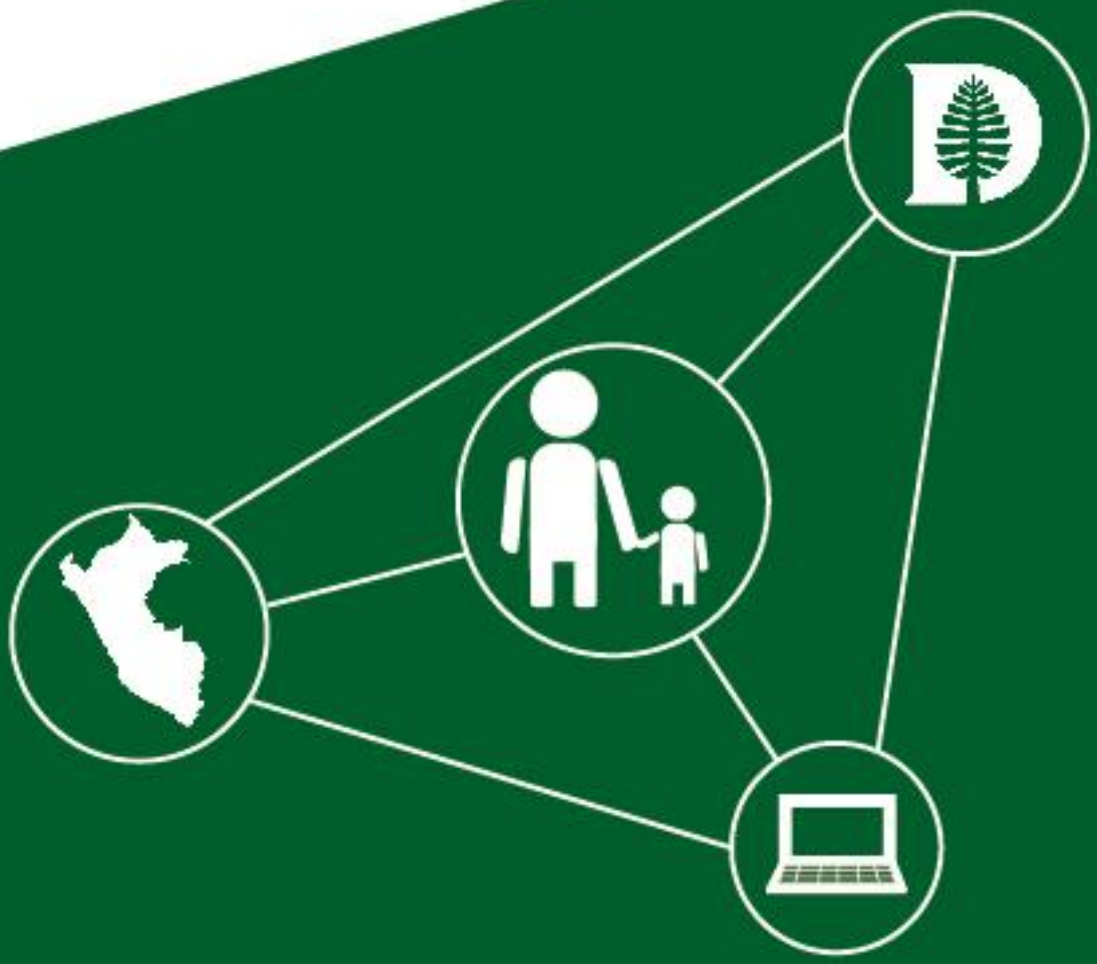
Increasing Access to Maternal and Pediatric Specialty Care via Telehealth in Peru: Recommendations and Frameworks

Dartmouth Global Health Policy Lab 2018



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About the Global Health Policy Lab

The Dartmouth Global Health Policy Lab responds to the need for a generation of leaders able to confront worldwide health challenges. A joint venture of the Dickey Center for International Understanding and the Nelson A. Rockefeller Center for Public Policy at Dartmouth College, the Global Health Policy Lab engages Dartmouth students in team-based projects conducted in partnership with Ministries of Health, nongovernmental organizations, and community partners in resource-constrained settings. The projects combine formal coursework at Dartmouth with a term of international field research culminating in the production of a policy brief. This report was co-published by Nelson A. Rockefeller Center under the same title as PRS Brief 1819-15.

Glossary of Terms

Consultant Facility: A health facility where practitioners receive requests for tele-consults from practitioners at other facilities. Consultant facilities often have a greater number of physicians and specialists than consulting facilities. Many reference hospitals are both consultant and consulting facilities.

Consulting Facility: A facility where practitioners send requests for tele-consults from practitioners at other facilities.

Information and Communication Technologies: All infrastructure and devices that connect people and organizations via digital transfer of information. This includes devices connected by both wired and wireless networks.

Telehealth: The use of information and communication technology (ICT) to provide health care across geographic distance. Telehealth can be used to refer to everything from image transfer for diagnosis to health services provided by mobile applications on smartphones. In this report, telehealth is used primarily to describe connecting health practitioners to other practitioners or patients through ICTs.

Telehealth Consultation (or Tele-Consult): When providers use technology to collaborate and share information with other providers around the care of a patient. Examples could include a primary care physician requesting input and review of a patient case by specialists, or a patient receiving pre- and post-operative care from a specialist.

> *Synchronous tele-consults:* Tele-consults where practitioners speak to each other and share information in "real-time."
>
> *Asynchronous tele-consults:* Tele-consults where a practitioner sends clinical information to be reviewed and assessed by another practitioner at a later time. Clinical information is often sent as text files, images, or audio files. This type of tele-consult is sometimes referred to as "Store and Forward."

Telehealth Infrastructure: All infrastructure that supports telehealth, from the ICT itself to the networks that connects it.

Telehealth Presenter (or Tele-Presenter) A staff member who assists in a clinical telehealth encounter, on the patient side, by assisting with aspects of the physical examination by the remote specialist. A variety of personnel, including technicians, medical assistants, nurses, midwives, or physicians, can be tele-presenters.

Reference:
Connected Care Glossary of Telehealth Terms, Dartmouth-Hitchcock Medical Center

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Increasing Access to Maternal and Pediatric Specialty Care in Peru via Telehealth: Recommendations and Frameworks

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Executive Summary

This report presents the findings of a three-month investigation conducted by a global health research team from Dartmouth, a university in the United States. The team was asked by Hospital Nacional Docente Madre-Niño San Bartolomé to investigate how the hospital could increase access to its pediatric and maternal specialty care services through the use of telehealth. As a secondary focus, the team was asked to provide recommendations for improving coordination between Hospital San Bartolomé and the telehealth unit at the Ministry of Health (MINSA), and to evaluate how MINSA could address system-level barriers to accessing specialty care via telehealth. The team investigated these questions by conducting interviews and focus groups and distributing a survey at Hospital San Bartolomé and three consulting hospitals around the country. The team also consulted the leaders of successful telehealth programs at other national reference hospitals in Lima. Through their research, the team concluded that the lack of standardized capacity for sending and receiving tele-consults was a central barrier to the creation of a robust telehealth program at Hospital San Bartolomé and consulting facilities. With input from stakeholders in Peru and the Connected Care Telehealth Program at Dartmouth-Hitchcock Medical Center, the team designed an analytical structure to standardize telehealth development at Hospital San Bartolomé and consulting facilities. This analytical structure provides the basis for immediate and long-term programmatic steps which Hospital San Bartolomé can take to increase its use of telehealth. The team also created recommendations for sustainable investment by MINSA in telehealth capacity-building and identified policy gaps which are barriers to telehealth use in the national health system.

Global Overview

Context of maternal and pediatric specialty care in Peru

In recent years, public health outcomes in Peru have improved, particularly in the areas of maternal and pediatric health. Rates of under-five mortality and maternal mortality are close to regional averages, and infant chronic malnutrition rates decreased by 10 percent between 2000 and 2015. However, health disparities remain: There is an urban-rural divide in rates of infant mortality, infant chronic malnutrition, and other maternal and pediatric outcomes [1,2].

Peru struggles with a lack and unequal distribution of human resources for health, particularly in the Ministry of Health (MINSA) publicly-funded health system. Nationally, Peru meets World Health Organization standards for physician and workforce levels, but regional variations are high and only 10 of 25 departments meet these minimum standards. Deficits in specialty care are especially pronounced and a gap of roughly 16,000 specialists exists across the country's health systems [3]. The Lima metropolitan area concentrates over half of specialists, while provinces in the Andes and Amazon regions have the lowest levels of access to specialty care. The uneven distribution of specialty care coverage in areas means that rural residents often must travel to the capital in order to consult a specialist or subspecialist [1,3,4].

Context of telehealth

Telehealth is a tool for providing health care, including specialty care, across geographic barriers and distance through the use of information and communication technology (ICT). It is a rapidly expanding global strategy for health care delivery which has great potential for facilitating broad and equitable access to medical care. Telehealth programs can be used for acute or primary care, and may include consults between doctors, consults between a doctor and a patient, and remote monitoring of a patient. Information and communication systems can also be used to provide remote trainings and management for health care providers. Due to the decreasing cost of health technologies, telehealth is an increasingly promising tool to overcome geographic, socioeconomic, and logistical barriers to care delivery [5,6,7,8].

Peru's National Institute of Telecommunications Investigation and Training created a National Telehealth Plan in 2004 with objectives of using telehealth to achieve universal health coverage and equitable access to care [9]. MINSA operates an office which oversees a telehealth network at publicly-funded health centers around the nation. The office coordinates tele-consults, tele-trainings, and image transfer for remote diagnosis. As of August 2018, 168 health centers were connected to the MINSA national telehealth network [10]. MINSA's telehealth initiative coincides with the Peruvian government's efforts to implement a fiber optic network connecting Lima to regional and provincial capital cities.

Project purpose and focus

Hospital Nacional Docente Madre-Niño San Bartolomé asked the Dartmouth Global Health Team to create policy recommendations for using telehealth consultations to increase access to maternal and pediatric specialty and sub-specialty services. Hospital San Bartolomé is a national reference center (category III-1) in the MINSA system. Stakeholders at Hospital San Bartolomé and MINSA are interested in formalizing, growing, and optimizing the hospital's ability to deliver specialty care via telehealth.

Hospital San Bartolomé is the only center in Peru which offers certain sub-specialty services in pediatric and maternal care. A telehealth program has the potential to extend access to forms of maternal and pediatric care which are currently out of reach for many Peruvians. The team's recommendations focus on programmatic initiatives which Hospital San Bartolomé and MINSA could undertake in order to connect effectively with consulting sites, build capacity for telehealth, and increase access to quality health care across the nation.

Research team

The Dartmouth Global Health Initiative fosters partnerships with health institutions worldwide to support the improvement of public health. The program facilitates international collaboration with Dartmouth students and faculty, selecting teams of students to work around the world on research projects based on the needs of foreign partners.

This year's Dartmouth Global Health Team consisted of three undergraduate students at the university. These students had significant experience with working internationally and conducting public health research.

A telehealth-focused collaboration with MINSA and Hospital San Bartolomé was initiated in 2017. With the guidance of two faculty advisors, the team spent three months at the university conducting preparatory research and designing the structure of their project. The team traveled to Peru from June-August 2018 to carry out their research and prepare their policy report.

The team also worked closely with Dartmouth-Hitchcock Connected Care, the telehealth unit at the university's medical center. Dartmouth is located in a rural area and the hospital serves communities spread over a large geographic region in New Hampshire and Vermont. Due to the geographic challenges of providing health care to these communities, telehealth has risen to the forefront as a promising tool for providing care across distance. Dartmouth-Hitchcock Connected Care seeks to use telehealth to support quality health care at rural hospitals and health centers, facilitate transfers when needed, and allow patients to receive their care close to home. The telehealth service provides tele-specialty, tele-emergency, tele-ICU, tele-pharmacy, and other services at 23 sites in northern New England. The Connected Care team consists of physicians, technical support personnel, and administrators at Dartmouth-Hitchcock Medical Center.

Methods

Methods were focused on assessing maternal and pediatric specialty care needs at health facilities around Peru; evaluating the capacity for telehealth and other forms of care delivery at Hospital San Bartolomé and other health facilities; and proposing programmatic steps to be implemented by Hospital San Bartolomé and MINSA. These central questions drove data collection methodology:

1. How could a telehealth program with Hospital San Bartolomé be used as a tool to increase maternal and pediatric health care access in remote areas of Peru?
2. What is the level of readiness for telehealth at Hospital San Bartolomé and consulting hospitals, and how could public policy interventions increase readiness?

