

Strengthening Urban Primary Healthcare through the Use of eHealth Programs - The  
SUPER Study in Peru  
by

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Thesis submitted in partial fulfillment of  
the requirements for the degree of  
Master of Science in the Graduate Program  
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ABSTRACT

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## **Abstract**

Background: Primary healthcare is an important facet of non-communicable disease treatment and eHealth is a viable strategy to strengthen PHC in urban low-middle income settings such as in Lima, Peru. This study aimed to describe the current use of eHealth technologies in primary healthcare settings in urban Peru, assess the perceived effectiveness of eHealth technologies in NCD service delivery at the PHC level, and identify barriers and facilitators to the utilization of eHealth technologies at the PHC level. Methods: In-depth interviews using a semi-structured interview guide were conducted among identified and invited policy makers, researchers and experts, and healthcare workers in Lima, Peru. Three districts in Lima were selected and interviews with healthcare workers were conducted at facilities from those districts. Interviews were transcribed and thematic analysis was utilized to identify themes in the data. Results: A total of 14 participants were interviewed, including 2 policymakers, 5 experts, and 7 healthcare workers. Current use of eHealth were electronic medical records and telehealth applications. Participants were in favor of eHealth use and perceived eHealth as being effective. Human resources and digital literacy were factors cited as facilitators while data security, political climate, and compatibility were seen as barriers to implementation and utilization of eHealth. Conclusions: The use of eHealth in Peru is still in its early stages, particularly in PHC

settings and for NCDs. At the intersection of these three topics there has been little progression of integration and utilization. Sentiment towards eHealth among researchers, policymakers, and healthcare workers is high and a number of barriers must be addressed to implement and utilize eHealth and reap its benefits.

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# 1. Introduction

Non-communicable diseases (NCDs) are the leading causes of global mortality and disability requiring sustainable, community-based care. Primary healthcare has been recognized by the World Health Organization, national health reform champions, and researchers for its important role in providing accessible, affordable, and high-quality care to patients and the public, particularly for NCDs<sup>1</sup>. However, effective strategies to continue development and strengthen primary healthcare are currently lacking. One direction to improve and strengthen primary health care is through the use of electronic health technologies, often referred to as eHealth. eHealth has the potential to improve and enhance service delivery at the primary healthcare level through improving quality of care, expanding the scope of health care delivery services to difficult to reach populations, and achieving cost-effective solutions.

Strengthening Urban Primary Healthcare through the use of eHealth Programs, abbreviated as the SUPER study, explored challenges, opportunities, and effective strategies for eHealth utilization in urban settings in low-middle income countries such as Peru. The SUPER study is a larger overall qualitative study focusing on eHealth utilization in PHC facilities for NCD service delivery.

Findings from other settings in the study, as well as findings in Peru, provide opportunities for robust comparison between a variety of settings.

Cardiometabolic diseases (CMD), which includes coronary heart disease and stroke, are the leading causes of death globally, with a vast majority of these deaths occurring in LMICs. In Latin America, deaths from cardiovascular disease was estimated to increase by 145% from 1990 to 2020 in both women and men, compared to increases of just 28% and 50% in women and men, respectively, in high income countries over the same time period<sup>2</sup>. As in other LMICs, many countries in Latin America face the issue of the double burden of disease, where non-communicable diseases increase in prevalence and gravity while infectious diseases continue to be an additional challenge. For instance, in Peru, non-communicable diseases were the causes of 66% of mortality in 2014, while communicable, maternal, perinatal, and nutritional conditions made up 24% of the causes of mortality. Primary healthcare plays an essential role in the treatment and care of NCDs, since often early symptoms of NCDs are not acute and are developed over the long term. As such, regular visits and continued care that can be provided at PHC centers are vital to the detection, management, and treatment of NCDs.

At the primary healthcare (PHC) level, eHealth has the potential to enhance service delivery in multiple ways, through improving quality of care, extending the scope and reach of health care delivery services reaching difficult to reach population, breaching geographical divides and achieving cost-effectiveness. However, systematic evidence on utilization of eHealth in strengthening PHC service delivery is far from adequate, despite the proliferation of new but often fragmented eHealth initiatives. There is also a lack of evidence on identifying the right services and expected outcomes and how eHealth technology does not function as merely tools but can help within a service delivery framework particularly at the PHC level. It is important to know why the eHealth tools are not fully utilized at PHC level and what are the essentials (such as digital connectivity, infrastructure, and human resources) to encourage eHealth utilization. Thus, there is a need for evidence-based studies to fill this gap, which can provide important guidance for the policy makers to create the favorable environment for implementing and utilizing eHealth at PHC service delivery level.

The standards and quality of PHC in Peru are largely dictated by the subsystem that the PHC facility belongs to. The healthcare system in Peru is decentralized and administered by several entities, similarly to many other Latin American countries<sup>3</sup>. Due to the segmentation of the Peruvian healthcare system,

each subsystem is self-contained, with its own network of providers and facilities. Each subsystem also has its group of decision makers and sources of funding, which has affected eHealth implementation and more. The largest part of the system is the Comprehensive Health Insurance system (SIS), which is directly administered by the Ministry of Health and covers about 60% of the population. The social security program EsSalud is available to people who are formally employed and covers approximately 30% of the population. The armed forces and police each have their own subsystems, and together with the private sector cover the remaining 10% of the population.

In the instances where eHealth has been explored in high income countries, findings have been promising, especially in terms of treatment of cardiometabolic diseases such as diabetes and hypertension. Mobile phones are commonplace, and use of eHealth technologies on the phones is common among PHC patients despite limited health literacy<sup>4,5</sup>. In the US, electronic messaging has been found to be easy to use for patients and have an impact on the health outcomes of both diabetic and hypertensive patients<sup>6,7</sup>. Use of other eHealth technologies such as electronic health records also show promise of improving the quality of care<sup>8</sup>. Even in high income countries, further evidence is needed to inform policy and practice relating to eHealth<sup>9</sup>.

