WEB-BASED INFORMATION MANAGEMENT SYSTEM FOR THE RURAL HEALTH UNIT IN BULAKAN, BULACAN

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Abstract

The purpose of this research study was to design and develop a Web-based Information Management System that will be useful and helpful to the Rural Health Unit of Bulakan, Bulacan by resolving their present difficulties. The researcher gathered and proposed some ideas that utilized the power of information technology to create a substantial and positive impact on improving the health conditions of the community.

The study identified the following difficulties currently encountered by the RHU using manual transaction system: data integrity, saving and retrieving of medical records, lost productivity, out-of-date systems, inaccurate order list, records can be accidentally lost or deleted, difficulties in scheduling, delayed and inaccurate medical reports and unreliable news.

To resolve those difficulties, the researcher integrated significant features into the system such as record management, inventory management, schedule management, information dissemination and report generation.

The Agile Development Methodology was used in the development of this project. Significant phases involved in this method such as requirement analysis, design, development, testing and feedback was strictly followed to ensure the success of system development.

To test the acceptability of the system, group of respondents were asked to do the evaluation using ISO 9126 Software Quality Standard. Positive results were obtained from the said evaluation.

Introduction

It is a logical fact that it's vital that country is as strong as its people. Providing quality health services is imperative for the government. In the Philippines, health program has been developed to bring services to every Filipino. The digital tools is a great step for getting personalized treatment and care.

The value of public health is an issue to every country and government. The Philippines has an agency that is responsible for providing primary health services which is the Department of Health. The Department of Health (DOH) governs the services of the Rural Health Unit and Barangay Health Center. Every project is under the supervision of the local government and the municipal health officer. Based on Republic Act No. 1082 the function of the Rural Health Unit was discussed that its goal is to cater first aid, maternal and family health service in every municipality. The Barangay Health Center is operated with doctors, nurses, medical technicians, and midwives. The convenience of getting service in one roof.

The Rural Health Unit (RHU) is the government's leading group for supplying exceptional health care for Filipinos. Despite the significant role that the RHUs play in ensuring the well-being of the community, technology remains to be a taboo subject among them, resulting in foregone technological advancement and opportunities.

The challenges in healthcare is a prevailing condition of inquiry in health status, poor infrastructure and absence of IT governance structure.

Bulakan, Bulacan is a municipality of the province of Bulacan, with a population of 76,565 people. Bulakan is has 14 barangays and has a RHU that gives primary level of care.

A management system in a RHU will improve the system and give a better healthcare for the community.

To solve one of the challenge is to use an information system. Information is the pillars to strengthen the health system. In today's medical center, we are facing some problems or difficulties because of the usage of manual transactions, which demand innovations.

In handling records, records should be precise especially it can mean a difference between life and death. Using manual system put a pressure to individuals to have a precise information.

Information consistency and miskeying information can be a problem and with this kind of system records can be easily switched, and can encounter difficulties in data recovery.

Using paper takes a lot of effort in handling, space and security. Manual operation can be costly because it requires papers and other materials. When mistakes are made, documents should be done over again instead of an update. Copying can also be a problem. Rewriting entire records takes time and effort. Hand writing that is hard to read for medical purposes can also be problem.

With manual system there can be problems in queries. Consolidation and retrieval of patient records can be difficult especially if records are not stored in a centralized location. Whereas in a computerized and paperless system, distribution of medical records and laboratory result will be a lot easier. This would also positively affect the process of securing vaccination records for future requirements, keeping the confidentiality of medical records, keeping tracks of who have permission to the records and ensuring information back up.

Because of those above-stated challenges, the researcher came up with the idea of developing a computerized management system that can enhance the existing transaction processes in the RHU of Bulakan, Bulacan. This proposal also includes a forum where stakeholders can share or discuss health-related topics.

Research Problem

The general problem of this study was "How could an information management system for Rural Health Unit of Bulakan, Bulacan be developed?"

