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Implementation of Extreme Programming Method on Emergency Room Patient Referral Information System

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Abstract: The rapid development of information technology has caused shifts in the order of society, nation, and state, one of which is a shift in the new order. This shift is represented by hospitals, one of which is in the medical records installation of the Cicalengka Regional Public Hospital in managing the referral patient reporting system in the emergency room, which has not been fully integrated. One possible application method is utilizing information technology as a digital-based information system. The problem is that the system already uses a national referral system. However, there are still no output results that can be printed as report material for patients who have been referred, hindering the creation of a reporting system based on the referral system for emergency room patients. Therefore, an information system design was made that could facilitate the preparation of fully integrated medical record referral patient reports. This study aims to improve the efficiency of medical record information services and create an integrated system to support the referral patient reporting system at the Cicalengka Regional Public Hospital.

Keywords: Emergency Room, Extreme Programming, Patient Referral, Information System

INTRODUCTION

The development of information technology in society has encouraged the digitization and transformation of services to various sectors, including health. People increasingly realize that information technology is essential in the digital era. The use of digital systems in all its elements is increasingly emphasized in the era of the Industrial Revolution 4.0, which is useful for streamlining human activities and work. The utilization of information technology in the health sector can be said to be underutilized. Most health institutions still rely on paper-based medical records, which can limit coordination between patients and doctors, so modernization efforts in health services are highly recommended to implement digital technology to improve service efficiency in the health sector.

According to the Regulation of the Minister of Health of the Republic of Indonesia Number 24 of 2022, medical records contain documents and records regarding patient identity, examination results, treatment, and other actions and services (Departemen Kesehatan Republik Indonesia, 2022). Medical records are a source of information and a means of communication needed by both patients/sufferers and healthcare providers for consideration in determining a management policy or medical action (Syifani & Dores, 2018). One form of activity in medical records is promotion carried out by reporting patient referral letters, especially in emergency installations.

Referrals are means and infrastructure used to provide information and support or strengthen statements with tasks. Referrals can include various forms of support, including evidence, value, and credibility (Soeripto, 2019). The health service referral system manages assistance that transfers the burden and obligation of health assistance relatively and reciprocally, both vertically and horizontally (Puspitasari et al., 2021). The referral letter aims to direct patients with conditions that first-level facilities cannot treat to advanced healthcare facilities staffed by specialists who can treat these conditions (Khairunnisyah & Heltian, 2022). A referral letter is made based on the diagnosis that the patient requires further treatment at the hospital and is given to the patient or the patient's family to take to the intended hospital. The patient is then escorted to the hospital for registration by submitting a referral cover letter. The referral letter received by the hospital is then reviewed to determine the appropriate compensation (Awalludin et al., 2022).

The obstacles in the Cicalengka Regional Public Hospital are the systems that already use the national referral system. However, there still needs to be output results that can be printed as report material for patients who have been referred. The design of this referral reporting information system seeks to solve problems in managing the patient referral system in the Emergency Department

by increasing the efficiency of medical record information and developing a computerized system that can print reports on patients referred to the hospital.

In this study, software development was carried out using the Extreme Programming (XP) methodology. This software development method was chosen because it is based on an idea that combines various simple ideas to increase productivity and adaptability without sacrificing the quality of the software produced. The purpose of this research is to find out the current patient referral system from the clinic to the hospital and design a visual studio-based patient referral information system so that patient data can be integrated quickly and accurately and that can print reports on patients who have been referred to the hospital. The designed system is expected to increase the effectiveness and efficiency of referral reporting activities and reduce the error rate of manual data recording in the emergency department installation.

Considering previous research by [(Nugroho et al., 2023), Web-Based Patient Referral System Design from Clinic to Hospital Using Object Oriented Programming System, the problems that occur and the result can solve problems in the circulation of referral systems and provide users with more optimal and integrated referral patient data information.

In research (Wirastuti et al., 2021), Analysis and design of a patient referral system using Microsoft Visual Studio 2010 at Health Center X using Waterfall methodology is applied to create a patient referral information system. This information system can assist officers in processing referral data and reporting patient referrals.

Research conducted by (Awalludin et al., 2022), Modeling information systems for managing referral cover letters at hospitals using business process models and notation (BPMN). The results of this study are to assist marketing and clinical officers in transparently recapitulating referral letter data so that it will be easier to supervise or supervise. Data from referral letters will be stored/appropriately archived in digital form, and the data can be accessed anytime if needed.