The WHO defines eHealth as “the use of information and communication technologies for health”<sup>10</sup>. Within this broad umbrella term exist subcategories of technologies and applications that cater to specific needs and uses. For instance, telehealth involves the use of telecommunications and virtual technologies in order to deliver care beyond traditional facilities and forms a basic foundation to eHealth. Another example of eHealth technology is mobile health. Mobile health, or mHealth, can be defined as the use of mobile telecommunication and multimedia technologies to aid in the delivery of healthcare<sup>11</sup>. Implementation of eHealth technologies have been ongoing at an international level throughout the past decade and a half in both developed and developing countries. The types of technologies used vary from country to country and setting to setting, such as the National Programme for Information Technology by the National Health Service in the United Kingdom, the eHealth investment in healthcare commitment by the United States, and mHealth programs in Argentina and Peru<sup>2</sup>. In low-middle income countries, information and communication technologies represent an avenue of pursuit using tools that could improve both quantity and quality of disease management. Specifically, in Latin America, coverage by the mobile phone network is high among the population with over 100% penetration<sup>12</sup>. With the widespread proliferation of smartphone adoption and continued growth of smartphone use, mHealth interventions are among the

most attractive types of eHealth technologies for implementation for prevention, management, and control of a number of diseases in the region.

Literature regarding eHealth use is relatively limited as this nascent field continues to develop. Much of the literature that has been previously published has primarily focused on and been conducted in settings in developed countries. A scoping review conducted as part of the SUPER project at large found a majority of studies on eHealth in PHC settings for NCD treatment were done in high-income countries such as the USA, Australia, the UK, and Canada. In the same vein, qualitative studies on eHealth more commonly report well-established implementations in high-income settings. Even in these settings, the participants in the majority of qualitative studies tend to be patients, although some studies involving doctors, nurses, and policymakers have also been conducted<sup>13-15</sup>. Qualitative research on eHealth in developing countries is lacking, but has the potential to provide valuable information and insights from a variety of stakeholders involved in various aspects of the health system.

Previous studies have found that mobile phone, especially smartphone, strategies including phone calls, short message system (SMS), applications for clinical decision support, and telemedicine have had benefits in a number of aspects, including improving patient-provider communication, promoting behavioral changes, and improving chronic disease management and medication

adherence<sup>16</sup>. Past studies found benefits in developed countries, but with the fast and massive growth of mobile phone use in LMICs, mHealth implementation is becoming a viable opportunity to address shortcomings in healthcare systems in these countries, such as overburdened and unevenly distributed health care workforce, limited financial resources, and growing prevalence of chronic diseases<sup>17,18</sup>. Effectiveness of mHealth and more generally eHealth in LMICs is still in need of continued evaluation, as do the attitudes and perspectives towards eHealth in these settings.

In developing countries, eHealth interventions have the potential to be a low-cost solution to several of the challenges faced in resource-limited settings. However, research in these potential avenues has been scarce, particularly in the contexts of primary health and NCDs. Early findings in countries such as China and Nepal have found that eHealth technologies such as blood pressure monitoring and mobile phone apps hold promise in improving health outcomes in these settings<sup>19,20</sup>. Due to the ubiquity of mobile phones, much of the research has been focused on the topic of mHealth and has found success in mobile phone based management packages for hypertension and diabetes<sup>21,22</sup>. Reviews that have been conducted in exclusively developing countries as well as those that include both developed and developing country have found early promise in eHealth technologies but a gap in evidence to fully support the use of eHealth<sup>23-</sup>

<sup>25</sup>. Especially in resource-limited settings like those found in developing countries, it is important to coordinate efforts using eHealth with other health programs of the country, such as community health worker training and outreach<sup>26</sup>.

Legal and political proceedings regarding eHealth in Peru have been primarily focused on telehealth, starting with the establishment of the establishment of the National Telehealth Commission in 2003, coinciding with the 2005 National Telehealth Plan. The 2005 plan included 3 axes of telehealth development: provision of health services, education and training for the population and health care workers, and management of health services. In 2016, a telehealth framework law was passed in the Peruvian congress, laying out plans to progressively incorporate telehealth services provision and establish stability. This effort is coordinated by the Ministry of Health (MINSA), which is also pursuing goals of universal health coverage in the country.

In Peru, eHealth research is primarily oriented towards telehealth and distance technologies for rural outreach. Research on eHealth for cardiometabolic conditions including diabetes, stroke, and hypertension is limited compared to research for infectious diseases including HIV and tuberculosis. There is also a gap in qualitative research on eHealth in Peru, a methodology that could better capture the context and details of eHealth use.

## **1.1 Objectives**

The objective of the study was to identify challenges, opportunities, and implications for eHealth utilization and integration for non-communicable disease care at the primary healthcare level in urban settings in Peru through qualitative methods. In order to achieve this objective, three main aims were targeted: (1) to describe the current use of eHealth technologies in primary healthcare settings in urban Peru, (2) to assess the perceived effectiveness of eHealth technologies in NCD care at the PHC level, and (3) identify barriers and facilitators to the utilization of eHealth technologies at the PHC level.

## **2. Methods**

The study was conducted in urban settings in Peru and is a multinational research project with arms underway in four other countries (China, Nepal, the Philippines, and Kenya). An overall protocol was used as the basis of the research, but appropriate adjustments were made to fit the contexts of Peru. Due to the nature of our aims, quantitative methods were inappropriate in order to properly capture context dependent, nuanced findings. We used qualitative methods including in-depth interviews among key informants and other stakeholders to achieve our aims.

Ethical approval was obtained from the Duke Kunshan University Institutional Review Board and the Institutional Review Board at Universidad Peruana Cayetano Heredia in Peru.

### **2.1 Setting**

The study was conducted in Lima, Peru, the capital of the country and an urban city where nearly one third (11 million) of the total population of Peru lives. The site selection was assisted by local collaborators to ensure accountability and feasibility. First, we selected two districts in Lima with PHC facilities, Chorillos and San Martin de Porres (figure 1). Second, we identified three PHC facilities from the selected districts where we would recruit key informants. The facilities were selected based on input from local collaborators.

Due to Peru's fragmented health system, health centers administered by EsSalud, the national social security program, and MINSA, the Ministry of Health, were included. Representatives of the private healthcare sector were additionally included.



