सूचना सञ्चार प्रविधिको ग्रहण</li> <li>सूचना सञ्चार प्रविधिको साक्षरता</li> <li>किफायती / लागत</li> <li>पहुँच</li> <li>चेतना</li> <li>कथित लाभ</li> <li>स्वीकृति</li> <li>स्वास्थ्य सेवा प्रदायकको आवश्यकता</li> <li>सीप/अनुभव</li> <li>सहयोग</li> <li>डाटा आदानप्रदान</li> <li>पूर्वाधारहरू</li> </ul> | प्रमुख<br>जानकार<br>अन्तर्वाता  | <ul style="list-style-type: none"> <li>IHMIS को प्रमुख</li> <li>NHEICC विभाग प्रमुख</li> <li>डिजिटल स्वास्थ्यमा काम गर्दै आई.एन.जीओ.का प्रतिनिधि</li> <li>स्वास्थ्य निर्देशनालय</li> <li>ICT फोकल व्यक्ति</li> <li>नगरपालिका स्वास्थ्य शाखा प्रमुख</li> <li>स्वास्थ्य संस्थाको इन्चार्ज</li> <li>महिला सामुदायिक स्वास्थ्य स्वयंसेविका</li> </ul> |
| ३.     | स्वास्थ्य सेवा वितरणमा डिजिटल स्वास्थ्य पहलहरूको कार्यान्वयन गर्ने सक्षम कारकहरू मूल्याङ्कन गर्ने | <ul style="list-style-type: none"> <li>नेटवर्क/कभरेज</li> <li>प्रविधि प्रवेश (मोबाइल फोन)</li> <li>समन्वय/सहयोग</li> <li>सूचना सञ्चार प्रविधि</li> <li>क्षमता निर्माण/प्रशिक्षण</li> <li>कोष</li> <li>आईटी साक्षरता</li> <li>सुशासन</li> <li>सुसंगत नीतिहरू</li> </ul>  | प्रमुख<br>जानकार<br>अन्तर्वाता  | <ul style="list-style-type: none"> <li>IHMIS को प्रमुख</li> <li>NHEICC विभाग प्रमुख</li> <li>डिजिटल स्वास्थ्यमा काम गर्दै आई.एन.जीओ.का प्रतिनिधि</li> <li>स्वास्थ्य निर्देशनालय</li> <li>ICT फोकल व्यक्ति</li> <li>नगरपालिका स्वास्थ्य शाखा प्रमुख/स्वास्थ्य संस्थाको इन्चार्ज</li> <li>महिला सामुदायिक स्वास्थ्य स्वयंसेविका</li> </ul>          |
| ४.     | राष्ट्रिय रणनीतिहरूसँग डिजिटल स्वास्थ्य पहलहरूको पङ्क्तिबद्धता विश्लेषण गर्ने                     | <ul style="list-style-type: none"> <li>रणनीतिर नीति र नियमहरू</li> <li>मुख्य प्रवाह</li> <li>एकीकरण</li> <li>अनुसन्धान</li> <li>योजना</li> <li>स्वास्थ्य व्यवस्थापन सूचना प्रणाली</li> <li>समन्वय/सहयोग</li> </ul>  | कागजात<br>समीक्षा<br>रणनीतिर<br>नीति<br>र नियमहरू<br><br>प्रमुख<br>जानकार<br>अन्तर्वाता | <ul style="list-style-type: none"> <li>कागजात समीक्षा</li> <li>डिजिटल स्वास्थ्य फ्रेमवर्क</li> <li>ई-स्वास्थ्य रणनीति</li> <li>नेपाल स्वास्थ्य नीति</li> <li>नेपालको स्वास्थ्य क्षेत्र रणनीति</li> <li>अन्तर्वाता</li> <li>IHMIS को प्रमुख</li> <li>NHEICC विभाग प्रमुख</li> </ul>  |
|        |   |   |   | <ul style="list-style-type: none"> <li>डिजिटल स्वास्थ्यमा काम गर्दै आई.एन.जीओ.का प्रतिनिधि</li> <li>स्वास्थ्य निर्देशनालय</li> <li>ICT फोकल व्यक्ति</li> <li>नगरपालिका स्वास्थ्य शाखा प्रमुख/स्वास्थ्य संस्थाको इन्चार्ज</li> </ul>   |

