ORIGINAL ARTICLE

Formative Evaluation of the Implementation of eHealth in the Philippines: A Qualitative Study

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ABSTRACT

Background and Objective. The utilization of information and communications technology (ICT) to support health, known as eHealth, is a crucial enabler of universal healthcare. It is important to identify various aspects that could support or hinder eHealth, especially in limited-resource settings. This study determined the factors influencing the implementation of eHealth solutions in the Philippines, in consideration of the development process and initial outputs of the Philippine eHealth Strategic Framework and Plan 2014-2020.

Methods. The descriptive-qualitative study was conducted among 15 municipalities/cities in the Philippines, recognized as early adopters of eHealth programs. Records review of eHealth solutions and key informant interviews among stakeholders (i.e., physicians and nurses) per study site were facilitated to gather data. Using directed content analysis, contextual, process, and content factors influencing eHealth implementation in the country were synthesized.

Results. Results showed a range of eHealth solutions in the selected facilities, majority of which involved electronic medical records. Various contextual, process, and content-related factors could serve as facilitators or barriers to eHealth implementation in the country. Particularly, contextual factors include individual characteristics (ICT experience/training, organizational commitment, readiness for change), perceived need/urgency for eHealth (provisions, policies, regulatory issues), and third-party involvement for financial/technical support. Meanwhile, process-related factors involve implementation team practices, appropriate top-down and bottom-up approaches in leader/member engagement, and resource management (ICT equipment, stable internet connection, power supply). Content-specific factors mainly include the eHealth design (complexity, adaptability to local context and service demands, interoperability or the capacity to connect or exchange information with other platforms/systems). Notably, limitations across the three dimensions could make eHealth implementation more complicated, which could lead to poor time management and resource wastage.

Conclusion. This study highlighted the importance of a multidimensional understanding of factors that influence the utility of eHealth in the health system. There is a need for leadership and governance, stakeholder engagement, resource and funding, implementation readiness, appropriate design of eHealth solutions, and proper training to ensure the successful implementation of eHealth in the country.

Keywords: eHealth, information and communication technology in health, process, content and contextual factors in implementation of eHealth

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INTRODUCTION

Information and communications technology (ICT) is changing how healthcare is delivered and how health systems are run. Otherwise known as eHealth, utilizing ICT in healthcare could improve the timeliness and accuracy of public health reporting and to facilitate disease monitoring and surveillance. It is used in information systems, which include electronic health records and patient registries for diagnosis, prevention, and treatment. More national governments are using eHealth systems to improve health.[1]

The World Health Organization (WHO) and International Telecommunication Union (ITU) has encouraged countries to have a strategic plan in eHealth to achieve long-term goals, such as universal access to care, health sector efficiency, reform or more fundamental transformation, and improved regional cooperation.[2] A country's eHealth strategy should be based on national health priorities, the available and potential resources, and the current eHealth environment. In low-income and middle-income countries, ICT is used for different purposes in various health-related areas: 42% to extend geographic access to health care, 38% to improve data management, and 31% to facilitate communication between patients and physicians outside the physician's office, improving diagnosis and treatment, mitigating fraud and abuse, and streamlining financial transactions.[3]

In the Philippines, under the 2011-2016 National Objectives for Health, the use of ICT has been encouraged and prioritized in key reform areas and programs of the government. Such is envisioned to maximize the effectiveness of health care delivery, data collection, and data analysis. Moreover, the WHO provided technical assistance to the Department of Health (DOH) for developing the eHealth Strategic Framework.[4] Hence, the Philippine eHealth Strategic Framework and Plan was first drafted in 2011, updated in 2013, and released in 2014.[5] Moreover, the DOH collaborated with the Department of Science and Technology (DOST) to update the country's eHealth framework to support Universal Health Care or *Kalusugan Pangkalahatan*.[5]

The Philippine eHealth Strategic Framework and Plan 2014-2020 uses the following components to ensure delivery of health outcomes: (1) leadership and governance, (2) strategy and investment, (3) services and applications or eHealth solutions, (4) infrastructure, (5) standards and interoperability, (6) legislation, policy and compliance, and (7) workforce (human resources).[2,5] In the last five years, stakeholders from public institutions, private sector, and academe have recognized their important roles in planning and utilizing eHealth. Systems and tools were developed to advance the application of eHealth in the country, such as electronic medical records, telemedicine, mobile health, disease surveillance, electronic referrals, medication management, and the like. Halfway through the implementation of the updated Strategic Framework (2014-2020), there was a need to determine the progress and gaps in the governance structure of the Philippine eHealth program and identify what improvements were needed to institutionalize eHealth in service delivery towards better health outcomes.

Studies often focus on the eHealth systems' workability but little attention is given to (1) eHealth's effects on roles and responsibilities; (2) risk management; (3) ways to engage with professionals; and (4) ensuring that the potential benefits of new technologies are made transparent through ongoing evaluation and feedback.[6] Barriers to implementation of eHealth in low- and middle-income countries include difficulty in scaling up because of persistent reliance on donor funding, difficulty in adapting an existing organization to a given technology, problems with the end user's acceptance of the technology, and lack of necessary infrastructure to provide reliable electricity and internet.[3]