**Figure 1. Districts of Lima, Peru, with San Martín de Porres and Chorillos highlighted.**

## **2.2 Sample**

The sampling of key informants was based on purposive selection in order to maximize variation. Utilizing partnerships and collaborations with universities, hospitals, and researchers in Peru, including the School of Public Health and the CRONICAS Center of Excellence in Chronic Diseases, both at

Universidad Peruana Heredia Cayetano (UPCH) in Peru, a sizeable knowledge base and connections with key informants were already in place and utilized. Additionally, recommendations from key informant research participants and snowballing of stakeholders further expanded stakeholder coverage. We aimed to recruit three types of stakeholders: policymakers, experts and researchers, and healthcare workers. Considering the variability in response rates, we approached more key informants in each category to ensure the numbers presented. The final sample included 2 policymakers, 5 experts and researchers, and 7 healthcare workers for a total of 14 participants.

We included policy makers at different levels. At the national level, we selected key informants from different ministries based on their experience in drafting and implementing policies related to eHealth. Inclusion criteria for policy makers were that they were formerly or currently held a policy making position at the Peruvian Ministry of Health or the National Institutes of Health, had experience in drafting and working on policies surrounding the topics of eHealth, primary healthcare, or non-communicable disease, and were able to discuss their experiences and knowledge on those topics. Some policy makers held other positions at UPCH or the National University of San Marcos (UNMSM), but were considered policy makers for the interview.

Interviews of researchers and experts prioritized those whose research focuses on NCDs, eHealth, and PHC. Researchers were contacted based on personal knowledge and recommendations. Snowballing of interviewed researchers and experts for other relevant researchers and experts was used to expand coverage. The inclusion criteria for researchers and experts were that they were currently or previously involved in work or research on the topics of eHealth, primary healthcare, or non-communicable disease, and were able to discuss and disclose their knowledge and experiences on those topics.

Healthcare workers were interviewed at the site of the healthcare facilities that they worked at. We included healthcare workers in a number of different roles, including facility directors, physicians, nurses, and support staff. Inclusion criteria for healthcare workers were that they were actively working in a primary healthcare facility, that they were responsible for providing care or support for care for patients with non-communicable disease, and that they were able to discuss their experiences in the healthcare facility.

### ***2.3 Procedures***

Potential participants who expressed interest were contacted to schedule a face-to-face interview. Written informed consent was obtained from the respondents before the interview commenced. Interviews were audio recorded in

their entirety in order to be transcribed for analysis. Interviews were conducted in a private setting to allow for the participant to speak freely and were conducted in Spanish. The interviews were conducted by a team of two researchers or trained research assistants. One researcher acted as the interviewer and the other acted as the notetaker, observer, and recording manager. The duration of interviews ranged from approximately 20 minutes to 120 minutes. Interviews with policy makers were conducted at the policy maker's offices, and interviews with experts were conducted at universities and health facilities where the stakeholders worked. Interviews with healthcare workers were conducted at the site of their health care facility.

Participants were given a unique study identification number. Following data collection, all identifiable information and the study identification number were stored separately from interview data and stored offline on an encrypted computer with access available only to the key project team members. This protected file was only accessed if the need to contact participants arose, a policy still in place. Identifiable information was not linked with responses, mentioned in future reports, or used for any other purposes. All identifiable information, as well as audio recordings, will be destroyed following the completion of all research activities and deliverables.

## 2.4 Data Collection Instruments

The in-depth interviews were semi-structured following a topic guide (Appendix A), which included opening questions and probes to further explore or clarify the responses. The topic guide was translated into the local language, Spanish. Back translation of the guide was applied to ensure the quality of translation. The topic guide used varied slightly depending on the type of stakeholder being interviewed. The interview guide was developed in part based on a scoping review completed before data collection as well as preliminary findings from other arms of the SUPER project in other country settings. The guide was divided into 5 sections, with each exploring a specific topic. A summary of the guide can be found in table 1.

**Table 1. Format of semi-structured interview guide**

Section	Name	Topics Covered
1	Background Information	<ul style="list-style-type: none"><li>• Personal Information</li><li>• Background and Experience</li><li>• Responsibilities</li><li>• PHC Facility Characteristics (Healthcare workers only)</li></ul>
2	Current eHealth Usage	<ul style="list-style-type: none"><li>• Defining eHealth</li><li>• Existing implementations of eHealth</li><li>• Objectives of existing eHealth</li></ul>
3	Usability and Attitudes	<ul style="list-style-type: none"><li>• Attitudes toward eHealth</li><li>• Effects of eHealth</li><li>• Factors affecting implementation and utilization</li></ul>

4	Effectiveness of Current eHealth Usage	<ul style="list-style-type: none"> <li>• Perceived benefits and drawbacks of eHealth</li> <li>• eHealth applications outside of PHC facilities</li> <li>• Reasons for success of eHealth</li> </ul>
5	Future Directions	<ul style="list-style-type: none"> <li>• Future development strategy</li> <li>• Areas to be strengthened by eHealth</li> <li>• Suggestions to improve eHealth use</li> </ul>

## **2.5 Analysis**

All interviews were conducted in Spanish, and were transcribed verbatim in Spanish. Data analysis was conducted with the original Spanish transcripts. Thematic analysis was used to identify emerging themes in the textual data. First, a codebook of structural codes was generated based on the interview guide. These structural codes mapped on to the aims of the study, including existing eHealth technologies, perceived effectiveness, and factors previously identified as affecting use and implementation. Next, transcripts were read line by line and open coding was performed to identify important themes and subthemes related to the research aims. Document and thematic memos were used to organize and address emerging themes to develop a codebook, which was used to code the transcripts. A priori themes based on a scoping review that was previously completed for the SUPER study were applied in addition to any emerging themes. The codebook was primarily organized by the specific aims of the study. For example, one code for perceived effectiveness of eHealth was “quality of

care.” This code was defined as “issues including continuity of care, coordination between levels of care, and patient provider relationship.” A representative quote or example was also included in the codebook for clarity. Interviews were grouped by stakeholder type (policy maker, researcher and/or expert, healthcare worker) and analyzed to identify any themes that emerged that were specific to a particular stakeholder type. Data were managed with NVIVO12 qualitative analysis software.

