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Automation Reporting Bed Efficiency using Verification and Validation Method

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Article Info	***ABSTRACT***
	Lack of information regarding the effectiveness of beds can lead to long waiting times and even patient rejection, thereby hampering hospital health services, especially the Resid internal medicine department. The existence of an efficient system using electronic beds is seen as a solution that also makes the inpatient service process more efficient. The research aims to create an electronic bed availability system that meets hospital needs. This study used a qualitative method with the verification and validation model as a development method which was chosen because it is suitable for rapid system development, so that adjustments are easier because the hospital can contribute to system development. Inpatient information system indicators generate reports on Bed Occupancy Rate, Length of Stay, Turn Over Interval and Bed Turn Over Interval of bed availability, daily census, daily reports, monthly reports, and all reports. Based on the research results, it is known that the system that runs in health service facilities, in this case the hospital, has a significant influence on service quality, certainly, the research carried out in the health sector has implications. Namely, a computerized system significantly contributes to the quality of health services.

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1.   INTRODUCTION

The hospital is an asset in health services by the community, which is the most important as a health facility [1]. It is necessary to develop a system to facilitate hospital health services [2]. Patients are becoming more discerning and demanding when choosing their hospitals. In addition, the system of hospital services has also changed during this time, evolving to be more digital [3]. The need continues to grow to improve the quality of hospital services with integrated technology according to the times. A hospital is a medical service organization that provides outpatient, emergency, and inpatient care and organizes comprehensive personal medical services [4]. Referring to the above legal provisions, hospitals, as medical service providers, cannot avoid using information technology as a support tool for the performance of services. Providing inpatient services is one of the hospital's efforts to save and rehabilitate patients [5]. The hospital's therapeutic and rehabilitation efforts to treat and recover patients include hospitalization. Report sections provide statistical data on health services and serve as a source of information about health services in hospitals. This region is of great interest to hospital administrators as they should always provide reliable and unbiased information as these reports can use to develop the service in healthcare quality [6]. According to Regulation No. 24 in 2022 of the Minister of Health, medical records must be stored electronically with the principle of data safety and confidentiality, so data management at hospital admission units, specifically Barber Johnson index reports, is done electronically [7]. This information system development uses Visual Basic 2010 programming language and MySql database management system. This study was carried out to create a bed performance information system to support the hospital information system (RL 1) Perform.

A study [8] concluded that the developed application for calculating indicators for hospital inpatient services had undergone expert evaluation, revision, and improvement and has been declared feasible for use as an application that facilitates the work process in hospitals, particularly the head of the room. His research only refers to the analysis of computerized data processing without the author's contribution to making the application. According to [9] showed that we can save more paper, speed up hospital services, and provide accurate service information by innovating medical record data processing applications. This study was not equipped with a Barber-Johnson chart, which plays a very important role as a source of information on bed availability. In a study conducted [6], the results of interviews with the head of medical records; discovered that information technology has a significant impact on service activities in hospitals, one of which is the process of calculating the four parameters/indicators of Bed Occupancy Rate (BOR), Length Of Stay (LOS), Turn Over Interval (TOI), and Bed Turn Over Interval (BTO) as Barber Johnson Graphics Processing material. The research [10] with a system built to facilitate hospital services. This study only discussed the inpatient daily census system, but no system design was implemented.

The waterfall method is a familiar technique for developing information system.linear system on watefall method forcing the final results to be aligned with the initial concept this can take a long time and has the potential to increase large costs so using verification and validation software development is a solution which corresponds to the problem. In addition, previous research was not equipped with a Barber-Johnson chart which plays a very important role as a source of information on bed availability. Barber Johnson designed in this study was taken to complement previous research with a more specific focus on problems. This study uses a focus on problems that are rarely found in previous studies and is expected to solve these problems, Based on the research results, it is known that the system that runs in health service facilities, in this case the hospital, has a significant influence on service quality, certainly, the research carried out in the health sector has implications. Namely, a computerized system significantly contributes to the quality of health services.