Specifically, this study sought answers to the following questions:

1. What difficulties currently hamper in the daily operations of the Rural Health Unit of Bulakan, Bulacan in terms of

1.1. record management

1.2. inventory management

1.3. schedule management

1.4. information dissemination

1. 5. report generation?

2. How may the present difficulties at the Rural Health Unit of Bulakan, Bulacan be   addressed through the design and development of a web-based management system?

3. How may the technology of online messaging or forum be integrated into the system?

4. How can the medical records be made available online without risking security protocol and confidentiality of information?

5. How acceptable is the system using ISO 9126 Software Quality Standards as perceived by the:

5.1. stakeholders and

5.2. experts?

Related Literature and Studies

Management Information System

Management Information System or MIS, is a computer-based system that helps an organization/company to organize and sort data stated by Beal (2013). The system will be able to deliver the past and the present data. In order to compare data information. It can help in decision making in terms of people management and project management.

The focus of the management system is the organization's information and technology system. The MIS helps the organization to determine problems and resolve incompetence. It is design to solve and to help in the evaluation of the company.

Record Management

A systematic way of supervision of paper or digital records. Paper records may be filed in physical boxes at a storage room. While a digital record is stored in a storage device or in the cloud. According to the ISO 15489: 2001 standard, Record management includes creation, receipt, classification, preservation, use and disposal of records.

Inventory Management

Inventory management according to Kotler (2000), refers to organizing the inventory levels of raw materials, semi-finished materials (work-in- progress) and finished well so that sufficient supplies are available and under stocks are low. A management that monitors the inventory and stocks. Inspect the flow of products from the suppliers to its client and from these facilities to point of sale. Inventory management includes monitoring of inventory and amount of product for sale.

Online Messaging and Forums

According to Kadir, Maros, and Hamid (2012), online forums is an area on a website,when human beings interact with one another by transmitting messages via networked computers.A registered account can post discussions and read and reply to posts by other members. A forum can be discussed on any topic and a sense of an online community.

Blog is different from this kind of forum. Blog is typically written by an individual. It only allows responses according to the blog material. While a forum allows all members to make posts and start new topics. It is also called a message board, discussion group, bulletin board or web forum.

Online forums increases the participation of the members by providing an access to the members anytime and anywhere.

Web-based System Securities

For Pilev (2014), there is three level of securities authentication, authorization and data security. Authentication is the process to verify if an account is genuine or valid. While authorization is the act of giving permission.

Data security is a digital confidentiality measure and also keeps records from corruption and protects the integrity of the data.

ISO 9126

Jung, Kim and Chung (2004) stated that International Organization for Standardization 9126 helps to clarify quality attributes and gives instruction for the resulting standards.

In the evaluation instrument for software quality standard like ISO 9126 that can be used in a study in determining the acceptability of the developed system.

Abbott Company is a well-known company that formulate drugs. In relation with the developed system, Abbott Company (2005) introduced STARLIMS, a leading Laboratory Information Management System (LIMS) software, is a comprehensive laboratory informatics platform that helps laboratories manage difficult processes and promote collaboration With these products STARLIMS can help laboratories consolidate multiple business processes into single, compliant platform.

STARLIMS Corporation supplies great laboratory information management systems that let labs to accomplish difficult processes and uphold enterprise-wide collaboration. The system is a web-based off-the-shelf solutions are designed for large group of laboratory settings, working in many disciplines and activities.

The developed system, record management is established. The list of test, treatments and other procedures that was done. This would help the users to view the ongoing health conditions, past visit information, preventive health reminders, and test results.

Design and Development using Agile Software Development

To use set of principles for software development under which requirements, it advocates adaptive planning, evolutionary development, early delivery, and continuous improvement, and it encourages rapid and flexible response to change. Agile development allows us to provide software products rapidly and with quality. Agile project development requires frequent and extensive communication between the development group and users to capture the real customer needs and objectives.