### **3. Results**

In total, 14 participants were interviewed for the study. Of the participants, 2 were policy makers, 5 were researchers and experts, and 7 were healthcare workers from 3 different primary care facilities. Among the experts, 3 were eHealth and telehealth researchers and 2 were experts in primary healthcare. The duration of interviews ranged from approximately 20 minutes to 120 minutes. Interviews with policy makers were conducted at the policy maker's offices, and interviews with experts were conducted at universities and health facilities where the stakeholders worked. Interviews with healthcare workers were conducted during visits to each of the primary care facilities.

#### ***3.1 Current Use of eHealth***

##### **Electronic health records and referral systems**

Electronic health record (EHR) systems and referral systems do exist but vary in scope and quality depending on the subsystem the facility is a part of. In SIS, both systems are a part of e-Qhali, an EHR platform specifically for primary care. This platform started as a maternal and child health program that expanded and added modules to become a tool for primary care centers. This expansion is still ongoing and not all e-Qhali modules are available for use in all health centers. In EsSalud facilities, the Health Services Management System (SGSS) is used and is more developed and expansive than e-Qhali. Private clinics also have

EHR systems, but these vary from clinic to clinic. Some systems, such as EsSalud and private facilities, have EHR systems that are interconnected between hospitals and facilities within its network but not with facilities associated with other systems. These platforms are also implementing features to make appointments for visits but walk-ins and appointments by phone are still more commonplace.

*“WawaRed was an electronic medical record only for the mother, but today, it has evolved with other modules. So, they already have their E- Qhali, E- Qhali is the name of the electronic medical record.”*

-Policy maker 2

*“Now, for example, in the EsSalud system, the SGSS, that reference was generated by me from my office. The Ministry of Health system, since everything is not computerized, the E- Qhali only works for some modules.”*

-Primary healthcare expert 1

### **Tele-diagnosis**

Another application of providing health at a distance is tele-diagnosis. Tele-diagnosis consists of sending measurements or screenings from a health center that may not have the capacity to read the result to a health professional who is able to make the reading. Participants mentioned its use specifically in the private sector as well as in EsSalud, the Peruvian social security insurance

scheme. The medical labs are also interconnected, allowing for tests to be sent to a laboratory in a centralized location and results to be uploaded to the patient's history to be immediately accessible at the facility.

*"[One] eHealth technology in the country is the tele diagnosis , where a large institution such as EsSalud has a lot of experience having implemented tele diagnostic services and have saved several million [soles (Peruvian currency)] and have also monetized it; [they made] several million [soles] centralizing all the readings of for example x-rays, tomography, resonance, centralized."*

-Policy maker 1

In addition to the existing tele-diagnostic tools, participants also mentioned developing deep learning, artificial intelligence tools to aid in the diagnosis as a way to further reduce workload when human resources are lacking.

*"What it does is take the X-ray plate, the photo is taken, the photo is sent to a cloud where there is an algorithm. The algorithm uses some artificial intelligence procedures and gives a score, that numerical score is sent as an alert to the doctor. This, to tell you that this patient does not have TB, do not worry. But if you have a high score, the specialist must confirm it."*

-eHealth expert 2

**Tele-mentoring**

Tele-mentoring was mentioned and emphasized by several of the participants. The purpose of tele-mentoring is to let health personnel in rural or resource limited settings communicate with specialists, with the goal of providing tools and information to improve performance. Although there is some emphasis on using tele-mentoring as part of training and education, it is also used as an extended support system for doctors and other personnel. Teleconsultation, connecting patients with health personnel, was also mentioned briefly, but is used more as a way to connect patients with specialists in hospitals, not primary care physicians. WhatsApp is used informally for both of these purposes as well; both for patient-provider communication and communication between providers.

*“Tele-mentoring is a concept where we provide support to personnel who are in remote areas. We do not tell them what to do, it is not a consultation area. They do not ask us about patients, but we provide advice that is more in the educational part. If they have a question about their medical work, we have a staff of teachers and health professionals who can answer those questions... management, ethics, legal, assistance.”*

-eHealth expert 2

### **3.2 Perceptions and effectiveness of eHealth**

#### **eHealth law**

In 2016, Peru passed a framework law on telehealth, providing concrete guidelines for structure and payment mechanisms for telehealth services by healthcare providers in the country. All of the participants were familiar with the law. In terms of the interface between the law and actual eHealth implementations, participants mentioned a number of issues. One commonly mentioned theme was that some eHealth technologies were implemented prior to the passing of the law and are not completely congruous with the framework. With the law being passed so recently, regulations are limited mostly to administrative aspects. Several participants were optimistic that with time the eHealth law and actual use of eHealth will become better aligned.

*“It is very likely that there are still information systems that have not gone through this process or that have not been identified in the reform process. This, to be able to control and align according to what the law and regulation says as such. So, what exists is partial. That is why we still have a challenge in the information, because we have not finished aligning.”*

-eHealth expert 2

#### **Equity**

A perception of eHealth that was repeated in interviews was that it can improve access and can streamline the health system. In particular, eHealth has helped to alleviate some of the strain on health personnel in Peru, which is limited in some places. Participants also noted that patients benefited as well; particularly in reducing wait times and improving access.

*“The effect is, first, it is a democratizing effect of health. Elsewhere they give part of social justice. That is to say, that health is no longer only for those who have access, those who can afford it or those who have somehow been informed that they can access it. So, this is a possibility of taking that leap.”*

-Primary care expert 1

*“In terms of positives, it’s power, in some way to centralize attention in basic services. This definitely helps especially to countries where they have different limitations at the demographic level. Another benefit of telehealth itself is also to decongest in some way the health system, which sometimes unfortunately cannot [handle the load] due to personal deficiency.”*

-eHealth expert 2

### **Quality**

Another perceived benefit of eHealth was that it could catch oversights and mistakes that are occur in systems that don’t use eHealth. This benefit is especially pertinent in cases where patients are visiting multiple healthcare

facilities or are in contact with several providers. By reducing oversights, such as not prescribing a patient the same drug twice from different clinics, eHealth can reduce costs and also help the patients.