This research is structured systematically the introductory section discusses the background of the problem, the research methods section discusses the methods used to find solutions, the results and analysis section discusses the results of the system design, and the conclusion discusses the conclusions and suggestions of this study.

2.   RESEARCH METHOD

This study is a qualitative descriptive method and v-model structure, then evaluated. This survey was conducted from December 6, 2022, to February 6, 2023, at the medical record facility of a hospital in Bandung City, focusing on reporting the effectiveness of hospital beds to support the implementation of the Hospital Information System(RL 1). Methods for collecting qualitative research data include observation, analysis of text or images, and interviews, but in health research, interviews are the most commonly used [11]. Data collection involves interviews and observations by directly witnessing activities while getting the information by performing questions and answers with a relevant source person [12]. Then identify the root cause of an existing problem, then find solutions to those problems [13]. Then design an effective information system for reporting hospitalizations. The author uses a step-by-step method to create V-patterns at the design stage [14]. The V model is an extension of the waterfall model because the stages are similar to those in the waterfall model in that the model execution process flows in a "V-shape." The V-model defines a series of phases executed sequentially, one at a time, until the project is completed. This model is also known as the "Verification

and Validation Model. The process in the V model is branched and describes the relationship between the software development and testing stages. The stages in the V model are requirement analysis and acceptance testing, system design and system testing, architecture design and integration testing, module design and unit testing, and coding. In this V model, the relationship between the software development and testing stages is illustrated as shown in Figure 1.
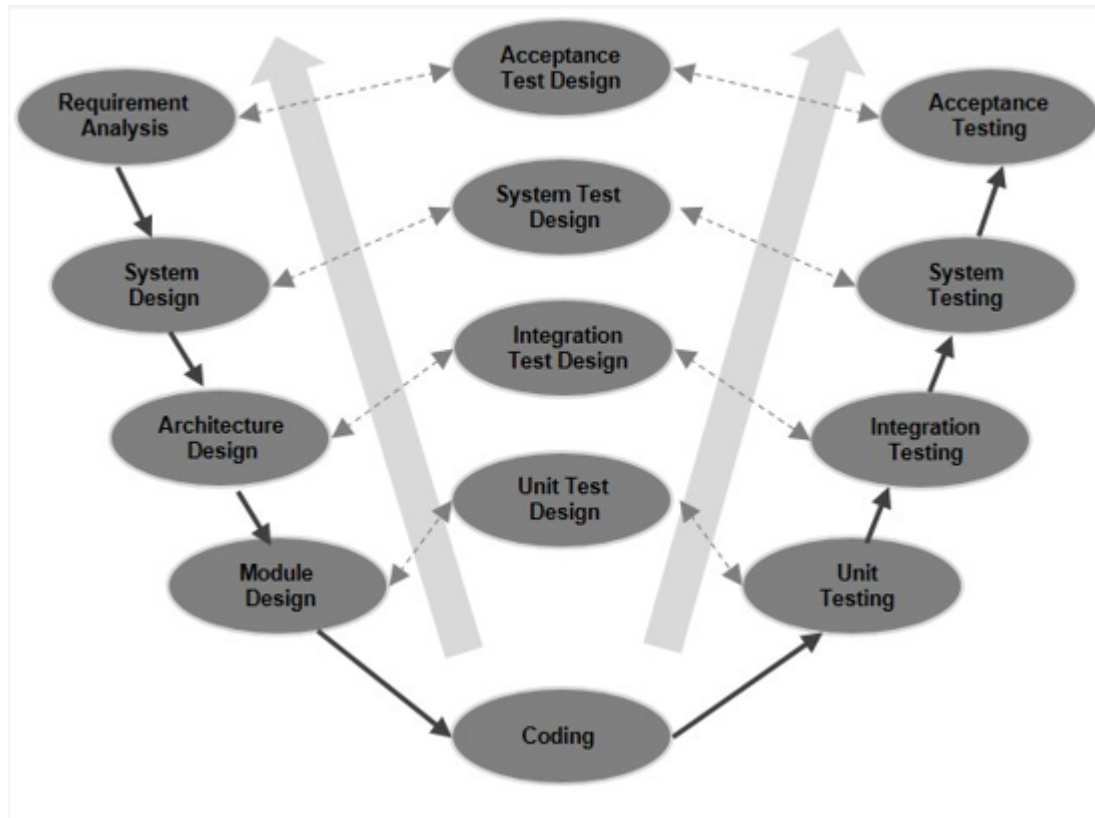