## Annex 3: Ethical Approval

Figure 5: KIT ethical waiver letter



**KIT** Royal  
Tropical  
Institute

### RESEARCH ETHICS COMMITTEE

Contact: Sandra Alba  
s.alba@kit.nl

To: Eliza Apprazia KC  
By E-mail: e.kc@student.kit.nl

Amsterdam, 1-04-2022

**Subject** Decision Research Ethics Committee regarding "Decision Research Ethics Committee regarding "Assessing the readiness of digital health among stakeholders from public and private health sector in health service delivery in Nepal" (S-178)"

Dear Eliza Apprazia KC,

The Research Ethics Committee (REC) of the Royal Tropical Institute has reviewed your application for a waiver for a "Decision Research Ethics Committee regarding "Assessing the readiness of digital health among stakeholders from public and private health sector in health service delivery in Nepal" (S-178) study that was originally submitted on 23-3-2022

Your proposal has been exempted from full ethical review based on the following considerations:

- a. the participants will be involved in their professional capacity only; the issues to be covered in the topic list cover information related to the duties of the respondents and information in the public domain; questions related to any personal questions are not included;
- b. the participants will be asked informed consent before the data collection. This to make sure voluntary and informed participation is taking place and the participant can decide to decline or withdraw participation at any moment during the process without any effect on reputation, or other consequences;
- c. participating in this study does not bear any physical, psychological and/or socio-economical risk or discomfort;
- d. all information will be derived, processed, stored and published anonymously;

The Committee grants this waiver provided that you inform the GDPR project officer about your research project for GDPR monitoring purposes.

The Committee requests you to inform the Committee if substantive changes to the protocol are made, important changes to the research team take place or researchers are added to the research team.

The Netherlands  
Fax +31 (0)20 568 8444

Moreover, the Committee requests you to send the final report of the research containing

ABIN AMR10 40 50 05 970  
ABIN AMR10 USD 62 62 46 183

Royal Tropical Institute

a summary of the study's findings and conclusions to the Committee, for research managing and training purposes of the REC.

Please note that in case the final report is not submitted to the REC, or GDPR measurements are not taken care of sufficiently, this may have consequences for your next research proposal.

Wishing you success with the research,

Sandra Alba  
Co-chair of the KIT REC

Figure 6: NHRC ethical approval letter



Government of Nepal  
**Nepal Health Research Council (NHRC)**



Ref. No.: 21062

5 June 2022

**Ms. Eliza Apprazita KC**  
 Principal Investigator  
 KIT Royal Tropical Institute/VU  
 Netherlands

**Ref: Approval of thesis proposal**

Dear Ms. KC,

This is to certify that the following protocol and related documents have been reviewed and granted approval through the expedite review process by the Expedited Review Sub-Committee meeting for its implementation.

|   |  |   |   |
|---|--|---|---|
| <b>Protocol Registration No/<br/>Submitted Date</b> | 218/2022 MT<br>16 May 2022   | <b>Sponsor Protocol No</b>  | NA  |
| <b>Principal Investigator/s</b>                     | Ms. Eliza Apprazita KC   | <b>Sponsor Institution</b>  | NA  |
| <b>Title</b>  | Assessing the readiness of digital health among stakeholders from public and private health sector in health service delivery in Nepal |   |   |
| <b>Protocol Version No</b>                          | NA   | <b>Version Date</b>   | NA  |
| <b>Other Documents</b>                              | 1. Data collection tools<br>2. Informed consent form<br>3. Work plan   | <b>Risk Category</b>  | Minimal risk                                |
| <b>Co-Investigator/s</b>                            | 1. Dr. Onaedo Ilozumba   |   |   |
| <b>Study Site</b>                                   | Nepal  |   |   |
| <b>Type of Review</b>                               | <input checked="" type="checkbox"/> Expedited<br><input type="checkbox"/> Full Board<br>Meeting Date: 27 May 2022                      | <b>Timeline of Study</b><br>5 June 2022 to August 2022<br><br><b>Duration of Approval</b><br>5 June 2022 to 5 June 2023<br><br>This approval will be valid one year | <b>Frequency of continuing review</b><br>NA |



Government of Nepal  
**Nepal Health Research Council (NHRC)**



Ref. No.: 4062

|   |               |
|---|---------------|
| Total budget of research  | NRs 31,000.00 |
| Ethical review processing fee   | NRs 10,000.00 |
| <b><u>Investigator Responsibilities</u></b>   |               |
| <ul style="list-style-type: none"><li>• Any amendments shall be approved from the ERB before implementing them</li><li>• Submit progress report every 3 months</li><li>• Submit final report after completion of protocol procedures at the study site</li><li>• Report protocol deviation / violation within 7 days</li><li>• Comply with all relevant international and NHRC guidelines</li><li>• Abide by the principles of Good Clinical Practice and ethical conduct of the research</li></ul> |               |