*“Of course, for example, with electronic medical records it is this that one does not need to review many physical things as before, but simply to look... let’s say, what the doctor has written in the other consultations.”*

-Primary care expert 2

### **Workload**

A perception that emerged was that eHealth was increasing the workload of some personnel. However, this increase was not directly due to the implementation of eHealth but instead was attributed to systems that are not well integrated into the existing system. For instance, when discussing EHR in EsSalud clinics, one participant noted that doctors could use the electronic record as a reference, but any changes made to the record also had to be printed out and signed by hand.

*“Well, many doctors complain that they have to do more things related to technology and spend less time on patients. That in relation to computerized medical records. Because prior to that, that they had to manually fill out, for example, laboratory orders, or some things or indications, they give it to the patient and the patient processed it elsewhere. But now with the system they have*

*to generate, print and give it. That takes a while. In fact, doing that probably decreases the consultation time."*

-Primary care expert 2

### **Wrong intentions**

A particular concern that emerged about eHealth is that sometimes technologies are being implemented for the sake of the technology, instead of being used as a means to the end goal of improving health. Not only are such programs ineffective but they also can make advocating for other programs or implementation of eHealth more difficult after the fact.

*"They are not oriented to solve people's problems, right? I have also witnessed projects that simply do it for financing or simply do it for using "x" technology that is sponsored by the "x" site. So that worries me a lot, because I see it, I see that it exists ... not enough, but that it exists, that there is."*

-Policy maker 1

## **3.3 Factors affecting implementation and utilization**

### **Age and Digital Literacy**

All of the participants mentioned that acceptability is a factor that affects integration and utilization of eHealth. Acceptability was identified a priori as a factor, but it emerged as being affected by a number of reasons, including digital

literacy. Some participants mentioned digital literacy explicitly, while others conflated the concept with age, suggesting that younger health personnel and patients are more accepting of eHealth. However, generally age was mentioned along with the fact that younger people tend to use other technology in the daily life, which translates to a willingness to accept technologies in their work as well.

*“There are some health workers, generally at all levels who are totally opposed to the introduction of technology. Some because they don’t have the skills, because they fear technology, ok. The average age of health personnel is above 40 years. They are not born in the digital age and do not understand it.”*

-Policy maker 2

*“People feel that younger doctors and nurses are more likely to use technology, it gives me that impression. It makes them more difficult for older doctors sometimes to adapt quickly to the use of technology. Then, facilitators could suddenly be age.”*

-Primary care expert 2

### **Fear of Technology**

Fear of technology was discussed by several participants as affecting acceptability among health personnel. Generally, the fears stemmed from not knowing how eHealth would affect their work or that the technology would be

able to replace them, which also reflects in part the perception that eHealth is able to streamline work and make the work flow more efficient.

*That change was tremendous, because many doctors disagreed. The work was different because it was not only to manage, but also to work on a system to follow up. So, in the part of what the staff is, there is a fear of being replaced by the machine, system or solution. That is something that is the main thing.*

-eHealth expert 2

### **Human resources and training**

Training and human resources at large are emphasized and identified a priori as a hugely important factor that, when properly implemented, serves as a facilitator to eHealth implementation and utilization. Training can prepare the health care workforce to properly use any new eHealth technologies and leverage that advantage to improve service delivery. Additionally, training is an opportunity to change attitudes towards eHealth. Participants generally discussed training as an area that is lacking, but inadequate human resources were not attributed specifically to a lack of training but seen as an issue in and of itself. For instance, appropriate human resources to support eHealth technologies without necessarily being directly involved in its use was cited as a facilitator. With appropriate human resources, participants noted that it would streamline the process of eHealth use and improve service.

*Because if the skills gap is not generated too. I will have super specialized technology that I know that, if I learn it, it will serve me, but without the human resource, it will definitely not help me...I think that we must strengthen human resources, at the first level of attention.*

-Healthcare worker 6

*Continue training, that is the best suggestion. It is important that we train ourselves and also from above, from the management that directs this, also that we continue training so that they can improve all processes. So be a better management.*

-Healthcare Worker 1

### **Data security**

As an emerging field, particularly in Peru, regulations surrounding eHealth have been lax or non-existent. This trend continues in regards to data. Policymakers, doctors, and patients in Peru have yet to reach a consensus on data management and patient rights in regards to data. The general consensus on the patient experience regarding data security was that it is not yet an issue that patients or the general public are aware of or well informed about. Concerns about data security that emerged were centered more on abuse of the data by those who already have access to that data rather than breaches in data security allowing for outside forces gaining access to the data. In that regard, participants

were not concerned, citing successful data security measures in other sectors such as banking.

*Another example are confidentiality issues regarding health data. Let's say, comparing it to US standards. Today insurers try to pull information and there are institutions that give it to them, with name and surname. That, let's say, is not ethical, but it is not prohibited*

-Primary care Expert 5

### **Future development strategy**

Although there are initiatives in place and a trend towards increased use of eHealth in PHC in Peru, a gap highlighted by policymakers, experts, and healthcare workers was a lack of a future development strategy. Despite the passage of the telehealth law, there is no national guidance on how eHealth should be implemented. The reasoning for this emerging theme was attributed to a number of factors. Most commonly mentioned was that eHealth is still in its early stages in Peru, and as the market and demand for these technologies matures and grows participants expected those in leadership positions to champion the cause and push for more guidance. Others discussed financial issues, that MINSA lacks the funding to add eHealth as a part of their development strategy.

*“No national guide has been done so far. For example, what is the appropriate technology for primary health care? There are the protocols about what is done when you have the flu, you have pneumonia and when you have everything. But there is not yet a national guide that is the standard. That is, the minimum that a health establishment should have in technology is the following: a, b, c. Well, we don’t have it. “*

-eHealth expert 1

### **Political climate**

The national political climate, an a priori theme, was described by most participants as a barrier to implementation. Obviously, when there is political support to emphasize eHealth, it is beneficial, but the issue is that political goals and the political climate shifts too fast for there to be constant support and long-term goals for eHealth and also for specific eHealth programs that may have been started by a previous regime.