Based on the findings of previous research on digitization, previous research has the same goal, namely for system development. Therefore, an emergency room patient referral reporting information system was created using the extreme programming (XP) software development methodology that can be used quickly without waiting to complete the development process.

RESEARCH METHOD.

The research method used is using qualitative and descriptive methods. Qualitative data is used to strengthen the problem under study. The research location was the Cicalengka Regional Public Hospital. The data was collected using interviews and observations, which were analyzed using qualitative Analysis, including the qualitative data category. A qualitative approach was taken to strengthen the data results by conducting in-depth interviews to obtain information. Qualitative type, research aims to identify and analyze data. Qualitative Analysis is used for data analysis by describing the results of observations and interviews in the field, especially the emergency room patient referral system, then determining the leading causes of existing problems and how to fix these problems, and then designing an emergency room patient referral report information system.

3.1 Requirement Collection

In this case, the researcher collects data utilizing direct interviews with the authorities who handle problems with this research (Ihromi et al., 2023). Interviews in the field specifically regarding the referral information system, then determine the main causes of existing issues and how to fix the problem and find a solution, then design a referral information system. The author collects appropriate data by observing and researching directly in the field to obtain the data needed according to research requires to provide a clear picture of the activities that occur (Israwati et al., 2021). In this observation, the author conducts a direct review based on the current Cicalengka Regional Public Hospital system to find and collect data directly. To add references to the system being studied, the authors conducted a literature study by researching and collecting data from several documents, books, and the internet related to the referral patient information system in the emergency room.

3.2 System Development Method

In the design of the Referral Patient Reporting System, the author uses the Extreme Programming (XP) development method. The author chose the Extreme Programming (XP) development method because the system's nature to be developed quickly has the ultimate goal of completing the project being worked on, including the planning, design, coding, and testing phases. Extreme Programming (XP) is part of a system development methodology that is applied to meet development needs. Aims to create small to medium-sized teams. XP can also be used to develop systems with ambiguous requirements or with rapidly changing requirements. The stages of Extreme Programming (XP) are carried out as follows:

1. Planning
   Planning starts with gathering requirements that allow team members to understand the context of the software to be created. Generates excellent insight into what output is needed and the software's main features (Somantri, 2022).
2. Design
   At this stage, the researcher describes or models the Referral Patient Reporting that will be made so that it can be seen what kind of system structure will be built. A simple and clear design is made to facilitate development. Application design using Flow map, Context Diagram, DFD, and ERD Diagram.
3. Coding
   Extreme Programming (XP) suggests that two people work together in one computer workstation to code from one story (pair programming) (Usanto et al., 2022). The system will be built based on Microsoft Visual Studio with a MYSQL database.
4. Testing

In the phase in which the elaborated code is implemented, it is initially ensured that the code does not generate errors; if it generates errors, they must be fixed quickly, and an acceptance test is carried out according to the user's story and ensures that it has run correctly (Usanto et al., 2022). This test uses a Black box.

The eXtreme Programming (XP) process in diagram form is shown below:

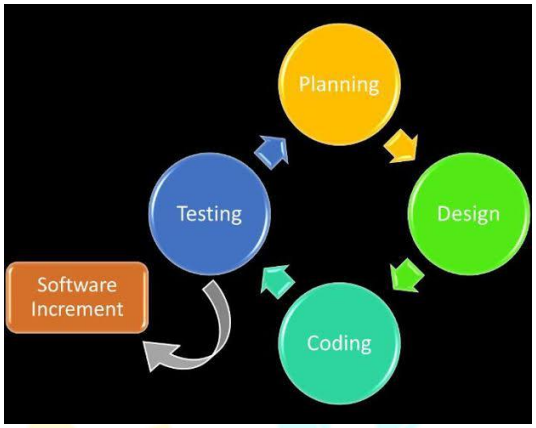

Figure 1. XP process

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RESULTS AND DISCUSSION

4.1 Requirements Analysis

Requirements analysis is the collection of requirements needed to develop a complete application. Flow map, context diagram, data flow diagram (DFD), Entity Relationship Diagram (ERD), and Relationship Table are used in the analysis stage. Here is the explanation:

1. Flow map

   A flow map is a combination of map and flowchart symbols that describe the activities and journey of documents in a system (Abdussalaam & Ramdani, 2023). The flow map design that the author designed is in Figure 2.