A mixed methods approach was used to address these questions and provide a basis for programmatic recommendations. Methods were implemented at Hospital San Bartolomé and through site visits to three hospitals in Peru which could be potential candidates for consulting with Hospital San Bartolomé specialists via telehealth.

Visits to consulting hospitals

The team traveled to three hospitals in different regions of Peru in order to learn about contexts of maternal and pediatric care across the nation. Three-day visits were conducted at each hospital:

- Hospital Regional de Loreto, a III-1 hospital in Iquitos, Loreto
- Hospital Goyeneche, a III-1 hospital in the city of Arequipa
- Hospital de Pampas Tayacaja, a II-1 hospital in Pampas Tayacaja, Huancavelica

All hospitals were MINSA facilities which both received and sent patient referrals. At each consulting hospital, data was collected using the methods outlined below. Through visiting consulting hospitals in three different areas of the country, the team sought to learn about the challenges to accessing maternal and pediatric specialty care in a variety of settings.

Visits to peer consultant hospitals

Through visits to the telehealth offices of Instituto del Niño San Borja and Hospital Cayetano Heredia, the team learned more about the existing landscape of telehealth in Peru. Both of these national reference centers have well-established telehealth units with demonstrated success at connecting with health facilities around the nation. During visits, the team spoke to telehealth coordinators, engineers, and support staff about their programs, with a focus on how telehealth leaders developed their initiatives and evaluated success.

Semi-structured interviews and focus groups

The team conducted semi-structured interviews, focus groups, and meetings with 38 health care providers, including physicians, residents, interns, midwives, nurses, technicians, and administrators. Interview guides focused on experience caring for patients with complex conditions; perspectives toward telehealth; and experience with current technology or existing telehealth services. For care providers at Hospital San Bartolomé, interview guides also contained questions about receiving transfers and providing specialty care. At consulting hospitals, interview guides had additional questions about transferring patients and managing patients who required specialized care not available at that facility.

All interviews and focus groups were recorded and transcribed. Thematic coding methods were used to analyze interview transcripts. Thematic codes were based on a framework for telehealth readiness. Coded surveys were analyzed for the frequency of themes and for patterns of expressed needs, telehealth experience, and desires for a potential telehealth program.

Survey of telehealth readiness

A survey was distributed to health care providers at Hospital San Bartolomé and consulting hospitals. The survey measured individual perceptions of various levels of readiness for a maternal and pediatric telehealth program: core, engagement, technology/infrastructure, organizational, and systemic

readiness. Contents of the surveys were adapted from existing literature on e-Health readiness, including from validated tools for measuring readiness and acceptance of technology in health care. The surveys distributed at Hospital San Bartolomé focused on readiness for delivering specialty care via telehealth, while the surveys distributed at consulting hospitals focused on readiness for receiving such care.

Paper surveys were given to individual staff and to department heads for distribution. All staff involved in the provision of care — including physicians, midwives, interns and residents, nurses, and technicians — were invited to complete surveys. All surveys were anonymous and participants were asked to indicate the name of their institution, their position, and years worked at the hospital.

Paper surveys were distributed and, upon collection, electronically logged for analysis. Eighty-eight surveys were collected at consulting hospitals and 37 were collected at Hospital San Bartolomé. For a first level of analysis, completed surveys from each site were scored for overall telehealth readiness, based on answers to Likert Scale questions. Then, surveys were scored for each level of telehealth readiness, based on answers to the questions which corresponded to the six levels. After overall analysis for each facility, surveys were stratified according to the participant's position at the facility, and according to years of experience. All analysis was performed using Excel.

Capacity assessment

In order to understand the broad context of the consulting hospitals visited by the team, capacity checklists were distributed to relevant stakeholders. Checklists were given to the hospital director; an engineer or technician (involved in telehealth, if applicable); and the directors or other knowledgeable staff in the departments of OB/GYN, pediatrics, and neonatology. The checklists included questions about topics related to human resource capacity, availability of infrastructure for telehealth and diagnostics, and typical patient volume. Information collected via the checklists was used to gain an understanding of the various contexts of the consulting hospitals and determine if there were characteristics that could make facilities more or less prepared to implement a telehealth connection with Hospital San Bartolomé.

Development of programmatic recommendations

Based on findings from interviews, surveys, and site visits, the team created recommendations for the growth and optimization of a telehealth program at Hospital San Bartolomé. Recommendations were targeted to Hospital San Bartolomé and MINSA. As the team developed their recommendations, they consulted stakeholders at Dartmouth and Hospital San Bartolomé to solicit feedback and ensure that proposed programmatic steps were feasible.

Human subjects protection

All data was maintained anonymously and confidentially. Participants were informed of their rights and gave verbal consent before participating in research. Researchers underwent training by the Dartmouth Committee for the Protection of Human Subjects. The Dartmouth Institutional Review Board approved all research methods.

Key Research Findings

The primary focus of the team's research was to create recommendations for increasing and optimizing the use of telehealth at Hospital San Bartolomé. Through interviews and surveys, the team collected data on the current state of telehealth and desires for the expansion of telehealth among health practitioners. Data was collected at Hospital San Bartolomé and three health facilities which could be candidates for receiving specialty consults: Hospital Regional de Loreto, Hospital Goyeneche in Arequipa, and Hospital Pampas Tayacaja in Huancavelica. A brief overview of findings is presented here (see Appendices 1 and 2 for more details).

Key Findings

There is significant engagement and desire by practitioners to access specialty care through telehealth: Practitioners at Hospital San Bartolomé and consulting sites were highly engaged with the prospect of a program for maternal and pediatric specialty tele-consults. All types of practitioners expressed high engagement with the idea of telehealth on surveys administered at Hospital San Bartolomé and consulting facilities. Physicians exhibited higher engagement readiness for telehealth compared to nurses and midwives. Additionally, consulting physicians exhibited higher engagement with telehealth than physicians at Hospital San Bartolomé. This finding suggests that more work may be needed at Hospital San Bartolomé to activate and engage practitioners around the use of telehealth to increase access to specialty care.

There is low trust in technological and organizational capacity for telehealth: At Hospital San Bartolomé and the consulting facilities visited by the team, there was a consistent lack of confidence in the current technological and organizational structures that support telehealth. On both the Hospital San Bartolomé and the consulting facility surveys, practitioners were least confident in their facilities' technological and organizational readiness for telehealth. During interviews, practitioners at all facilities said that internet connectivity and a lack of computers in most workspaces were impediments to the success of a telehealth program at their facility. Additionally, practitioners said that time, coordination, and scheduling of telehealth consults were barriers to their consistent use of the system.

There has been some investment in technology but not in systems and programs for telehealth: At Hospital San Bartolomé and the consulting facilities visited by the team, technological infrastructure for telehealth existed, but there was a lack of strong systemic support and programmatic organization around this infrastructure. Some of the facilities considered part of MINSA's national telehealth network did not have programs in place to support consistent and effective use of telehealth. During interviews, practitioners at all facilities expressed a desire for a structured telehealth program with human resource support.

Policy Gaps

As a secondary focus of this research, the team looked at gaps in current national telehealth policies. Some gaps include:

- A lack of national policy on the interoperability of telehealth technology
- A lack of standardization of telehealth documentation and electronic medical records
- A lack of commitment to ongoing national funding for telehealth development

Addressing these policy gaps would greatly help increase access to and use of telehealth. These policy gaps are described in more detail in the MINSA-Led System Level Initiatives section.

Context of Hospital San Bartolomé

The primary focus of the team's research was creating recommendations for increasing and optimizing the use of telehealth at Hospital Nacional Docente Madre-Niño San Bartolomé, a level III-1 health facility in Lima. Through interviews and surveys, the team collected data on the current state of telehealth and desires for the expansion of telehealth among health practitioners at Hospital San Bartolomé. Following is a summary of findings.

Hospital context

As a national reference center for maternal and pediatric health, Hospital San Bartolomé provides specialty and sub-specialty care for complex cases. Patients are referred from lower-level facilities throughout Peru and many travel long distances to receive care. In obstetrics and gynecology, physicians said that patients are referred from other sites to receive specialty care for high-risk pregnancies, oncology, and infertility. In pediatrics, patients often require specialty management in cardiology, neurology, pulmonology, and gastroenterology, as well as diagnostic imaging and genetic testing. Sub-specialty services for neonatology patients include audiology screening, enteral and parenteral nutrition, and neonatal intensive care.

Practitioners said that the hospital's capacity poses challenges, as there are sometimes no available beds to accommodate a referral. The hospital building is a historic monument, so major infrastructure renovations to increase capacity are not possible. Referring to the neonatology department, a pediatrician said, "Right now, since yesterday, there should have been 12 intermediate [care] and referral patients, and we had 26. So this generates overcrowding and risks of infection." Practitioners said that they must either wait until a bed opens up or do what they can do make room for the patient. "You see if there is a form of expanding, or giving a bed, or another service," an OB/GYN physician said. "But you do not stop attending [the patient], because they were already sent."

Current context of telehealth

Hospital San Bartolomé has a fixed telehealth unit connected to a private MINSA network, unofficial coordination and support staff, and a schedule of trainings and consults. The telehealth program is not included in the hospital's service portfolio; therefore, the program is not official and personnel who work on telehealth do so in addition to their other work.

Tele-trainings take the form of weekly lectures, each related to a different topic in specialty maternal and pediatric medicine. Tele-consults occur sporadically when a request is received from a consulting site. Depending on internet connectivity and the consulting site's equipment, consults are performed using a direct IP address connection on the fixed telehealth unit, a Zoom video conference on a laptop, or a WhatsApp call on a personal device. Telehealth activities are organized by the central coordinator in conjunction with leaders in various departments. Some departments have technological infrastructure for telehealth, but none have dedicated space for tele-consults.

Practitioner perspectives

Health care practitioners said they had generally heard of the hospital's telehealth program, and many had participated in the weekly tele-trainings. Fewer had experience with tele-consults. Practitioners said that a well-implemented telehealth program could make their work easier and save time.

Using telehealth to provide specialty consults would, according to practitioners, be beneficial to support high-quality care at health facilities with limited resources. "At many sites in provinces, sometimes there are no doctors or sometimes there are doctors who do not stay there. So...there is not a lot of training," one OB/GYN physician said. However, practitioners also said that telehealth alone could not solve the larger issues with the lack of specialty care outside of Lima, and training of skilled practitioners and specialists at consulting sites must accompany a telehealth initiative.

Practitioners cited scheduling difficulties as a main barrier to their use of telehealth. Many suggested that a fixed schedule be implemented, where each practitioner had dedicated hours for responding to tele-consults. "[Tele-consults] should be like an external consult in the hospital," one physician said.

"They should be scheduled, so that the doctors have the space they need to resolve tele-consults." Practitioners also said that it would be beneficial to have an official telehealth coordination staff who were always available to respond to requests from consulting sites, and to have the human resource capacity to respond to tele-consults 24 hours of the day.

Other barriers to increasing use of telehealth raised by practitioners included unreliable technological infrastructure and internet connection; limited space for creating dedicated telehealth offices; and lack of time for providers to respond to tele-consults on top of their existing patient load. Practitioners believed their colleagues would support a telehealth program, though a successful program would require organization and investment by the hospital direction and MINSA.

Analytical Structure for Telehealth Development

Through data collected at consultant and consulting facilities, the team has found that existing telehealth programs vary in their capacity to receive and deliver specialty consults. The capacity of programs depends on several factors, including personnel awareness and support, organizational buy-in, and technology infrastructure.

In order to provide recommendations for Hospital San Bartolomé and MINSA's expansion of telehealth for maternal and pediatric specialty care, the team has created a structure for understanding telehealth capacity. The structure outlines characteristics of telehealth capacity levels at consulting and consultant facilities and demonstrates how to align capacity at both ends. By focusing on building capacity for sending and receiving tele-consults, it is possible to sustainably increase access to specialty care.

