

An Assessment: Respiratory Analysis Using Data Mining Method - A Decision Support System

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Article Info

Volume 83

Page Number: 4824 - 4829

Publication Issue:

March - April 2020

Article History

Article Received: 24 July 2019

Revised: 12 September 2019

Accepted: 15 February 2020

Publication: 27 March 2020

Abstract

The purpose of the study is to provide an aid to clinicians in making sound decision with the help of the Clinical Decision Support System. The proposed system aims to offer fast data analysis technique in order to make reliable predictions based on the stored data in the developed system. The prediction is based on regression analysis, a common way of generating prediction based on the data available. The main feature of the study concerns the capacity of Clinical Decision Support System in providing predictions in order to see possible future problems or course of actions needed to address. The proposed developed system addressed the problems encountered by providing fast data analysis technique to make reliable predictions. Decision making is now easier to the management (Physicians and Nurses) when using the system. Moreover, timeliness of record's summary provides instant result of the current medical records, provide analysis of the past records and its main feature: to offer predictions based on the records stored and analyzed by the system.

Keywords: *Decision Support System, Data Mining, Prediction, Predictive Analysis*

I. INTRODUCTION

Many problems encountered in clinical practice could benefit from the aid of computerized clinical decision support systems—computer programs that offer patient specific, actionable recommendations or management options to improve clinical decisions⁴.

Information Technology (IT) as well as the sophisticated analysis presented by wide range of decision support systems provide and offer a big factor in making a good decision.

“Factors Influencing Implementation Success of Guideline-Based clinical decision support system: A Systematic Review and Gaps Analysis”³, it is concluded that future research within the field of guideline-based clinical decision support system should focus on evaluating implementations through the use of socio-technical models to study guideline

based clinical decision support system implementations from a multidimensional view.

In the Philippines, performance monitoring and record keeping have remained underdeveloped, making it hard for all tiers of government to keep track of incumbent health care delivery targets. Many hospitals lack basic IT infrastructure, which would allow for better management.

Hospitals are often forced to rely on an offline system whereby data from their respective practice is transferred to a central database via memory stick⁶.

The Rural Health Unit (RHU) of Cauayan City, Isabela is currently using file cabinets to store patient's medical records. Paper-based management system as a traditional way of record keeping is still being used by the clinic. Current analysis of the existing records is time-consuming when needed by the clinicians.

With these scenarios, the researcher was moved to come up with this study. The need of Clinical Decision Support System (CDSS) in the locality seems to be highly important aspect in order to provide a better quality of service to patients.

The focus of this study is to provide a Clinical Decision Support System, a DSS for clinicians.

In this regard, the researcher chooses the RHU of Cauayan City, Isabela as the main beneficiary.

The proposed computerized Respiratory Analysis Using Data Mining Method: A Decision Support System aims to improve the patient record management of the clinic. The computerized record management, as one key aspect of the study, will provide enhanced record keeping in terms of efficiency, security, portability, and timeliness.

A DSS is use to help in decision-making but does not necessarily give a decision itself.

II. STATEMENT OF THE PROBLEM

This study entitled “An Assessment: Respiratory Analysis Using Data Mining Method: A Decision Support System” sought to find answers of the following problems:

1. What are the current practices, challenges and problems encountered by the Rural Health Unit with respect to the management of ailment analysis?
2. What proposed system can be developed to address the problems and issues by the Rural Health Unit participants?
3. What is the extent of compliance of the proposed developed application in terms of: Efficiency, Security and Portability?

III. METHODOLOGY

A. Research Design

This study used descriptive research design and Extreme programming (XP) is an agile model used in the software development process.

The goal of extreme programming is described as a software-development discipline that organizes people to produce higher-quality software more productively and introduces a number of basic values, principles and practices on top of the agile programming framework.

B. Participants of the Study

The participants of the study comprised of the administrative staff of the respective health clinic where the study was conducted.