Figure 1. Stage of v-model method

One of the health management information systems in bed availability reports is the system development life cycle (SDLC). This system is used to process the steps involved in a project; in this case, it is to process or decipher the system to find out bed availability reports. Figure 1 of the v-model depicts a user-emphasis scheme, implying that users participate in all phases of the development cycle. Figure 1 represents the relationship between each development lifecycle stage and the associated testing phase. Horizontal and vertical lines include time and abstraction. This approach is good, and the early test preparation approach always works [15]. This is related to the requirements of the hospital computer system and data processing [16]. The Model V is implemented as a hospital device, starting from the left as the stakeholder and going to the right as the implementation; the testing happens at LAW. The problem's meaning includes the deficit level for medical disciplines such as anatomy and physiologythe most beneficial aspect of conducting clinical trials and testing innovations. The horizontal part of the V-model shows the verification and validation comments [17]. The testing process in this design uses black box testing, where the application is evaluated through a series of tests to determine if it matches the desired outcome.

Requirements Collection, The research uses observation and interviews in qualitative research using participants, ethnography, and fieldwork [18]. Based on the observations obtained, the bed occupancy rate in January was 75%, which means it could be better. This can lead to long waits and even rejection by the patient. Lack of information forced hospital staff to contact ward staff by phone. So it is necessary to design an inpatient performance information system to improve inpatient services. Design Usecase DiagramUsecase where an agent, entering data from the Daily Patient Count table, sees the repeat data, then displays the Daily Patient Count summary data in each department. The services involved are Paediatrics, Surgery, Obstetrics, Internal Medicine, Perinatology, Critical Care, Isolation, and Transit. The agent then inputs graphical data to calculate the Bed Occupancy Rate, Length Of Stay, Turn Over Interval, and Bed Turn Over Interval data presented in a graphic report and a visual format. In addition, the hospital summary

includes these two hospital department statistics.

As presented in Figure 2 below, medical record officers log in to be able to access this system, n the login process, the staff requires a username and password, then checks the completeness of the data to manage data, and then input census data as a source of bed availability data, then manage daily census recapitulation and barber jhonson indicator data. The Usecase diagram describes the functionality, i.e., what the system does and not how it is done.
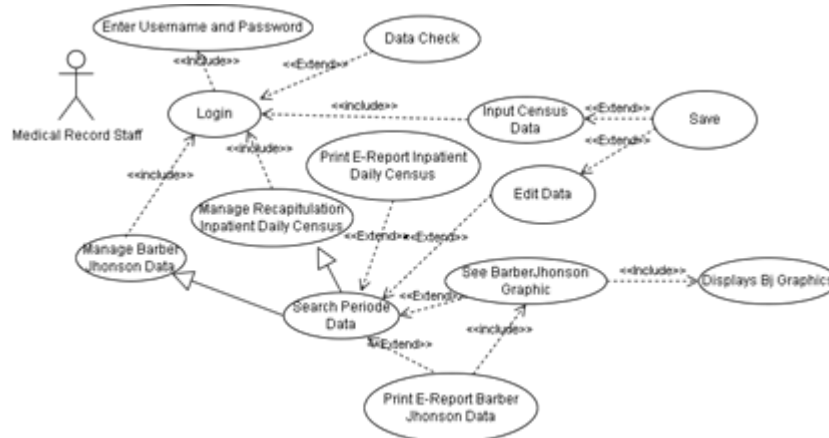
Figure 2. Usecase Diagram

