

# Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines

Eileen Rose Cabildo Quilon, Amando Pimentel Singun

**ABSTRACT**--- *The inequality in healthcare access remains more serious by the shortage of health workers and providers resulting to slower and less efficient delivery of healthcare services in the country. In the Province of Ilocos Sur, one of the main problems is the prolonged waiting time during medical consultation apart from the unavailability of Municipal Health Officer (MHO) in some of the municipalities in the upland. However, there are Rural Health Midwives who are assigned in every Rural Health Units (RHUs) and Barangay Health Stations are being established in which Barangay Health Workers (BHWs) are dynamically working in order to respond to the immediate primary healthcare needs of the community. To address such aforementioned concerns, Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines has been developed. It is an android application that serves as a tool for checking symptoms that are related to the patient's health concerns. The system stores information about the various symptoms associated to particular illnesses. However, the developed system can never be an absolute substitute for medical practitioners' knowledge and expertise. This is only perceived as a helpful tool to support consulting services.*

**Keywords** — *Healthcare, Symptoms, Teleconsultation, Mobile Application, Primary Care, Rural Health Units*

## I. INTRODUCTION

Hospitals and Rural Health Units or Centers deliver relief against sicknesses and diseases. They play a major part in both curative and preventive health services in the community. Through the assistance of continuous progress, their efficiency and operations have developed significantly. The effectiveness of hospital and rural health units is determined by the service provided to the patients, patient care management, and patient satisfaction.

The Philippine Health System is a combination of public and private systems. There are healthcare levels in the country such as public sector which composed of the Department of Health (DoH) and the Local Government Units (LGUs). The private sector are being well-established and continuously improved through the specialized clinics and private hospitals.

However, the Philippine Health System may view to have good standards regardless of the fact that its facilities may not be that trendy, techy, and impressive as compared to the developed countries having high-end health systems. Though it is a common knowledge that the country has highly educated and competent doctors who graduated from top universities in the country and abroad. Similarly, nurses, medical technologies, and pharmacists are also being trained competitively to have excellent standards.

The Rural Health Units (RHUs) is the primary institution in the community which is responsible for the promotion of health and prevention of illnesses. The services offered by RHUs are not only focusing to particular individuals but also to the entire family and the community-at-large.

Among the thirty-two (32) municipalities of the province of Ilocos Sur, there are thirty-two (32) RHUs but unfortunately, some of the municipalities in the upland do not have Municipal Health Officers (MHOs).

One of the problems in the delivery of healthcare in rural areas is the shortage of its physicians, medical staff, personnel, and community health workers because they usually seek for greener pastures from other organizations that offer more benefits and professional growth.

Going to health centers for medical consultation may take a lot of time waiting for the result. Such an example of difficulty in the access of the healthcare facilities and services may lead to the increase of patients' physical and emotional stress and the reduction of the chance to seek for follow-up medical care and consultation. Therefore, one of the best ways to overcome such a problem is a tool that will help and provide facilities to the people especially across the rural areas. To address such a concern, the Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines has been developed. It is a tool for checking symptoms that are related to the patient's health concerns. This tool can address the unwieldy and inefficient waiting time, abortive consultations and treatments while waiting for the results. Further, this study targets to have a wider range in extending and providing better quality care to the Ilocanos and ensures that they receive the best care that is available at times when they would need it. However, the teleconsultation system is, by no means, a replacement of a physician's primary care but rather serves as an extension of traditional healthcare that creates more efficient process for all patients while allowing for greater access to healthcare.

## CONCEPTUAL FRAMEWORK

The Input-Process-Output (IPO) Model as shown in figure 1 had been utilized in order to identify the system's inputs, output, and the processing steps required to transform the inputs into the required output.

