DESIGN OF ELECTRONIC-BASED MEDICAL RECORDS TO SUPPORT THE QUALITY OF REPORTING IN THE INTERNAL DISEASE POLYCLINIC AT AL IHSAN HOSPITAL

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Abstract. Electronic medical records (RME) are a digital transformation solution to overcome the inefficiencies of conventional paper-based systems. This study aims to design a GUI-based RME system using Python Tkinter to improve the quality of reporting at the Internal Medicine Poly of Al Ihsan Hospital. The research methods include observation, interviews, and literature study, with the waterfall approach including needs analysis, design (flowmap, ERD, DFD, context diagram), implementation, and black box testing. As a result, the system is integrated with key features: ICD-10-based patient management and medical records, automated reporting (daily/monthly) in Excel format, visualization of diagnostic statistics, and role-based access control. Testing showed improved data search efficiency (from 15 minutes to <1 minute) and reporting accuracy (95%). The system meets user-centered design standards and is ready for widespread implementation, with recommendations for the development of BPJS API integration and follow-up notifications. For further development updates, it can be done by integrating hospital databases and done efficiently by adding AI automation features for more efficient and optimal data classification by relying on AI, which is expected to help the work process to be shorter and more optimal with a simple program.

Keywords: Electronic Medical Records, Python Tkinter, ICD-10.

Introduction

Medical records are an important component of healthcare that contains complete documentation of the patient's identity, examination, diagnosis, treatment, and other medical procedures. Medical records according to the Regulation of the Minister of

Health Number 24 of 2022 are documents that contain data on patient identity, examination results, treatment, actions, and other services (Permenkes 2022). The regulation also emphasizes the importance of electronic medical record systems to improve the efficiency and security of patient data. In the context of modern health services, medical records not only function as administrative documentation, but also as a basis for service quality evaluation, case analysis, education, and health service planning.

The development of information technology has driven the transformation from a paper-based conventional medical record system to an electronic medical record (RME) system. This transition is an urgent need given the various limitations inherent in the conventional medical record system. Al Ihsan Hospital as one of the referral hospitals in West Java, especially in the Internal Medicine Poly. Based on initial observations and interviews with medical and administrative staff, several main problems were found, including the process of searching medical record files that required an average of 10-15 minutes per patient which caused long queues, difficulties in tracking patient examination history chronologically, limited access to patient information between service units, and difficulties in producing fast and accurate reports for leaders (Erlangga 2023).

These problems have a direct impact on the quality of health service reporting at the Internal Medicine Poly of Al Ihsan Hospital. The quality of the reporting in question includes aspects of completeness, accuracy, timeliness, and ease of access to data. Based on internal hospital data in 2023, the delay in monthly reporting of the Internal Medicine Poly reached 40% with a data input error rate of 15%. This situation hinders clinical and managerial decision-making processes, and has the potential to affect the overall quality of patient care (Rizky et al. 2024).

Departing from these problems, the application of an electronic medical record system is a relevant solution. Electronic medical record systems offer various advantages, including ease and speed of data access, improved data security, reduced recording errors, ease of producing reports, and savings on resources such as storage space and office stationery (Setiatin, Ningrum, and Aulia Zeta Andhani 2023). In the research of Rosalinda et al., 2021 showed that the implementation of Pamekasan electronic medical records succeeded in increasing the efficiency of service time by up to 40% and reporting accuracy by up to 95%.

This research focuses on designing a GUI-based electronic medical record system (Graphical *User Interface*) using Python Tkinter to support the quality of reporting at the Internal Medicine Poly at Al Ihsan Hospital (Seetha et al. 2023). The selection of Python Tkinter was based on the consideration that this framework is open-source, multiplatform, has a relatively fast learning curve for users, and can be easily developed according to the needs of hospitals in the future (Sumual, Pinontoan, and

Latumakulita 2021). The scope of the research was limited to designing software for recording patients' medical records and producing reports that support reporting needs in the Internal Medicine Poly, without including integration with the hospital's overall information system.