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

Thanking you,

**Dr. Pradip Gyanwali**  
Member Secretary

Tel: +977 1 4254220, Fax: +977 1 4262469, Ramshah Path, PO Box: 7626, Kathmandu, Nepal  
Website: <http://www.nhrc.gov.np>, E-mail: [nhrc@nhrc.gov.np](mailto:nhrc@nhrc.gov.np)

## Annex 4: Informed Consent

English version

I am Eliza Apprazita KC a student from the KIT Royal Tropical Institute studying MSc. in Public Health. I am conducting a study to assess the readiness of digital health among stakeholders from private and public health sector for health service delivery in Nepal. The study will collect information from stakeholders (health care professionals and actors from Ministry of Health) from the three tier levels (federal, province, and local) within four months' time-period.

### ***Procedure including confidentiality***

If you agree I would like to interview you about the readiness of digital health among stakeholders from public and private health sector in Nepal. This interview will take place through virtual platform (zoom, Microsoft team and/or agreed virtual platform) which will last for about an hour. To make sure that I do not forget or change what you are saying, I will tape record the answers you give if you permit. Everything that will be said, written down will be kept totally confidential. Your name will not be recorded or written down. Notes and recording will be stored in a computer folder where the passcode will only be accessible to myself. Only the team involved in the thesis supervision can have access to the notes. Later the data will be used to conduct the analysis to draw some major findings. Tape recording will be destroyed 6 months after completing the study.

The study will be qualitative following purposive sampling strategies using maximum variation sampling technique. As a data collection technique, key informant interviews with above mentioned stakeholders will take place

### ***Risk, discomforts and right to withdraw***

You can refuse to answer the questions and/or withdraw from the study anytime without negative consequences.

### ***Benefits***

This study might not help you directly, but the findings obtained from this study will help to inform the policy makers in Nepal on effective implementation of digital health in health service delivery by identifying the challenges and solutions through the study methodology. The participants of this study will be provided with internet cost of Rs. 300 each as a benefit since the KII would be conducted using online platform. The money will be reimbursed to the participants after taking the consent from each participant

### ***Sharing the results***

After analyzing the data from this study, I will be sharing the results with my supervisors, thesis panel members, and pertinent stakeholders involved in this study process. In addition, the outcome of this study will be compiled in written format through the thesis report. If you would like to receive a copy of the thesis report, please let me know and I will make this possible for you.

### ***Consent and contact***

Do you have any questions that you would like to ask? \*

Are there any things you would like me to explain again or say more about?

Do you agree to participate in the interview?

**DECLARATION: TO BE SIGNED BY THE RESPONDENT**

Agreement respondent

The purpose of the interview was explained to me, and I ..... (Name of participant) agree for the interview.

---

Signed \_\_\_\_\_ Date \_\_\_\_\_

If you have any questions or want to file a complaint about the research, you may contact:

|   |   |   |
|---|---|---|
| Contact information organization<br>Name: Eliza Apprazita<br>KC (PI)<br>Position: Student<br>Email:<br><a href="mailto:e.kc@student.kit.nl">e.kc@student.kit.nl</a> | Contact for Ethics Committee<br>Name: Sandra Alba<br>Position: Co-chair of the KIT REC<br>Email: <a href="mailto:s.alba@kit.nl">s.alba@kit.nl</a> | Nepal Health Research Council<br>Name: Nepal Health Research Council<br>Email: <a href="mailto:nhrc@nhrc.gov.np">nhrc@nhrc.gov.np</a><br>Address: Ramshah Path, Kathmandu, Nepal<br>P.O. Box 7626 |
|---|---|---|

\*Questions raised by the participants

| Questions | Response |
|-----------|----------|
|           |          |
|           |          |

## Informed Consent Nepali version

मेरो नाम एलिजा अपराजीता केसी हो, हाल म (KIT) रोयल ट्रिपिकल इन्स्टिच्युटमा एम. पि.एच डिग्री अध्ययन गर्दै आएकी छु। यसै अध्ययनको क्रममा मैले मेरो थीसिस “नेपालमा स्वास्थ्य सेवा प्रवाहका लागि निजी र सार्वजनिक स्वास्थ्य क्षेत्रका सरोकारवालाहरूबीच डिजिटल स्वास्थ्यको तत्परता र तयारीको मूल्याङ्कन” भन्ने विषयमा अध्ययन गर्न गईरहेको छु। यस अध्ययनले ६ महिनाको अवधिभित्र तीन तहका (संघ, प्रदेश र स्थानीय) विभिन्न सरोकारवालाहरूबाट (स्वास्थ्य सेवा प्रदायक, र स्वास्थ्य मन्त्रालयका अधिकारी) जानकारी संकलन गर्नेछु।