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**Eileen Rose Cabildo Quilon**, University of Northern Philippines. (E-mail: eileenrose.quilon@unp.edu.ph)

**Dr. Amando Pimentel Singun Jr.**, Higher College of Technology, Muscat. (E-mnail: Amando-Singun@hct.edu.om)

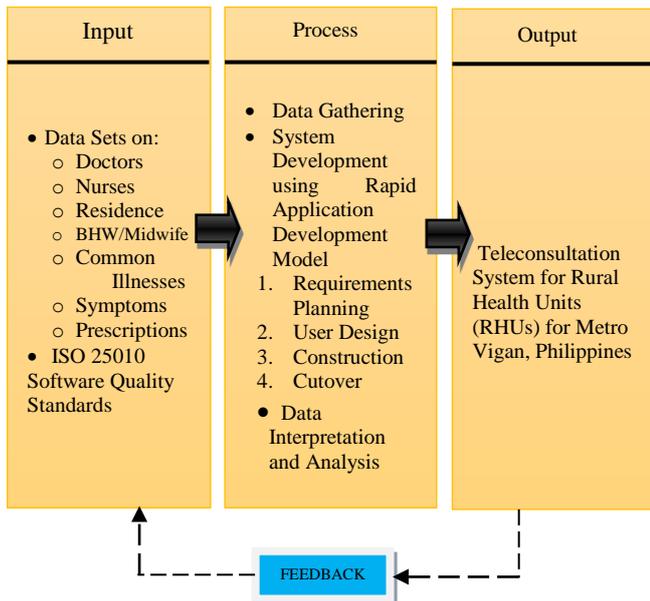


Fig. 1. Conceptual Paradigm

The data sets in Input serves as one of the foundations in order to develop the teleconsultation system, while the use of ISO 25010 Software Quality Standards can determine the extent of usability of the teleconsultation system and it satisfies the stated and implied needs for the users, healthcare providers, and stakeholders; thus, it provides value.

On the Process, the researchers had undergone through Data Gathering as it serves as a guide, design, and to understand the idea behind the teleconsultation system. However, the researchers adopted the Rapid Application Development (RAD) as the Systems Development Model which had helped in speeding up the systems development and at the same time ensuring the maximum quality of the project before the development. After analyzing the needed data, the researchers had to describe and summarize these data in order to conceptualize the structure, features, and functions of the teleconsultation system.

The Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines serves as output after summarizing the evaluated needs and resources on the Data Sets and other needed data related to the study.

STATEMENT OF THE PROBLEM

The study aims to design and develop a Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines. Specifically, it sought to answer the following research questions.

1. What are the challenges encountered by the patients and health workers of RHUs in Metro Vigan, Philippines?
2. What proposed system can be developed to address the identified problems and issues encountered in the existing system?
3. What is the extent of compliance of the developed application to ISO 25010 Software Quality Standards?
4. Is there a significant difference in the extent of compliance of the developed application to ISO 25010 Software Quality Standards as assessed by the IT Expert and Users?
5. What are the strengths and weaknesses of the proposed system?

SOFTWARE DEVELOPMENT METHODOLOGY

In developing the Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines, the researchers came up with an idea that the system model to be used that best fit the requirements of the development is the Rapid Application Development, otherwise known as RAD, as shown in figure 2.

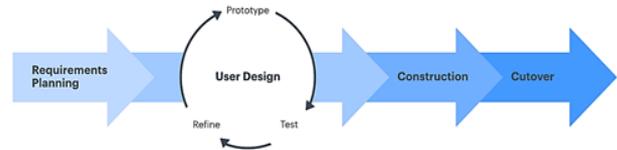


Fig. 2. Rapid Application Development (RAD) Model

1. Requirements Planning. In this phase, the researchers conducted an interview with the Municipal Health Officers (MHOs) in Rural Health Units in Metro Vigan regarding the process on how they administer their patients based on the consultation in order to gain idea in conceptualizing the teleconsultation system.
2. User Design. The flow of data and activities had been represented and designed. The developers used system models such as Data Flow Diagram (DFD), Entity Relationship Diagram (ERD), and Use Case Diagram, which served as the graphical representations of the developed system. These diagrams described how the system transforms data into information resulting to knowledge.
3. Construction. The developers used Apache as the Web Server, PHP as its web programming language, and MySQL as the database tool. On the other hand, the developers used Cordova/Phonegap on the mobile application development framework.
4. Cutover. In this phase, after the development of the teleconsultation system, the system underwent a pilot testing to the MHOs, rural residents, RHU staffs, and IT experts. After the pilot testing, the system has been linked to the system of the RHUs in Metro Vigan, Philippines in order to improve the quality of their healthcare services particularly on medical consultation.