Assessing Business Problem. In the first phase of iterative requirement definition, it is the system developer responsibility to gather data about the present business problem so that it can be resolve. There are several ways to collect useful data. First, an interview with the medical officers and users of the system was conducted by the system developer. Medical officers and user will have an idea of their own expectation about the system. Second, the system developer collects documentation or relevant information resources about the current system.

In this study, the researcher arranged an interview with the Administrators and employees of RHU Bulakan who are using the existing system. Important information was collected for the study and design of the system.

Documenting Assessment. In evaluating the system problem, the system developer created document to describe the present system and the proposed solution. Those artifacts can have different forms, but usually include these items: documentation of the current system; solution goals; clients' requirements and expectations; and issues and risks related to the solution.

In analyzing the developed system, diagrams like data flow diagram (DFD) and Use Case diagram was used to represent all the different processes and procedure which will be done by the system and its relationship with different entities.

Presenting to the Client and Get Feedback. The system developer then presents drafted artifacts to the client. These artifacts can include requirements document, a draft user interface, user stories, and so forth. If the client think that the specified requirements are incomplete, they can give their comments so that system developer can improve the system. And that makes the iterative requirement cycle go back to the document assessment phase.

Delivering Requirements. When the requirement definition gets confirmation from the client, the project team delivers the requirement.

In this study, this will be the last stage where the researcher will bring all deliverables to the company. The proposed system after its development will be installed. Trainings will be conducted for the proper installation and usage of the system.

Related Studies

According to Hillestad (2005), Electronic Medical Record (EMR) can help in the health services and funds. With extensive implementation of electronic medical record systems, and concludes that operative EMR application and networking could finally save more than $81 billion yearly—by successful health care efficiency—and that HIT-enabled avoidance and supervision of chronic disease could eventually double those funds while improving health services. However, this is questionable to be understood without connected changes to the health care system.

Research showing better patient service from EMR use in hospital and ambulatory care mostly focus on warnings, prompts, and other components of Computerized Physician Order Entry (CPOE).CPOE makes information open to physicians at the time they enter an order—for example, warning about potential interactions with a patient's other drugs.

Healthcare information technology (HIT) aims to be a helping aid to reduce errors or produce new safety risks that result in harm. Healthcare leaders must value the difficulty of EMRs and know the safety matters in order to order sound EMR scheme, development, implementation, and use. The information provided seeks to give awareness to the executives, clinicians, and technology professionals what has been learned through published research on the security of HIT systems, involving in computerized physician order entry (CPOE), clinical decision support systems (CDSS), and bar-coded medication administration (BCMA).

Ju and Choi (2017) discussed the significance of the Electronic Medical Records (EMR) in identifying latent classes for risk issues for coronary artery diseases. There were 2,022 patients who were diagnosed with coronary artery disease with the support of Statistical Package for the Social Sciences (SPSS) version 20.0 it helped to improve the intervention strategies for the effective prevention of the disease.

EMR becomes manageable according to Kumar (2017) when information can be access through the use of mobile devices. Staying healthy would be easier with the right tool. Through this feature patients has can view the schedule of the physician and can set an appointment with the physician.

Methodology

This study used gathering, recording, analysis and interpretation of data called descriptive method of research. Descriptive statistics use collection of data and analysis of techniques results to sum up the methods of central tendency, variation, and correlation. Research has three main purposes those are to define, clarify, and confirm findings.

The researcher used Agile Software Development Method for the design and creation of web-based management system. Agile methods help developers respond to irregularity through incremental, iterative work cadences and empirical feedback.

The results of this "inspect-and-adapt" approach to development greatly lessen both development costs and time to market. Because researcher can develop software at the same time they're collecting requirements, the phenomenon known as "analysis paralysis" is less likely to hamper a researcher from making progress. And because a work cycle is limited to two weeks, it gives stakeholders recurring opportunities to regulate releases for success in the real world. Agile development methodology helps businesses construct the right item.

