Development and Evaluation of Rural Health Unit Record Management System with Data Analytics for Municipality of Bay, Laguna using ISO 25010

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Abstract— Software quality standards are very significant matters nowadays, especially that this era reigns with software technology and systems to innovate the work process in any institution. Assessments are conducted to measure the quality of services as well as products. This paper focuses problem encountered by the employees of Rural Health Unit in terms of difficulties in managing the patients' records and notifying the patient for the follow check-up. The situation helped the researcher to develop a system that will help the employees to organize the patients' records in Rural Health Unit and easily notify the patient for the check-up schedule with the help of SMS Notification.
The results as describe in this paper shows the significant differences of systems as evaluated by the respondents using the ISO/IEC 25010 model.

Keywords—Assessment of Software Quality, RHU Record Management System, Data Analytics, ISO/IEC 25010, Software Quality Standards,

I. INTRODUCTION

As time goes by, number of population in Bay, Laguna become large and still growing. Today, Bay has Fifteen (15) Barangays. Based from the 2015 census, it has a population of Sixty-Two Thousand, One Hundred Forty-Three (62, 143) residents. It had a land area of 42.66 square kilometres and approximately located at the East of Los Banos, West of Calauan, Northeast of Santo Tomas and Northwest of Alaminos.

Bay, Laguna is politically subdivided into Fifteen (15) Barangays namely Bitin, Calo, Dila, Maitim, Masaya, Paciano, Puypuy, San Antonio, San Isidro, Santa Cruz, Santo Domingo, and San Agustin, San Nicolas, Tagumpay and Tranca. Rural Health Unit manually recorded every check-up

for the patients with general consultation, maternal, child health and nutrition services. The Rural Health Unit serves as the health office of the Municipality of Bay, Laguna. The health office offered services for general consultation in all cases, Rural Health Unit also offered the issuance of medical certificate; maternal and child health and nutrition services like immunization and deworming; reproductive health and family planning like health education; tuberculosis prevention and control; diabetes; dental services; visual inspection with acetic acid; a regular blood pressure measurements; a breast feeding program education and periodic clinical breast examinations; a counselling for lifestyle modification; counselling for lifestyle modification; counselling for smoking cessation; body measurements; asthma with nebulization services; Acute Gastroenteritis (AGE) with no or mild dehydration; and Urinary Tract Infection (UTI)[1]. With these numbers of services, Rural Health Unit was currently offering to the residents of Bay, Laguna.

In the current system of the Rural Health Unit, Rural Health Unit was using Microsoft Excel to input all the records of the patients. The assigned physician performed a consultation and input the data of the patients in Microsoft Excel. The records in every disease are not categorized. And for the diagnosis, the assigned physician only wrote it on a paper and gave it right away to the patient [2]. Rural Health Unit doesn't have a medical report to give to the patient. In addition, to those patients who have a follow check-up, the physician will only tell the patients the date of their next consultation. So, to avoid a missed or delayed check-up, the researchers created this kind of system because the number of patients is numerous and continue to expand.

Also, this system features a data analytics that will help the employees in terms of analyzing the data of the patients. Categorizing and analyzing all the patients records manually will be a burden. The numbers of patients' consultation per month are too much to analyse[3]. With the use of data analytics, it will improve the operational efficiency of the Rural Health Unit. The patients' consultation records will be categorized and arranged in every Barangay. The data analytics will show the number of patients' consultation records for every disease, barangay and every month.[4]

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II. AIM OF PAPER

A. *Objectives of Paper*

The aim of this paper is to develop and evaluate the RHU Record Management System with Data Analytics.

This paper will explore on the evaluation results based on the ISO/IEC 25010 dimensions as necessary. Specifically, the study seeks to evaluate the developed systems in terms of:

1. Functionality;
2. Reliability;
3. Usability;
4. Efficiency;
5. Maintainability;
6. Portability.

Lastly, the results of this paper will give light on the readers on how to improve the software quality of a RHU Record Management System with Data Analytics.

B. *Theoretical Background*

The theoretical background served as a guide in systematically identifies the logical precisely defined relationships among variables. This also helps the researcher see clearly the variables of the study. The researchers used the Input-Process-Output Diagram to show the development processes, functional model and conceptual schema of the developed system and to provide the general structure and guide for the direction of study.