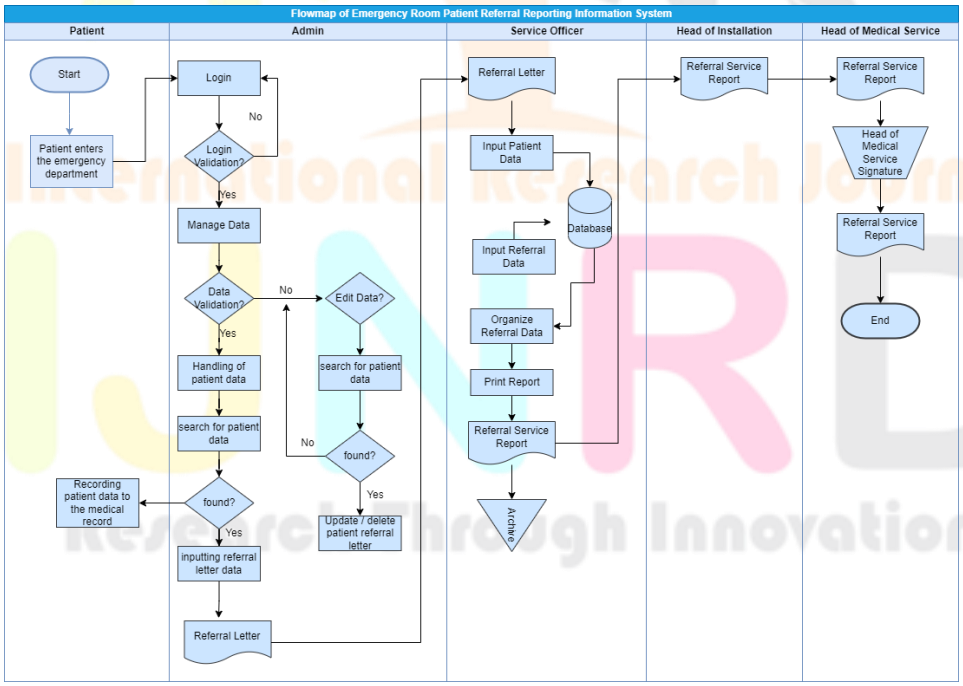


Figure 2. Flow map

2. Context Diagram

   Figure 3 shows the Emergency Room Patient Referral Information System context diagram. A context diagram is a diagram that consists of a process and describes the scope of a system that contains an overview (outline) that will be made (Abdussalaam & Badriansyah, 2021).

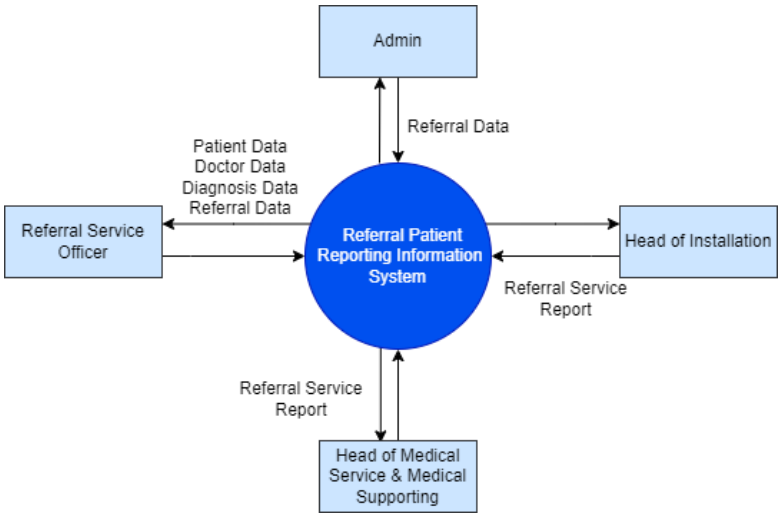


Figure 3. Context Diagram

3. DFD Level 0

This DFD is divided into 2, namely DFD level 0 and level 1, where level 1 is a detailed description of the flow chart conceptualized in the level 0 flow chart (Majid et al., 2020). Level 0 diagrams are often called context diagrams, the lowest diagrams of other diagrams (Ishak et al., 2020). The following is a Level 0 Data Flow Diagram shown in Figure 4 below:

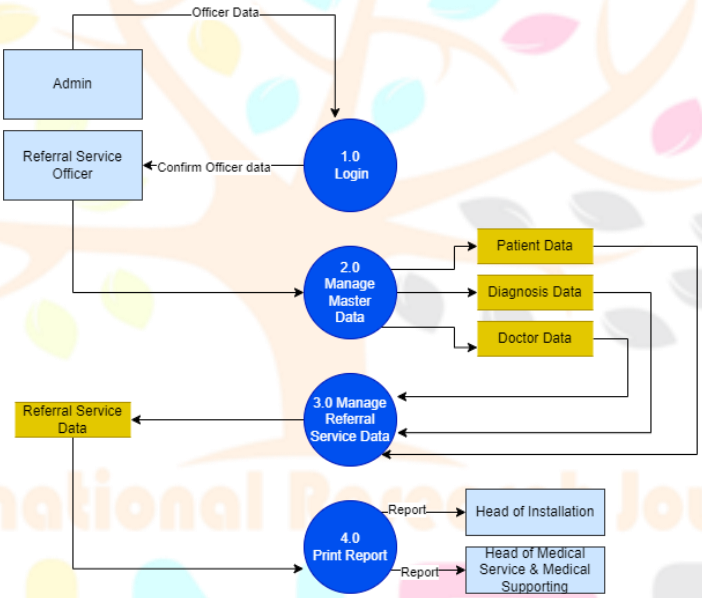


Figure 4. DFD Level 0

4. DFD Level 1 Process 1.0

The Level 1 Data Flow Diagram is an advanced form of the Level 0 Data Flow Diagram in which the Level 0 Data Flow Diagram process is described in greater detail. The level 1 data flow diagram consists of one large circle containing a smaller circle within it. The context diagram is dissected in diagram zero (Abdussalaam & Oktaviani, 2020). This data-storing diagram is depicted in Figure 5.

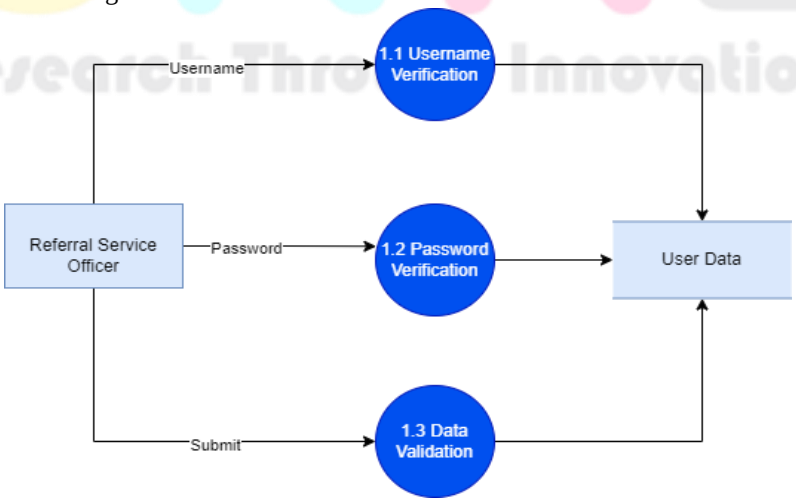


Figure 5. DFD Level 1 Process 1.0

5. ERD

Entity Relationship Diagram (ERD) is a diagram in the form of a graphical notation that connects data during the construction of a database. The ERD serves as a tool for database creation and provides an overview of how the database will function (' Afiifah et al., 2022). Figure 6 is an Entity Relationship Diagram (ERD) of the database and user interface of the Emergency Room Patient Referral Information System at Cicalengka Hospital.