Context Diagram is the highest-level Data Flow Diagram (DFD). DFD is a graphical representation of how the data flows in an information system. DFD organizes the data in the program. It is commonly used to make an outline of the system to achieve its intended purpose.

It displays the flow of data from the system to its external entity. The Context Diagram was use to show how the system manages its user.

For the evaluation of the system, the researcher selected the respondents that are well matched in the study. Random Sampling was used in selecting the patient and stakeholders. It is the simple type of sampling and unbiased surveying method. The principle of the random sampling is the reason why it was used in this study is that all object has the similar probability of being chosen. The advantage of a random sample it is easy to use and generate precise illustration of the larger population. This method was used in the group of the stakeholders and the Municipality of Bulakan has a large population that the fits the method.

Purposive sampling is used in the group of IT Experts. A purposive sample is a non-probability sample that is particularly based on characteristics of a population and the aim of the study. Purposive sampling is known as critical and subjective sampling. . The researcher used a scale of 1 to 5 where 5 indicates that the respondent Highly Acceptable and 1 as Totally Unacceptable. The researcher devised an evaluation instrument based on the ISO 9126 Software Quality Model following a five-point Likert-type .

The following range of weighted mean served to established the exact values that obtain a scale of 1-5 and their corresponding verbal interpretation.

| Numerical Rating	Descriptive Interpretation
5	Highly Acceptable
4	Acceptable
3	Neutral

| 2 | Unacceptable |
| 1 | Totally Unacceptable |

Results and Discussion

The difficulties in the daily operation of RHU in as follows: 1.) record management: Duplication of records is one of the problem when using manual system. Like, when an information of a client appearing more than once. To provide good health service, information should be accurate and prepared to offer personalized care. Some of the advantages using the system improved data accessibility, computerized physician order entry and preventative health.2.) inventory management: . Outdated systems, ordering the wrong item/amount, inaccuracies, and records can be accidentally lost or deleted. Using the develop system, it will provide precise and detailed inventory including drugs expiration dates 3.) schedule management: Outdated systems, ordering the wrong item/amount, inaccuracies, and records can be accidentally lost or deleted. Using the develop system, it will provide precise and detailed inventory including drugs expiration dates. 4.) information dissemination: The new way of communication is through internet. Its faster and accessible to everybody. Unlike the traditional way of exchanging of information from one person to another or source to another, information can be unreliable and before the information reaches the community it takes an amount of time. 5.) report generation: One of the problems in the daily operation, RHU wants to give attention are delivering of reports on time, problems in frequency analysis, reports generated are not reliable and accurate. Using manual system in generating reports is time consuming. One of the most important task every RHU staff needs to complete the reports. It would be easier and faster if it is already automated. This would increase productivity and efficiency, hence RHU staff can maximize the schedule they have.

This section provides the overall design of the system. That shows the different interface design of each page and also it describes how each feature works in the system

Home page or the main page of the website serves as the table content of the website. The user can control what page appears in the screen.

Figure 1 shows the design view of the Management System. All the main feature of the system is shown.
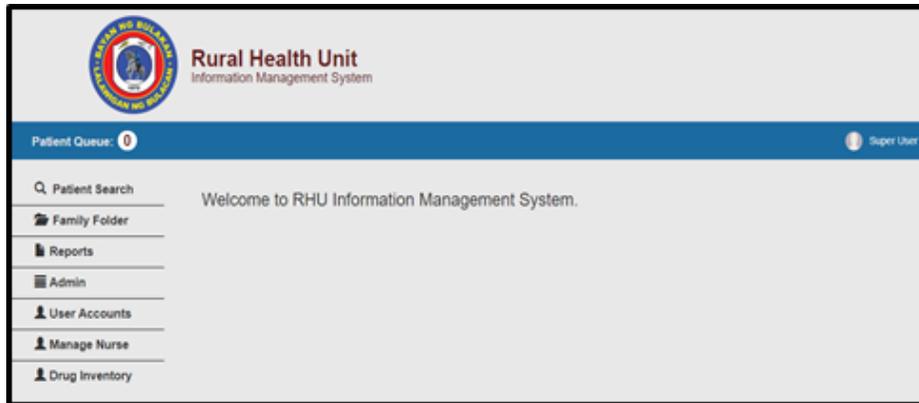
1 - Figure 1. Home (Management System)

Figure 2 shows the design view of user's home web page. This is the website that can be access by the registered patient.