This research is expected to provide practical benefits in the form of appropriate technological solutions that can improve the efficiency of medical record management and the quality of reporting at the Internal Medicine Poly of Al Ihsan Hospital. Theoretically, this study contributes to the development of an implementation model of the Tkinter GUI-based electronic medical record system that can be adapted by other health facilities with similar characteristics.

Methodology

This research is an engineering research that focuses on the design of an electronic medical record system. The location of the study is Al Ihsan Hospital, specifically at the Internal Medicine Poly, with a research duration of 6 months in 2025.

Data collection was carried out through direct observation, interviews, literature studies. The development of the system using the Waterfall Model with the following stages:

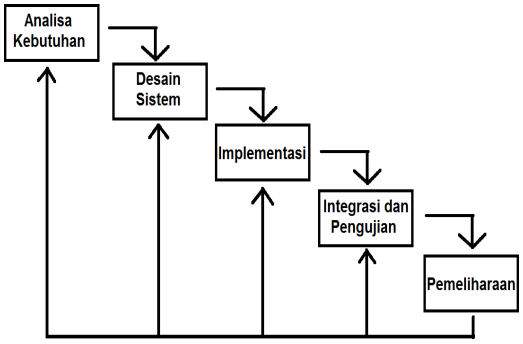


Figure 1. Waterfall Method

1. Needs Analysis: Identify the functional and non-functional needs of the system based on the results of data collection.
2. System Design: Includes system design in the early stages before creating programming, which aims to provide an overview of what is needed before creating the programming and the coding process is carried out.
3. Implementation: System coding using the Python programming language with the Tkinter framework for the development of a graphical user interface (GUI).
4. Testing: Black box testing is carried out to ensure system functionality and usability testing by involving the end user.

5. Maintenance: the final stage of the program is created and run according to the function to facilitate service, this program must always be checked so that it continues to run as needed.

Results and Discussion

A. Electronic Medical Record System (RME) Architecture Analysis

The design of the RME system at the Internal Medicine Poly of Al Ihsan Hospital refers to a modular-based approach with the principle of integration between clinical, administrative, and analytical aspects. The system architecture is built in a three-layer model (presentation layer, logic layer, and data layer) that separates user interface, application logic, and database management.

1. Flowmap

A flowmap is a diagram that describes a system that is depicted with certain symbols.

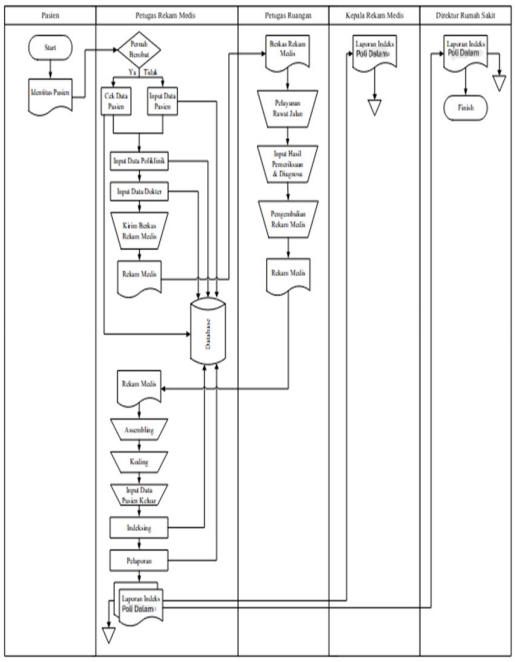


Figure 2. Flowmap

Figure 2 illustrates medical record activities at Al Ihsan Hospital, including reporting at the internal medicine poly. Starting with the patient registering by submitting their identity, then the medical record officer carries out the registration procedure and the medical record file is ready to be submitted to the room officer, after the diagnosis and examination results are input into the medical record document, then the medical record document is returned to the medical record officer for further data processing, then the report can be submitted to the hospital director as well as the head of medical records.