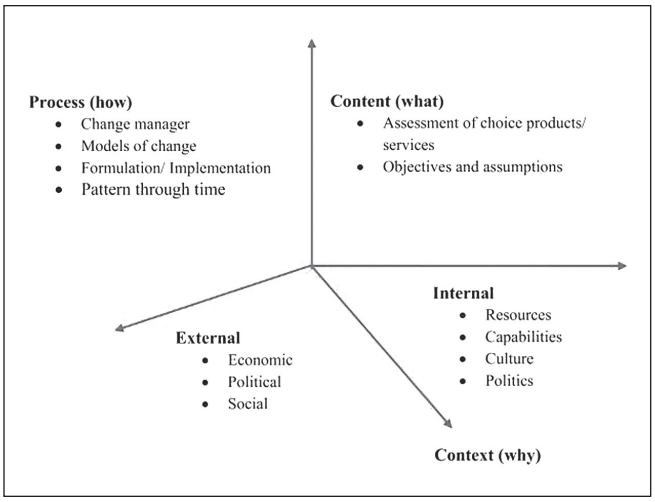

Figure 1. Model of strategic management of change.
Adapted from Pettigrew & Whipp.[7]

The research team conducted a formative evaluation of the development process and initial outputs of the Philippine eHealth Strategic Framework and Plan 2014-2020 covering the short-term period of 2014-2017. Particularly, the current study aimed to explore the eHealth solutions utilized in the country, and more importantly, the factors that influence their implementation in the local setting. By facilitating a more comprehensive understanding of various dimensions affecting eHealth implementation in the country, the study findings could benefit policymakers and stakeholders in promoting wider access to appropriate eHealth solutions.

Conceptual Framework

This study utilized the *Model of Strategic Management of Change* by Pettigrew and Whipp (Figure 1)[7] to describe the factors that influence the implementation of eHealth in the country. This model elucidates three dimensions that impact organizations toward facilitating changes or promoting practices, which include context, process, and content.

Context defines the internal and external factors that address "why" the need for eHealth solutions. This is divided into internal and external domains. The process factor describes "how" the eHealth solutions are implemented. The content factor answers the "what" in describing the eHealth solutions.

METHODS

Research Design

This study utilized a descriptive-qualitative research design to explore the factors influencing the implementation

of eHealth in various areas of the country. This design is used to extrapolate relevant insights from individuals' perspectives by directly gathering information from them and describing their attributed meanings.[8] Particularly, key informant interviews (KIIs) and records review were utilized to gather relevant data from the target participants. KIIs enabled the exploration of individual views by focusing on specific scenarios and clarifying responses.[9] Meanwhile, the records review contributed to the formative evaluation by identifying the range of eHealth solutions being implemented so far in the country.

Participants

Purposive sampling of municipalities and cities was done based on a review of regions and provinces with eHealth solutions obtained from DOH, DOST, and PhilHealth. Health facilities that were included have: (1) adopted eHealth solutions/ technologies, (2) utilized eHealth solutions/ technologies in their business process flows, and (3) meaningful use of eHealth solutions/ technologies in 2014-2017. Fifteen health facilities, ranging from healthcare centers under their respective LGUs to tertiary hospitals under the Department of Health, utilizing eHealth solutions from different providers in Metro Manila (Pasig City, Quezon City, and Muntinlupa City), Luzon (Pangasinan, Tarlac, Laguna, and Cavite), Visayas (Iloilo, Leyte, Bohol, and Cebu), and Mindanao (Sultan Kudarat, Cotabato, Davao City, and Davao Oriental) participated in the study.

The lead persons for the eHealth program in the chosen facilities were the main participants in the study. These participants (n = 15) are physicians and nurses involved in the eHealth program implementation, functioning as data managers, supervisors, and data encoders.

Data Collection

After ethics approval was obtained from the National Ethics Commission (NEC Code: 2017-005-Bonito-eHealth), data were collected from the selected sites from 2017 to 2018. Document review and KIIs were done at the regional/national level to determine the implementation of the eHealth program in the Philippines. Particularly, records review from DOH, DOST, and PhilHealth provided the list of health facilities implementing eHealth solutions. KIIs were done in the respective health facilities and sites to determine factors for success and challenges in the implementation.

The selected sites were asked to list all eHealth solutions or technologies they are using in the hospital and community. Based on the guiding framework mentioned earlier,[7] a semi-structured interview guide was developed to determine the factors (contextual, process, and content) that affect the implementation of these eHealth solutions. The interview guide was pre-tested on three participants who approximated the characteristics of the target participants. They were invited to answer the questions and determine the clarity, relevance, and appropriateness of the questions.

The KIIs were facilitated by three trained research assistants for purposes of interview facilitation and note-taking. The interviews were conducted in the participants' private offices or areas in their health facilities without other people. The interviews lasted an average of 60 to 90 minutes, and were audio-recorded upon the participants' permission. Data collection ceased when no new findings were culled from the interviews and participants returned describing similar topics.

Data Analysis

The audio-recorded interviews were transcribed and field notes were incorporated to facilitate analysis. Directed content analysis was then used to deductively analyze the data based on the pre-established framework[10] containing the contextual, process, and content dimensions involved in eHealth implementation. The significant statements were coded and classified under these three dimensions and were further categorized into facilitators and barriers.

Table 1 gives the summary and definition of the three dimensions of change and the factors within each dimension. The definitions were operationalized according to the study domains.

The research team members independently read and re-read the transcripts to facilitate coding and content analysis. The initial findings were then discussed together to finalize the results and promote credibility and confirmability. The participants' significant statements were then translated into English and presented in the results to establish understanding of the three dimensions and determine their transferability to eHealth implementation.

RESULTS

Inventory of eHealth Solutions

The selected sites list eHealth solutions that were existing from 2016-2018. The list showed collaborative efforts of the government and the private sector including academic institutions. The eHealth solutions were divided into the following types: (1) Electronic Medical Record (EMR), which is a digital version of the traditional paper-based medical record for an individual; (2) Hospital Information Systems (HIS), which is an element of health informatics that focuses mainly on the administrative needs of hospitals and Health Information Technology Provider (HITP); and (3) Others, referring to technologies and tools in eHealth.