The activity diagram showed in Figure 3 below. The following figure shows a flowchart for designing a system in that staff input daily inventory data, daily inventory reports, and visual data to process hospital report statistics. In addition, the agent produced a daily inpatient inventory report and a Jhonson Berber graphical report. Finally, the system presents the homepage and generates the reports. Figure 3 describes the running system activities, where in this activity, there is an interaction between humans and the software system that has been designed, as illustrated above. This activity diagram models a workflow that describes conditions, constraints, and sequential and concurrent activities.
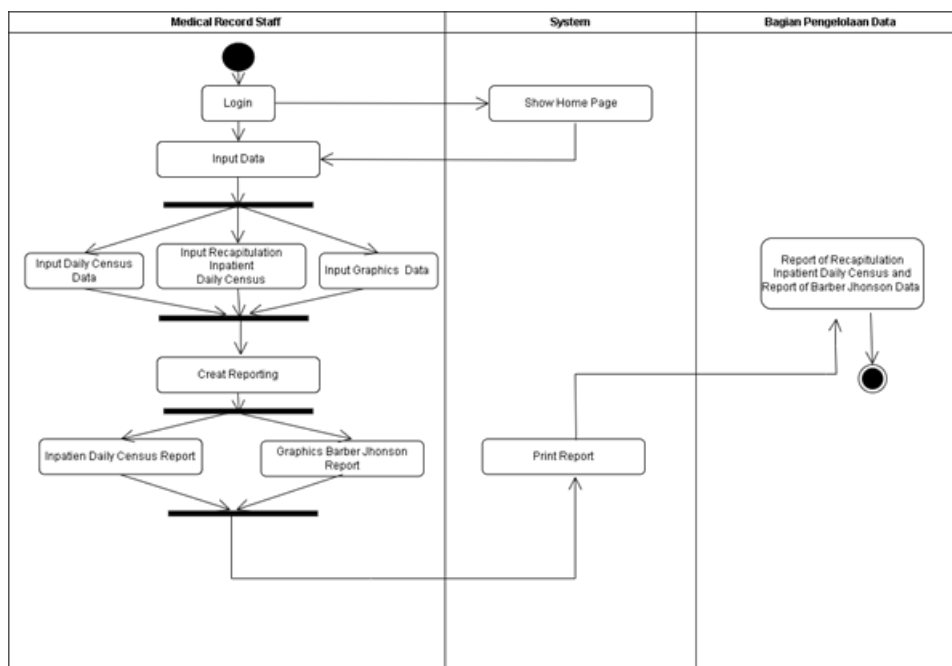