### गोपनीयता र प्रक्रिया

यदि तपाईं सहमत हुनुहुन्छ भने, म तपाईंलाई नेपालमा सार्वजनिक र निजी स्वास्थ्य क्षेत्रका सरोकारवालाहरू बीच डिजिटल स्वास्थ्यको तयारीको बारेमा अन्तर्वार्ता लिन चाहन्छु। यो अन्तर्वार्ता भर्चुअल प्लेटफर्म (जुम, माइक्रोसफ्ट टिम र/वा सहमत भर्चुअल प्लेटफर्म) मार्फत हुनेछ जुन करिब एक घण्टासम्म चल्नेछ।

तपाईंले भन्नु भएको कुराहरू नबिर्सिन वा त्यसमा केहि परिवर्तन नगर्ने कुरा सुनिश्चित गर्दै तपाईंको अनुमतिमा म तपाईंले दिनुहुने जवाफहरू टेप रेकर्ड गर्नेछु। तपाईंले भन्नु भएको कुराहरू र मैले लेखेको टिप्पणीहरू पूर्ण रूपमा गोप्य राखिनेछ। तपाईंको नाम कहीपनि उल्लेख गरिने छैन। यस अध्ययनका क्रममा गरिएका रेकर्ड वा नोटहरू कम्प्युटर फोल्डरमा सुरक्षित राखिने छ, जसको पासकोड म सँग मात्र उपलब्ध हुनेछ। थीसिस सुपरिवेक्षणमा संलग्नहुने टोलीलाई मात्र नोटहरू उपलब्ध हुनेछ। संकलन गरिएका सूचना तथा जानकारीहरू प्रमुख निष्कर्षहरू निकाल्नको लागि मात्र उपयोग गरिनेछ। अध्ययन पूरा भएको ६ महिनापछि टेप रेकर्डिङ नष्ट गरिनेछ।

यस अध्ययन संचालन गर्नको लागि गुणात्मक अध्ययन (Qualitative study) र उद्देश्यपूर्ण नमूना (Purposive sampling) का विधिहरू अपनाइनेछ। तथ्याङ्क सङ्कलनकालागी माथि उल्लेखित सरोकारवालाहरूसँग मुख्य सूचनादाता अन्तर्वार्ताहरू हुनेछन्।

### जोखिम, असुविधा र अध्ययन छोड्ने अधिकार

तपाईंले प्रश्नहरूको जवाफ दिन अस्वीकार गर्न सक्नुहुन्छ र/वा नकारात्मक परिणामहरू बिना कुनै पनि समय अध्ययनबाट असहभागी हुन सक्नुहुनेछ।

### फाइदाहरू

यस अध्ययनले तपाईंलाई प्रत्यक्ष रूपमा मद्दत नगर्न सक्छ, तर यस अध्ययनबाट प्राप्त निष्कर्षहरूले अध्ययन पद्धति मार्फत चुनौती र समाधानहरू पहिचान गरी स्वास्थ्य सेवा वितरणमा डिजिटल स्वास्थ्यको प्रभावकारी कार्यान्वयनका लागि नेपालका नीति निर्माताहरूलाई जानकारी गराउन मद्दत गर्नेछ।

### नतिजाहरूको आदानप्रदान

यस अध्ययनबाट प्राप्त तथ्याङ्कहरू विश्लेषण गरेपछि, म मेरा पर्यवेक्षकहरू, थीसिस प्यानल सदस्यहरू, र यस अध्ययन प्रक्रियामा संलग्न सम्बन्धित सरोकारवालाहरूसँग नतिजाहरू साझा गर्नेछु। साथै, यस अध्ययनको नतिजालाई थीसिस रिपोर्ट मार्फत लिखित ढाँचामा परिणत गर्नेछु। यदि तपाईं थीसिस रिपोर्टको प्रतिलिपि प्राप्त गर्न चाहनुहुन्छ भने, कृपया मलाई धाढा दिनुहोस् र म तपाईंको लागि यो सम्भव बनाउनेछु।

### सहमति र सम्पर्क

- के तपाईं मलाई केहि प्रश्न सोध्न चाहानुहुन्छ ? \*
- के तपाईं केहि कुराहरू थप व्याख्या गराउन चाहनुहुन्छ ?
- के तपाईं अन्तर्वार्तामा भाग लिन सहमत हुनुहुन्छ ?