The potential to improve the diagnosis quality, reduce diagnosis errors, while improving the patient safety and reducing cost in health care by implementing information systems (IS) has been established by prior studies while the high rate of missing records, the absence of communication amongst doctors, poor communication between doctors and pharmacists, mistaken diagnoses and an inadequate number of medical professionals in the area of South Africa have made some search for the precise storage and access of medical information is a priority[5]. The study is undertaken as part of the M-tech course. The study is inspired by the manual systems that are currently used by medical practitioners in South Africa to capture, store and access patient's records. The main objective of the study is to determine the factors that affect the adoption of electronic patient's records management systems, the risk, creditability, and the usefulness of adopting this technology and to make recommendations to practitioners, policy makers, researchers, and other stakeholders regarding the adoption of electronic patients' record management system particularly in South Africa. This country has shown a slow adoption of such technologies. The slow adoption indicates the need for research in this field.[6]

The electronic patient's records management system have been a successful method for managing patient's medical records globally.[7] The diagnoses knowledge base systems has been known as a feature contained in electronic record management systems, this is the method for ensuring medical knowledge creation, utilization, transfer and sharing.[8]

In most cases, information stored on electronic systems is sought by and may be shared with different medical experts such as hospitals, laboratories, pharmacies, government agencies, employers, managed care organizations, academic research organizations and public health organizations.[9]

III. RESEARCH DESIGN

A. *Research Design*

The purpose of the study is to develop and evaluate RHU systems that will help in optimizing the managing records of patients. This study utilized the descriptive design. Hence, the study used a score assessment sheet based on ISO 25010 that tests the software quality of the systems as assessed by the experts through testing.

The researcher of the study used two different research designs which are the Developmental Research Design and Descriptive Research Design. Descriptive Research, it is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way [10]. The researcher conducted an initial interview to the employees of Rural Health Unit in Bay, Laguna to find out the total population of the study and calculated the statistical number of respondents.

Descriptive Research was used to gather data from the client that will help the researcher in developing the system. And for Developmental Research, as describe, it is systematic study of designing, developing and evaluating an instructional program, processes and the product that must meet criteria of internal consistency and effectiveness [11]. The researcher used Modified Waterfall Model as a methodology that follows the execution of the processes to develop the project. Developmental Research was used by the researcher because of its traditional stages of Planning, Conducting, and Reporting a Research Project.[12]

B. *Research Methods*

The evaluation of the system has been conducted by the I.T. experts under the Department of Information Technology of Laguna University. The evaluators used the 5 point likert scale in evaluating the developed systems, where 5 is the highest and 1 is the lowest with a descriptor of 5 – Outstanding, 4 – Good, 3 – Satisfactory, 2 – Poor, and 1 – Unsatisfactory.

C. *Analysis of Data*

The study used mean percentage to analyze the data that was obtained from the test and evaluation of the developed system. The evaluation has used the different dimensions of ISO 25010 which consists of Functionality that has indicators of functional completeness; second is on Reliability with indicators of time - behavior, resource utilization, and capacity; third is on the Usability of the system with indicators of learnability, operability, user error protection, user interface aesthetics, and accessibility; fourth dimension is on Efficiency with indicators of how the system is efficient with the users; then fifth dimension is the Maintainability with indicators of modularity, reusability, analysability, modifiability, and testability; lastly, is on Portability with indicators of adaptability, installability, and replaceability.

The results of the evaluation was interpreted using the indicators below:

Range	Scale	Interpretation
4.51 – 5.0	5	Outstanding
3.51 – 4.50	4	Good
2.51 – 3.50	3	Satisfactory
1.51 – 2.50	2	Poor
0 – 1.50	1	Unsatisfactory

IV. RESULTS AND DISCUSSION

The distribution of responses was tabulated into couple number of tables to have a clear presentation of data. This was necessary in order to analyze and interpret data accurately and accordingly. The following tables below shows the results of each criterion used in the evaluation of the developed system. The researcher used the weighted mean formula to determine the descriptive equivalent of each dimensions

Table 1 revealed that the respondents who evaluated the developed system based on the questions of Functionality answered "Good" with an over-all weighted mean of 3.64.

Table 1. Evaluation by the Respondents of the Functionality of Rural Health Unit Record Management System with Data Analytics

FUNCTIONALITY	WM	VI
1. The software perform the tasks required.	3.71	Good
2. The results expected were delivered.	3.71	Good
3. The system can interact with another system.	3.5	Good
4. The software prevent unauthorized access.	3.86	Good
5. There is a system of communication between user sites and the system developer which may include newsletters, telephone assistance, and annual evaluations	3.43	Satisfactory
AVERAGE WEIGHTED MEAN	**3.64**	**Good**

Table II revealed that the respondents who evaluated the developed system on Reliability answered "Good" with an over-all weighted mean of 3.54.