Figure 3. Activity Diagram

The flowchart in Figure 4 is a diagram that illustrates the general workflow of the system. This diagram shows the sequence of existing system procedures. Below is a block diagram of the installation based on the realized project. A flowchart is also a diagram describing the steps and solutions carried out in a program. For example, in the picture below, it is explained that the room nurse, who is a ward officer, fills out the daily inpatient census form, which is then delivered to the medical record department every day at 06.00. then the medical record officer logs into the available application by entering a username and password. Then the census data of incoming and outgoing patients is inputted and stored into the database, after which the officers conduct a daily census recapitulation, which later becomes a daily inpatient census report and is processed again to be used as bed availability data, namely Bed Occupancy Rate, Length Of Stay, Turn Over Interval, and Bed Turn Over Interval. After that, the data that has been in the form of a report is stored and reported to the health office as implementation RL 1.
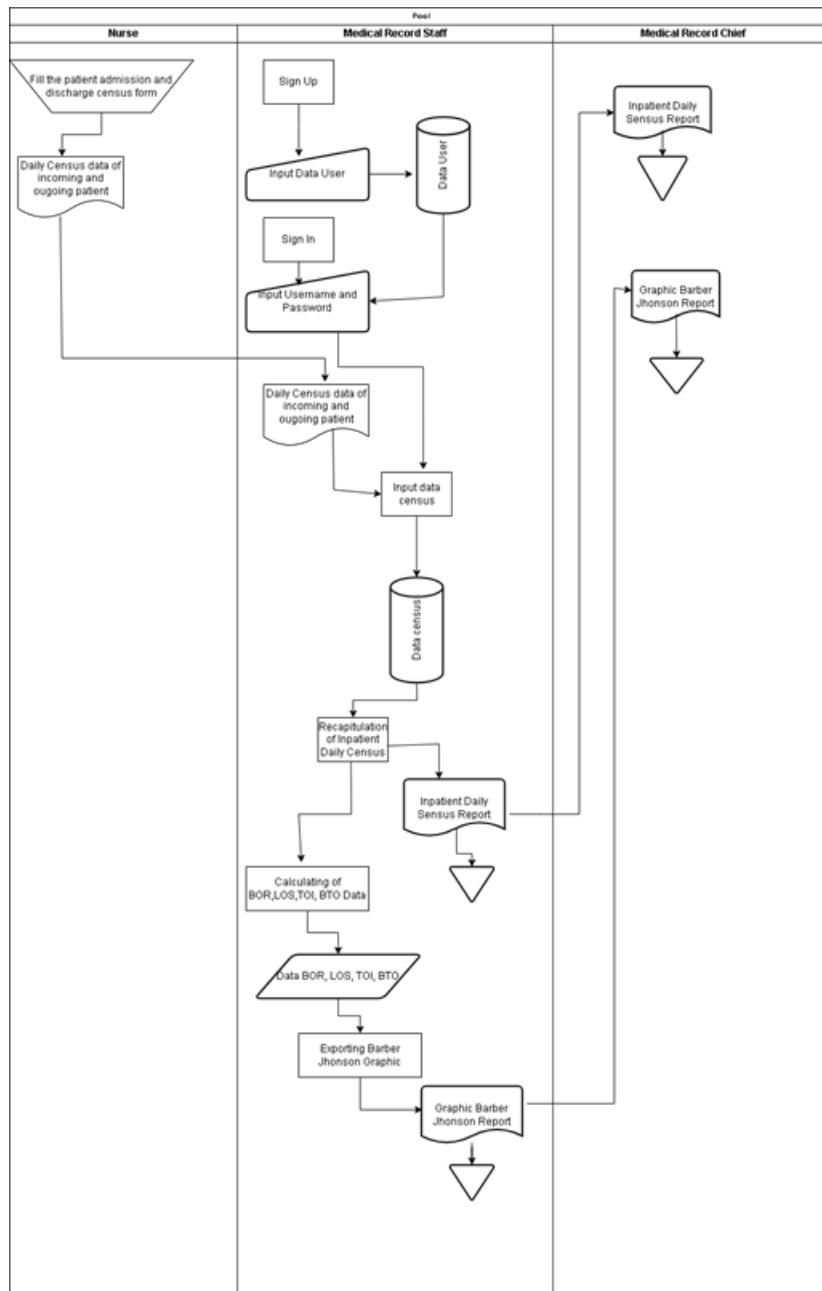

Figure 4. Flowchart

3. RESULT AND ANALYSIS

The implementation follows the application design in the software development process. As a result of this study, it was found that there were problems that required a new innovation in the processing of medical records. The process of processing medical records based on computerization can facilitate the processing of medical record data, especially in reporting the availability of beds. The study results found that the Bed Occupancy Ratio was at 75%, as shown in Figure 11. The result of these investigations is implementing a Hospital information system interface design to improve RL 1. By studying the literature in previous studies, this research has improved because it is followed by a graph that can contain related information, namely the availability of beds

The login page in Figure 5 has username and password fields. Agents must register before accessing the system when the plan is open to maintain proper security measures. The registration page for this system looks like the image below.
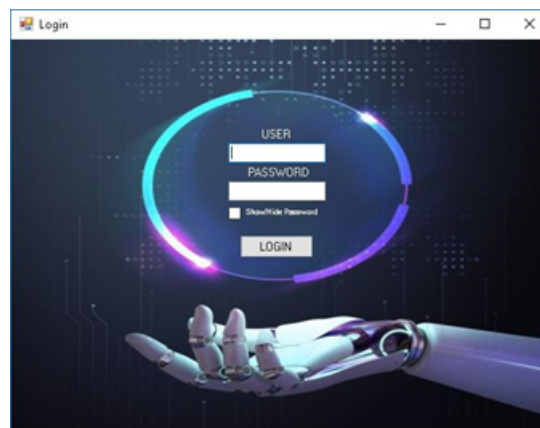