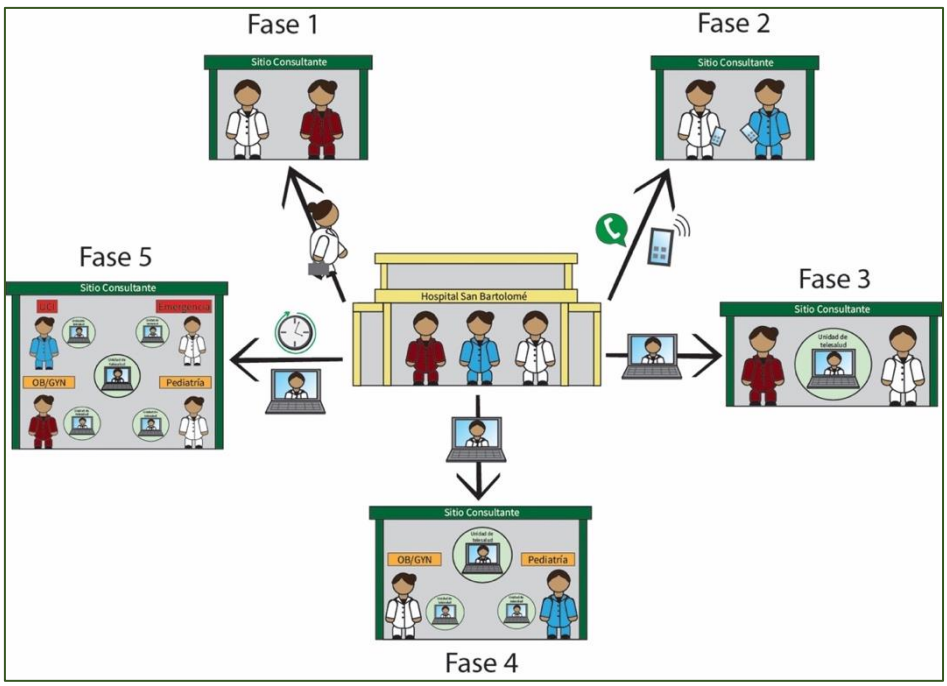
The analytical structure for capacity-building is based on the team's work at Hospital San Bartolomé, other consultant hospitals in Lima, and consulting facilities across Peru. The structure contains five stages of telehealth development, both for Hospital San Bartolomé and for consulting facilities. These stages illustrate what types of consultations are possible given current capacity at Hospital San Bartolomé and consulting facilities. This analytical structure provides the foundation for the recommendations in the following section.

This structure focuses on how Hospital San Bartolomé can increase its network of telehealth consultations with *reference centers (levels II-1, II-2, and III-1)*. These facilities receive references from smaller health centers, and also send referrals to national hospitals such as Hospital San Bartolomé. Reference centers have personnel and infrastructure for managing some complex and specialized maternal and pediatric cases but could significantly benefit from specialty tele-consults with Hospital San Bartolomé.

This structure does *not* focus on how Hospital San Bartolomé can increase its network of tele-consults with *health centers and health posts (levels I-1, I-2, I-3, and I-4)*. These facilities attend the largest proportion of demand in the system, and mainly see low-complexity cases. The team does not believe these institutions should be a main focus of Hospital San Bartolomé's telehealth efforts at this time. Health problems of higher complexity may require transfer to a regional reference center, but it would be rare for a case to be referred directly to a national center. If local health centers were connected directly to Hospital San Bartolomé's telehealth network, the volume of tele-consults could become too high for one reference institution to manage. Additionally, a direct connection could lead to tele-consults regarding cases which could have been resolved at a regional reference center.

Outline of Telehealth Development Stages

Telehealth Stage	Examples of Specialty Care Possible through Telehealth
Stage 1: Pre-Telehealth	• N/A
Stage 2: Emerging Telehealth	• Diagnosis of pediatric dermatological conditions via image transfer • Second opinions on pre-eclampsia symptoms
Stage 3: Established Telehealth	• Regular tele-consults on the state of pediatric and neonatal intensive care patients • Regular tele-consults on high-risk maternal cases • Pre- and post-operative care for pediatric facial clefts, neurosurgery (if CT Scan possible), and pulmonology (if X-Ray possible)
Stage 4: Departmental Telehealth	• Psychiatry tele-consults between specialists and patients at the consulting hospital • Training organized by specialists in the department of pediatrics and infectology to consulting departments of pediatrics on treating childhood malaria, dengue, tuberculosis, and leptospirosis
Stage 5: Advanced Telehealth	• Emergency tele-consults for high-risk pre-eclampsia cases • Specialist to patient care for chronic conditions like maternal diabetes or pediatric endocrinology and hematology • Managing patient medication regimens via specialist tele-consult • Diagnosis of childhood heart defects via remote stethoscope



Stage 1 | Pre-Telehealth

Telehealth Programming Possible at this Stage:

N/A

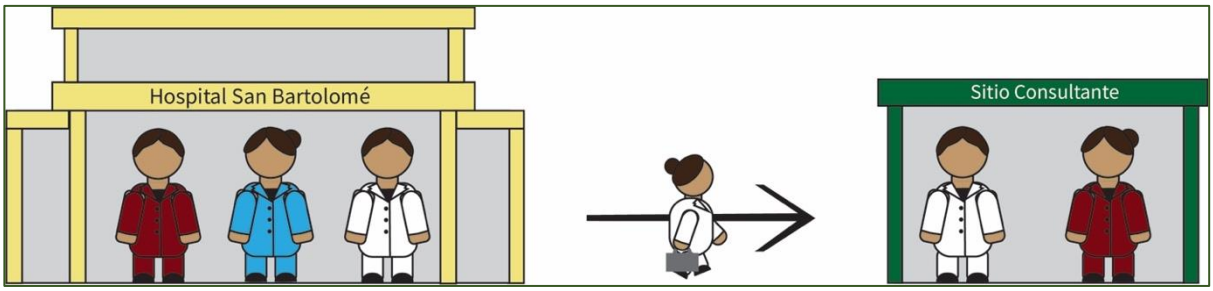
Consulting Facility Characteristics:

At Stage 1, consulting facilities do not have broad access to ICT including institutional or non-institutional computers and personal cell phones. Even if some of this infrastructure exists, the network connection is not strong enough to sustain reliable video calls or messaging. There is a lack of human resource capacity to support technological initiatives.

Hospital San Bartolomé Stage Characteristics:

Human and organizational capacity to exchange practitioners: Specialists at Hospital San Bartolomé have time in their work schedules to allow for visits to consulting hospitals. Hospital San Bartolomé also has the capacity to receive visiting practitioners from consulting facilities for specialty training and to communicate the care needs of their sites.

Designated director of remote health: The Director of Remote Health develops relationships with consulting facilities and organizes site visits and rotations based on the care needs of the sites.



Stage 2 | Emerging Telehealth

Telehealth Programming Possible at this Stage:

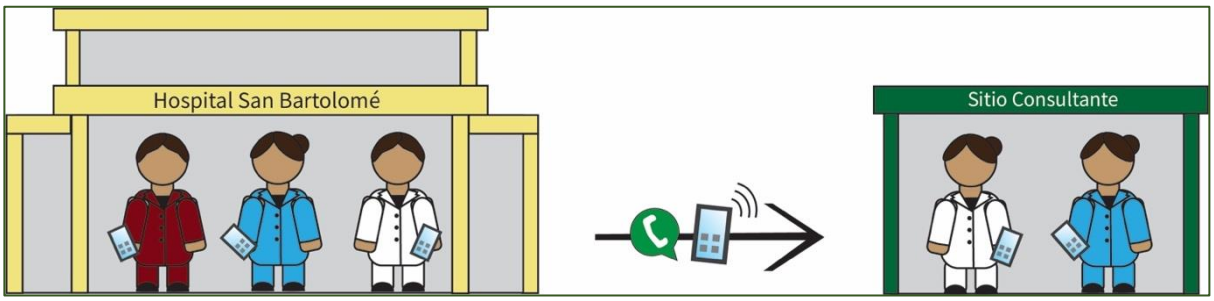
Programming	Examples
• Decentralized forms of communication with pediatric and maternal care specialists (via WhatsApp, email, Zoom, or other secure method of transmitting patient information)	• Diagnosis of pediatric dermatological conditions via image transfer • Second opinions on pre-eclampsia symptoms

Consulting Facility Characteristics:

At Stage 2, consulting facilities have no devoted telehealth infrastructure, staff, or center. There are ICTs within the facility, such as computers and laptops, which may have webcams. Most, if not all, staff have cell phones with internet access.

Hospital San Bartolomé Stage Characteristics:

Telehealth leaders (unofficial or official): There are champions for telehealth growth who are willing to engage with practitioners at consulting facilities and specialists at Hospital San Bartolomé to develop relationships and organize tele-consults.



Stage 3 | Established Telehealth

Telehealth Programming Possible at this Stage:

Programming	Examples
• Synchronous direct doctor-to-doctor tele-consults centered around the patient encounter • Pre- and post-operative care via tele-consult for specific surgeries	• Regular tele-consults on the state of pediatric and neonatal intensive care patients • Regular tele-consults on high-risk maternal cases • Pre- and post-operative care for pediatric facial clefts, neurosurgery (if CT Scan possible), and pulmonology (if X-Ray possible) • Education sessions and care planning for chronic conditions such as gestational diabetes

Consulting Facility Characteristics:

At Stage 3, consulting facilities have official telehealth centers and telehealth-specific infrastructure. Organizationally, these hospitals have some staff devoted to telehealth. These hospitals have the capacity to make formal video calls to consultant hospitals and have some human resources to organize ongoing scheduling and cooperation.

Hospital San Bartolomé Stage Characteristics:

Official telehealth program: An official telehealth program ensures that specialists are aware that the telehealth program has the support of hospital leadership. An official telehealth program is far more likely to receive serious engagement and buy-in from practitioners at Hospital San Bartolomé and consulting sites.

Telehealth director: The official director of telehealth:

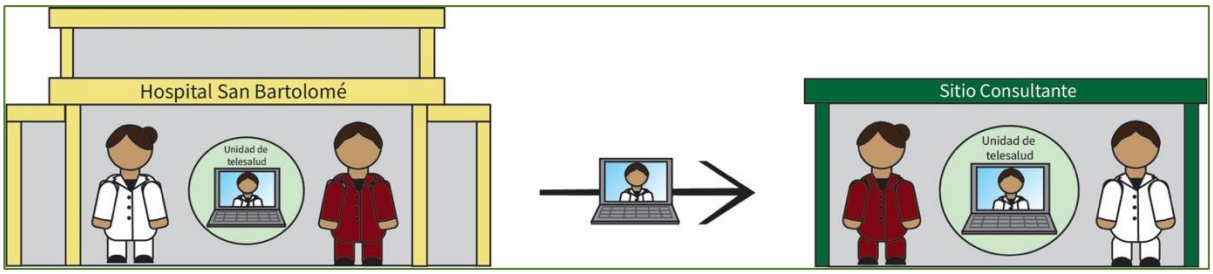
- Guides the trajectory of the program
- Engages specialists at the hospital and introduces them to the telehealth system
- Connects with telehealth programs at other facilities
- Provides updates to MINSA on the development of the program, central challenges to expansion, and key lessons that can be applied to other consultant facilities in the national telehealth network

Telehealth coordinator: The telehealth coordinator facilitates the telehealth center in two ways: (1) by working with consulting facilities to promote telehealth engagement, organize tele-trainings, and schedule telehealth calls, and (2) by working with specialists at Hospital San Bartolomé to seamlessly integrate tele-consults into their workflow.

Official center for telehealth: An official center of telehealth forms the heart of telehealth operations at the hospital. This is where the director and coordinator work, where tele-consults and tele-trainings take place, and where promotional materials for the telehealth program are designed.

Tele-consults included in hospital portfolio of services: Tele-consults are normalized and offered officially alongside all other care services at Hospital San Bartolomé.

Telehealth wireless network: A dedicated wireless network for tele-consults is needed to ensure quality and reliability. If the telehealth program only has access to the general hospital network, heavy use of the network by other programs and practitioners may slow or interrupt tele-consults.



Stage 4 | Departmental Telehealth

Telehealth Programming Possible at this Stage:

Programming	Examples
• Synchronous doctor-to-doctor tele-consults organized at the departmental level • Synchronous doctor to patient tele-consults for specific types of care • Synchronous specialist-to-consulting practitioner trainings organized at the departmental level	• Psychiatry tele-consults between specialists and patients at the consulting hospital • Training organized by specialists in the department of pediatrics and infectology to consulting departments of pediatrics on treating childhood malaria, dengue, tuberculosis, and leptospirosis

Consulting Facility Characteristics:

At Stage 4, consulting facilities have departmental telehealth leaders and infrastructure alongside the primary telehealth centers. Tele-consults and trainings can be organized by departments and by the main telehealth center. These consulting facilities have a high capacity for synchronous doctor-to-doctor tele-consults and can also perform some forms of direct specialist-to-patient tele-consults (e.g. psychiatry tele-consults).