Electronic Medical Records (EMR)

The providers of electronic medical records included in the study were: Community Health Information Tracking System (CHITS), Wireless Access for Health (WAH), and eHealth Tablet for Informed Decision Making of LGUs (eHATID LGU). CHITS is an electronic medical records system developed by the National Telehealth Center to improve health information management at the RHU

Table 1. Dimension of Change and the Factors within each Dimension

Dimensions of change	Factors within each dimension
A. Context *Refers to the organizational setting where eHealth is implemented, either a community or hospital setting*	• Individual characteristics, resources, and capabilities – factors that influence the ability of users to adopt e-Health which includes sociodemographic characteristics, personal traits, belief in their capabilities, perceived relationship with the organization, and attitudes towards the intervention • Perceived need for eHealth – perception or belief that eHealth fulfills a specific need or service demand • Third-party involvement – Involvement of actors or stakeholders that do not belong to the targeted user group
B. Process *Series of actions or steps taken across time with the aim of implementing eHealth*	• Implementation team/practices – stakeholders or actors within the organization and activities that initiate or promote change • Bottom-up approach – Implementation strategy based on shared project ownership based on horizontal relationships between stakeholders • Top-down approach – Implementation strategy based on centralized project ownership with vertical relationships between a single stakeholder and external actors • Resource management – Strategic allocation of scarce resources • Conflict management – Management of competing stakeholder interests as well as their ideas on the project; the difference between role expectations and actual roles performed • People and organizational issues – Problems among individuals and organizations that occur when implementing eHealth, such as with technical support
C. Content *Refers to any interactive communication and information technology aimed at enhancing the quality of life and/or health outcomes*	• Project design – The set of shared ideas about what the project is, including its aims, costs, and conditions for success. This considers adaptability, availability, accessibility, complexity, and design quality. • e-Health design – Technical and user features of the implemented eHealth • Sustainability – The enduring adoption of eHealth content; this primarily refers to funding and costs

level. Meanwhile, the WAH Initiative is a public-private partnership (PPP) that aims to further access to quality health data and encourage local health governance. WAH works to capacitate LGUs in the use of e-/m-Health technology to generate quality electronic data for informed decision-making. The eHATID LGU is a software application designed for mobile Android devices, which provides a health information system and decision-making support to LGUs through an electronic medical records system.

CHITS and eHATID started as studies in 2004 and 2014, respectively, while WAH was developed in 2009, expanding to different sites in the Philippines. The projects were continually improved and revised as they received inputs from the pilot testing. They received funding and assistance from several institutions that were instrumental in the continuous development and expansion of these programs.

The participants cited several inspirations before these programs were developed. These include: (1) recognizing the need for a health information management system in the country, (2) enabling the LGUs to make better plans for the community, (3) addressing the imbalance between allocating time for patient care and submission of reports, and (4) finding solutions to the problem of inaccurate health data brought by insufficient time in completing reports.

Several milestones in the development of eHealth solutions have also been mentioned. CHITS explored how to use and dispense electronic information in 2012, then enhanced the project into a mobile platform or application in 2013, and focused on developing data generation from 2014 onwards. WAH was transformed into a full-fledged non-profit organization funded by private and public organizations in 2013, and successfully expanded to different sites in the Philippines. The eHATID was implemented in several local government units in the country.

These providers also have different strategies in terms of the management of the implementation of the eHealth solutions. The UP Telehealth Center, the provider of CHITS, evaluates the use of the product by the end-users as well as its acceptance by the patients and the healthcare personnel. They also evaluate its effect on health delivery and on the improved decision-making of the local chief executives. In WAH, there are designated persons responsible for running a specific function, like advocacy, training, and operations. They have a system to evaluate the quality of data and save backup for the LGUs. They also utilize a tool which they call RHU scorecard wherein they evaluate the timeliness and completeness of data being submitted to them by the LGU. For eHATID, the core team was in charge of orienting the users to the EMR and conducting initial training. They hired Regional Technical Assistance Partners (RTAPS) to manage issues reported by the users at the regional level before they ascend the issue to their main office.

Hospital Information System (HIS) and Health Information Technology (HIT) Providers

Segworks Technologies Corporation developed a data collection system for Mindanao called Mindanao Integrated Health Information System (MIHIS) as requested by the DOH Region XI. There are two versions of the hospital information system. The first system (SeGHIS) has charging and billing of fees as its core, and the other system, *SegRHIS*, is an electronic medical record (EMR). They are also one of

the seven certified health information technology providers of PhilHealth for the eClaims. SegHIS is a Hospital Information System (HIS) designed to manage the clinical, administrative, and financial aspects of a health system. SegRHIS or the Segworks Rural Health Information System is a web-based Electronic Medical Record and rural health information management system designed to automate the operation of health centers.

Segworks has installed hospital information systems in 16 healthcare institutions in Visayas and Mindanao. Their pilot site was the Davao Medical Center (now Southern Philippine Medical Center) wherein they had roles in the development of the HIS (Phase 1 and 2) as well as maintenance procedures and IT support from 2006 to 2012. The identified stakeholders were the Department of Health, the local government unit, pharmaceutical companies, device manufacturers, talent suppliers, healthcare professionals, institutional providers, public health insurers (PhilHealth), private health insurers, and patients. The goal of the information system was to create a shared health record among these stakeholders in line with the Philippine Health Information Exchange.

Topaz Philippines Software Development and Management Services is an information technology provider founded in the United States, branching to the Philippines. They offer *Topaz-WN8*, a full-featured hospital billing and management software with a direct link to PHIC for patient benefits verification and electronic claims. The *Topaz-EMR*, and electronic medical record that is fully integrated into the Topaz- WN8 software is also available. It offers advanced features such as transcription report writing, templating, electronic signature, prescriptions, medication history, graphical index tracking, and more. These may be used separately or in cohesion. Another eHealth solution available is the *Topaz PERK* or the Personal Electronic Records Keeper, which collects important personal and business information at all times with a USB mobile memory device. It is fully encrypted with double password protection.