Figure 5. Login

The main menu page in Figure 6 has the following display of the home page. This site offers various types of services, e.g., intensive care units, ambulatory services, and hospitalizations. After successfully logging in, the officer will be presented with the main menu display, as shown in Figure 6. There are several menus available that can be visited as needed by a medical record reporting data processor. In this case, inpatient reporting is required, so the officer only needs to click on the inpatient menu because the report on the availability of beds is part of the hospitalization.
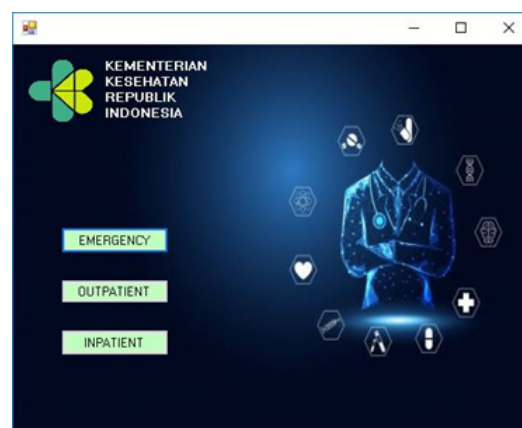

Figure 6. Main Menu

As illustrated in Figure 7 below, Census Resume View explains that Daily inventory data was reviewed by workers, as was the nurse's data census performed every morning. A count is taken every morning in the children's room, operating, maternity, internal medicine, perinatal, intensive care room, isolation room, and transit room. As illustrated below, the data transferred every morning will be input into the system. This data is used as input to develop a hospital management design concept. This census shows the

number of hospitalized patients at a certain time. Officers only need to click the census recapitulation button to get the daily census recapitulation for inpatient care.
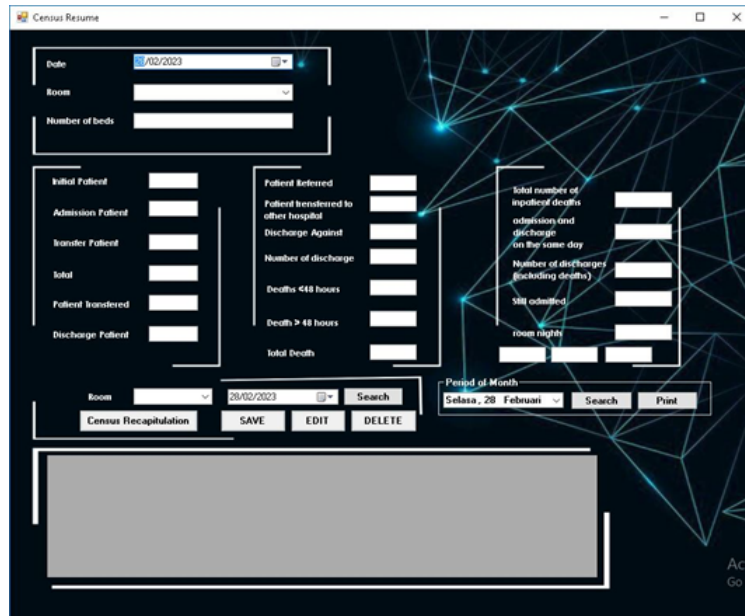