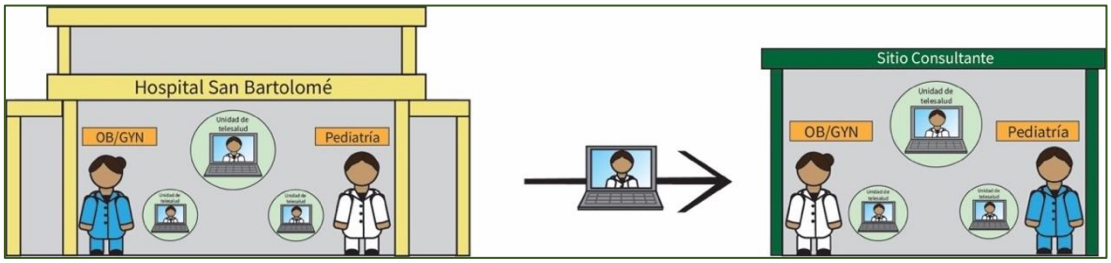
Hospital San Bartolomé Stage Characteristics:

Departmental telehealth infrastructure: Fixed and mobile units exist in all major departments and are broadly accessible by practitioners in those departments. At least one room in each major department is totally or partially devoted to tele-consults.

Departmental heads of telehealth: Departmental heads work with the telehealth director at the hospital to manage the overall trajectory of the program. Similarly, departmental heads engage their department's practitioners in telehealth, correspond with departmental heads of telehealth at other reference hospitals to manage patient loads, and guide initiatives for promoting tele-consults and tele-trainings.

Departmental coordinators of telehealth: Departmental coordinators work with departmental heads to promote engagement with the telehealth system, and to organize tele-trainings and tele-consults. Departmental coordinators work with specialists and consulting practitioners to schedule calls at at both facilities.

Sufficient departmental technical support: Departments have access to technical support to fix software and hardware issues during normal working hours.



Stage 5 | Advanced Telehealth

Telehealth Programming Possible at this Stage:

Programming	Examples
• On-demand tele-consults for specialty care • On-demand acute synchronous care • Advanced remote diagnosis • Broad range of specialist to patient tele-consults	• Emergency tele-consults for high-risk pre-eclampsia cases • Specialist to patient care for chronic conditions like maternal diabetes or pediatric endocrinology and hematology • Managing patient medication regimens via specialist tele-consults • Diagnosis of childhood heart defects via remote stethoscope

Consulting Facility Characteristics:

At Stage 5, consulting facilities have accessible mobile and fixed telehealth infrastructure in acute care settings such as the emergency department and intensive care units. This infrastructure can be used on-demand when time-sensitive tele-consults are needed. Similarly, consulting hospitals have mobile and fixed telehealth infrastructure in patient care settings such as hospitalization wards. This infrastructure can be used for more complex forms of video-diagnosis and for specialist-to-patient tele-consults such as pre- and post-operative care, chronic care, and tele-psychiatry. Consulting facilities have sufficient diagnostic machinery and peripheral devices to support tele-consults for a variety of specialties. Facilities also have access to 24-hour technical support to ensure that acute care telehealth units can be repaired quickly. Back-up telehealth units may also be available in the case of equipment failure.

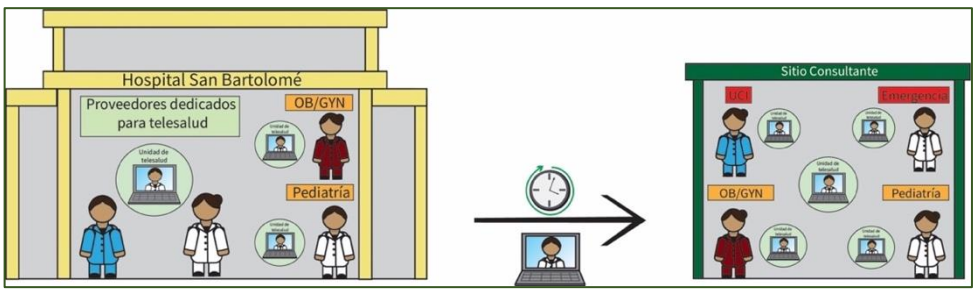
Hospital San Bartolomé Stage Characteristics:

Develop ongoing needs-assessment reports: See Stage 1 MINSA-Led capacity building.

Telehealth infrastructure for acute care tele-consults: Hospital San Bartolomé has the infrastructure capacity to receive on-demand calls from consulting facilities.

Dedicated care providers for telehealth: Hospital San Bartolomé has specialist emergency care doctors whose entire workload is devoted to receiving and managing telehealth consultation calls from consulting hospitals.

24-hour technical support: Hospital San Bartolomé specialists have access to 24-hour technical support to ensure that telehealth units can be fixed without interruption.



Recommendations

Recommendations for using telehealth to increase access to maternal and pediatric specialty care are derived from the analytical structure described in the previous section.

Due to the differing levels of telehealth capacity across Peru's consulting and consulting facilities, it is necessary to develop a standardized plan for building capacity. This includes Hospital San Bartolomé-led initiatives to strengthen connections with consulting facilities and MINSA-led initiatives to increase telehealth capacity at all health facilities. Along with capacity-building at consulting and consultant facilities, there are also steps which MINSA should take to reduce barriers to telehealth use in the health system as a whole.

The team has compiled recommendations targeted at three levels of intervention:

1. Immediate initiatives for building telehealth capacity at Hospital San Bartolomé
2. Long-term initiatives for building and sustaining capacity at Hospital San Bartolomé and consulting facilities
3. MINSA-led initiatives for facilitating the use of telehealth at all levels of the health system

Immediate Initiatives at Hospital San Bartolomé

This section includes next steps for increasing capacity for telehealth at Hospital San Bartolomé. The telehealth program at Hospital San Bartolomé currently lacks standardization and official status. This lack of standardization creates fragmentation and a mismatch between current capacity and program goals. Based on the team's analytical structure, the telehealth capacity at Hospital San Bartolomé falls between Stage 2 (Emerging Telehealth) and Stage 3 (Established Telehealth). Following are immediate next steps which Hospital San Bartolomé and MINSA can take in order to create a fully established and sustainable telehealth program.

Recommendations for Hospital San Bartolomé:

Create an official telehealth program with dedicated staff: An official telehealth program ensures that specialists are aware that the telehealth program has the support of hospital leadership. An official telehealth program is far more likely to receive serious engagement and buy-in from practitioners at Hospital San Bartolomé and consulting facilities.

Designate a telehealth director: The official director of telehealth:

- Guides the trajectory of the program
- Engages specialists at the hospital and introduces them to the telehealth system
- Connects with telehealth programs at other consultant facilities
- Provides updates to MINSA on the development of the program, central challenges to expansion, and key lessons that can be applied to other consultant hospitals in the national telehealth network

Designate a telehealth coordinator: The telehealth coordinator facilitates the telehealth center in two ways: (1) by working with consulting hospitals to promote telehealth engagement, organize tele-trainings, and schedule telehealth calls, and (2) by working with specialists at Hospital San Bartolomé to seamlessly integrate tele-consults into their workflow.

Create an official center for telehealth: An official center of telehealth forms the heart of telehealth operations at the hospital. This is where the director and coordinator work, where tele-consults and tele-trainings take place, and where promotional materials for the telehealth program are designed.

Add tele-consults to hospital portfolio of services: Tele-consults are normalized and offered officially alongside all other care services at Hospital San Bartolomé.

Create a dedicated network for telehealth: A dedicated wireless network for tele-consults is needed to ensure quality and reliability. If the telehealth program only has access to the general hospital network, heavy use of the network by other programs and practitioners may slow or interrupt tele-consults.

Facilitate ability to contact Hospital San Bartolomé specialists (e.g. actively advertising email lists): This includes designing web materials and working with MINSA to produce and distribute outreach materials at consulting hospitals. Specialists at Hospital San Bartolomé should have some portion of their time dedicated to tele-consults.

Organize site visits to consulting hospitals with limited ICT: By visiting consulting sites which do not yet have the capacity for telehealth, Hospital San Bartolomé providers can build inter-institutional connections to increase access to specialty maternal and pediatric care.

Recommendations for MINSA:

Support the hiring of telehealth staff at Hospital San Bartolomé: A dedicated telehealth director and telehealth coordinator should be hired to oversee the telehealth program.

Support improvements to ICT infrastructure at Hospital San Bartolomé: MINSA should support the creation of a dedicated telehealth network, work to ensure interoperability of telehealth systems, and assist with maintenance of telehealth equipment.

Long-Term Initiatives at Hospital San Bartolomé and Consulting Facilities

Long-term development of national telehealth networks requires collaboration between consultant facilities and MINSA. Consultant facilities should adjust their telehealth programs based on the capacity of the consulting facilities with which they are connecting. MINSA should increase standardization of capacity through investment at consulting facilities. MINSA investment will allow consulting facilities to sustainably connect with consultant facilities to receive specialty tele-consults. The following recommendations provide guidance for consultant facilities and MINSA. They outline programs and forms of investment which vary given the telehealth capacity of consultant facilities.

Recommendations for Stage 1 | Pre-Telehealth

Defining Characteristics of Consulting Facility:

- No Information and Communication Technologies (ICTs)
- Electricity is not broadly accessible
- Little to no human capacity for technical programs

Defining Characteristics of Hospital San Bartolomé:

- Human and organizational capacity to exchange practitioners

Hospital San Bartolomé-Led Initiatives and Programs	**MINSA-Led Capacity Building at Consulting Facility**
Initiatives • Organize site visits • Organize rotation programs *Telehealth Programming Possible at this Stage* • N/A	• Conduct a needs assessment • Invest in ICT infrastructure • Invest in technical support • Expand national fiber optic network

Hospital San Bartolomé-Led Initiatives:

Organize site visits: Site visits allow health care providers from Hospital San Bartolomé to travel for short times to consulting facilities to provide care for complex cases, carry out training courses, and better understand the specialty care needs of the patient population.

Organize rotation programs: Rotation programs allow health care providers from consulting facilities to visit Hospital San Bartolomé for specialty training programs.

MINSA-Led Capacity Building at Consulting Facility:

Conduct a needs assessment: MINSA should work with practitioners at the consulting facility to assess the gaps in resources, expertise, and care which could be addressed through specialist visits at Stage 1 or telehealth consultations with specialists at later stages. After this assessment, reports should be written outlining the needs of each consulting facility and these reports should be distributed to consultant facilities in Lima. Assessment reports should be developed whenever a consulting facility is evolving into the next stage of telehealth capacity. This ensures that consultant facilities are providing tele-consults and tele-trainings which are responsive to the needs of consulting facilities.

Invest in ICT infrastructure: Institutional ICTs, like computers and webcams, should be integrated into the consulting facility.

Invest in technical support: Basic technical support should be added to the consulting facility, likely through the addition of a new staff member.

Expand national fiber optic network: MINSA should work with the Ministry of Transportation to ensure the continued development of the national fiber optic network to provide network connection to consulting facilities.

Recommendations for Stage 2 | Emerging Telehealth

Defining Characteristics of Consulting Facility:

- Some ICTs
- No telehealth staff
- No telehealth-specific infrastructure
- No telehealth center

Defining Characteristics of Hospital San Bartolomé:

- Telehealth leaders (unofficial or official)

San Bartolomé-Led Initiatives and Programs	MINSA-Led Capacity Building at Consulting Facility
Initiatives • Facilitate ability to contact Hospital San Bartolomé specialists • Organize site visits *Telehealth Programming Possible at this Stage* • Decentralized forms of communication with pediatric and maternal care specialists (via WhatsApp, email, Zoom, etc.)	• Conduct a needs assessment • Strengthen and fund telehealth infrastructure • Facilitate the creation of a telehealth center • Hire dedicated technical support • Designate a telehealth director • Designate a telehealth coordinator • Telehealth facilitation trainings • Create a dedicated network for telehealth at the consulting facility

Hospital San Bartolomé-Led Initiatives:

Facilitate ability to contact Hospital San Bartolomé specialists: Through email lists, social media, and other forms of outreach, Hospital San Bartolomé should advertise their telehealth offerings to consulting facilities.

Organize Site Visits: Site visits allow health care providers from Hospital San Bartolomé to travel for short times to consulting facilities to provide care for complex cases, carry out training courses and better understand the specialty care needs of the patient population.