2 - Figure 2. Home (RHU Website)

Figure 3 shows how the RHU staff communicate via forums. This page includes most asked questions and subjects. The registered patient can make a comment and shared it through posting and replying in the topics they want to engage in.
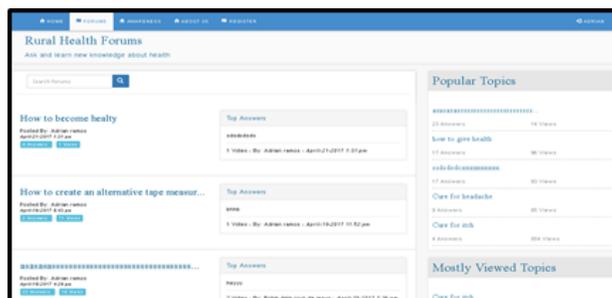
3 - Figure 3. Forums Page

Figure 3 shows how the RHU staff communicate via forums. This page includes most asked questions and subjects. The registered patient can make a comment and shared it through posting and replying in the topics they want to engage in.
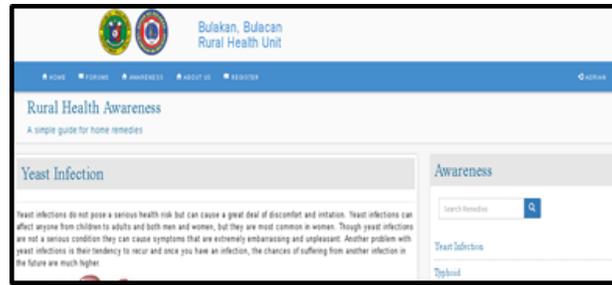
4 - Figure 4. Awareness Page

Figure 4 shows article about health awareness to prevent disease and give health tips. Help you research medical conditions, understand possible treatment plans, and help you make decisions about your care.
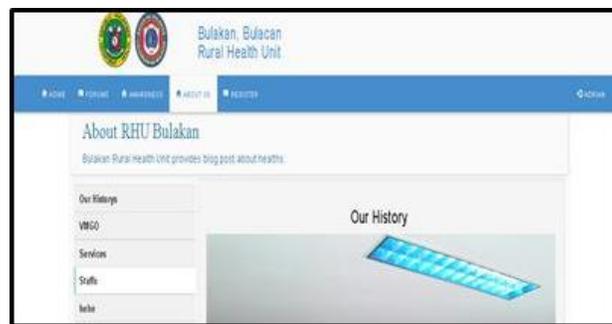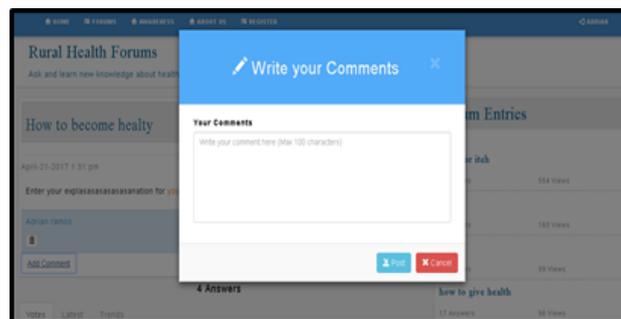

Figure 5. About Us Page

Figure 5 shows the information about RHU Bulakan, including history, VMGO , RHU services and personnel information. It will help the community to know who to inquire with in the RHU.