2. Diagram Context

A Context Diagram is a diagram that represents a system or process in a simple and clear way, showing the relationship between that system or process and the associated external environment or entity. These diagrams are typically used as a starting point for the system analysis and design process, and are used to understand the overall context and needs of the system.

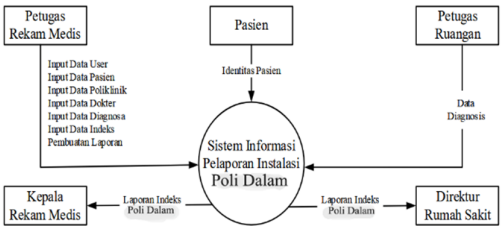


Figure 3. Context Diagram

Figure 3 is a data flow diagram that shows where the data comes from, where it goes, and how it is processed and stored to generate reports.

3. Data Flow Diagram (DFD)

A data flow diagram is defined as a process that is created to explain by using an overview of where the data came from and where it went to, as well as where it was stored.

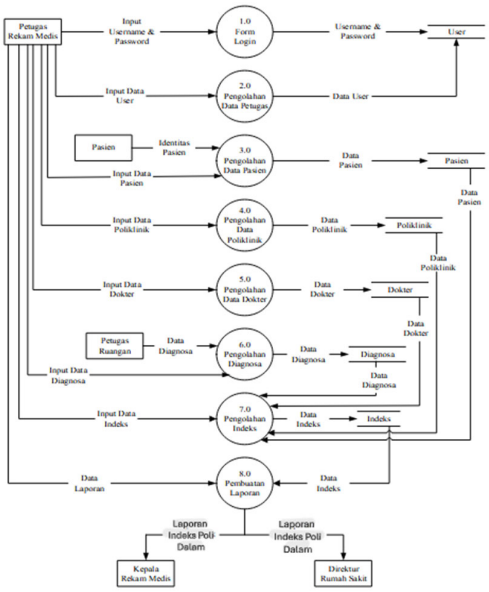
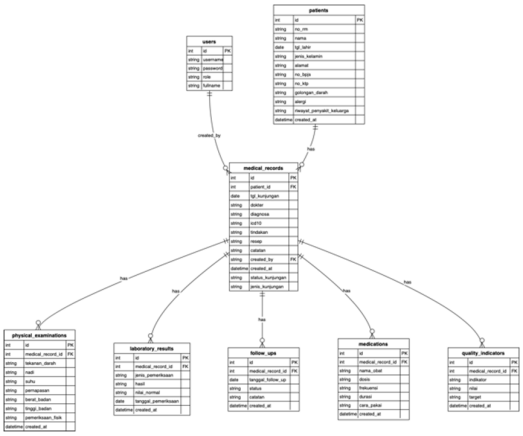


Figure 4. DFD

Figure 4 explains the flow of the process that runs in the system, starting from the login process and then processing officer data, patient data processing, polyclinic data processing, doctor data processing, diagnostic processing, index processing to report management.

4. Entity Relationship Diagram (ERD)

The database structure reflects the relationships between key entities, such as users, patients, medical_records, and quality_indicators. Usually used for analytical systems at the analyst levelis ini merupakan suatu persyaratan untuk pengembangan suatu sistem.



Gambar 5. Entity Relationship Diagram (ERD)

Figure 5 Explains the relationships between the entities that are running in the system, by creating this ERD we can perform a quick analysis and find the relationships between each piece of data by combining all the related information.

B. System Implementation and Functionality

The implementation of the RME application was carried out in a real simulation environment at the Internal Medicine Poly of Al Ihsan Hospital. Testing is performed on key functions that include patient management, medical record recording, and data-driven reporting.