*“The Ministry of Health has made many changes. The ministers last a year, half a year. Then, the Minister has a vision and says now, then comes another and says no. So, that does not allow them to advance in information technologies for a single path.”*

-Primary care expert 1

*“In the last two years all cabinets have changed three times. [T]here are many applications that were made in these last two years to monitor Dengue. Then when they changed the entire cabinet, that remains archived. Well, at least I think that is not used. So, because they want to move forward, they want to make progress, but so there are many changes so many things go back.”*

-eHealth expert 1

### **Compatibility and Integration**

Given the segmentation of the health system in Peru, the issue of compatibility and integration was generally viewed as a barrier. Because decisions about which eHealth technologies to use are independently made, there is no coordination between the different subsystems. Additionally, there is also a disconnect between different levels of care. For instance, within SIS, the EHR program that is used within some of the hospitals and the health centers are different and incompatible. Furthermore, some facilities lack any sort of EHR system, further complicating the issue. Policymakers noted that compatibility was a topic that they had thought about when implementing some programs, but due to the nature of the health system in Peru it was something that was not entirely in their control.

*“Of the hospitals, the only hospital that already has a system is Villa El Salvador. When you tell me about the clinics, for example the Delgado clinic has its own system, they bought their system. The San Felipe clinic also has a system. But one of the big problems is that the systems are not necessarily inter operable and they are not thinking about that.”*

-Policy maker 2

### **Prioritization of PHC and NCDs**

PHC and NCDs are not high priorities from both a national health and eHealth perspective. Primary goals and where most eHealth is being used is in maternal health and infectious diseases, while secondary and tertiary facilities are receiving more support for eHealth use. Among HCWs in facilities run by MINSA, which are more resource limited than EsSalud or private facilities, patients with NCDs are referred to more complex hospitals. Awareness of NCDs, both in the general public as well as in government-led health targets, is minimal, overshadowed by other health objectives, namely infectious diseases and maternal and child health and nutrition. The lack of emphasis on NCDs is compounded by the prioritization of eHealth use in higher level hospitals first. As a new field, eHealth is being deployed first in these settings, while pilot testing and basic technologies are the only options utilized in primary care facilities.

*Hum, no. Noncommunicable diseases ... well, most doctors have training, there are trainings or they themselves are trained to be able to care for patients. But it would really be interesting if it happened. If there are opportunities for these [eHealth technologies] to occur, it could be done.*

-Healthcare worker 2

## 4. Discussion

This study provides perspective into the experiences and current state of eHealth use for NCD care in primary care settings in Lima, Peru. The results show that in PHC facilities eHealth technologies are beginning to be implemented, most notably in the areas of HER and telehealth applications. Our findings indicate that eHealth in primary care is perceived as having positive effects even in its current limited state, but inadequacies in factors such as training and human resources pose barriers to increased implementation and utilization. As eHealth in this setting is in its early stages, some procedures and regulations have not yet been formalized, leading to some negative perceptions towards effectiveness. Other factors that were identified as barriers, facilitators, or both for implementation and utilization of eHealth include digital literacy, data security, political climate, compatibility, and prioritization of health goals.

Our findings found that the most prevalent eHealth technologies currently in use in primary healthcare facilities in Lima were electronic health records and telehealth applications, particularly tele-diagnosis and tele-mentoring. The electronic health record system E-Qhali was developed from a system initially targeted towards maternal and child health, Wawared. The benefits of Wawared were not only validated in studies but also mentioned by some participants and its successes led to its expansion to its current form as E-

Qhali<sup>27</sup>. Another example of EHR systems in use in Peru is the PIH-EMR, developed by Partners in Health specifically to support TB treatment in Peru, although this system runs parallel to E-Qhali and is neither coordinated nor compatible<sup>28</sup>. Telehealth applications generally fell in line with the framework established by the 2016 telehealth law. Four general groupings of telehealth are described in the law: tele-management, tele-diagnosis, rural telehealth use, and telemedicine<sup>29</sup>.

Generally, participants viewed eHealth in primary care facilities as beneficial. These technologies were seen as a way to improve quality, and equity, and participants were in favor of using eHealth. Previous studies conducted in hospitals elsewhere in Peru had similar findings. One such study noted that the majority of healthcare workers found EHR systems to be satisfactory<sup>30</sup>. Our findings differ from past findings in that the workload was increased through the use of some eHealth technologies. This could be due to a number of reasons. The PHC facility setting is different from a hospital setting, and these differences could be a cause for the increased workload. The additional work that healthcare providers had was centered around the fact that they had to print out documentation and physically sign them even after adding the information to the system. Other arms of the SUPER study conducted in various settings found similar themes of redundant work, such as in Nepal, the Philippines, and China.

Some of the factors that were viewed as facilitators to the implementation and utilization of eHealth at the PHC level for NCD treatment were digital literacy and adequate human resources and training. Digital literacy was conflated with age among participants, with younger people tending to have better digital literacy. Most agreed that increased digital literacy among healthcare workers led to increased acceptance of eHealth technologies. This sentiment has been found to be similar in other settings as well, not only among providers but also among users and patients<sup>31</sup>. In other settings of the SUPER study, digital literacy was not highlighted as a beneficial factor, but digital illiteracy was cited as a concern for use of eHealth. Other factors affecting eHealth implementation and use have been noted in previous studies, although not in the context of urban Peruvian PHC facilities. Some of the most notable factors include fear of technology, data security, and compatibility<sup>32-34</sup>. Political climate and future development strategy are a pair of factors that dovetail into one another, and both were seen as barriers to implementation and utilization. Having a specific, targeted strategy is valuable in order to provide guidance based on evidence, identify and describe specific needs, and ensure that expenditures are justified<sup>35</sup>. Establishment of such a strategy requires political support and willpower. However, participants generally described the political climate in Peru as unstable, especially given the changes in objectives as those in

positions of power and leadership regularly change. Regime change was a barrier that was identified in other settings where eHealth is in its early stages of development, such as Nepal. Many of the factors identified were not specific to NCDs in particular. This could be due to the nature of PHC as the first level of care; needs for care of specific NCDs may be too focused for the PHC level to spend resources to address. General care has its place and value, and balancing that with the need and importance of disease specific care is crucial to maximizing the benefits of PHC.