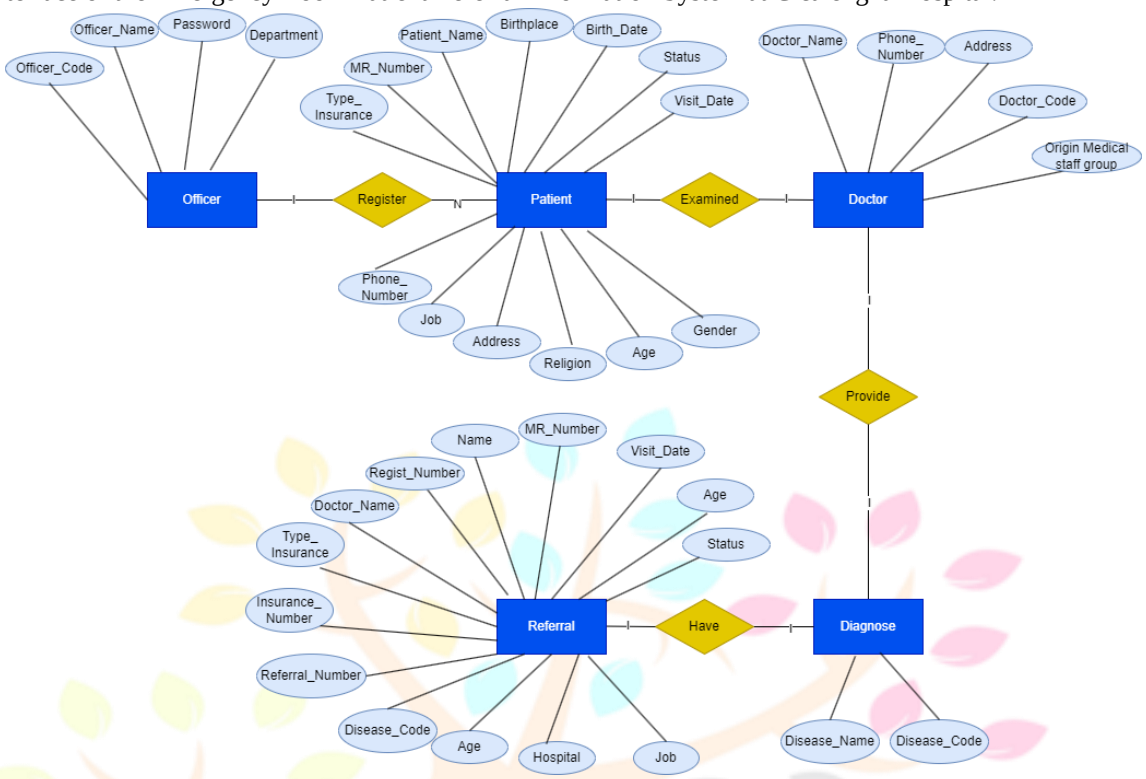


Figure 6. ERD

6. The Relation Table

The relation table comprises the number of record types used to illustrate the table-to-table relationship. Figure 7 shows the relation table of the Emergency Room Patient Referral Information System at Cicalengka Hospital.

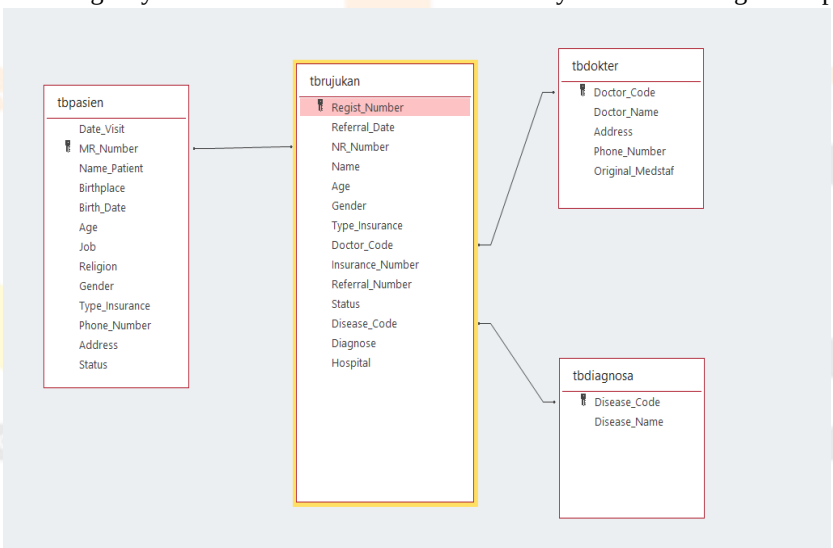


Figure 7. The Relation Table

4.2 Implementation

This research results in implementing the interface design of the emergency room patient referral reporting information system at Cicalengka Regional Public Hospital. The design of this information system starts from the initial display to the final show of the application. The following is the implementation of the design;