MINSA-Led Capacity Building at Consulting Facility:

Conduct a needs assessment: See Stage 1 MINSA-led capacity building.

Strengthen and fund telehealth infrastructure: Telehealth-specific infrastructure should be added to the consulting facility to transition specialist consultations from informal and decentralized mediums (like WhatsApp) to formal tele-consults.

Facilitate the creation of a telehealth center: MINSA should work with the consulting facility to designate or construct a new center for telehealth. This center should be broadly accessible and advertised to practitioners at the facility.

Hire dedicated technical support: Staff should be hired to provide technical support to newly-added telehealth infrastructure and to aid consulting practitioners in the use of the infrastructure.

Designate a telehealth director: The telehealth director guides the development of the telehealth program at the consulting facility, contacts MINSA with progress updates and evaluations, and connects with telehealth directors at other facilities.

Designate a telehealth coordinator at site: The telehealth coordinator promotes telehealth engagement, organizes tele-trainings, and schedules telehealth calls. The coordinator should work with practitioners to seamlessly integrate tele-consults into their workflow. The telehealth coordinator should work closely with the telehealth director, especially to ensure that there is always a point person available to receive telehealth requests to the consultant facility.

Telehealth facilitation trainings: Telehealth facilitation trainings should be developed in cooperation with consultant facilities. These trainings would educate consulting practitioners about the global context of telehealth development, MINSA's national telehealth goals, the various specialty services offered via tele-consult, and skills for tele-consults.

Create a dedicated network for telehealth at the consulting hospital: A wireless network should be established exclusively for the tele-consults and trainings to ensure the reliability of calls with consultant facilities.

Recommendations for Stage 3 | Established Telehealth

Defining Characteristics of Consulting Facility:

- Telehealth-specific infrastructure
- Telehealth-specific staff
- Official center for telehealth

- Tele-consults included in facility portfolio of services
- Sporadic connections to national telehealth network

Defining Characteristics of Hospital San Bartolomé:

- Official telehealth program
- Telehealth director
- Telehealth coordinator
- Official center for telehealth
- Dedicated wireless network for telehealth

Hospital San Bartolomé-Led Initiatives and Programs	MINSA-Led Capacity Building at Consulting Facility
Initiatives • Design and carry out telehealth facilitation trainings in pediatric and maternal care • Organize dedicated hours for tele-consults based on specialty *Telehealth Programming Possible at this Stage* • Synchronous direct doctor-to-doctor consults centered around the patient encounter • Diagnosis of patient conditions via practitioner-to-practitioner tele-consults • Pre- and post-operative care via tele-consult for specific surgeries	• Conduct a needs assessment • Increase accessibility to telehealth infrastructure outside of the telehealth center • Invest in technical support on the department level • Support organizational development at the departmental level • Increase knowledge and use via department-specific programming

Hospital San Bartolomé-Led Initiatives:

Pediatric and maternal telehealth facilitator trainings: These trainings would be carried out over one-to-two-day periods via videoconference with specific consulting facilities. The trainings would educate consulting practitioners about how telehealth can be used for pediatric and maternal care and would involve pre-planned practice tele-consults on example pediatric and maternal cases.

Organized specialty tele-consult hours: Weekly tele-consult hours for each specialty would be advertised via physical and online mediums. These hours would be organized by the telehealth coordinator, in accordance with the schedules of specialists and sub-specialists.

MINSA-Led Capacity Building at Consulting Facility:

Conduct a needs assessment: See Stage 1 MINSA-led capacity building.

Increasing accessibility to telehealth infrastructure: Mobile and fixed telehealth units should be added to the consulting facility at the departmental level. Consulting practitioners will then be able to access the national telehealth network from the department where they work. Units should be added to departmental spaces where non-physician health care providers, such as nurses and midwives, can easily access the national telehealth network.

Invest in technical support at the departmental level: Along with infrastructure, MINSA should ensure that ICT infrastructure can be managed by the technical support team at the consulting hospital. More technical staff may need to be hired to support new departmental infrastructure.

Support organizational development at the departmental level: To facilitate the integration of new telehealth technology, MINSA, in co-operation with the consulting facility, should designate departmental heads of telehealth. These departmental heads should undergo telehealth facilitator certification, engage practitioners on using the system, and work closely with the head of telehealth to develop the hospital's program.

Increase knowledge and use of telehealth via departmental programming: MINSA should invest in producing promotional materials for departmental telehealth programs. These materials should advertise services for departmentally-relevant specialties.

Recommendations for Stage 4 / Departmental Telehealth

Defining Characteristics of Consulting Facility:

- Broadly accessible telehealth infrastructure at the departmental level
- Departmental telehealth coordinators/coordination
- Resilient technical support
- Widespread awareness and use of telehealth infrastructure

Defining Characteristics of Hospital San Bartolomé:

- Departmental telehealth infrastructure
- Departmental heads of telehealth
- Departmental telehealth coordinators
- Departmental programming and outreach
- Sufficient departmental technical support

Hospital San Bartolomé-Led Initiatives and Programs	MINSA-Led Capacity Building at Consulting Facility

Initiatives • Organize meetings and coordination amongst telehealth leaders at Hospital San Bartolomé • Conduct outreach and networking for departmental telehealth programs centered around specialty services *Telehealth Programming Possible at this Stage* • Synchronous doctor-to-doctor tele-consults organized at the departmental level • Synchronous doctor to patient tele-consults for specific types of care • Synchronous specialist-to-consulting practitioner trainings organized at the departmental level	• Conduct a needs assessment • Invest in telehealth infrastructure in acute care settings • Invest in telehealth infrastructure in direct patient care settings • Invest in advanced diagnostic machinery and peripheral devices at consulting hospitals • Hire and/or train tele-presenters to manage direct specialist-to-patient tele-consults

Hospital San Bartolomé-Led Initiatives and Programs:

Coordination amongst telehealth leaders at Hospital San Bartolomé: Once tele-consults begin occurring outside of the telehealth center, hospital leadership must ensure that there is active engagement amongst all telehealth leaders in the hospital. Leadership should facilitate coordination between departments, evaluate successes and challenges, and minimize redundancy in department-level programmatic offerings.

Outreach and networking for departmental telehealth programs: Departments should be producing and advertising the various types of tele-consults and tele-trainings they offer. This can occur through physical mediums at consulting facilities and through webpages and social media.

MINSA-Led Capacity Building at Consulting Facility:

Conduct a needs assessment: See Stage 1 MINSA-led capacity building.

Invest in telehealth infrastructure in acute care settings: MINSA should work with the facility to provide telehealth infrastructure within acute care settings, such as the Emergency Department and intensive care units. Both mobile and fixed telehealth units may be necessary to work within acute care settings (See Dartmouth Case Study).

Invest in telehealth infrastructure in direct patient care settings: MINSA should work with the facility to provide telehealth infrastructure within patient care settings, such as hospitalization wards and consultation rooms. Both mobile and fixed telehealth units may be necessary to work within patient care settings (See Dartmouth Case Study).

Invest in advanced diagnostic machinery and peripheral devices: MINSA should work with the consulting facility to provide diagnostic machinery so that more exams can be performed in-house. This could include machinery for diagnostic imaging and laboratory testing. Peripheral devices, such as electronic stethoscopes and blood pressure cuffs, would allow a consulting specialist to perform a patient evaluation remotely.

Hire and/or train tele-presenters to manage direct specialist-to-patient tele-consults: MINSA should hire tele-presenters or train existing care providers to act as tele-presenters.

The tele-presenter manages cameras and performs other hands-on activities in order to facilitate a tele-consult between a consultant specialist and a patient.

Recommendations for Stage 5 | Advanced Telehealth

Defining Characteristics of Consulting Facility:

- Accessible telehealth infrastructure in acute care settings (ER, ICU)
- Accessible telehealth infrastructure in patient care settings
- Advanced diagnostic machinery
- Peripheral devices for remote examinations
- 24-hour technical support

Defining Characteristics of Hospital San Bartolomé:

- Telehealth infrastructure for acute care tele-consults
- Dedicated care providers for telehealth
- 24-hour technical support

San Bartolomé-Led Initiatives and Programs	MINSA-Led Capacity Building at Consulting Facility
Initiatives • N/A *Telehealth Programming Possible at this Stage* • On-demand tele-consults for specialty care • On-demand acute synchronous care • Advanced remote diagnosis • Broad range of specialist to patient tele-consults	• Conduct ongoing needs assessments • Maintain systems and equipment

Hospital San Bartolomé-Led Initiatives and Programs:

N/A

MINSA-Led Capacity Building at Consulting Facility:

Maintain systems and equipment: Physical infrastructure for telehealth should be maintained and updated when necessary. MINSA should be in ongoing communication with the facility to address any infrastructure or personnel needs.

MINSA-Led System Level Initiatives

Overview

The Dartmouth Global Health Team focused its research on recommending how Hospital San Bartolomé can best improve telehealth coordination with MINSA and consulting facilities to increase access to maternal and pediatric specialty care services.

Since telehealth is a health intervention project and not only a technology project, use of telehealth is determined by three major units: the consulting facility, the consultant facility, and the overall system within which these facilities work. The team has drafted recommendations for all three of these levels. *However, the level of the overall system is not the primary focus of this report.* These recommendations will be described in less detail than the recommendations for Hospital San Bartolomé's telehealth program with level II and III consulting facilities.

Each of the following recommendations address barriers that have been described by practitioners and administrators during semi-structured interviews in Peru and consultations with Dartmouth-Hitchcock Connected Care. This section is an overview of system-level barriers to telehealth, and future research should explore each area in more detail.

Summary of System Recommendations

Topic Area	Recommendations
Technology	• Uniform interoperability of technology • Standards for network connections • Third-party players in telehealth • Types of telehealth technology
Legal	• Uniform system of responsibility
Inter-institution Connections	• Exchange of practitioners • Telehealth facilitation trainings • National telehealth conferences
Medical Systems	• Electronic medical records • Standardized telehealth documentation • Frameworks of evaluation
Planning and Financing	• Standardized vision for national telehealth development • Stable national financing for telehealth

Technology

Uniform Interoperability of Technology

At every site the team visited, practitioners expressed their dissatisfaction with the lack of interoperability between telehealth infrastructure at consulting and consultant facilities. Because there are no uniform national standards for telehealth technology across consultation sites, facilities will often purchase infrastructure or have infrastructure brought in by third parties. This makes it difficult to reliably connect with telehealth units at other facilities. A lack of interoperability of telehealth infrastructure represents an inefficient use of funding and is a major barrier to a nationally robust telehealth network. As such, MINSA should work to produce uniform standards for the telehealth equipment which is placed in consulting and consultant facilities to ensure interoperability between units.

Standards for Network Connections

The quality of network connection for tele-consults affects the quality of communication between practitioners, and thus the quality of care, as well as the satisfaction of practitioners. To ensure good connections across facilities, MINSA should establish quality standards for network connections used in tele-consults.

Third-Party Players in Telehealth Technology

As telehealth systems develop, third-party services may be needed to provide support for the overall network. For instance, many practitioners at consulting and consultant facilities currently use the video communications service Zoom to consult with other practitioners. Other practitioners use telehealth-specific communication platforms, like CareNation, to conduct video consultations and track patient records (See San Borja Case Study).

Types of Telehealth Technology

Many different types of technology can be used for tele-consults. Some of these technologies are specially designed for telehealth and the clinical context; others are designed for public use but have the capacity to be adapted to clinical contexts. Each type of technology has advantages and disadvantages. The tables on the following two pages help provide context for different types of telehealth units.

Overview of Technology for Telehealth:

Technology	Comparative Initial Investment	Interoperability	Upkeep Costs	Difficulty of Use
Tablets	Low	Can connect to all other tablets and most computers via video software like Zoom or Skype	Low, cheaply replaced	Simple
Computers	Intermediate	Can connect to all other tablets and most computers via video software like Zoom or Skype	Intermediate	Simple to intermediate
Private Network Conferencing Equipment	Intermediate	Can only connect to other hardware within the same tele-consult system*	Intermediate	Intermediate to complex
Telehealth-Specific Technology	High	Depending on the hardware can connect with all other hardware through Zoom often can only connect to other hardware with the same software*	High	Intermediate to complex

*See San Borja Case Study

Technologies allowing practitioners to perform different types of tele-consults:

Tele-consult Type	Tablets	Computers	Private Network Conferencing Equipment	Telehealth-Specific Technology
Non-video forms of communication (via WhatsApp, email, etc)	**X**	**X**		
Diagnosis of patient conditions via practitioner-to-practitioner video tele-consults	**X**	**X**	**X**	**X**
Diagnosis of patient conditions via practitioner-to patient video tele-consults	**X**	**X**	**X** †	**X**
Pre- and post-operative care via video tele-consults	**X**	**X**		**X**
Video tele-consults in general patient care settings	**X**	**X** **		**X**
Video tele-consults in acute care settings	**X** *	**X** *		**X**
Complex forms of remote diagnosis and clinical data transfer				**X**

* If fixed
** If mobile
† If the unit is accessible to patients and for specific types of tele-consults (for instance, telepsychiatry)

Not all telehealth initiatives require telehealth-specific technology. If the goal of the telehealth program is to increase access to specialist consultations, technologies such as tablets and computers can be a cost-effective and sustainable option.