They have allowed for the possibility to check billed amounts in any period and compare them to the processed amount, which was deemed unavailable in other providers. The program continually collects inputs, as the patient progresses through the hospital care system, and this is submitted to the Department of Health. It also has the ability to report monthly consumption of pharmacy and other patient-related quantities dispensed. They also use the regularly updated PhilHealth Forms (CF1, 2, and 3) with the patient electronic eligibility verification.

Other Technologies and Tools

RxBox is a multi-component program (biomedical device, electronic medical record system, and telemedicine training) designed to provide better access to life-saving health care services in isolated and disadvantaged communities nationwide. It is one of the Department of Science and Technology's efforts for a "Smarter Philippines." It is also an ICT (Information and Communications Technology) innovation designed to support the Department of Health's call for "*Kalusugang Pangakalahatan*" or Universal Health Care. *Getz Clinica*l is another information system, an IT software company in the perioperative industry. They specialize in Anesthetic Information Management Systems.

Factors Affecting Implementation of eHealth Solutions

Information from the key informant interviews was broadly described and categorized under the dimensions of the model of Pettigrew and Whipp.[7] Some examples of the responses from the participants are quoted in italics to emphasize the factors described. It is important to note that the rich qualitative information obtained from the interviews overlaps and cuts across more than one dimension of the model.

Contextual Factors Influencing eHealth Implementation

Results showed the following contextual factors that facilitated the implementation of the eHealth program. In terms of individual characteristics, resources, and capabilities, what facilitated eHealth adoption and implementation includes having ICT experience which for most users came from the training and seminars provided to them as well as previous exposure to ICT and technology resulting from their work or personal interests:

> *"DOH conducted a training and asked for a representative… In the first training, we assessed and planned how we would implement the system. Afterwards, we did a similar training for our own staff."* [Participant 1]

The efforts to promote, advocate for eHealth, and perform their assigned roles show commitment within the organization that points to positive eHealth implementation:

> *"At times, records are misplaced, highlighting the necessity for an integrated system. For instance, during patient consultations, I often receive vague chief complaints like 'Follow up' without accompanying details. This prompts staff to search for the complete records, only to discover they are missing. Consequently, I'm compelled to conduct additional patient interviews. Given the volume of patients I handle, exceeding 60 on average, it's impractical to recall each one. Hence, I've resolved that transitioning to an electronic medical records (EMR) capable facility is imperative."* [P2]

Those with ICT skills, young, or familiar with other technologies, are also more likely to adopt eHealth. On the other hand, those who are not technology-capable may have difficulty adjusting and adapting to an eHealth environment. Older healthcare staff who trained expressed difficulty in

using desktop and mobile computers as well as adjusting to the change. One key informant said that they had a hard time adjusting to the new system, especially those who are older and are used to paper-based documentation, thus, they prefer younger staff:

> *"Younger midwives exhibit a higher proficiency in technology, which enhances efficiency in tasks and report generation. Thus, choosing to hire younger individuals would yield notable benefits. Staff members proficient in computer skills are better equipped to maximize system performance."* [P1]

The second category focuses on the stakeholders' perceived need or urgency for eHealth. Following national and local directives, one participant described:

> *"The city contacted (the provider) to introduce the EMR … in all our eleven health centers. All upgrades and updates of the software were collaborated with (the provider). … In Maternal and Child Health (MCH), a need was seen for the use of the Electronic Medical Record (EMR), and interoperability to facilitate referrals. PHIC also mandated compulsory use of the portal for maternal, newborn and child health."* [P3]

Another verbalized the importance of eHealth,

> *"Nurses find it greatly beneficial, as they can easily access the doctor's orders and patient results. Providing information to patients upon request is likewise easily achievable."* [P10]

Barriers in this category included the perception that the program does not fulfill a specific need in their institution and that given the regulatory issuances they "felt forced" to adopt and implement eHealth:

> *"…Due to the mandates from DOH and PhilHealth requiring the use of EMR for eclaims, we had no alternative but to comply. Therefore, I opted for the eHealth solution endorsed by the DOH. However, personally, I would have preferred to explore other EMR options if given the opportunity.…"* [P1]

Some of the participants verbalized lack of awareness or understanding of eHealth solutions:

> *"The Sangguniang Bayan members were evidently not fully informed about the necessity of the eHealth solutions due to insufficient explanation." One member expressed, "In our experience, we weren't introduced to the full EMR options. We were hoping for a forum or symposium to enable us to make an informed decision on which option to utilize and determine the most suitable one for our needs."* [P5]

Third-party involvement is based largely on the financial and technical support (such as hardware equipment and internet connection) provided by various agencies to help fund the project implementation given the lack of these resources in some LGUs.

> *"The local government supplied the hardware, showing their support in this matter. However, we were uncertain about the quantity of laptops or desktops required. We received assistance from the Joint Program for Maternal and Neonatal Health (JPMNH), with contributions from AusAID. However, this support was not explicitly targeted towards eHealth initiatives."* [P3]

In some provinces, they did not limit themselves to the eHealth solution offered to them. There were instances where the choice was based on the ability of the eHealth provider to meet their needs before and after implementation:

> *"The Municipal Health Officer (MHO) and another nurse initially attended an orientation organized by the DOH, where they developed an interest in the eHealth solution compared to other systems. Following this, the MHO coordinated with the provider, leading to training sessions for all staff members. The eHealth solution provider furnished a list of required materials, which were procured using the PhilHealth Capitation Fund. Subsequently, the eHealth solution was installed on laptops and desktops for implementation."* [P5]

While some Local Government Units (LGUs) managed to secure supportive stakeholders, others encountered challenges in coordinating with them, particularly regarding timely technical support from eHealth solution providers. Furthermore, one interviewee voiced apprehension regarding the long-term implementation costs associated with eHealth solutions.