Figure 6 shows the textbox provided to answer and comment on topic found in the forums.

5 - Figure 6. Write Comment Window

This feature can generate reports depending on certain subject like daily reports, list of patients, list of families and health programs.

Figure 7 contains popular topics, top answer and hot topics. This is where communication between patient and the personnel interact.
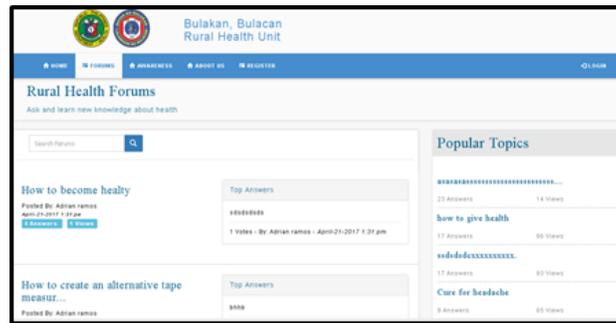
6 - Figure 7 Forum, News and Announcement

In this page patient can ask about health issue and all registered patient can comment to his query. Only registered patients have the access to post and comment on the forum. Online forum is important can benefit an individual and the society as well.

The administrator can change the featured news and pictures. The RHU can also informed the community of the programs they offer by posting it in the RHU website.

The RHU website also include some a feature where the community can learn some medical terminologies and also its meaning.

Level of Acceptability of the Web-based Information Management System

In the evaluation of the system, the researcher chose the respondents that are well-matched in the study. The first group of respondents are IT experts (13), and the second group are the RHU staff (7) and patients (30) who have enough knowledge in using the internet and computer peripherals.

ISO 9126 Software Quality Standards was implemented to measure the operational feasibility of the system. The following criteria were used in order to assess the developed system: (a) functionality, (b) accuracy, (c) reliability, (d) user-Friendliness, and (e) security.

Table 1

Frequency Distribution and Descriptive Measures of the Evaluation Rating of Web-based Information Management System in terms of Functionality

Items	Responses					Mean	Descriptive Interpretation
	5	4	3	2	1		
1. The system is capable of running on different platforms.	40	30	2	0	0	4.42	Acceptable
2. The system responds correctly based on the user's input	36	32	5	0	0	4.32	Acceptable
3. The system provide an error message box which prompts the user whenever they enter a wrong input.	35	28	10	0	0	4.28	Acceptable
4. The system can trap errors and can identify corrections by its clear directions.	28	29	14	1	0	4.08	Acceptable
5. The system provides all needed information for all transactions it performs.	22	40	10	0	0	4.12	Acceptable
				Total Mean		**4.27**	**Acceptable**

As shown in Table 1, in terms of functionality, the experts graded the developed system as "Acceptable" in terms of Functionality with a weighted mean of 4.27 which indicates that functions are appropriate to specifications. Based on the survey the respondents was able to test if the system works in different types of devices.

Table 2

Frequency Distribution and Descriptive Measures of the Evaluation Rating of Web-based Information Management System in terms of Accuracy

Items	Responses					Mean	Descriptive Interpretation
	5	4	3	2	1		
1. The system generates correct and accurate report.	43	30	0	0	0	4.44	Acceptable
2. The system can offer the user to respond in time for query in information.	38	33	1	0	0	4.38	Acceptable
3. The system automatically updates the records in the database.	36	35	0	1	0	4.36	Acceptable
				Total Mean		**4.43**	**Acceptable**

As shown in Table 2, the general weighted mean of accuracy is 4.43 which indicates that functions are appropriate to specifications. The respondents was able to observe the real-time response if the system. Records is accurate and data integrity was shown while using the developed system.