#### ***4.1 Implications for policy and practice***

There are a number of important implications for future policy and practice regarding eHealth in Peru, particularly in regards to its use in PHC and for NCDs. Although each of these three topics may be regarded as areas worth strengthening, there is currently little being done at the intersection of these fields. For instance, headway on the telehealth law has not had a major impact in primary care settings. Clarification on what types of technology and how and when they should be used for specific levels of care would benefit both providers and patients. In the same vein, the lack of a future development strategy is an issue that should be addressed quickly; developing and implementing eHealth technology without top-down guidance risks lack of compatibility and

potentially increases inequity<sup>35</sup>. The low priority of NCDs and primary care is another issue that should be addressed through policy, but the caveat is that in resource limited settings, not all goals and targets can be weighted equally. Issues like vaccination for infectious disease and maternal child health have been emphasized at the cost of NCDs. With that being said, NCDs are an already known threat whose gravity will increase as time goes on. If possible, attending to these issues, especially through primary care, will benefit Lima and Peru in the long term. Existing sentiment among healthcare workers, policy makers, and researchers is strongly in favor of eHealth, and this attitude has propelled the field forward. Leveraging these opinions could quickly advance development through interactions with enthusiastic participants at all levels of the health system.

#### ***4.2 Implications for further research***

This project aimed for a broad overview of the current eHealth landscape in the urban Lima PHC facilities. Because our findings show that availability of eHealth varies by subsystems within the Peruvian health system, this suggests that further depth can be explored within each of the major subsystems in Peru. The private sector and the social security program, which tend to serve a different economic demographic than the MINSA administered SIS program,

could face different challenges and opportunities. Furthermore, the Peruvian government plans to continue to expand SIS to achieve universal health coverage. Given this difficult goal, additional research into how eHealth can help reduce costs and improve efficiency would be useful not only for NCDs and in a PHC setting but for the system as a whole. Another route to providing guidance for this goal is to further explore patient experiences with eHealth. This study focused entirely on health care providers; qualitative studies on the patient perspective on patient-provider interactions with eHealth could shed light on apparent weaknesses. Additionally, there are eHealth technologies that are patient-side only, experiences and opinions on technologies should also be covered.

Given the dearth of activity around eHealth and NCDs in Peru, further research in this area should be continued and specified. Pilot studies have started on the effect of eHealth on mental health patients, and additional specificity would also be beneficial. Finally, there are eHealth efforts and research underway in Peru that do not have to do with NCDs. Identifying successful cases from those findings that could have relevant applications for NCDs is another viable future endeavor. While the focus of this study was eHealth use in urban settings, eHealth in resource limited rural settings is also of importance. This is

particularly valuable in Peru, where significant geographic barriers such as the Amazon rainforest and the Andes mountains pose physical barriers.

### ***4.3 Study strengths and limitations***

The findings of this study may serve as a basis for future research on eHealth use in non-communicable disease care in primary healthcare settings in Latin American countries like Peru. However, due to the limited sample size generalizations are not possible. The small sample size of the study raises further questions of whether data saturation was achieved. In order to address this issue, ideally more interviews would be conducted, increasing the interview count for all 3 stakeholder types. Additionally, due to the fragmentation of the health system in Peru and convenience sampling, the results may have been different if other informants were involved. We acknowledged this issue and interviewed participants from multiple subsystems in order to mitigate this. Additional interviews with healthcare workers who did not use eHealth technologies or work in facilities that do not use them would provide more context and alternative perspectives. Conducting interviews in more facilities, including facilities in subsystems beyond SIS and EsSalud, such as the private health sector, would also achieve this. Another limitation of this study is that it was based on experiences and opinions from a primarily provider-focused

perspective. It is important to note that perceptions and experiences of eHealth of healthcare providers are likely to be drastically different from those of patients receiving care. Patient interviews could also shed light on the interactions between patients, healthcare providers, and eHealth. Finally, the study lacked methodological triangulation; additional questionnaires and quantitative outcomes would have strengthened the findings further.

The variety of participant types interviewed for the study was a strength. By collecting data from different types of informants from policymakers to researchers to healthcare providers allowed for data triangulation to better frame and contextualize the results. The use of a semi structured interview guide provided rich data, allowing for participants to share and express their own thoughts and experiences. In order to strengthen the credibility of data collection, the same trained interview team conducted all the interviews. The findings and interpretations were discussed with other researchers, which also helped to improve credibility and validity of the results.

## 5. Conclusion

The findings of this study show that eHealth use for NCD care in PHC settings in Lima, Peru are limited to electronic medical records and applications of telehealth. Although eHealth use is limited, players involved in the healthcare system of Peru have already seen benefits from the early cases of implementation and utilization. A number of factors including digital literacy and human resources serve as facilitators implementation and utilization of eHealth, while others are seen as barriers, including political climate, data security, and compatibility and integration. While there is promise in using eHealth for NCD treatment in PHC facilities, a long road lies ahead to fully realize its potential in settings such as Lima. With the right actors and taking advantage of positive attitudes already present, eHealth can be a key tool to address the rising issue of NCDs.