Process-related factors influencing eHealth implementation

Another cluster of factors that help explain the adoption outcomes in eHealth implementation focused on process factors. The process factors included six categories: (1) implementation team practices, (2) bottom-up approach, (3) top-down approach, (4) resource management, (5) conflict management, and (6) people and organizational issues.

Some implementation team practices were found to motivate staff such as: providing appropriate guidelines, technical support, monitoring, and field visits. They consider these important as these facilitate the realization of expected outcomes especially during the start-up period:

> *"DOH gives advisories and assists with the implementation of the program…" and "CHD – monitors it monthly through field visits and online checking, solves problems through self-learning. In some cases, weekly uploading and daily monitoring of the extent of the implementation and number of covered patients…"* [P6]

When asked about the role of stakeholders in the implementation of the program, participants responded they

> *"…support through financing, implementing, logistics and technical issues…"* [P4]

Although all eHealth solution providers organized training and seminars during the initial implementation phase, in certain areas, only one individual from each LGU was trained. These individuals were then assigned the responsibility of training their program staff, a structure that some consider insufficient in terms of numbers to fully develop staff skills and capability:

> *"During the seminar, only one tablet was provided for two attendees, posing a challenge for data encoding. If I were to use the tablet, the nurse would have to wait for her turn, potentially causing delays. Effective time management and addressing system inefficiencies are crucial considerations, in addition to the poor internet connection provided."* [P7]

Some participants focused on the lack of resources, lack of time, and poor internet connection, while others suggested the need for more data encoders:

> *"The capability for implementation is a significant concern, especially considering the necessity to enroll and encode all our patients. Encoding is expected to be time-consuming, requiring staff with proficient computer literacy due to the substantial workload. Thus, the first crucial step in implementation is to secure skilled encoders. While the process is expected to become more manageable once all patients are enrolled, the initial phase poses a significant challenge."* [P8]

One significant barrier was the interference with the health care professional and patient relationship. Doctors report that rapport with patients is lost when they find themselves typing or encoding during consultations; while nurses find themselves "taken away from patient care" when they have to handle the encoding of data themselves:

> *"Encoding between patient interviews and physical examinations disrupts rapport-building. To maintain patient engagement, I initially jot down notes on paper before encoding them later."* [P9]

This was echoed by another:

> *"…unfortunately, the shortage of encoders places an additional burden on the nursing staff already overwhelmed with clinical duties. Instead of focusing on patient care, they must divert their attention to encoding tasks."* [P8]

Facilitators for the bottom-up approach included leadership engagement as when the local chief executive initiated program implementation by providing linkage to the e-health solution provider/vendor; a sense of shared project ownership expressed in a common commitment of both the LGU and the health care staff to implement the program:

> *"…with the surge of computerization globally, the LGU has kept up with the trend keeping in mind the advantages of an organized and easily accessible data gathering and recording. It was a collective effort in facilitating the establishment of programs in eHealth: acceptability of staff and willingness to learn, clear directions, and commitment from local executives down to the grassroots level."* [P3]

The lack of coordination among key stakeholders – the program provider and in some cases, the local chief executive himself, arising from a lack of perception regarding eHealth – poses a barrier:

> *"The commitment of the LGU, as well as that of the staff and other stakeholders involved, including the PhilHealth coordinator, is crucial for successful implementation. However, in our municipality, there is a notable lack of coordination. This hinders constructive discussions when issues arise. The team leader must effectively communicate concerns with the LGU, recognizing that they may not fully grasp the intricacies of our work. Building a mutual understanding is essential for getting the support we need."* [P12]

After DOH and PhilHealth mandated the use of EMR to claim for reimbursements, they provided the orientation and training for this purpose as signified by one participant:

> *"It started when they received a memo from the DOH Regional Office XI that they needed to use the official EMR. Three of the staff members then underwent training in Davao City."* [P2]

In addition, seminars were conducted in some cases to link users with eHealth providers/vendors to assist in choosing the program that best works for them, thus, creating collective learning through openness to diverse groups:

> *"Their approach was top-down, originating from the province and cascading downwards to the barangay level. They introduced their system and offered funding for our training, which we accepted. While they covered the financial aspect of the training, our responsibility was to implement it in the Rural Health Units (RHUs). The RHUs, in turn, procured their own IT equipment. As you can observe, nothing came entirely free of charge, except for the open-source system itself. Despite this, the approach proved effective for us."* [P4]

The capability for implementation when it comes to resource management rests on the availability of sufficient resources such as ICT equipment and a stable ICT infrastructure (internet connection and power supply):

"...the data servers have a room, controlled 24 hours, and there are ITs and other technicians who look after these. I believe that this is the biggest data center in the country. It is worth more than 100 million pesos. We have six database servers. When one is down, five are running, and so forth. Now if anything happens inside, the engineers in Singapore are directly alerted. Every important change in the eHealth system is monitored, cross-checked, and well documented since we are also ISO accredited." [P14]

For the most part, they identified the availability of ICT equipment or the lack of it as facilitating or hindering eHealth implementation:

"They lack dedicated workstations specifically designated for the iHOMIS system. These workstations should be exclusively utilized for eHealth purposes without any connection to other applications or services. Currently, the computer used for laboratory data transactions is also serving as the workstation for iHOMIS, which may compromise the system's effectiveness." [P13]

"…mainly lack of encoders and frequent server malfunctions are the problems we have as frontliners who frequently go to the health center. If there are computer problems, the eHealth solution contact persons are always accessible…" [P2]