Table 3

Frequency Distribution and Descriptive Measures of the Evaluation Rating of Web-based Information Management System in terms of Reliability

Items	Responses					Mean	Descriptive Interpretation
	5	4	3	2	1		
1. The information provided in the website is up-to-date and with consistency.	40	25	5	2	0	4.42	Acceptable
2. The website responses quickly to the user's selection.	37	28	5	3	0	4.30	Acceptable
3. The system produces consistent information processing according to the chosen task and transaction.	32	39	1	1	0	4.16	Acceptable
4. The system outputs the necessary information/data for the user and can be used for daily operations.	34	37	0	1	0	4.12	Acceptable
5. The system secures the transactions done by authorized personnel only.	38	32	2	1	0	4.20	Acceptable
				Total Mean		**4.31**	**Acceptable**

As shown in Table 3 the developed system interprets that the website is responsive and reliable with a weighted mean of 4.31 graded as "Acceptable". It shows that the developed system function as what the respondents expected from it.

Table 4

Frequency Distribution and Descriptive Measures of the Evaluation Rating of Web-based Information Management System in terms of User-Friendliness

Items	Responses					Mean	Descriptive Interpretation
	5	4	3	2	1		
1. The system is easy to manipulate using its Graphical User Interface (GUI).	37	29	5	2	0	4.17	Acceptable
2. The system's interface is easy to use and navigate.	39	32	1	1	0	4.33	Acceptable
3. The buttons are organized and consistent.	33	37	2	1	0	4.10	Acceptable
4. The flow of the system can be clearly understood.	31	35	5	2	0	4.02	Acceptable
				Total Mean		4.15	Acceptable

As shown in Table 4, in terms of user-friendliness, the experts graded the developed system as "Acceptable" in terms of User-Friendliness with a weighted mean of 4.15 which means that the respondents find the system easy to use.

The developed system is convenient to navigate, update easily and has an appealing design.

Table 5

Frequency Distribution and Descriptive Measures of the Evaluation Rating of Web-based Information Management System in terms of Security

Items	Responses					Mean	Descriptive Interpretation
	5	4	3	2	1		
1. The system requires username and password before log- in.	42	28	2	1	0	4.40	Acceptable
2. Confidential transactions require admin access and higher system privileges.	35	25	6	5	2	4.10	Acceptable
3. The system cannot be accessed without the administrator's authority.	44	27	2	0	0	4.46	Acceptable
				Total Mean		4.21	Acceptable

As shown in Table 5, Security has a weighted mean of 4.21 which indicates that respondents find the system secured and information is confidential.

The developed system shows that medical records are confidential. Password is secured.

Data or medical information can only be accessed by the authorize personnel. Transactions and user logs are recorded in the system.

Table 6

Summary Table for the Level of Acceptability of the Developed System

Criteria	Experts Response	
	Weighted Mean	**Description**
Functionality	4.27	Acceptable
Accuracy	4.43	Acceptable
Reliability	4.31	Acceptable
User-Friendliness	4.15	Acceptable
Security	4.21	Acceptable
Overall Weighted Mean	**4.26**	**Acceptable**

As shown in Table 6 the developed system garnered "Acceptable" in terms of Functionality (4.27); Accuracy (4.43); Reliability (4.31); User-Friendliness (4.15); and Security (4.21). Overall, the acquired mean value of 4.26 indicates the developed system was "Acceptable" and was recommended for use.

Accuracy got the highest ratings because the user was able to analyze that the data entered into the system are processed properly, thus producing an accurate result. User-Friendliness gained an average of 4.15 in which the respondents recommend to enhance the user interface such as additional picture, color can be changed, and fonts can be resized.

Recommendations

In light of the findings and conclusion of the study, the following recommendations were drawn and can be used by future researchers who want to develop a similar kind of study:

1. Future researcher may add features that will allow the users to download health forms.

2. If possible integrate the system to the current domain of Bulakan

Municipality website.

3. It is suggested that the system be implemented with other RHU via a

networked system.

4. Dynamic interface management may be used so that the other Rural Health Unit of different municipalities can easily adapt the system.

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