Legal

Uniform System of Responsibility
During interviews, providers expressed concerns about potential legal liabilities associated with telehealth. Such fears of legal liability discourage use of tele-consults by practitioners. To ensure active use of tele-consults, a uniform legal framework of responsibility should be developed for all of Peru.

Inter-Institution Connections

Exchange of Practitioners
A key aspect of a telehealth program is interpersonal relationships between care providers. Practitioners in Peru often operate within very different regional and clinical contexts. Outside of referrals, practitioners may have little personal contact with each other. To increase use of tele-consults for specialty care, practitioners from different regions of Peru (especially between Lima and rural regions) must interface with each other. Practitioners are more likely to call a specialist whom they know personally than a name on a national registry. Similarly, such exchanges of practitioners between facilities would provide opportunities for consultant specialists to share their knowledge and for consulting practitioners to express their care needs.

Telehealth Facilitation Trainings
Credentialing mechanisms for telehealth are an important tool for increasing knowledge and use of telehealth systems (See Recommendations for Long-Term Initiatives).

National Telehealth Conferences
To ensure that successes and challenges to telehealth expansion are being communicated among hospitals in the national telehealth network, MINSA should organize conferences to bring together telehealth directors from different parts of Peru.

Medical Systems

Electronic Medical Records
Most medical records in Peru are maintained on paper and not electronically. The lack of standard electronic medical recordkeeping poses a challenge to the amplification of telehealth consultations nationally. Without electronic medical records, forwarding patient information to the appropriate facility and tracking patient health outcomes post-consult is challenging.

Standardized Telehealth Documentation
In order to easily relate relevant information about patients between facilities, MINSA should design standardized forms to document tele-consults. These forms should collect information about patient history, assessments of current conditions, and previous recommendations given by consulting practitioners for their case.

Frameworks of Evaluation
To ensure the continual improvement of tele-consults, MINSA should produce mechanisms for evaluation at consultant and consulting facilities. Frameworks should include factors such as: number of tele-consults, types of tele-consults, outcomes of tele-consults, and practitioner satisfaction with tele-consults.

Planning and Financing

Standardized Vision for National Telehealth Development

Standards for health information and a National Plan for Telehealth were created in 2005 to help guide the progression of telehealth. While these are important stepping stones, more definition is needed. MINSA should lay out a vision for the operation of the national telehealth network, the context of telehealth within broader national health priorities, and the steps which facilities should take to sustainably grow their telehealth programs.

National Financing for Telehealth

Increasing access to specialty care via tele-consults requires sustainable funding for infrastructure upkeep, technical support, and staff. A commitment from the government to the continued funding of telehealth in national legislation would be the most effective means of guaranteeing this support. Investment in telehealth will likely reduce costs in other parts of the health system through reducing transfers and reduce the costs to families and individuals who must travel for medical care (See San Borja Case Study).

Conclusion

Telehealth holds great potential to increase access to specialty maternal and pediatric care in Peru. Health facilities around the country have already made great strides in starting telehealth programs. However, the sustained success of programs requires a standardized vision of ongoing growth. This vision should include plans for capacity-building at consultant and consulting facilities and be responsive to the care needs of communities. In researching how Hospital San Bartolomé can increase access to its specialty care services via telehealth, the Dartmouth Global Health Team created one such vision of immediate and long-term national telehealth development.

The team's analytical structure outlines five stages of telehealth capacity, illustrates which types of specialty care programs could be offered at each stage, and provides recommendations for how health facilities and MINSA can increase telehealth capacity. Based on these stages, the team suggested initiatives which Hospital San Bartolomé can begin in order to standardize and increase its organizational and technological capacity for telehealth. The team also outlined recommendations for the reduction of system-wide barriers to telehealth use. By creating a standardized vision and plan for telehealth expansion, it is possible to foster connections between health facilities and increase access to quality care.

APPENDIX 1

Case Studies

The Dartmouth Global Health Team visited several health facilities in order to learn about various contexts for telehealth around the nation. The team visited three hospitals which could be candidates for consulting with Hospital San Bartolomé via telehealth, as well as peer institutions of Hospital San Bartolomé which have already implemented successful telehealth programs. The following section outlines the findings from site visits. Data for consulting facilities and Hospital San Bartolomé is derived from interviews, focus groups, surveys, and capacity assessments; data for other consultant facilities is derived from informal interviews with telehealth personnel.
Note: All quotes have been translated from Spanish.

Consulting Facilities

Hospital Regional de Loreto

Location
Iquitos, Loreto

Level of the Healthcare System
III-1: Regional Reference Hospital

Hospital Context
Hospital Regional de Loreto serves a patient population spread throughout the Amazon Rainforest region. The hospital is located in Iquitos, a city which is accessible only by river or air. About two-thirds of the hospital's patients live in the city and periphery of Iquitos, and the other third live in geographically-disparate locales, some of which have little to no health care infrastructure. The latter group of patients may need to travel by boat for multiple days to reach the hospital.

The geographic isolation of the hospital means that transfers to Lima for more specialized care must occur by plane, posing difficulties for families of low socioeconomic class. A pediatrician explained that SIS covers the cost of a plane ticket for a patient who requires a transfer, but does not cover the costs for other family members. If a family cannot afford the trip, he said, their child's condition will just get worse. The transfer process is further complicated when Lima hospitals do not have the capacity to accept the patient: "Sometimes we are fighting for a bed," the pediatrician said.

Health Context and Needs
As the highest level of care in the Loreto region, the hospital sees cases which require complex specialty and sub-specialty management. Practitioners also see cases of acute infectious disease. Patients who must travel a long distance to reach the hospital often arrive in the advanced stages of a condition. Practitioners highlighted the following maternal and pediatric health challenges:

- Loreto has a high infectious disease burden. The hospital sees a large volume of infectious diseases including malaria, rabies, dengue, tuberculosis, and leptospirosis. Sepsis is a principal cause of morbidity and mortality in the region.

- The hospital lacks pediatric sub-specialties, including neonatology, pediatric endocrinology, pediatric cardiology, and pediatric surgery. Pediatric patients requiring sub-specialist care are typically referred to hospitals in Lima.
- Difficult-to-manage neonatology conditions include: gastroschisis and gastrointestinal malformations requiring parenteral nutrition, hyaline membrane disease (i.e. infant respiratory distress syndrome), spina bifida, and retinopathy.
- The hospital lacks some diagnostic equipment. A pediatrician said that they were not able to diagnose a potentially cancerous tumor in a patient, and were struggling to transfer the patient to Lima.

Telehealth Stage

Stage 3 - Established Telehealth

The hospital has a central telehealth office with a dedicated coordinator and other staff. The office has one fixed telehealth unit, which was donated by a university in South Korea in 2017. The hospital is a leader in the country for the number of tele-consults which it performs. The telehealth office is only open when the coordinator or support staff is present, and there are no department-level units. Telehealth is used when a patient needs higher care than the hospital can provide, and also to connect with remote health facilities throughout the region. The system has frequently been used to coordinate transfers for acute maternal cases.

To reach Stage 4 of telehealth development, the hospital would need to expand their system to the department level and increase accessibility and awareness. Pediatric nurses said that they had little knowledge and experience with the telehealth system since it was far from their department, not easily accessible, and in a room that was often locked. They said that they would prefer a unit located in their department so they could access it in acute care situations. Nurses and physicians expressed a desire for 24/7 access to telehealth services.

Poor internet infrastructure is a major obstacle to the success and expansion of the hospital's telehealth program. In Iquitos, "the whole city suffers from the internet," according to one practitioner. Despite practitioners' willingness to incorporate telehealth into their work, the current state of technological infrastructure could pose a difficulty for creating a consistent telehealth connection. On the consulting site survey, practitioners at Loreto expressed low confidence when asked if their current training and the current hospital infrastructure would be sufficient for telehealth consultations.

Practitioner Perspectives

Health care practitioners were interested in using telehealth in order to overcome the geographic barriers that their hospital faces. A pediatrician said, "There are many things that can't be done — specialties, sub-specialties — that are only in Lima. And from, precisely, telehealth, from tele-conferencing, it can be done." Practitioners expressed hope that telehealth could facilitate the coordination of transfers or make it possible to avoid a transfer altogether. In the survey, practitioners at Loreto indicated the greatest level of confidence among all practitioners when asked about their curiosity around possibilities for telehealth and the willingness of themselves and their peers to invest time into telehealth consultations.

Due to the difficulty of attending trainings and conferences in Lima, practitioners were interested in connecting with other health care providers remotely. Physicians and nurses expressed a desire to receive training from specialists at Hospital San Bartolomé. Pediatric nurses said that they would enjoy trainings for technical skills such as mechanical ventilator use and biomedical safety. A physician said that support for image interpretation, especially for ultrasound images, would also be useful.

Possible and Suggested Programs

- Tele-consults in infectology
- Tele-consults in neonatology, especially for parenteral nutrition support and neonatal audiology and optometry screening
- Tele-consults in pediatric endocrinology, pediatric cardiology, and pediatric surgery

- Tele-consults to evaluate a patient prior to transfer, and to provide follow-up care once the patient is back home
- Tele-trainings to increase interpersonal and inter-institutional connections

Hospital Goyeneche

Location
City of Arequipa

Level of the Healthcare System
III-1: Regional Reference Hospital

Hospital Context
Hospital Goyeneche is located in Arequipa, Peru's second-largest city. The hospital serves patients who have been referred from Arequipa and elsewhere in the Southern Andean region of the country, including the departments of Puno, Cusco, and Tacna. Maternal patients are commonly referred if they are in need of intensive care or surgery, as the hospital offers these services.

Despite needs for infrastructure improvement, the hospital is a beloved institution to many residents of Arequipa. "There is lots of confidence and credibility in the hospital," said an OB/GYN doctor. "Sometimes, when choosing between [other Arequipa hospital] Honorio Delgado, which is much bigger, which has the personnel and services which we do not have, [patients] prefer to come here." Practitioners said that some patients feel that they have been poorly treated in Lima hospitals, and so they would rather stay in Arequipa for care.

Health Context and Needs
Hospital Goyeneche is a regional reference facility, and many patients arrive after seeking sought treatment at other health facilities. Practitioners highlighted the following maternal and pediatric health challenges:

- The hospital has an adult ICU and a neonatal ICU but no pediatric ICU, and it is difficult to transfer pediatric patients in need of intensive care or mechanical ventilation.
- There is a lack of pediatric sub-specialty care, including for neurology, endocrinology, pulmonology, gastroenterology, neurosurgery, and thoracic surgery
- It is difficult to manage acute maternal cases requiring ICU care, as the ICU has a low capacity.
- It is difficult to manage maternal cases requiring specialty care, such as hematology care for low platelet count, support for diabetic patients, endocrinology care for thyroid issues, and neurology.

Telehealth Stage
Stage 2 - Emerging Telehealth
Hospital Goyeneche was incorporated into MINSA's national telehealth network in June 2018. However, the hospital has no telehealth office, formal telehealth infrastructure, or dedicated staff. Most practitioners were aware of telehealth and used informal methods of connecting with practitioners at other facilities, such as sending photos and video calling via WhatsApp on their personal devices. A pediatric resident said that she had recently performed a tele-consult at a nearby internet café, due to the lack of ICT infrastructure at the hospital.

To reach Stage 3 of telehealth development, the hospital would need to create a formal telehealth center with a dedicated staff, and would need to invest in ICT infrastructure. As of now, it is only possible to communicate with individual practitioners on their personal devices, due to the lack of a formal telehealth program.