## Appendix A: Semi-structured Interview Topic Guide

(Spanish)

### Guía de entrevista Proveedores de servicios de salud

<b>I. Información personal / del centro de salud</b>
1.1 ¿Cuál es su experiencia profesional?
1.2 ¿Cuáles son sus responsabilidades actuales?
1.3 ¿Cuántos años lleva trabajando en este campo y en este centro de salud?
<b>II. Implementación de Telesalud</b>
La definición de telesalud dada por la Organización Mundial de la Salud es: <b>“El uso de las tecnologías de la información y la comunicación para la salud”</b> 2.1.1 ¿Está Ud. de acuerdo con esta definición? Si no es así, ¿Nos puede dar su definición de telesalud? 2.1.2 ¿Usted tiene conocimiento de la Ley Marco de Telesalud? ¿Conoce los principios y la definición que le dan a la telesalud en dicha ley? <i>-En caso de que no conozca sobre la Ley, se explicará y se dará un hoja que contenga un breve resumen de la definición y los principios de la telesalud mencionados en la ley.</i>
2.2 ¿Cuáles son las tecnologías de telesalud que se utilizan actualmente en su centro de salud? El enfoque del estudio se encuentra en un entorno del tratamiento de las ENT, pero también puede hablar sobre tecnologías que pueden estar relacionadas. <i>(En caso de que el entrevistado no mencione más información relacionada a las tecnologías)</i> - ¿Alguna de estas u otras tecnologías de telesalud han sido implementadas en las siguientes áreas? <input type="checkbox"/> Admisión <input type="checkbox"/> Referencia <input type="checkbox"/> Servicios de seguro <input type="checkbox"/> Comunicación entre el paciente y el proveedor  <i>Entrevistador: Usa la tabla de abajo para documentar las tecnologías. Siguiendo, pregunte si hay tecnologías para las primeras 4 áreas (resaltadas)</i>



<b>III. Usabilidad y Actitudes</b>
<p>3.1 ¿Ha identificado efectos en las conductas del personal de salud o en la atención a los pacientes dentro de su centro?</p> <p>¿Cuáles son los efectos positivos del uso de estas tecnologías de telesalud?</p> <p>¿Identifica algún efecto positivo relacionado específicamente a las ENTs?</p>
<p>3.2 ¿Cuáles son los efectos negativos del uso de estas tecnologías de telesalud en sus centros?</p> <p>¿Identifica algún efecto negativo relacionado específicamente a las ENTs?</p>
<p>3.3 De acuerdo con las consideraciones anteriores, ¿Cuál es su actitud hacia el uso de la tecnología de telesalud? (<i>Pregunta abierta</i>)</p>
<p>3.3.1. Ud. diría que su actitud general hacia la telesalud es:</p> <p style="text-align: center;"><i>leer las opciones</i></p> <p>a. Muy a favor</p> <p>b. Un poco a favor</p> <p>c. Neutral</p> <p>d. Un poco en contra</p> <p>e. Muy en contra</p>
<p>3.4 ¿Tiene alguna preocupación por el uso de la tecnología de telesalud? (por ejemplo: relacionada al costo, a la privacidad, a la pérdida de datos, etc.)</p> <p>¿Considera alguna preocupación relacionada específicamente en la gestión de enfermedades no transmisibles? Si así fuera, cuéntenos más sobre esto.</p>
<p>3.5 ¿Cómo cree que su centro de salud puede mejorar el uso de las tecnologías de telesalud en su diseño y funciones?</p>
<p>3.6 ¿Qué factores cree Ud. que influyen en el uso de la telesalud en su centro de salud? ¿En atención primaria o para ENTs? (<i>pregunta abierta</i>)</p>
<p style="text-align: center;"><i>Para cada uno de los factores antes mencionados</i></p> <p>3.6.1 ¿Considera Ud. que son facilitadores, barreras, ambos y por qué?</p>
<p>3.7 Adicionalmente, los factores que se mencionarán a continuación han sido identificados como factores que afectan el uso y la implementación de la telesalud. ¿Cuál es su opinión sobre ellos? ¿son facilitadores, barreras, o ambos, y por qué?</p>

Factor
3.7.1 Clima de político (en su centro de salud/a nivel nacional)
3.7.2 Desarrollo tecnológico: Software, hardware, acceso a Internet
3.7.3 Fondos: Adquisición y mantenimiento de software y hardware
3.7.4 Recursos Humanos: Motivación del personal para utilizar la telesalud, capacitación, apoyo de liderazgo en diferentes niveles
3.7.5 Datos y seguridad de datos: Seguridad y confidencialidad de los datos, propiedad de los datos
3.7.6 Compatibilidad e integración
3.7.6.1 De diferentes aplicaciones de telesalud
3.7.6.2 Con las responsabilidades del centro de salud
3.7.6.3 Con los sistemas de salud existentes (entre centros de atención primaria, hospitales, farmacias, etc.)
3.7.6.4 Con otros departamentos (agencias gubernamentales, compañías de seguros, compañías de Internet, etc.)
<b>IV. Efectividad</b>
4.1 En su opinión, ¿Qué tecnologías de telesalud han funcionado/funcionan en su centro?
4.1.1 ¿Qué factores contribuyeron al éxito de estos casos?
4.2 ¿Conoce algunos casos exitosos en cuanto al uso de telesalud en el Perú? ¿Conoce alguno relacionado específicamente a las ENTs?
4.2.1 ¿Qué factores considera que contribuyeron al éxito de esos casos?
<b>V. Direcciones futuras</b>
5.1 ¿Cuál es la estrategia de desarrollo futuro y la orientación de su centro de salud, con respecto a la telesalud? ¿Hay estrategias especialmente para las áreas de atención primaria y la gestión de enfermedades no transmisibles?

<p>5.2 ¿De qué maneras cree que sus instalaciones pueden fortalecer el uso de la telesalud?</p>
<p>5.3 Adicionalmente, ¿Cuál de las siguientes áreas podrían ser reforzadas en su centro de salud?:</p> <ul style="list-style-type: none"> <li>a. Admisión</li> <li>b. Referencia</li> <li>c. Servicios de seguro</li> <li>d. Comunicación entre el paciente y el proveedor</li> </ul> <p>¿Identifica alguna otra área que podría ser reforzada?</p>
<p>5.4 ¿Cuáles son sus sugerencias para integrar mejor las tecnologías de telesalud?</p> <p>¿Qué sugerencias podría dar especialmente para el control de las enfermedades no transmisibles?</p> <p><i>Nota: Si el entrevistado considera que el problema es demasiado amplio, el entrevistador puede guiarlo para responderlo a nivel de política, nivel de instalación y nivel individual (administradores, personal médico, residentes).</i></p>
<p>Fin de la entrevista</p> <p><i>Resumir los temas de la entrevista.</i></p> <p><i>Pregunte si el entrevistado tiene alguna pregunta adicional.</i></p> <p>Hemos concluido con la entrevista. ¡Gracias por tu tiempo!</p>

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