1. Dashboard and Login Access

The login page is designed with simple authentication and access rights restrictions. After successfully logging in, users are redirected to an interactive dashboard that presents important statistics in real-time, such as the number of registered patients, daily visits, average wait times, and user satisfaction levels.

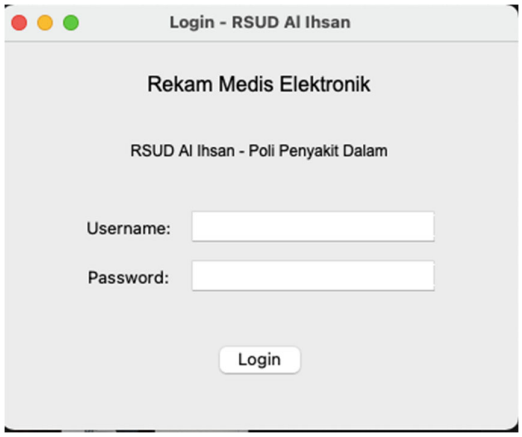


Figure 6. System login page

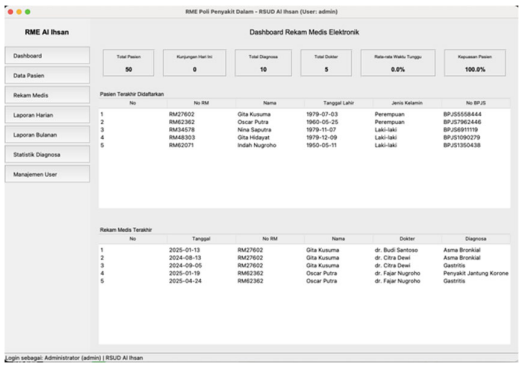


Figure 7. Dashboard page

2. Management of Patient Data and Medical Records

The patient management module facilitates the input and search of patient data based on medical record number or BPJS number. Within the medical record module, doctors can record physical examinations, add ICD-10-based diagnoses, and prescribe medications.

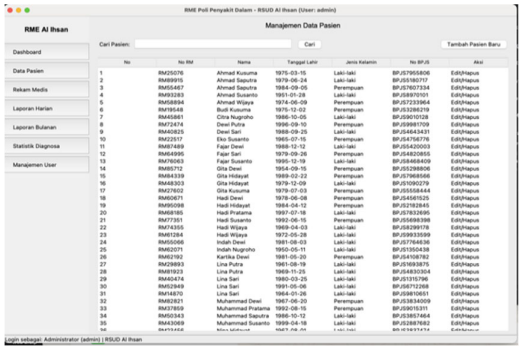


Figure 8. Patient management and add patients

An example of an implementation shows the use of the code E11 for Type 2 Diabetes Mellitus and the ingestion of the prescription of Omeprazole 20mg. In addition, the system also stores follow-up visits for easy long-term monitoring.

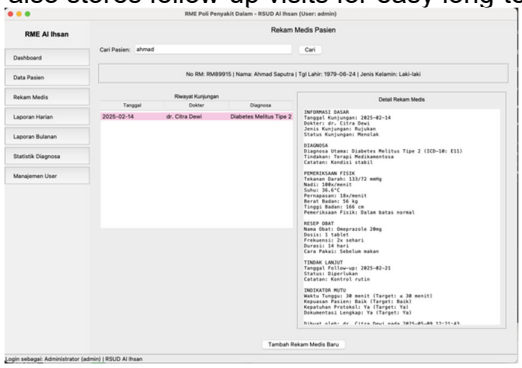


Figure 9. Medical record page

3. Automated Reporting

The system automatically generates daily and monthly reports that can be exported in Excel format. This makes it easier to report to hospital management without the need for manual recaps. The data in the report reflect clinical variables that can be further analyzed.