A. Login Page

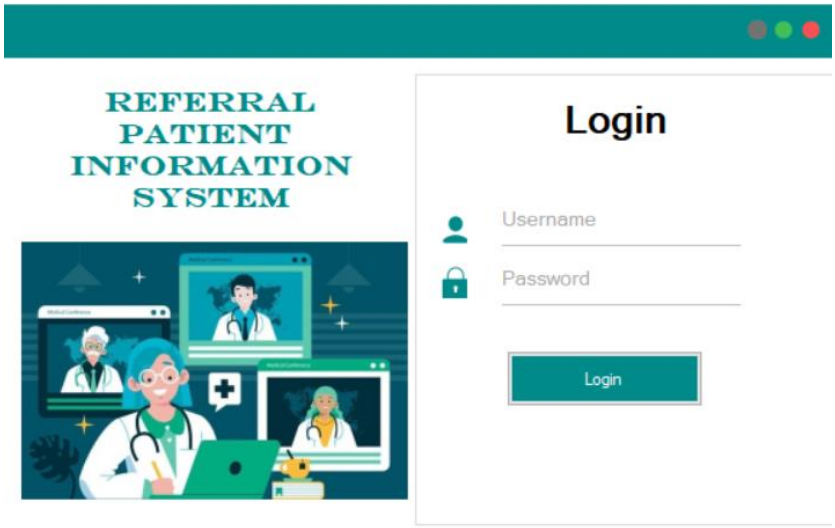


Figure 8. Login Page Display

The login menu is the initial display when this information system is run. This design contains a username and password form to access the system. After entering a valid username and password, the system will automatically enter the application homepage. On the home screen, there are several main menus.

B. Main Menu

Figure 9. Main Menu Display

The main menu display is found on the initial screen of the system. Some features can be used in this menu to change, delete, or add to the application's main menu. This page provides several types of data menus are provided, namely master data, service data, and reports.

C. Patient's Data Page

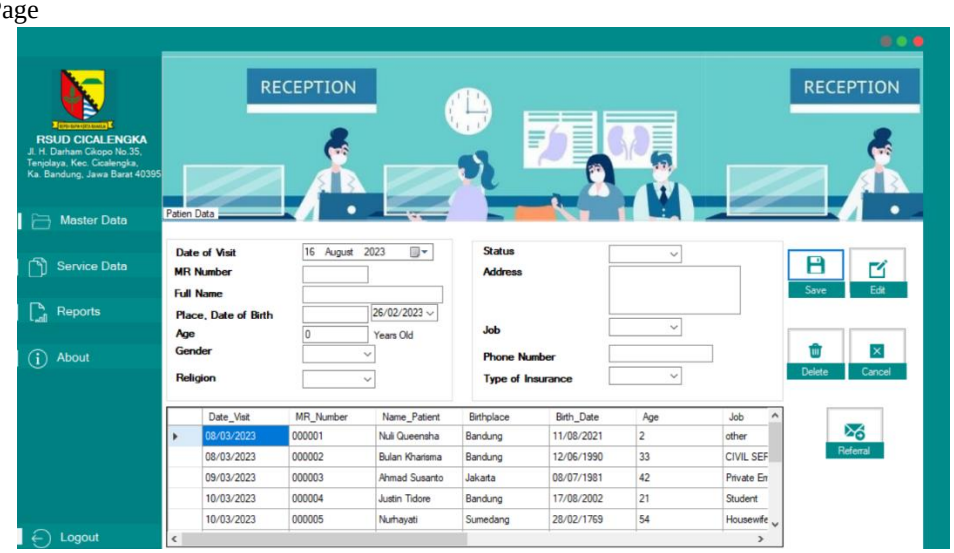


Figure 10. Patient's Data Page Display

Above is Figure 10 of the patient data menu display for referral patient information system application users. On this page, a form must be filled in to fill in the patient's complete identity.