Figure 7. Daily Census Resume

Inpatient Daily Census Recapitulation, as presented in Figure 8, generates the daily inventory report by day, month, and period. The daily count is helpful in counting the number of patients admitted, discharged, and deceased in the hospital on a given day and calculating the availability of healthcare facilities and beds. In addition to the personal data of patients treated on a given day, this information is communicated without delay to the head of the medical service and any other units that request it. This daily inpatient census summary controlled the number of patients admitted to the room and reported to the medical record for one month or quarter. The design of this system is based on problems found in the field at one of the hospitals in the city of Bandung.
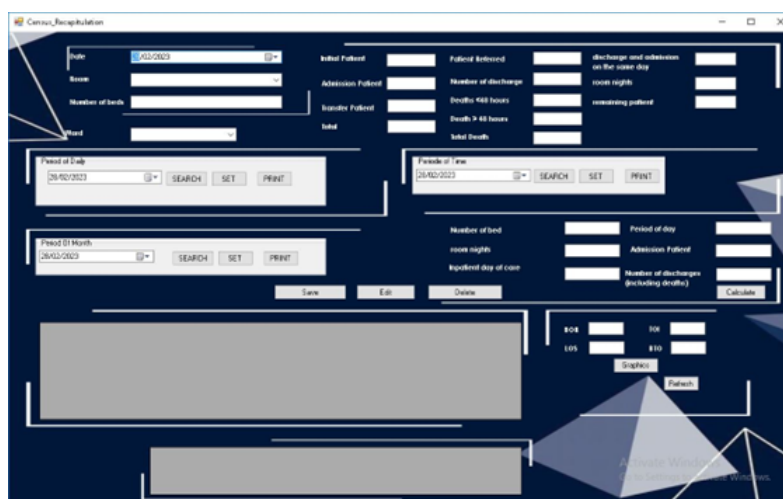

Figure 8. Recapitulation Daily Census

Figure 9 below shows the daily inpatient census summary output in Figure 8. This page contains the daily census summary report, which will be reported within a certain period. For example, the period on the page below is one month, namely January, with

the operating ward, meaning that the operating ward has 30 empty beds in January. This is in line with the aim of this study, which is to obtain information regarding the availability of beds in a hospital for a certain period. Therefore, information on the availability of beds comes from the daily census recapitulation reports of hospitalizations.

Figure 9. E-Report of Inpatient Daily Census

The graphic Data Input Page in Figure 10 below is a form for inputting Johnson's barometer indicator data: bed occupancy rate, length of stay, turn-over interval, and bed turn-over interval. The input data comes from the daily census recapitulation output in Figure 9 above. The decision information is used as a parameter to determine whether the bed occupancy rate is ideal or not. Likewise, for length of stay, turn-over intervals, and bed turn-over intervals. The search data column shows the required period, so if the officer clicks on the period from January to February, information on the numbers for bed occupancy rate, length of stay, turn-over interval, and bed turn-over interval will be displayed with ideal information or not. Then the data is exported into the graph depicted in Figure 11.
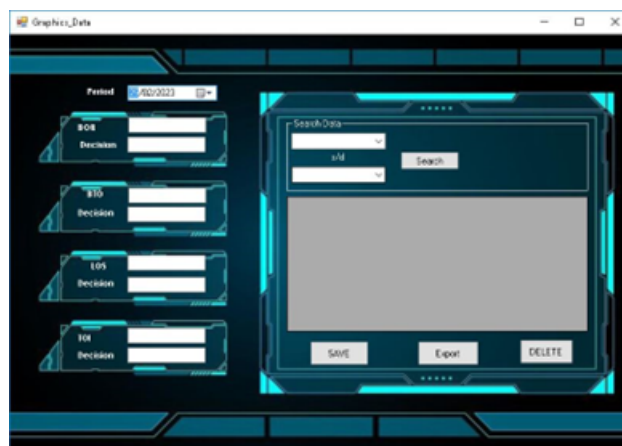

Figure 10. Graphic Data Input

The Reporting of Barber Jhonson Graphic in Figure 11 below explains that the bed occupancy rate in January 2023 will be at 75%, which is ideal. This Barber Johnson graphic is the output of Figure 10, which is the final result of the system design that was

created. Because the Barber-Johnson chart is used as an aid for analyzing, presenting, and making decisions regarding comparisons over time, namely showing the productivity of the hospital over time, Hospital management will get better with decreasing Length Of Stay and increasing Bed Occupancy Rate, Turn Over Interval, and Bed Turn Over Interval. In addition, the results of reports regarding efficiency indicators can be verified by entering the data into the graph.
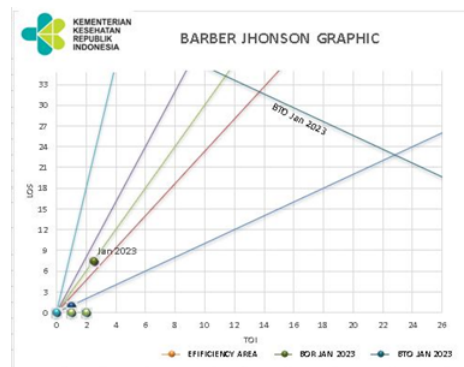

