GIJES
Greenation International Journal of Engineering Science
+62 81210467572 https://research.e-greenation.org/GIJES greenation.info@gmail.com
GREENATION RESEARCH
DOI: https://doi.org/10.38035/gijes.v4i2
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Automation of Medical Record Completeness Monitoring Based on Assembling Data in the Electronic Medical Record System at Dustira Hospital

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Abstract: Dustira Hospital in Cimahi has gradually implemented Electronic Medical Records since 2022. However, the reporting of inpatient medical record completeness is still conducted manually, causing the recapitulation process to take a long time, making it prone to calculation errors, and often resulting in delayed report submission. This study aims to design a web-based application integrated with the Hospital Management Information System to accelerate and simplify the reporting process. The research method used is qualitative, with data collected through observation. System design applies the System Development Life Cycle waterfall model, comprising the creation of a flow map, context diagram, data flow diagram, and entity relationship diagram. The application was built using the PHP programming language and a MySQL database. The results show that the web-based application can shorten data-processing time, automate the generation of medical record completeness reports, and reduce calculation errors. In addition, the system provides archiving features, report printing, and the ability to update the identities of the report preparer and the head of medical records, equipped with QR-code signatures.

Keywords: *Web-Based Application, Medical Record Completeness, SDLC Waterfall*

INTRODUCTION

Digital transformation in healthcare today demands the availability of instant and accurate data at every point of care. Technological innovation has become a necessity to ensure that all medical information can be properly integrated. This shift is marked by the emergence of Electronic Medical Records (EMR), a transition reinforced by Minister of Health Regulation No. 24 of 2022, which requires all healthcare facilities to implement EMR no later than December 31, 2023, with strict sanctions for non-compliance.

In response to this regulation, Dustira Hospital in Cimahi has implemented EMR in stages since 2022. However, although the assembling and completeness-analysis process for inpatient medical records at Dustira Hospital has technically been integrated into the Hospital Management Information System (SIMRS), an automatic medical record completeness reporting feature is not yet available within the SIMRS. Thisforces assembling staff to

transfer data manually and reprocess it using a third-party application, namely Microsoft Excel.

As a result of this separated, manual process, monthly data recapitulation takes a considerable amount of time and ultimately increases the risk of calculation errors (human error), which frequently causes monthly completeness reports to be submitted late to hospital management. This raises the question of whether the design of a web-based medical record completeness reporting application would be able to reduce working time while simultaneously providing high data accuracy for assembling staff.

Numerous efforts to address this issue have been undertaken by previous researchers; however, the solutions proposed still leave a research gap. For example, Aqilah et al. (2022) designed a KLPCM (incomplete medical record completion) system using PHP and MySQL, but the study remained at the design stage and was not implemented as a ready-to-use application.

Subsequently, Gunawan and Putri (2023) proposed the use of Google Spreadsheets, which was considered more effective than paper-based methods but had limitations in terms of interface and data security. Meanwhile, Hidayat et al. (2025) successfully developed a secure web-based information system, but the scope of their research was considered too broad.

In addition to the studies above, supporting research includes that conducted by Ihsan et al. (2023), who designed a retention application using the waterfall method, and Muhammad and Setyawan (2025), who examined a web-based sales information system using PHP/MySQL to improve the efficiency and accuracy of general data. Based on this analysis, the present study aims to fill this gap by not only designing a concept or relying on a third-party platform, but also focusing on developing a complete, independent reporting application.

This underlies the importance of conducting the present study by building a web-based application using PHP and MySQL that is directly integrated with the SIMRS. Accordingly, this study is guided by several research questions: how to design the architecture of a medical record completeness reporting system based on assembling data, how to implement it so that the application can operate optimally, and how feasible the system is once tested. All of these questions were addressed through a highly structured and systematic conceptual framework. The research began by determining the study location at Dustira Hospital, Cimahi, followed by field data collection through direct observation and interview techniques.

The information obtained from the field was then converted into a detailed data-flow design. The architectural design process relied entirely on the System Development Life Cycle method using the waterfall model. The researcher progressively developed the system design, comprising a flow map, context diagram, data flow diagram, and entity relationship diagram. In the final stage, the design was translated into PHP program code and a MySQL database. Once completed, the application was tested to ensure that all functions operated smoothly without obstacles, and it successfully provided supporting operational features such as an archiving menu, document printing, and identity updates integrated with a QR-code-based digital signature.