D. Referral Service Page

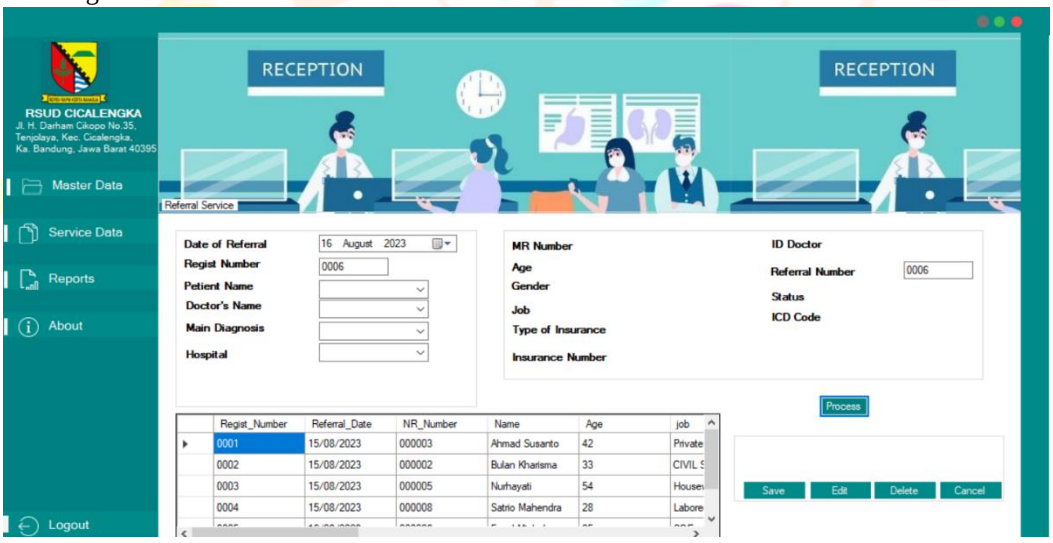


Figure 11. Referral Service Page Display

Filling in the information that will be used to input patient data to be referred is depicted in Figure 11 using the referral service form. This section serves as a database for program information, which is crucial for processing report generation.

E. Report Page

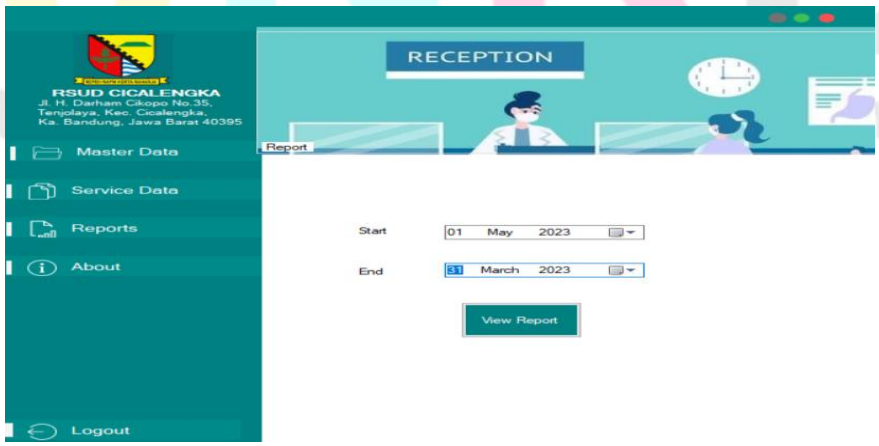
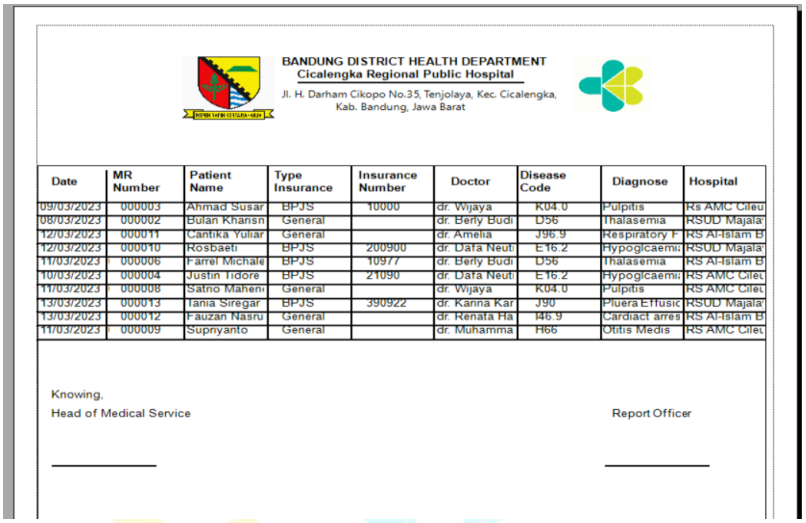


Figure 12. Report Page Display

The year is used to generate a report of referred patient data, as shown in Figure 12. The show button on this form makes viewing the specified report output easy.