Practitioner Perspectives
Practitioners in the pediatrics and OB/GYN departments said that they would welcome the use of telehealth to receive specialty and sub-specialty care support. They cited uncommon but complicated cases — such as maternal thyroid issues, maternal neurological issues, pediatric gastroenterology, and pediatric neurosurgery — as areas of interest for tele-consults with Hospital San Bartolomé. OB/GYN practitioners said that they would be interested in consulting specialists about abnormal ultrasounds and other diagnostic images.

Practitioners said that they would benefit from the ability to connect with specialists in emergency situations and for 24-hour support. In the OB/GYN department, one physician said, it would be useful to consult a specialist when attending to obstetric emergencies during the hours when there are fewer personnel at the hospital.

Some physicians in the OB/GYN department felt that it could be difficult to incorporate telehealth into their practice, as they would feel uncomfortable consulting a specialist for conditions that they were expected to know how to manage. One physician explained:

> "You need to take away a certain type of pride, if you will. To be able to communicate with someone and to be able to say, 'I have doubt about this.'... 'I have a severe pre-eclampsia, it is almost an eclampsia, what should I put?' Would that be stupid? In other words, I suppose that I know that. I should know that."

Physicians said that they would be more likely to use a telehealth system if they knew the consultant practitioner well and felt comfortable soliciting a second opinion. "We communicate between ourselves...because we know each other well," a physician said. They expressed interest in participating in tele-trainings and conferences as a way to build connections. Confidence, a physician said, "is what is going to bring us to the end of the bridge."

Possible and Suggested Programs
- Connecting individually with physicians to offer support for specialty consults via WhatsApp and Zoom
- Tele-consults to evaluate diagnostic images, especially for ultrasound
- Tele-trainings to increase interpersonal and inter-institutional connections

Hospital Pampas Tayacaja

Location
Pampas Tayacaja, Huancavelica

Level of the Healthcare System
II-1: Hospital I/Reference Center

Hospital Context
Hospital Pampas Tayacaja is located in the city of Pampas and serves the province of Tayacaja, in the Huancavelica department. Tayacaja is considered part of the VRAEM Zone, a region characterized by very high poverty rates and insecurity. Many residents of Tayacaja live in isolated, mountainous zones with access to only basic health services. For some, reaching Hospital Pampas Tayacaja requires a three-hour drive along partially- or non-paved roads. The hospital has "mobile clinic" buses which have been used to provide primary care services throughout the region, although the buses are not currently in use due to a lack of funding.

Since the hospital has a small emergency department, few specialists, and no ICU, patients with acute or complex conditions often require referral to regional hospitals in Huancayo, Huancavelica, or, in some cases, Lima. However, practitioners have encountered difficulties with references. A midwife said, "The hospitals are very saturated and sometimes they do not want to receive us, and we need to bring [the patients] to the emergency entrance. And, practically, the personnel need to fight there,

they make an effort so [the patient] is accepted, yes or yes." Additionally, the hospital has only one reliable ambulance for transferring patients, according to an emergency department physician. This creates difficulties when multiple patients must be transferred to facilities with higher-level care.

Tayacaja has a large indigenous population, and traditional medicine practices are prevalent. In the area of maternal care, some traditional medicine users prefer to give birth outside of the hospital, although, according to one practitioner, the volume of home births has decreased in recent years. Hospital personnel said that they faced difficulties treating patients who did not want to receive care at the hospital.

Health Context and Needs

Hospital Pampas Tayacaja is a reference facility and typically sees patients who have previously received care at smaller health centers and health posts. Practitioners cited low health literacy as difficulty, as some of their patient population lacks knowledge related to disease prevention and treatment. Practitioners highlighted the following maternal and pediatric health challenges:

- There is a need for support for evaluation, diagnosis, and treatment of conditions in neonates and premature births, as there are no pediatric sub-specialists or neonatologists.
- In cases of home birth, neonates sometimes arrive at the hospital with conditions such as hypoglycemia, hypothermia, and infection.
- Pediatric respiratory conditions are common in the wintertime due to the cold weather and the lack of heating in most homes. Respiratory issues requiring mechanical ventilation are difficult to manage because many personnel are not trained in mechanical ventilation.
- There is a lack of diagnostic imaging equipment, as the CT scanner and all but one ultrasound machine are broken. There is also low capacity to diagnose tumors.
- High-risk pregnancies — twin pregnancies, abnormal presentations, molar pregnancies — often require transfer for higher-level management. Pre-eclampsia management is also difficult due to a lack of patient knowledge of this condition.

Telehealth Stage

Stage 3 - Established Telehealth

Hospital Pampas Tayacaja has an official telehealth unit with a designated coordinator. They have a mobile telehealth unit which is used for tele-trainings, tele-conferences, and doctor-to-doctor tele-consults. Telehealth consults are used to coordinate transfers to hospitals with higher levels of care. Informal methods of telehealth connection — such as calling and sending photos via WhatsApp — were also used to coordinate references. Additionally, the hospital receives references from the smaller health centers and health posts which comprise the health network of Tayacaja. Several of these sites have telehealth units.

To reach Stage 4 of telehealth development, the hospital would need to focus on increasing accessibility to telehealth units at the department level. A neonatology nurse said that it was difficult for her to access telehealth because she could not leave her patients alone, and the telehealth office was far from her workspace. Practitioners were engaged with the idea of connecting with Hospital San Bartolomé for tele-consults and tele-trainings, and expressed interest in having devices such as tablets and laptops in their offices for tele-consults.

Practitioner Perspectives

Health care practitioners were open to using telehealth to connect with Hospital San Bartolomé. They said that they would benefit from consulting with specialists about the management of complex maternal, neonatal, and pediatric conditions, since the hospital lacks specialty care in these areas. This could help to avoid transfers or make transfers easier. "It could improve efficiency, no?," a midwife said. "I could resolve, perhaps, some patients' health problems more quickly...I wouldn't spend a long time finding a reference, when we can find an available specialist if we don't have one, through the internet." Practitioners also expressed interest in receiving training from Hospital San Bartolomé specialists, especially in technical areas such as the use of mechanical ventilators, and in less-frequently-seen maternal and pediatric conditions.

A neonatal nurse said that tele-consults with Hospital San Bartolomé could be useful because a specialist could speak directly with her patients' parents and help them to better understand their child's condition. She said that some families do not want their children in the hospital to stay in the hospital for treatment, as they do not understand the gravity of the situation. She said, "Maybe if we call a specialist from the city, from Lima, he can explain, he can help them to see, 'Ah, yes, my child is being attended, all the way in Lima they are intervening."

Possible and Suggested Programs

- Tele-consults in neonatology and other pediatric specialties
- Tele-consults for management of acute and chronic maternal conditions
- Tele-consults to evaluate a patient prior to transfer, and to provide follow-up care once the patient is back home
- Tele-trainings to increase interpersonal and inter-institutional connections

Consultant Facilities

Hospital Cayetano Heredia

Location
San Martín de Porres, Lima

Level of the Healthcare System
III-1: National Reference Hospital

Hospital Context
Hospital Cayetano Heredia is a reference hospital which serves patients from northern cone of Lima and those referred from other health facilities nationwide. The hospital is not specialized in one discipline, but rather has a variety of specialty and sub-specialty care services.

Telehealth Stage
Stage 3: Established Telehealth
Hospital Cayetano Heredia has a telehealth office with a dedicated coordinator, engineer, and administrative assistant. The office contains a fixed telehealth unit donated by a South Korean university in 2017 (the same university which donated a unit to Hospital Regional de Loreto). The unit is used for responding to tele-consults in a variety of specialties. The office maintains a calendar of availability of specialists, and then receives requests for tele-consults on-demand from consulting centers. When a request is received, the office finds an available specialists and sends a document to the consulting site so that the consulting practitioner can send patient information prior to the start of the tele-consult.

In addition to tele-consults, the hospital leads tele-trainings on various topics in specialty care. The trainings take the form of lectures which are recorded and posted on a YouTube channel. The telehealth office also maintains a Facebook page where they post information about trainings and raise awareness of their specialty consult offerings.

The telehealth office evaluates performance based on the number of tele-consults and tele-trainings which they perform. In 2017, they performed 164 tele-consults. Future plans for telehealth at the hospital include connecting with more sites, decentralizing their program to the department level, and formalizing the system as to ensure sustainability and support.

Instituto Nacional de Salud del Niño San Borja

Location
San Borja, Lima

Level of the Healthcare System
III-2: Specialized Institute

Hospital Context
Instituto San Borja is a national institute for pediatric care. The institute has a variety of pediatric sub-specialty services, including cardiology and cardiovascular surgery, complex neonatal surgery, neurosurgery, comprehensive care for burns, and bone marrow transplantation. Patients needing these advanced levels of care are referred from health facilities around the nation.

Telehealth Stage
Stage 3 - Established Telehealth

Instituto San Borja has a large, official telehealth program with a dedicated office, staff, and fixed telehealth units. They receive frequent tele-consults and also lead tele-trainings and conferences. The telehealth unit is currently centralized to one office, and does not operate at the departmental level. Currently, tele-consults are only held between a consultant specialist and consulting practitioner; future plans include creating telehealth units which can be used for direct specialist-to-patient consults in certain specialties, such as psychiatry.

Instituto San Borja's telehealth program is currently in a stage of consolidation and integration, as the program is expanding the number of connected consulting sites and specialty services offered. To facilitate this expansion, the telehealth unit has focused on identifying needs for specialty care at consulting sites, strengthening one-on-one connections with practitioners, and streamlining the tele-consult and referral process.

The institute has a Cisco telehealth unit which they can use to connect with certain consulting sites via CareNation software. CareNation is a telehealth software with capability to maintain clinical data confidentially, save a patient's medical history, generate appointment times, and connect automatically. If a consulting site cannot connect via CareNation, Zoom or a direct IP address is used instead.

The institute has measured the success of its telehealth program by the number of transfers avoided through a tele-consult, and the resultant financial savings. Fewer than 25 percent of patients whose cases are consulted through telehealth are referred to Lima. Based on the costs of transfers, this translates to a cost savings of roughly S/. 19 million.

APPENDIX 2

Survey Analysis

Survey Breakdown

Overview
The consulting hospital and Hospital San Bartolomé surveys measure practitioner perceptions of their facility's readiness for a telehealth program. This measure may be quite different from the actual capacity. Rather, it is a measure of practitioner belief that tele-consults would be possible or useful.

Understanding perceptions is essential for formulating any successful public health initiative. Without buy-in from health practitioners, any added infrastructure for telehealth could go unused or under-utilized. Although the survey was only distributed at three consulting hospitals and Hospital San Bartolomé, the data can help provide Hospital San Bartolomé and MINSA with a perspective of where investment may be needed.

Survey Logic
The analysis of the consulting hospital and Hospital San Bartolomé telehealth surveys is broken down into two main sections:

1. General data analysis for trends in practitioner and hospital readiness for telehealth
2. Specific data analysis of the five levels of readiness based on question categories

General Analysis of Surveys

General Measures
Average "readiness" scores of each of the hospitals visited
Average perceived readiness scores for doctors at each consulting hospital
Average perceived readiness scores for nurses at each consulting hospital
Average above- and below-median perceived readiness at consulting hospitals
Average highest- and lowest-confidence questions for each consulting hospital

Readiness-Specific Analysis

The questions in the surveys are broken into two categories: questions regarding the respondent's own readiness as an individual, and questions regarding the respondents perceived readiness of their organization (e.g. the facility in which they work).

Along with these two categories, the questions were designed to be split up into five readiness measures. Each measure corresponds to a level of readiness for telehealth.