"…internet connectivity, particularly in Geographically Isolated and Disadvantaged Areas (GIDA) and the 5th to 6th class municipalities, is a primary concern. The challenges primarily stem from the lack of infrastructure and resistance to change. Additionally, users have reported issues such as system slowness, which we are actively working to address alongside other related issues." [P2]

Some factors they cited as causes of problems:

"... the personnel and funding are indeed significant contributing factors. During brownouts, they are unable to sync, and when the internet is weak, they sometimes have to stay longer. I believe the internet infrastructure across the entire Philippines or in the region is a challenge because many municipalities struggle with internet access. Additionally, since the iClinicSys module can be used for Barangay Health Stations (BHS), most BHSs lack internet access. If they do have access, it is usually slow.." [P13]

All areas reported receiving "free" training, equipment (desktop computers, laptops, and tablets), and internet connection during the initial phase of the implementation. However, problems started to occur with maintenance costs, wear and tear of equipment without replacements, and unstable internet connection. This led to situations where users needed to "share use of tablets," endure power interruptions, and even do manual backing up of files using flash drives to prevent the loss of data. One cited an experience when the computer crashed, and they lost data:

"When the computer I was using crashed, I lost three months' worth of data as it couldn't be recovered. Unfortunately, I had neglected to back up the data from the last quarter—a lesson learned the hard way. It's clear that regular backups are essential, especially considering that computer lifespans typically don't exceed five years." [P12]

It was further noted that the provision of required resources and the maintenance of these depended on the financial capability of the LGU or hospital and the fact that eHealth solution providers came from the private sector.

The conflict management category includes facilitators of coordination and commitment among key stakeholders (local officials and staff) particularly in creating a climate that supports program implementation.

"LGU support is crucial; they readily provide assistance upon our request. It's equally important for our staff to remain compliant with the guidelines set forth." [P3]

"Leadership and commitment to the eHealth program facilitated its adoption." [P1] *and,*

"We are in constant partnership and communication with the provider for improvements and technical repair." [P14]

However, instances such as delays in response to technical issues and assistance from providers, politicking among local government officials, and changes in reporting requirements of PhilHealth between the use of printed copies and logbooks over EMRs reflect a lack of consensus and commitment among key stakeholders.

"Our IT personnel initiated the request for technical support by sending a screenshot of the issue. Typically, minor problems are resolved within the same day. However, in the case of major technical issues, such as a hard disk drive failure, resolution could take up to one month. During this period, we are unable to synchronize or backup the data, leading to potential disruptions in our operations." [P3]

"I was genuinely enthusiastic about transitioning to paperless patient consultations, which was actively encouraged at the time. However, for reasons unknown, PhilHealth denied us accreditation for the Primary Care Benefit. During their inspection, they requested logbooks, case numbers, and printed copies of reports, rendering the printing of EMR data redundant. We were even

informed that the eHealth solution was not intended for EMR but rather for managing medicine inventory. Despite these setbacks, I firmly believe in submitting electronic reports and support the shift towards paperless documentation using the provided eHealth solution. Nonetheless, as I mentioned earlier, there appear to be inconsistencies that need addressing." [P3]

Finally, people and organizational issues include problems among individuals and between organizations that can occur when implementing eHealth and includes factors related to demographics (age), lack of coordination among key stakeholders, logistical problems, and problems with technical support, external policy, and regulations.

"Whenever we encounter technical issues and concerns, such as system error messages during the encoding of vital signs or the systems review and physical assessment, we typically submit requests for technical support. However, we often face delays in receiving feedback or assistance in resolving these issues." [P2]

Content-related Factors Influencing eHealth Implementation

The third cluster of factors related to eHealth content which looks into the eHealth solution itself in terms of its overall ability to achieve the reason for its use as intended, the technological aspect, and the continuity of the program in terms of funding and support. These factors are grouped into three categories: project design, eHealth design, and sustainability.

Participants acknowledged the benefits derived or can be derived from the use of eHealth solutions particularly in terms of use:

"The EHR benefits the stakeholders in its mobility and portability (improved access anytime, anywhere). Having a responsive design for desktop and mobile devices gearing towards paperless transactions, ease of providing clinical decision support such as with alerts and reminders, the capability of e-charting and having the telemedicine program ready." [P14]

At the same time, some factors restricted adoption in terms of project design which include aspects of data privacy, complexity, and the inability of the technology to meet the needs and desired outcomes as planned:

"We ensured patient consent by clearly indicating in the form section that it is based on and in compliance with the Data Privacy Act. It's important to note that there is no violation of human rights in this process, as patients have the right to refuse or withhold consent if they choose to do so." [P5]

The eHealth design factors that facilitate adoption and use include the ability of the technology to meet the service demand, eHealth interoperability (i.e., capacity of eHealth to connect or exchange information with other platforms/systems), and technological features that promote connectivity, flexibility, and mobility. This was emphasized in the document *National Implementation of Health Data Standards for eHealth Standardization and Interoperability*.[8] One design that was considered useful was the online-offline feature:

"When internet connectivity poses challenges, the eHealth solution we utilize offers both online and offline features. Personally, I find the online feature more convenient to use. However, individuals in the barangay encounter difficulties with the offline mode, particularly with syncing data, which can be time-consuming. I've advised them to sync their data daily, but some prefer to perform bulk syncing after several days." [P6]

"The eHealth solution provider should make sure that it will be readily integrated in the plan of DOH to pass all records in a consolidated network…thus, a need for upgrading the system." [P5]

However, there were identified situations or features that may hinder or limit the usability of the eHealth solution:

"The eHealth solution we utilize is compatible with Android phones and tablets but not with iOS devices. This limitation poses challenges, especially considering the time-consuming nature of other applications on the Android platform. Encoding data for a hundred patients per day becomes even more challenging, particularly when online access is required. Additionally, since we lack our own server, all our data is stored with DOST." [P5]

On the sustainability question, a representative of the DOH Knowledge and Management and Information Technology Service (KMITS) explained that the program is continuously being upgraded and therefore evolving since it is integrated or part of the strategic plan:

"This is outlined in the strategic plan, particularly concerning operations, maintenance, and continuous enhancement. Scheduled updates, such as yearly updates, are projected in our work plan to ensure the system remains up-to-date and optimized." [P11]

Table 2 summarizes the various contextual, process, and content-related factors of eHealth in the Philippines, which are further categorized as facilitators or barriers to implementation.