Table II. Evaluation by the Respondents of the Reliability of Rural Health Unit Record Management System with Data Analytics

RELIABILITY	WM	VI
1. Most of the faults in the software have been eliminated over time.	3.36	Satisfactory
2. The software was capable of handling errors.	3.5	Good
3. The software resume working and restore lost data after failure.	3.64	Good
4. If the program creates a permanent record for a user, that record is secure and confidential. There is provision for erasing the record when the information is no longer valuable in providing services	3.64	Good
AVERAGE WEIGHTED MEAN	**3.54**	**Good**

Table III revealed that the respondents who evaluated the developed system based on the questions of Usability answered "Good" with an over-all weighted mean of 3.65.

Table III. Evaluation by the Respondents of the Usability of the Rural Health Unit Record Management System with Data Analytics

USABILITY	WM	VI
1. The user easily understand/comprehend how to use the system.	3.5	Good
2. The user learn to use the system easily.	3.64	Good
3. The user use the system without much effort.	3.5	Good
4. The interface looked good and attractive.	3.79	Good
5.The organization is clear, logical, and effective, making it easy for the intended audience to understand	3.5	Good
6. The individual can operate the system independently.	3.79	Good
7. If there are "help" and "hint" messages, they are easy to access.	3.86	Good
AVERAGE WEIGHTED MEAN	**3.65**	**Good**

Table IV revealed that the respondents who evaluated the developed system based on the questions of Efficiency answered "Good" with an over-all weighted mean of 3.8.

Table IV. Evaluation by the Respondents of the Efficiency of Rural Health Unit Record Management System with Data Analytics

EFFICIENCY	WM	VI
1. The system responds quickly in all its functionality and operation.	3.57	Good
2. The system utilizes all its resources efficiently.	3.71	Good
3. The individual has the choice of going directly to desired function/operation or using a structured search to identify easily what the user wants.	4	Good
4.The system is demonstrably effective with the intended audience, including people of varying abilities and experiences	3.93	Good
AVERAGE WEIGHTED MEAN	**3.8**	**Good**

Table V revealed that the respondents who evaluated the developed system based on the questions of Maintainability answered "Good" with an over-all weighted mean of 3.66.

Table V. Evaluation by the Respondents of the Maintainability of Rural Health Unit Record Management System with Data Analytics

MAINTAINABILITY	WM	VI
1. Faults and errors can be easily diagnosed.	3.5	Good
2. The Software can be easily modified in accordance to what user needs.	3.5	Good
3. The Software continue functioning when modifications/changes are made.	3.79	Good
4.The Software can be tested easily.	3.86	Good
AVERAGE WEIGHTED MEAN	**3.66**	**Good**

Table VI revealed that the respondents who evaluated the developed system based on the questions of Portability answered "Good" with an over-all weighted mean of 3.84.

Table VI. Evaluation by the Respondents of the Portability of Rural Health Unit Record Management System with Data Analytics

PORTABILITY	WM	VI
1. The Software can be easily moved from one to another environment.	3.93	Good
2. The software be installed easily.	3.93	Good
3. The software comply with the portability standards.	3.71	Good
4. The software can replace other software.	3.79	Good
AVERAGE WEIGHTED MEAN	**3.84**	**Good**

Table VII revealed the summary of the software evaluation made by the respondents answered "Good" with an over-all weighted mean of 3.69.

Table VII. Summary of Software Evaluation

CRITERIA	WEIGHTED MEAN	VERBAL INTERPRETATION
Functionality	3.64	Good
Reliability	3.54	Good
Usability	3.65	Good
Efficiency	3.8	Good
Maintainability	3.66	Good
Portability	3.84	Good
OverallWeighted Mean	**3.69**	**Good**

V.CONCLUSION

Based from the results and discussions presented above, the following conclusions have been drawn:

1) The developed system turns out to be "Good" in all dimensions of the ISO/IEC 25010 model when evaluated according to the respondents.

2) Though the results of the assessment have the same descriptive equivalent of "Good" based on the sub-dimensions or sub-criteria, it is very useful to the municipality of Bay, Laguna to have this kind of system which was evaluated using ISO 25010.

3) Based on the overall weighted mean, the researcher conclude that, it is best to implement this system to the government of Laguna particularly in Bay, Laguna for thorough testing and implementation.

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