F. Referral Report Form



BANDUNG DISTRICT HEALTH DEPARTMENT
Cicalengka Regional Public Hospital
Jl. H. Darham Cikopo No.35, Tenjolaya, Kec. Cicalengka, Kab. Bandung, Jawa Barat

Date	MR Number	Patient Name	Type Insurance	Insurance Number	Doctor	Disease Code	Diagnose	Hospital
09/03/2023	000003	Ahmad Susar	BPJS	10000	dr. Wijaya	K04.0	Pulpitis	Rs AMC Cileu
08/03/2023	000002	Bulan Khansn	General		dr. Berly Budi	D56	Thalasemia	RSUD Majala
12/03/2023	000011	Cantika Yuliar	General		dr. Amelia	J96.9	Respiratory F	RS Al-Islam B
12/03/2023	000010	Rosbaeti	BPJS	200900	dr. Dafa Neuti	E16.2	Hypoglcaemi	RSUD Majala
11/03/2023	000006	Farrel Michale	BPJS	10977	dr. Berly Budi	D56	Thalasemia	RS Al-Islam B
10/03/2023	000004	Justin Tidore	BPJS	21090	dr. Dafa Neuti	E16.2	Hypoglcaemi	RS AMC Cileu
11/03/2023	000008	Satrio Maheni	General		dr. Wijaya	K04.0	Pulpitis	RS AMC Cileu
13/03/2023	000013	Tania Siregar	BPJS	390922	dr. Karina Kar	J90	Pluera Effusic	RSUD Majala
13/03/2023	000012	Fauzan Nasru	General		dr. Renata Ha	I46.9	Cardiact arres	RS Al-Islam B
11/03/2023	000009	Supriyanto	General		dr. Muhamma	H66	Otitis Medis	RS AMC Cileu

Knowing,
Head of Medical Service

Report Officer

Figure 13. Referral Report Form Display

Figure 13 displays the results of the referral patient report: referral date, RM number, patient name, insurance type, insurance number, doctor name, ICD code 10, diagnosis, and referral hospital origin. The desired report will be displayed when the report period in the group box is selected in Figure 12

G. Prototype Assessment

This phase involves user feedback on the prototype design; here, the system is tailored to the user's preferences, and critical feedback is gathered to enhance its efficacy.

H. The Black-box system test determines whether or not all software functions conform to the functional requirements specified during development (Ambarwati, 2020). Black-box testing enables software to obtain a set of input conditions that utilize all of the program's functional requirements (Golian et al., 2022). Based on the research results using Black-box testing, it can be concluded that all Interface components are valid.

Table 1. Black-box Testing

Scenario Test	Expected Test Results	Testing Process	Decision making
User login, based on the information stored in the database.	Successfully log into the system.	If Login Successful, the message "Login successful" will be displayed. If you fail to log in, the message "Failed to log in; check your username and password" will appear.	Appropriate
Select the menu from the patient data form	Display the patient data page.	Successfully enter the patient form page.	Appropriate
Complete the Patient form with the relevant information, then click the save button.	All patient information has been successfully saved into the database.	The patient data is successfully saved to the database, and the message "Patient data has been saved to the database" appears.	Appropriate
Create a patient referral by clicking on the "service data" form on the main menu.	Display the service data form.	Successfully enter the service data page.	Appropriate
Complete the referred patient data, then click the save button	All emergency room patient referral information has been successfully saved into the database.	The patient data is successfully saved to the database, and the message "Patient data has been saved to the database" appears.	Appropriate

Print Report	Menampilkan Laporan rujukan pasien IGD	Display the emergency room patient referral report	Appropriate

Conclusion

Researchers found that the use of information technology at Cicalengka Regional Public Hospital was not optimal and not fully integrated because there were no output results that could print report materials for patients who had been referred, which could hamper the process of the emergency room patient referral system reporting system. This finding is based on observations and interviews conducted at Cicalengka Hospital. Therefore, based on the results that researchers get from the Analysis, design, and implementation that has been done, it can be concluded that the referral patient reporting information system that utilizes the extreme programming method can facilitate the performance of medical record officers and doctors in supporting the reporting system process accurately because it is in a computerized system and has been well integrated.

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