C. Research Instruments

The researcher used reliable tools and valid instruments to gather the expected and accurate data for the study, namely: questionnaire, interview, medical records and Web.

D. Data Collection Procedure

The Rural Health Unit (RHU) is the main beneficiary of the study.

1. The researcher asked permission to the Office of the Mayor to conduct the research;
2. After permission granted, the office had been asked to provide the needed input in order for the development of computerized Respiratory Related Ailments Predictive Analysis: Decision Support System.
3. Personnel involve in decision making process had been interviewed in order to identify these variables.
4. The confidentiality of patient's information shall be handled through the user access level within the system.
5. The analyzed medical records shall only be seen by the authorized personnel. The confidential information provided by the Clinic shall only be used to its purpose.
6. These medical records shall only be seen by the researcher and no other else.

E. Data Analysis

Regression analysis in statistics is mainly used to find tendencies in set of data. This data analysis method had been used by the proposed CDSS in order to provide prediction close to the actual data.

R squared value in which range between 0 and 1 will be used to identify how good the model defined from the regression analysis.

Considering the problems to be solved by this study, the analysis of the response of the respondents to questionnaire is the key source to solve these problems.

IV. RESULTS AND DISCUSSION

A. Current Practices

The Rural Health Unit (RHU) keeps patients records within a filing cabinet. They used computers to make forms or reports that they are going to print. Age bracket, gender, and other morbidity diseases reports are manually counted and recorded. After counting and recording these records, they encode it on their computer and print a copy for reference.

Generating predictions is quite private. They add 10% in every total ailment count to make assumptions.

Based on the researcher's conducted interview and careful observation, this practice is continuously done because the clinicians are already familiar of their work.

B. Challenges and Problems Encountered

The conducted interview as well as careful observation by the researcher evidently underlines challenges and problems encountered by the Rural Health Unit related to preparations and generations of predictions. The following highlights the challenges and problems encountered by the clinic:

a. Organizing, storing and retrieving of data related to respiratory ailments requires more work and time consuming for it's manual;

b. On time summary reports use for prediction are likely impossible to monitor;

c. Prediction as a result of 10% addition of the current year's morbidity report is not always reliable.

Thus, the provision of quality health care among their patients is affected by these challenges and problems encountered.

C. Proposed System that Addresses the Problems

The performance relative to the amount of resources used under stated conditions"2. Thus, the proposed developed system provides performance efficiency that will help the clinic manage resources while using the system. The available resources that is already being used by the clinic can also be used by the proposed system to function. Thus, no large amount of money is needed to install and use the proposed system.

The Assessment: Respiratory Analysis Using Data Mining Method: A Decision Support System is aimed to address the challenges and problems encountered by Rural Health Unit.

The proposed system aims to provide fast data analysis technique in order to make reliable predictions based on the stored data in the developed system. The prediction is based on regression analysis, a common way of generating prediction based on the data available.

Hence, the use of the proposed system to the RHU is expected to provide them opportunity to experience the advantages of current trends in Information Technology.

Software sustainability has been identified as one of the key challenges in the development of scientific and engineering software as we move towards new paradigms of research and computing infrastructures7.

Summary of reports: (viewing predictions and/or actual data)

The following can be performed on this form:

1. Retrieve the past and the present data using the date tab group. This is also use to show the predictions of the system on the future selected date within the next five (5) years.
2. The settings tab group is use to show the ailment selected as well as the range of age within the graph.
3. The group by tab group is use to show the different groupings available within the report
4. Bar, Line, or Pie graph can also be selected available within chart tab group.
5. View tab group is use to show whether a graph or a tabular list of data.
6. The window tab group has a refresh button to redraw the graph base on the newly retrieve data.
7. The report area (as indicated above) shows the reported data in the form of either graph or table.

“It sees as a constituent of quality in use and as software quality attribute”¹. Thus, the result of the evaluation shows that the proposed developed system for RHU is appropriate for their needs, enables the clinicians to learn how to operate it, easy to operate, enables pleasing and satisfying interaction, and can be used by people with the widest range of characteristics and capabilities to achieve a specified goal.