Figure 11. E-Report of Barber Jhonson Graphic

Testing with Black Box, The black box plays an important role and is tested in functional tests to obtain specific information for system validation [19]. Based on the observations obtained, the bed occupancy rate in January was 75%, which means it is ideal. This can lead to long waits and even rejection by the patient. Lack of information forced hospital staff to contact ward staff by phone. The design is needed to improve the performance information system for inpatient services. [20]. Testing is carried out to determine the system's design, function, and usability. Testing is being done to avoid bugs and make it easier to use [21].

Table 1. System Test Results Using the Black Box Method [1]

Testing Activities	Expected Results	Test Activity Results	Conclusion
Testing staff access based on data in the database.	Reached for login.	Sign-in reached, and The messageConnect is displayed successfully." On error connect, view the message "Connection failed; please check your username and password."	Proper
Selecting home page	Go to the home page	Entering the home page	Proper
Choosing a Menu of Inpatient menu	Go to Inpatient Reporting sheet.	Entering the Inpatient Reporting Page.	Proper
Fill in the patient data and save.	The census resume was successfully saved to the database.	Completed the census summary stored in the database, and a message is displayed" Census biography recorded in database. " Then go to Consolidated List.	Proper
Create a recapitulation daily census by clicking	Go to the Recapitulation	Successful entry Daily Summary of the census data entry displays Daily Summary of the census with success stored in the database and contribution list". Summarystored in Database".	Proper
By" recapitulation census" on the outpatient	Daily census data Input		
Census resume page of the inpatient.	Display		
Fill out the recapitulation census in the Medical the recapitulation census input form, then save.	Recapitulation daily Census was successfully saved to the database.		Proper
Create graphic data input by "graph data" on the recapitulation Census page of the inpatient	Go to the graphic data interface	Entering graphic data input interface	Proper
Complete the data form, then click save	Graphic data was successfully saved to the database	Accurate graphic data	Proper
		Registered in the database, and The message "Graph data ." appears stored in the database."	
Print E-report of recapitulation Inpatient daily census	E-report output show	E-report output successfully appears.	Proper
Print E-report of Barber Jhonson Tabel wajib dirujuk	E-report output appears	E-report output successfully appears.	Proper

The [8–10] showed that we can save more paper, speed up hospital services, and provide accurate service information by innovating medical record data processing applications because computerized system, but the system uses is waterfall method which was forcing the final results to be aligned with the initial concept this can take a long time and has the potential to increase large costs so using verification and validation software development is a solution which corresponds to the problem. In addition, previous research was not equipped with a Barber-Johnson chart which plays a very important role as a source of information on bed availability. Barber Johnson designed in this study was taken to complement previous research with a more specific focus on problems. This study uses a focus on problems that are rarely found in previous studies and is expected to solve these problems. Based on the research results, it is known that the system that runs in health service facilities, in this case the hospital, has a significant influence on service quality, certainly, the research carried out in the health sector has implications. Namely, a computerized system significantly contributes to the quality of health services.

4.   CONCLUSION

Based on research conducted regarding the creation of a bed availability information system in a hospital in the city of Bandung provides many benefits for all medical staff and patients. The process of inputting data can be done computerized using this application. Based on the research results, it is known that the system that runs in health service facilities, in this case, the hospital, significantly influences service quality. Certainly, the research carried out in the health sector has implications. Namely, a computerized system significantly contributes to the quality of health services, enabling hospitals to achieve excellence. For this reason, it is necessary to make efforts to maintain the quality of service. Research that is rarely done can be adding information related to improving bed information systems in hospital health services that require manual reporting of manufacture and inventory with the innovation from previous research, namely the Johnson Barber chart are expected to complete information about the importance of designing bed efficiency information system as a previous study and can be integrated into the hospital management information system (SIMRS) at the Ministry of Health.

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