घोषणा: उत्तरदाता द्वारा हस्ताक्षर गर्न

सहभागीतको सम्झौता

म ..... लाई अन्तर्वार्ताको उद्देश्य व्याख्या गरिएको थियो र म अन्तर्वार्ताको लागि सहमत छु ।

| हस्ताक्षर   | मिति   |   |
|---|--|---|
| यदि तपाईं सँग कुनै प्रश्नहरू छन् वा अनुसन्धानको बारेमा उजुरी दर्ता गर्न चाहनुहुन्छ भने, तपाईं निम्न व्यक्तीहरूसँग सम्पर्क गर्न सक्नुहुन्छ : |  |   |
| अनुसन्धानकर्ता<br>नाम: एलिजा अपराजिता के.सी<br>स्थिति: विद्यार्थी<br>इमेल:<br>e.kc@student.kit.nl   | (KIT) इथिकल कमिटी<br>लागि सम्पर्क गर्नुहोस्<br>नाम: सान्द्रा अल्वा<br>स्थिति: सह-अध्यक्ष<br>इमेल:<br>s.alba@kit.nl | (NHRC)इथिकल कमिटी लागि<br>सम्पर्क गर्नुहोस्<br>नाम: नेपाल स्वास्थ्य अनुसन्धान परिषद्<br>इमेल: nhrc@nhrc.gov.np<br>ठेगना: रामशाह पथ, काठमाडौं, नेपाल<br>पोस्ट बक्स नम्बर: ७६२६<br>फोन नम्बर: ९७७-१-४२५४२२० |

सहभागीहरूले उठाएका प्रश्नहरू \*

| प्रश्नहरू | जवाफ |
|-----------|------|
|           |      |
|           |      |

## Annex 5: Search Strategy

Literature search was done using Google Scholar, PubMed, WHO research portal, web page of Ministry of Health and Population (MoHP). Snowballing technique was also used to search further relevant articles. As the literature availability on digital health readiness in Nepal was limited, therefore, filter by date was used from the year 2000. The inclusion criteria for data search were associated with Nepal and other low-middle-income countries within the range of digital health readiness for health service delivery. Anything that was beyond the utilization of digital health technologies in health service delivery within the country's health system were all excluded in this study. Following table presents the detail search strategy:

Table 4: Detailed chain of key words and combination

| Key words   | Key words and Booleans  | Sources                     |
|---|---|-----------------------------|
| “Digital Health”<br>“e-health”<br>“m-health”<br>“Health service delivery”<br>“Health System”<br>“Conceptual framework”<br>“Developing countries”<br>“Readiness”<br>“Nepal”<br>“Low-middle-income-countries” | “Digital Health” OR "e-health" AND<br>"Conceptual framework" AND<br>"Developing countries" es” AND “Global” | Google Scholar              |
|   | “Digital Health” OR “(e-health)” OR “(m-health)” AND “Readiness” AND “Policies” AND “Global”                | Google Scholar              |
|   | “Digital Health” AND “strategies” AND<br>“World health Organization”  | WHO portal/PubMed           |
|   | “Digital Health” AND “strategies” AND<br>“Nepal”  | Google Scholar/MoHP website |
|   | “Digital Health” AND “Health service delivery” AND “Low Middle-income countries”                            | Google Scholar              |
|   | “Digital Health” AND “Health service delivery” AND “Low Middle-income countries”                            | PubMed/Google Scholar       |
|   | “Digital Health” AND “Challenges” AND<br>“Low Middle-income countries”                                      | Google Scholar              |
|   | “Digital Health” AND “opportunity” AND<br>“Low Middle-income countries”                                     | Google Scholar              |
|   | “Digital health” AND “Public health sector” OR “government” AND “global” *                                  | Google Scholar              |

|  |   |                |
|--|---|----------------|
|  | “Digital health” AND “network” AND “feasibility” AND “Low Middle-income Countries”            | Google Scholar |
|  | “Digital Health” AND “External Development Partners” AND “Global”                             | Google Scholar |
|  | “Digital Health” AND “Health worker” “Low Middle-income Countries”                            | Google Scholar |
|  | “Digital Health” OR “(e-health)” AND “Government readiness” AND “Low Middle-income countries” | Google Scholar |