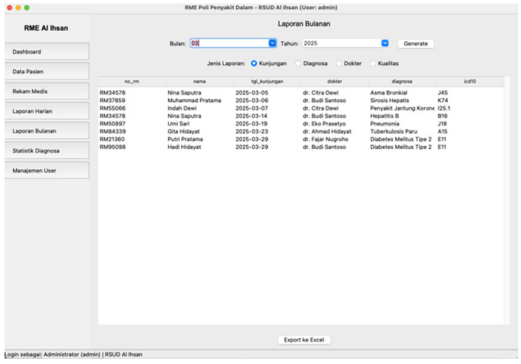


Figure 10. Monthly reporting page

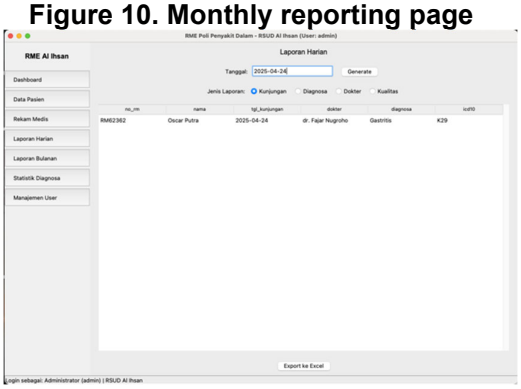


Figure 11. Daily reporting page

4. Diagnostic and Visualization Statistics

Accurately recorded diagnostic data is presented in the form of bars, circles, and lines graphs based on a specific time period. This statistic features the top 10 most diagnoses, such as Gastritis, Essential Hypertension, and Chronic Kidney Disease. This feature greatly supports the internal epidemiology analysis process of the hospital.

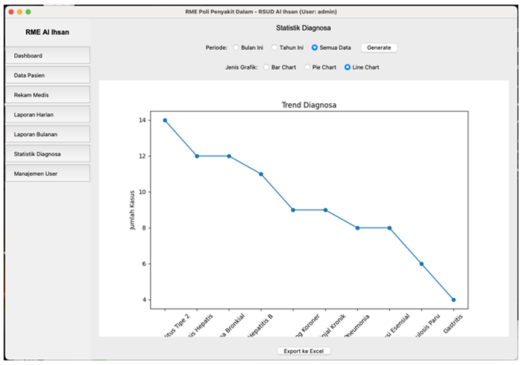


Figure 12. Automated reports in the form of statistics

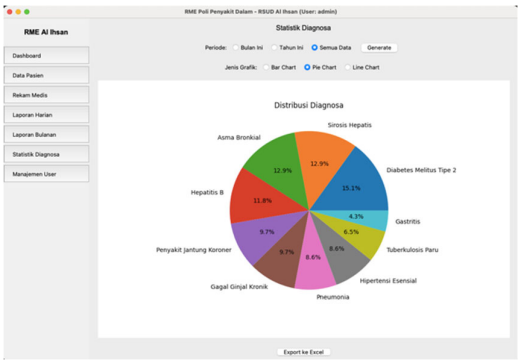


Figure 13. Pie chart automatic statistics report

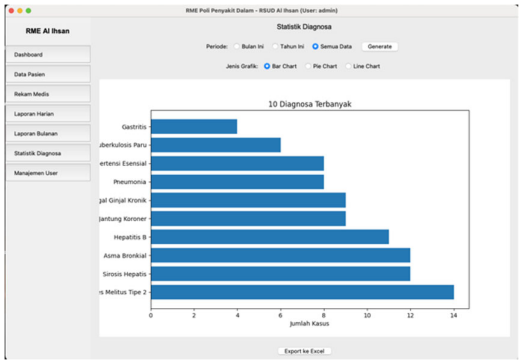


Figure 13. Automatic statistics report bar chart

5. User Management

System admins can add or edit users based on roles. With role-based authorization, data security and access restrictions are more secure.