The eHealth adoption and implementation are promoted when the design includes the following factors: (1) eHealth project is tailored to specific and agreed needs; (2) technology is publicly available and accessible; (3) technological artifacts are similarly interpreted by stakeholders; and (4) realistic and pragmatic goals are set for both development and adoption in line with the available funding.

DISCUSSION

This study, which is part of the formative evaluation of the Philippine eHealth Strategic Framework and Plan, specifically focused on determining the different factors associated with the implementation and achievement of performance targets of eHealth solutions in the country. It provided a distinct opportunity for eHealth users, both managers and staff, across the country to share their experiences and contextual perspectives about eHealth.

The model of strategic change developed by Pettigrew and Whipp[7] served as the organizing framework. This perspective suggests that organizational change is influenced by context, process, and content, highlighting that change is perceived as a continuous interaction within and across these dimensions.[7] The use of this model to understand change

Table 2. Contextual, Process, and Content-related Factors Influencing eHealth Implementation in the Philippines

Category	Facilitators	Barriers
Contextual factors		
Individual characteristics, resources, and capabilities	• ICT experience • Commitment to organization	• Demographics (e.g., age) • Inadequate ICT skills • Inadequate readiness for change
Need for eHealth	• External policy • Management commitment and support to change • Available alternatives for receiving services/ information	• Does not fulfill a specific need • Regulatory issues
Third-party involvement	• Stakeholder engagement	• Lack of or poor stakeholder engagement
Process-related factors		
Implementation team practices	• Capable, skilled, motivated implementation staff/team • Implementation strategy to motivate people (both from within and without) • Training/capacity-building	• Interference with health care professional and patient relationship • Lack of capable, skilled, motivated implementation staff/team • Lack of coordination
Bottom-up approach	• Leadership engagement • Shared project ownership • Implementation leadership, creating collective learning through openness	• Lack of awareness/coordination with LGU • Inadequate information on eHealth for facilitating decision-making and support
Top-down approach	• Centralized project ownership • Implementation leadership, creating collective learning through openness • Top-down decision making	• Breakdown in communication • External policy on specific use of eHealth solution
Resource management	• Provision of available needed ICT equipment	• Inadequate personnel compensation and remuneration • Insufficient resources • Lack of needed ICT equipment • Lack of required ICT infrastructure
Conflict management	• Coordination among key stakeholders • Commitment among key stakeholders	• Lack of coordination among key stakeholders • Lack of commitment among key stakeholders (provider) • Lack of consensus • Lack of shared receptivity to intervention
Content-related factors		
Project design	• Accessibility • Adaptability • Availability • Design quality	• Complexity • Design quality • Lack of adaptability • Data privacy
eHealth design	• Fits local context • Meets service demand • eHealth interoperability • Technological features (connectivity, flexible, mobile)	• Complexity • Does not meet service demand • Lack of interoperability • Technological features – lacking in reliability, flexibility • Not user-friendly
Sustainability	• Funding and costs • Monitoring and feedback • Stakeholders' sense of ownership • Stakeholders' commitment and involvement	• Lack of stable ICT infrastructure • Limited funding being project-based • Lack stakeholders' commitment and involvement

implementation has been cited in other health-related studies.[11,12] Using this framework, the study looked into factors that either facilitated or hindered the implementation of eHealth.

There are significant contextual factors that could explain why eHealth implementation was successful and what served as barriers to its implementation. Internal factors that facilitated implementation included eHealth users with ICT experience and belonging to a younger age group, mutually perceived commitment to the organization and support to change, and perceived need for eHealth supported by external policy from the national government down to the local level. Personal attributes such as the healthcare professionals' computer skills, abilities, and experience could impact the implementation and acceptance of e-health systems.[13] These can shape positive attitudes when eHealth solution users perceive the benefits and usefulness of the system.

Although the local government and healthcare staff express commitment and support to implement the program, the need for eHealth adoption and implementation was widely accepted as a policy issued by both the DOH[14] and PhilHealth[15] towards which they have to comply for electronic claims purposes. Some considered this positive since they are ready for a paperless system, while others felt burdened by the lack of fit between the perceived need and the e-health solutions provided, in addition to regulatory issues that affect workplace efficiency. Implementation climate encompasses the compatibility or overall alignment between the e-health intervention and the organization. When e-health systems seamlessly integrate with existing workflows, and when they are perceived to enhance workplace efficiency, this facilitates their adoption and use.[16,17] However, when healthcare professionals perceive that these systems disrupt workflows and the delivery of care, they are regarded as barriers to adoption and implementation.[16]

Third-party involvement consisted mostly of support from the local government and e-health solution providers in terms of finances, provision of resources, and technical support. Adequacy of training, and timeliness of needed support or the absence of these elements can either be a facilitator or barrier to e-health implementation. Ensuring sufficient time for staff training and allowing for a transition period to adjust to the new system are regarded as crucial.[16] The availability of resources, such as reliable internet connectivity and access to computers, is also seen as essential for the successful implementation of the project.[17]