Readiness Measure	Definition	Associated Questions on the Consulting Site Survey	Associated Questions on the San Bartolomé Survey
Core Readiness	Gauges the extents to which members of a community are dissatisfied with the current status of their healthcare service provision and understand what telehealth is and other similar contexts in which it is being used	Q1, Q7, Q8, Q13	Q1, Q7, Q8, Q14
Engagement Readiness	Gauges the extent to which members of a community are actively curious about implementing telehealth. This includes the willingness of members to accept and invest time into additional training and investment into telehealth.	Q9, Q10, Q11, Q12, Q14	Q9, Q10, Q11, Q12, Q15
Technological and Infrastructural Readiness	Gauges the availability and affordability of ICT resources necessary to implement a proposed telehealth innovation (e.g. skilled human resources, ICT support, quality ICT infrastructure and power supply).	Q2, Q3, Q4, Q5, Q6, Q15, Q16, Q17, Q25	Q2, Q3, Q4, Q5, Q6, Q17, Q18, Q26
Organizational Readiness	Gauges the extent to which the institutional setting and culture supports and promotes awareness, implementation, and use of e-health innovations (e.g. presence of relevant policies; senior management support).	Q19, Q20, Q21, Q22, Q23	Q20, Q21, Q22, Q23, Q25
System Readiness	Gauges the degree of 'interaction' associated with a healthcare institution.	Q24	Q24

Survey Results by Facility

Hospital Regional de Loreto

Measure	Result
Total Responses	21
Types of Practitioners in Survey	Doctors and Nurses
Number of Responding Doctors	7
Number of Responding Nurses	13
Overall Hospital Readiness Score (maximum readiness = 5.0)	3.80
Overall Doctor Readiness Score (maximum readiness = 5.0)	3.50
Overall Nurse Readiness Score (maximum readiness = 5.0)	4.13
Overall Above Median Experience Score (maximum readiness = 5.0)	4.19
Overall Below Median Experience Score (maximum readiness = 5.0)	3.35
Overall Highest Confidence (i.e. Highest-Scoring) Questions	Q12, Q3, Q11
Overall Lowest Confidence (i.e. Lowest-Scoring) Questions	Q4, Q5, Q19

Readiness Measure	Hospital Average	Doctor Average	Nurse Average
Core Readiness	3.81	4.29	3.44
Engagement Readiness	4.19	4.43	4.02
Technological and Infrastructural Readiness	3.58	3.88	3.32
Organizational Readiness	3.7	4.06	3.62
System Readiness	3.94	4.43	3.7

Hospital Goyeneche

Measure	Result
Total Responses	31
Types of Practitioners in Survey	Doctors, Nurses and Midwives
Number of Responding Doctors	20
Number of Responding Nurses	6
Number of Responding Midwives	5
Overall Hospital Readiness Score (maximum readiness = 5.0)	3.59
Overall Doctor Readiness Score (maximum readiness = 5.0)	3.90
Overall Nurse Readiness Score (maximum readiness = 5.0)	3.44
Overall Midwife Readiness Score (maximum readiness = 5.0)	3.75
Overall Above Median Experience Score (maximum readiness = 5.0)	3.70
Overall Below Median Experience Score (maximum readiness = 5.0)	3.54
Overall Highest Confidence (i.e. Highest-Scoring) Questions	Q12, Q3, Q11
Overall Lowest Confidence (i.e. Lowest-Scoring) Questions	Q5, Q4, Q22

Readiness Measure	Hospital Average	Doctor Average	Nurse Average	Midwife Average
Core Readiness	3.82	3.99	3.38	3.5
Engagement Readiness	4.14	4.24	3.8	4.08
Technological and Infrastructural Readiness	3.57	3.59	3.64	3.42
Organizational Readiness	3.71	3.8	3.63	3.44
System Readiness	3.71	3.8	4	3

Hospital Pampas Tayacaja

Measure	Result
Total Responses	36
Types of Practitioners in Survey	Doctors, Nurses and Midwives
Number of Responding Doctors	4
Number of Responding Nurses	24
Number of Responding Midwives	8
Overall Hospital Readiness Score (maximum readiness = 5.0)	3.79
Overall Doctor Readiness Score (maximum readiness = 5.0)	3.85
Overall Nurse Readiness Score (maximum readiness = 5.0)	3.69
Overall Midwife Readiness Score (maximum readiness = 5.0)	3.56
Overall Above-Median Experience Score (maximum readiness = 5.0)	3.70
Overall Below-Median Experience Score (maximum readiness = 5.0)	3.86
Overall Highest Confidence (i.e. Highest-Scoring) Questions	Q12, Q11, Q3
Overall Lowest Confidence (i.e. Lowest-Scoring) Questions	Q4, Q19, Q15

Readiness Measure	Hospital Average	Doctor Average	Nurse Average	Midwife Average
Core Readiness	3.62	3.88	3.57	3.63
Engagement Readiness	3.82	4.20	3.73	3.90
Technological and Infrastructural Readiness	3.46	3.75	3.35	3.59
Organizational Readiness	3.55	3.85	3.43	3.73
System Readiness	3.59	4.00	3.32	4.13

Hospital San Bartolomé

Measure	Result
Total Responses	37
Types of Practitioners in Survey	Doctors and Nurses
Number of Responding Doctors	16
Number of Responding Nurses	21
Overall Hospital Readiness Score (maximum readiness = 5.0)	3.74
Overall Doctor Readiness Score (maximum readiness = 5.0)	3.77
Overall Nurse Readiness Score (maximum readiness = 5.0)	3.71
Overall Above Median Experience Score (maximum readiness = 5.0)	3.62
Overall Below Median Experience Score (maximum readiness = 5.0)	3.87

Readiness Measure	Hospital Average	Doctor Average	Nurse Average
Core Readiness	3.85	3.88	3.84
Engagement Readiness	3.84	3.86	3.81
Technological and Infrastructural Readiness	3.46	3.48	3.45
Organizational Readiness	3.65	3.79	3.56
System Readiness	3.82	3.87	3.78

General Results: Consulting Hospital Survey

Combined results for Hospital Regional de Loreto, Hospital Goyeneche, and Hospital Pampas Tayacaja

Measure	Result
Total Responses	88
Types of Practitioners in Survey	Doctors, Nurses and Midwives

Number of Responding Doctors	31
Number of Responding Nurses	43
Number of Responding Midwives	13
Telehealth Stage 2 Hospital Responses	31
Telehealth Stage 3 Hospital Responses	57

Readiness Measure	Total Doctor Average (maximum score = 5.0)	Total Nurse Average (maximum score = 5.0)	Total Midwife Average (maximum score = 5.0)
Core Readiness	4.04	3.51	3.58
Engagement Readiness	4.28	3.82	3.97
Technological and Infrastructural Readiness	3.68	3.38	3.5
Organizational Readiness	3.86	3.51	3.62
System Readiness	3.97	3.53	3.70

Consulting Hospital Survey Questions

Number	Question
1	Entiendo claramente qué es el servicio de telesalud
2	Tengo una base de conocimiento sólido en el uso de computadoras, tabletas, celulares inteligentes y el internet
3	Uso el Internet con frecuencia
4	Creo que no necesitaría capacitación adicional para operar un sistema de consultas de telesalud si el sistema fuera introducida a mi trabajo
5	Creo que no sería necesario contratar a personal nuevo para operar un sistema de consultas de telesalud si el sistema fuera introducida a mi trabajo

6	Creo que el etorno en mi trabajo (la infraestructura, la conectividad del Internet, etc.) podría apoyar un sistema de consultas via telesalud
7	Siento que los recursos y herramientas que tenemos ahora para ofrecer cuidado maternal y pediátrico a través de los sistemas de telesalud son insuficientes
8	Siento los efectos negativos del aislamiento de otros recuros de cuidado de salud
9	Estoy consciente de cuáles problemas de salud maternal y pediátrica se podrían resolver con el uso de teleconsultas en el Hospital San Bartolomé
10	Estaría dispuesto/a a tomar un papel de liderazgo en la introducción de telesalud en mi hospital
11	Estoy curisoso/a acerca de los posibles beneficios de la telesalud para mejorar la entrega de servicios de salud maternal y pediátrico
12	Creo que sería útil interactuar más con los médicos especializados de otros hospitales cuando se trato casos complejos maternales y pediátricos
13	Tengo suficiente confiaza con el empleo de telesalud en el contexto clínicos semejantes
14	Estoy dispuesto/a a hacer una inversión de tiempo adicionál para la implementación de un sistema de telesalud
15	Creo que un servicio de telesalud puede ser integrado fácilmente al volumen de trabajo de los empleados del hospital
16	Me siento confiado acerca de la fiabilidad del equipo de telesalud
17	Me siento confiado si habría inmediato apoyo técnico suficiente cuando se requira
18	(Opcional) Comentario: por qué dio Ud estas clasificaciones?
19	Siento que mi organización esté insatisfecho con los recursos y herramientas que ahora puede aceder para entregar el cuidado maternal y pediátrico especializado
20	Siento que mi organización tenga un fuerte apoyo de los profesionales para una initiativa de la telesalud en la implementación de telesalud en San Bartolomé
21	Siento que mi organización tenga médicos y otro personal que tomarían los papeles de liderazgo para organizar e implementar un programa de telesalud
22	Creo que otros profesionales de mi hospital estén dispuestos a hacer una inversión inicial de tiempo para la implementación de un sistema de telesalud
23	Siento que mi organización esté receptiva a las innovaciones origionales para el cuidado de salud, empleando la telesalud
24	Siento que mi organización tenga colaboraciones con otros hospitales
25	Siento que mi organización tenga acceso al apoyo técnico comprehensivo y siempre disponible
26	(Opcional) Comentario: por qué dio Ud estas clasificaciones?
27	Tiene algún comentario adicional?

Hospital San Bartolomé Survey Questions

Number	Question
1	Entiendo claramente qué es el servicio de telesalud y cómo San Bartolomé puede implementar este servicio
2	Tengo una base de conocimiento sólido en el uso de computadoras, tabletas, celulares inteligentes y el Internet
3	Uso el Internet con frecuencia
4	Creo que no necesitaría capacitación adicional para operar un sistema de consultas de telesalud si el sistema fuera ampliado en el hospital San Bartolomé
5	Creo que no sería necesario contratar a personal nuevo para operar un sistema de consultas de telesalud si el sistema fuera ampliado en el San Bartolomé
6	Creo que el entorno del San Bartolomé (la infraestructura, la conectividad del Internet, etc.) podría apoyar la ampliación de un sistema de teleconsultas
7	Siento que los recursos y herramientas que tenemos ahora para ofrecer cuidado maternal y pediátrico a través de los sistemas de telesalud en el Hospital San Bartolomé son insuficientes
8	Percibo que San Bartolomé tiene una sobrecarga de pacientes que acuden buscando consultas especializadas
9	Siento que ampliar el sistema de consultas de telesalud en San Bartolomé reduciría el número de pacientes que necesitan viajar al San Bartolomé para recibir cuidado especializado
10	Siento que ampliar el sistema de consultas de telesalud podría optimizar el manejo de los pacientes y mejorar la eficiencia del acceso a cuidado
11	Yo estaría dispuesto/a a tomar un papel de liderazgo en la ampliación y optimización del sistema de consultas de telesalud en el San Bartolomé
12	Tengo interés en explorar los posibles beneficios de telesalud para mejorar la entrega de servicios de salud maternal y pediátrico en el San Bartolomé y a otros hospitales consultantes
13	Creo que los hospitales y clínicas en lugares remotos que manejen casos complejos (maternales y pediátricos) se beneficiarían con la interacción de los médicos del hospital San Bartolomé
14	Siento familiar con los usos de la telesalud en contextos clínicos semejantes
15	Estoy dispuesto/a a hacer una inversión de tiempo adicional para ampliar y optimizar el sistema de telesalud del San Bartolomé
16	Creo que la telesalud puede ser integrado fácilmente al volumen de trabajo de los empleados del San Bartolomé

17	Siento confiado acerca de la fiabilidad del equipo de telesalud
18	Siento confiado de que hay apoyo técnico suficiente e inmediato cuando se requiera
19	(Opcional) Comentario: ¿Por qué dio Ud. estas clasificaciones?
20	Siento que el San Bartolomé esta insatisfecho con los recursos y herramientas que tiene ahora para entregar el cuidado maternal y pediátrico especializado vía la telesalud
21	Siento que el San Bartolomé tiene un apoyo fuerte para la implementación de la telesalud
22	Siento que San Bartolomé tiene médicos y otro personal que tomarían papeles de liderazgo para organizar y ampliar un programa de telesalud
23	Siento que el San Bartolomé esté receptivo a las innovaciones originales para el cuidado de salud
24	Creo que San Bartolomé tiene buenos colaboradores en otros hospitales
25	Creo que otros profesionales de mi hospital estarían dispuestos a hacer una inversión inicial a tiempo para la implementación de un sistema de telesalud
26	Siento que el San Bartolomé tiene acceso a un apoyo técnico comprehensivo y siempre disponible
27	(Opcional) Comentario: ¿Por qué dio Ud. estas clasificaciones?
28	Tiene algún comentario adicional?

Process of Data Analysis:

For general readiness averages, all completed surveys (i.e. surveys for which the respondents answered all questions) were considered. For each readiness category, all surveys completed for that readiness category were considered (See Table in Readiness Specific Analysis of Telehealth Survey).

Data will be digitized and logged for ongoing research in cooperation with Hospital San Bartolomé and MINSA.

APPENDIX *3*

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