Figure 14. Manage users

6. ICD-10 Interface Design and Automatic Charging Mechanism on Electronic Medical Record (RME) System

The Electronic Medical Record System (RME) developed using a GUI-based interface on *the* Python-Tkinter-based desktop platform is designed to support the efficiency of patient data management and recording of medical visits at the Internal Medicine Polyclinic of Al Ihsan Hospital. There are three main components in this system that are the focus of testing and validation of functions: patient data management, visit data input, and ICD-10-based medical diagnostic filling.

7. Patient Data Management

This module provides a facility for new patient data entry through an input form that includes important attributes such as: Medical Record Number (No. RM), Patient's full name, date of birth in YYYY-MM-DD format, Gender (selected from the dropdown menu), Residential address, BPJS Number and KTP Number.

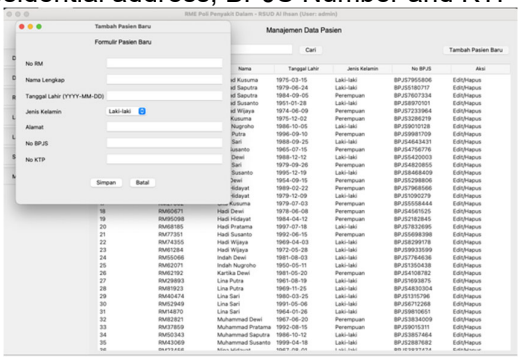


Figure 15. Patient management page

This form is accessed via the "Add New Patient" button and comes with 'Save' and 'Cancel' buttons to validate or cancel data entry. Saved patient data is displayed in the form of a table, complete with a search function and the option to edit or delete data.

8. Medical Record Data Input

Each medical record entry is made through a tabbed dialog window, with the first tab containing the basic information of the visit: Date of visit, name of the examining doctor, type of visit (new or old), Status of the visit (completed, in progress, etc.)

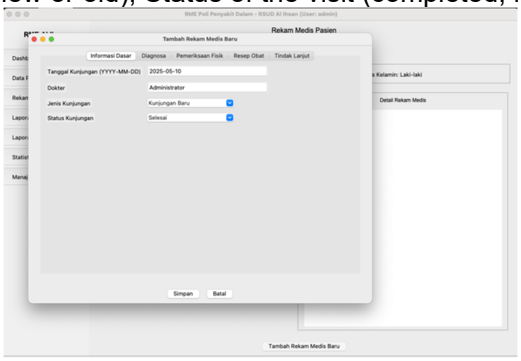


Figure 16. Medical record page

This data is stored in the system as part of the patient's visit history, and becomes the basis for recording subsequent actions and diagnoses.

9. Filling in the ICD-10 Code Diagnosis and Autocomplete

The "Diagnoses" tab allows the medical officer or physician to input the patient's primary and secondary diagnoses. The system is equipped with a *string-based autocomplete* mechanism that provides automatic suggestions when the user starts typing the name of the disease. This list of diagnoses has been mapped with ICD-10 references so that: When the user selects a diagnosis, the system automatically fills in the "ICD-10 Code" field according to the selected diagnosis. The same process applies to secondary diagnoses and secondary ICD-10 codes.

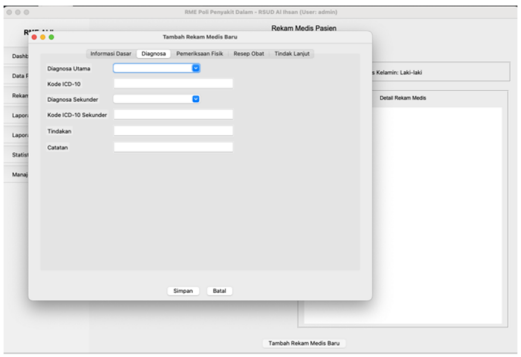


Figure 17. Medical record page

For example, when a user types "diabetes", the system will provide a list of suggestions such as "Type 2 Diabetes Mellitus", and automatically populate the ICD-10 code field with the value "E11". This mechanism is designed to: Reduce errors in the writing of diagnostic codes. Improve the consistency of medical record recording. Speed up the data entry process by reducing the manual burden on medical personnel.