II. RESULTS

A. Challenges encountered by the Patients and Health Workers of RHUs in Metro Vigan, Philippines

Presently, there are challenges encountered by patients and health workers at RHUs in Metro Vigan, Philippines, such as: On Environment - a) lengthy time in registration, prolonged waiting time for consultation, and limited space to accommodate patients; On Human Resources - b) shortage of medical staffs, need for IT personnel, and incompetent staffs; On Facilities - c) lack of diagnostic modalities, lack of transport services, and lack of storage for medical records. These findings imply that these challenges are causing rural residents to receive low and unequal



quality of health services. It is consistent to the study of Tumampus, et al. (2018) that the RHUs are moderately providing complete facilities. Laboratories are at the minimum required level but with no accreditation from the Department of Health (DoH). Furthermore, they lack in other parameters that physician could use to better assess patients' health condition.

#### B. *The Developed Teleconsultation System to address the identified challenges of the healthcare industry in Metro Vigan, Philippines*

The researchers developed a teleconsultation system that would provide solutions to the identified challenges when it comes to:

*On Environment.* Engaging the patient through the consultation application can help maintain appointments and healthcare schedules as the developed system provides schedule and clinic's contact number of a specialized doctor. It allows the user to check his schedule and may even call the doctor's clinic to set for an appointment to reduce overcrowding in the vicinity and it may even have wider space for waiting time and to accommodate patients in the facility.

*On Human Resources.* Due to the uneven distribution of health workers in the RHUs, users may be able to find whose specialized doctor to consult with and be able to check his schedule through the developed application. Thus, it improves the communication between primary care providers, specialized doctors to patients, and may even reduce the frequency of and demand for subspecialty consultation.

*On Facilities.* As it recommends specialized doctor to consult for a particular disease, residents in Metro Vigan may benefit from quicker and more convenient way to access specialists. Moreover, it provides the clinic's contact number in order to further discuss his health condition and in that way, the user may able to acquire the quality of healthcare.

#### C. *Extent of Compliance of the Developed Application to ISO 25010*

The results of the evaluation of the developed application is compliant to the Software Quality Standards of ISO 25010 with an overall mean of 4.31 which equates to an overall descriptive evaluation of "Very Great Extent." The result implies that the developed application met the needs and requirements of its users, and in turn, users of the developed application have the assurance when it comes to: Functional Sustainability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability.

#### D. *Significant Difference in the Extent of Compliance of the Developed Application to ISO 25010 Software Quality Standards as assessed by the IT Experts and Users*

Generally, the eight (8) factors of the ISO 25010, namely: Functional Sustainability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability were complied by the developed Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines and had met the

expectations and demands of the different types of participants and users. Thus, there is no significant difference on the assessment between and within groups.

#### E. *Strengths and Weaknesses of the Developed Application*

The strengths and weaknesses of the developed application had been ranked according to their frequency counts. They were identified by the residents, health workers, and IT experts who evaluated the system. The IT experts played a big role in identifying the application's technical flaws (Singun, 2018).

*On Strengths.* Availability of primary diseases in the database, easier navigation, availability on web and mobile, availability throughout 24/7, can suggest specialized doctors, can analyze related diseases, can provide a lesser waiting time during medical consultation, can provide doctor's relevant details, can provide accuracy of suggested analyzed diseases, and less paper.

*On Weaknesses.* Emergency hotlines or directories, application should also be available in iOS, it should not only focus on Metro Vigan, limited coverage for the branch of medicine, choices in language, option for female patient if pregnant, user registration, provide treatment or home remedies, and appointment details for lab test.

### III. CONCLUSION

The developed teleconsultation system is an android application that aids the challenges in Rural Health Units (RHUs) in Metro Vigan, Philippines as this serves as a tool to check symptoms which are related to the user's medical condition. The system makes use of the Naïve Bayes algorithm in order to ensure the accuracy of the analysis of the diseases associated to the patient's symptoms and information.

Further, the Teleconsultation System for Rural Health Units (RHUs) for Metro Vigan, Philippines is fully compliant with the ISO 25010 Software Quality Standards. The full compliance with the accepted Software Quality Standards means that the needs of Rural Health Units (RHUs) in Metro Vigan, Philippines has been fully met.

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