D. Extent of Compliance of the Proposed Developed Application

Table 1. Compliance of the Proposed Developed System in terms of Performance Efficiency

Indicator	Mean	Mean	Overall	Description
	IT Expert	End User	Mean	
1. The response and processing times and throughput rates of the proposed clinical decision support system, when performing its functions, meet requirements	3.79	3.80	3.79	VGE
2. The amounts and types of resources used by the proposed clinical decision support system, when performing its functions, meet requirements	3.80	3.80	3.80	VGE
3. The maximum limits of the proposed clinical decision support system, parameter meet requirements	3.83	3.76	3.80	VGE
Category Mean	3.83	3.76	3.79	VGE

Table 1 shows the compliance of the proposed system Efficiency. The overall description of “Very Great Extent” shows that the performance of the proposed system meets the requirements.

The proposed developed system provides performance efficiency that will help the clinic manage resources while using the system².

Table 2. Compliance of the Proposed Developed System in terms of Security

Indicator	Mean	Mean	Overall	Description
	IT Expert	End User	Mean	
1. Data are accessible only to those authorized to have access	3.80	3.80	3.80	VGE
2. The proposed clinical decision support system prevents unauthorized access to, or modification of, patients' data and other confidential information.	3.80	3.80	3.80	VGE
Category Mean	3.80	3.80	3.80	VGE

Table 2 shows that the proposed system passed the security standard of the software quality model. This shows that the protection of medical records stored complies the confidentiality of these records.

Computer security is one of the most important tasks. However, although there are works on the interfaces design secure and usable, it is necessary to perform an investigation to integrate these two attributes in a more easy way⁵.

Table 3. Compliance of the Proposed Developed System in terms of Portability

Indicator	Mean IT Expert	Mean End User	Overall Mean	Description
1. The proposed clinical decision support system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments.	3.50	3.80	3.65	VGE
2. The proposed clinical decision support system can be successfully installed and/or uninstalled in a specified environment.	4.00	3.80	3.90	VGE
3. The proposed clinical decision support system can replace another specified software product for the same purpose in the same environment.	3.90	3.90	3.90	VGE
Category Mean	3.80	3.83	3.82	VGE

Table 3 shows the compliance of the proposed system in terms of Portability in which the overall description of “Very Great Extent” shows that the proposed system is Portable.

Portability is one of the characteristics of a high-quality software, thus, the proposed system was designed to be portable. Windows based computers are common environment among standard computer users. The proposed system was also designed to work in any windows working environment of today’s generation of computers. As long as a computer at the Rural Health Unit of Cauayan City is Windows based, the proposed system can be installed.

CONCLUSION/S

Upon careful review of the findings, the following conclusion was determined.

The proposed computerized Respiratory Analysis Using Data Mining Method: A Decision Support System will greatly enhance the operation of Rural Health Unit. Electronic record keeping of patient’s record was proved to be more efficient, secured, portable, and space wiser. Moreover, timeliness of record’s summary provides instant result of the current medical records, provide analysis of the past records and its main feature: to offer predictions based on the records stored and analyzed by the system.

RECOMMENDATIONS

Based on the findings and conclusion of this study, it proved that the proposed computerized Respiratory Analysis Using Data Mining Method: A Decision Support System will greatly affect the pace of improvement in the quality of service to patients. Thus, the researcher recommends the following:

1. The LGU may consider allocating budget for the implementation of the proposed computerized Respiratory Analysis Using Data Mining Method: A Decision Support System without sacrificing quality will be improved;
2. The RHU is also strongly advice by the researcher to use the proposed and implement the computerized Respiratory Analysis Using Data Mining Method: A Decision Support System for their patients such as medicines, physicians, and nurses. The researcher recommends that the personnel in-charge on the use of the proposed system will be trained in order to familiarize and use the features and functions of the proposed system;

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