Meanwhile, process-related factors concern how eHealth implementation is carried out, covering implementation practices, bottom-up and top-down strategies, resource management, and conflict management on competing interests and ideas, including people and organizational issues.[13,16] Leadership engagement, management support, and shared project ownership ensure collective learning through organizational openness.[15,17] When program staff members are more capable, better skilled resulting from training, and motivated, this will have a positive effect on eHealth implementation.[5,18]

Challenges in implementation stem from breakdowns in communication, insufficient coordination with local government entities, inadequacies in sustaining resource provisions, external policies mandating the use of specific e-health solutions, and a lack of sustained commitment among eHealth users. Such situations as described add more work on the part of eHealth users. Addressing these multiple factors, including personal factors, is essential; otherwise, there is a risk of failing to sustain and enhance crucial aspects of the implementation process.[19,20]

As in any organizational change process, those involved within and outside the organization need to undergo a period of transition to allow for preparation and acceptance to ensure correct implementation and long-term commitment.[21] Successful implementation is achieved if it involves a planned strategy to spread the program with an identified needs-based eHealth service, and when possible, user engagement in design and development.[22]

According to Hage and colleagues,[18] the adoption of e-Health is fostered through project designs that incorporate several key factors: customization of the e-Health project to meet specific and agreed-upon needs; ensuring the technology is publicly available and accessible; ensuring that technological artifacts are interpreted similarly by all stakeholders; and setting realistic and pragmatic goals for both development and adoption in alignment with available funding. In addition, appropriate eHealth design essentially means that the technical design features must align with the local context, ensuring that the technology is reliable, flexible, mobile, ergonomic, user-friendly, and, where applicable, offers high image quality.

Project design-related factors identified in the study that promote eHealth adoption included the ability of the eHealth solution to fit the local context, ease of use, the ability of the technology to meet desired outcomes, interoperability, and technical features that allow ease of connectivity, flexibility, and mobile. If these features or characteristics are missing, they tend to make the tasks more complex leading to poor time management and waste of resources.[16-18] In some cases, these can even be a deterrent to using the system.[5]

To ensure the sustainability of the project, the collaboration among stakeholders will benefit implementation when their roles are transparent in terms of objectives, benefits, and outcomes, and this should be an essential part of the project design.[12,13,16] The national commitment to a successful implementation of eHealth programs and actions should be backed by sustainable funding that allows for the development, capacity-building, and evaluation of the program that is aligned with a national strategy for eHealth.

Study Limitations

The study has some limitations. Due to funding limitations, the study only included one representative from

each of the 15 study sites. Involving more stakeholders in the eHealth implementation might have enriched the discussions and provided more insights regarding the topic. Nonetheless, the key informants were the lead persons involved in the eHealth implementation in their organization. The potential for social desirability bias among the participants cannot be ruled out, as the interviewers are also healthcare professionals. There was also the possibility of recall bias among some participants when they were asked to describe their experiences with the utilization of eHealth solutions in their respective institutions. Nevertheless, the interviewers utilized probing techniques to reduce such biases. For a more objective evaluation of eHealth implementation, future studies could utilize quantitative measures with larger samples.

CONCLUSION

The range of eHealth solutions being developed and implemented in the Philippines shows their potential to help improve the efficiency and quality of healthcare delivery systems, especially in the roll-out of universal health care. However, there are issues regarding the utilization, adoption, and implementation of eHealth, evident across regions within the country.

Majority of the eHealth solutions implemented in the country involved electronic medical records. Meanwhile, contextual, process, and content-related factors either facilitate or hinder the integration of ICT in healthcare. Contextual factors include various individual characteristics, perceived need/urgency for eHealth within the organization, and involvement of third parties providing additional support. Process-related factors to consider are the implementation practices, top-down and bottom-up approaches, and resource management across health facilities. Moreover, eHealth content-specific factors highlight the complexity, adaptability, and usability/compatibility of eHealth in connecting/exchanging information with other systems. Notably, the study highlights the need for leadership and governance, stakeholder engagement, adequate resources and funding, implementation readiness, appropriate design of e-Health solutions, and training to ensure the successful implementation of eHealth in the country.

Recommendations

Based on the results of this study, we provide the following recommendations to strengthen the implementation of eHealth in the Philippines:

In leadership and governance, a clear delineation of the roles among government agencies and eHealth solution providers is important. There should also be sufficient legislative support for eHealth implementation and standards, and for technology to address interoperability, security, and privacy. Key stakeholders and implementation champions in the LGUs should be included as early as possible in the implementation process. The key stakeholders must include not only the health workers who will implement but also the clients who will be the recipients of the service and the eHealth solutions. Sufficient financial support needs to be in place not only for the start-up implementation but provision to sustain the program. It was mentioned several times in the study the need to ensure data integration at the national/regional level to maximize the features of the data systems in terms of report generation and other usability. Ensuring that organizations are ready to implement in terms of needed equipment, internet access and data encoders are also considered. The key implementation approach should also consider social preparation such as awareness of the public and other stakeholders.

The development of appropriate eHealth solutions needs to carefully consider the following: adaptability of the system, complexity of the system, compatibility with existing systems and work practices, and financial capacity of implementers and users. There must be an effort to incorporate into the design established standards for technology addressing interoperability, security, and data privacy which will enhance acceptability and eHealth implementation.

There is also a need for the provision of training and education to all those involved in the implementation of the specific eHealth solutions. Training should include regular updates in the form of continuing professional development (CPD) seminars about health information and eHealth solutions.

Successful adoption and implementation of eHealth necessitate not only recognizing and comprehending the factors that influence implementation but also being adequately equipped to devise strategies and interventions aimed at enhancing the widespread, effective utilization of eHealth and mitigating barriers to implementation.

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Both authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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