The output of the report generates excel files in each filtering according to the category needed to support all forms of reporting, including these are the results obtained with neat formatting and tabulation.

Laporan Diagnosa

Dicetak pada: 2025-05-09 19:37:18

diagnosa	icd10	jumlah	dokter
Gastritis	K29	1	dr. Fajar Nugroho

Figure 18. Excel Report Results

Laporan Kunjungan

Dicetak pada: 2025-05-09 19:39:16

no_rm	nama	tgl_kunjungan	dokter	diagnosa	icd10
RM34578	Nina Saputra	2025-03-05	dr. Citra Dewi	Asma Bronkial	J45
RM37859	Muhammad Pratama	2025-03-06	dr. Budi Santoso	Sirosis Hepatis	K74
RM55066	Indah Dewi	2025-03-07	dr. Citra Dewi	Penyakit Jantung Koroner	I25.1
RM34578	Nina Saputra	2025-03-14	dr. Budi Santoso	Hepatitis B	B16
RM50897	Umi Sari	2025-03-19	dr. Eko Prasetyo	Pneumonia	J18
RM84339	Gita Hidayat	2025-03-23	dr. Ahmad Hidayat	Tuberkulosis Paru	A15
RM21360	Putri Pratama	2025-03-29	dr. Fajar Nugroho	Diabetes Melitus Tipe 2	E11
RM95098	Hadi Hidayat	2025-03-29	dr. Budi Santoso	Diabetes Melitus Tipe 2	E11

Figure 19. Excel report results

The data entered are the input results for dummy data samples for data fungibility and flexibility testing.

C. Function Validation (Black Box Test)

The entire interface is tested using *a black box testing* approach to ensure that: Each button and form function works according to specifications. Valid inputs produce correct outputs (e.g. successful storage, data shows up in a table). Invalid inputs are rejected by the system with an error message. The *autocomplete function* in the diagnostic column works dynamically and accurately.

Table 1.
Blackbox test results

Features Tested	Testing Scenarios	Input	Output	Status
User Login	User fills in a valid username and password	admin/admin123	The system successfully logged into the dashboard	Succeed

Login Validation Failed	User enters the wrong password	admin / salahpassword	A "Login failed" notification appears	Succeed
Add New Patient Data	Admin fills out the complete patient registration form	Name, NIK, RM No, Address, BPJS No	Patient data is stored and displayed in patient tables	Succeed
Medical Record Diagnostic Input	The doctor selects the patient, fills out the diagnosis and prescription	ICD-10: E11, Drug: Omeprazole	Medical record data is stored and displayed in the patient's details	Succeed
Print Daily Report	Admin selects a specific date for the daily report	Date: 24/04/2025	Downloaded Excel file with data as per date	Succeed
Statistics Diagnosa	Admin selects the "This month" filter on the chart	Filter: This Month	Bar graph appears according to the top 10 diagnoses	Succeed
Add New Users	Admin fills out the add new user form (doctor/admin)	Username, Password, Role	New users are saved and can be used to log in	Succeed
Validation of Patient Blank Inputs	Admin saves patient data with a blank form	All columns are blank	A notification "Please complete the data" appears	Succeed
Filter Statistics Diagnosa	The admin selects the "All Data" filter and then changes it to "This Year"	Filters: All Data → This Year	Graphs updated as per filters	Succeed

Conclusion

The RME system developed has been able to meet the needs of medical recording and reporting in the Internal Medicine Poly functionally. With a systematic approach based on the waterfall model, the system is built from conceptual design (ERD, DFD, Flowchart, and context diagrams) to the real implementation stage. Excellence in data standardization (ICD-10), reporting efficiency, and quality indicator support make the system worthy of further development for a larger, integrated scale.

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