This study focuses on the automation of inpatient medical record completeness reporting within the hospital information system and was used to assess the extent to which the resulting web-based program is able to facilitate, monitor, and generate completeness reports accurately in accordance with hospital service quality standards, while providing ease of use for users. To understand how this system functions, the study was conducted in the medical record assembling and completeness-analysis unit.

Referring to Minister of Health Regulation No. 24 of 2022 concerning medical records, the assembling activity involves compiling medical record forms and serving as a document control mechanism to ensure medical records are completed in full. This assembling activity

is related to the preparation of medical record completeness reports, which are subsequently reported to the hospital's quality committee. Meanwhile, the completeness-analysis process is defined as a quantitative and qualitative evaluation of medical record files within a given period.

To measure medical record completeness, a standard formula is used, whereby the medical record completeness percentage is obtained by dividing the number of medical records analyzed within a given period by the total number of medical records analyzed, multiplied by 100%. The resulting figure must comply with the Minimum Service Standard (SPM) provisions under Minister of Health Regulation No. 6 of 2024, as well as hospital accreditation standards, which require an absolute rate of 100%. If the achievement does not meet the SPM, the quality committee team is required to implement a quality-improvement program.

To achieve reliable and rapid reporting in accordance with the SPM requirements, this web-based application was developed. According to Simarmata (2022), a web-based application is software that requires a server and a browser to be accessed over a network, whether local or internet-based.

The programming language used is PHP; according to Medina (2023), PHP is designed for website development and is executed on the server rather than the browser. The database used is MySQL, which according to Prasetiyo (2023) is a freely distributed database program, but not as closed source or a commercial derivative.

System Development Life Cycle (SDLC), as described in the software engineering literature by Rosa A.S. et al. (2011), is defined as a model and methodology used to develop software based on tested practices, while according to Tristianto (2022), waterfall is a method whose workflow proceeds sequentially, resembling a waterfall.

METHOD

This study used the System Development Life Cycle method with the waterfall model, comprising the following stages:

1. Interviews using a structured interview guide and a Google Form containing a list of questions directed at assembling officers, analysis staff, and report preparers.
2. Observation, in which the researcher used field notes to record all observations, including how officers performed file analysis and the obstacles encountered in preparing manual reports.
3. Literature study, conducted by compiling data obtained from various sources such as books, papers, and relevant scientific journals.

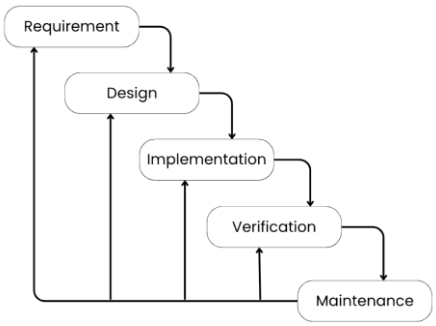

Figure 1. Waterfall

The waterfall model begins with:

1. *Requirement* (needs analysis): collecting data through interviews, direct observation, and literature study, followed by analysis to determine requirements.
2. *Design* (design): developing the design of the web-based reporting system and formulating the overall system architecture to serve as a guide during system development.

3. *Implementation* (implementation): the process of writing program code, translating the design into a programming language, and breaking the program down into modules, which are then developed and tested for functionality.
4. *Verification* (verification): testing and inspection of the system to check whether it operates smoothly, involving users in the process.
5. *Maintenance* (maintenance): carried out after the program is deployed, to maintain system performance, resolve issues that may arise, and further develop the system as needed.

At the design stage, the researcher applied structured system design comprising the following modeling types:

1. Flow Map

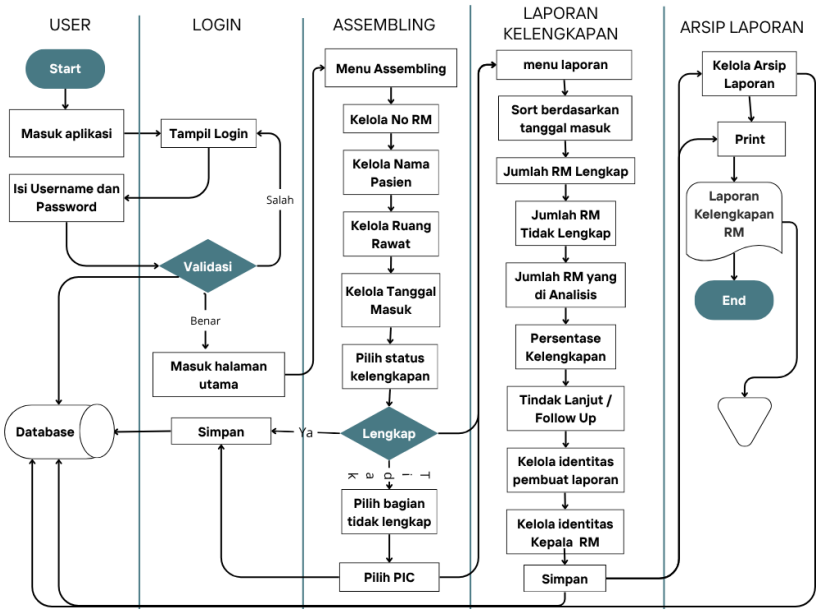

Figure 2. Flow Map of the Digital Medical Record Completeness Report

According to Purabaya (2021), a flow map is a combination of a map and a flowchart depicted using symbols. The flow map above illustrates the sequence of the medical record completeness reporting process, from user login to the point at which the report can be downloaded or printed.

2. Context Diagram

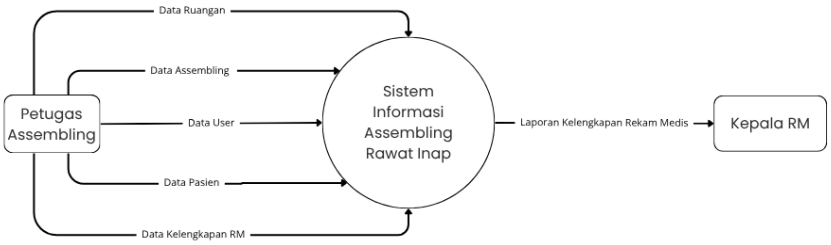

Figure 3. Context Diagram of the Medical Record Completeness Report

According to Mukhlis and Santoso (2025), a context diagram is a top-level data flow diagram that illustrates the flow of data into and out of a system. Figure 3 illustrates the data flow received by the inpatient assembling information system, as well as the data output by the system.

3. Data Flow Diagram Level 1

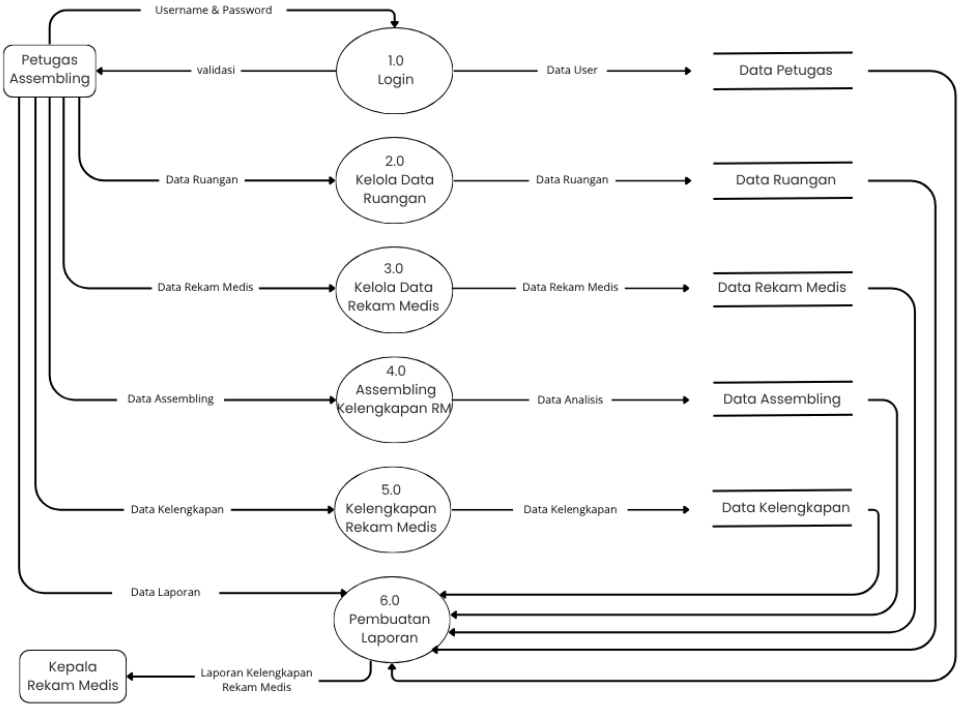

Figure 4. DFD Level 1 of the Medical Record Completeness Report

According to Mukhlis and Santoso (2025), DFD Level 1 explains the processes carried out within each process contained in DFD Level 0. Figure 4 above describes the process of managing assembling data, from the beginning through to the printing of the medical record completeness report.

4. Entity Relationship Diagram (ERD)

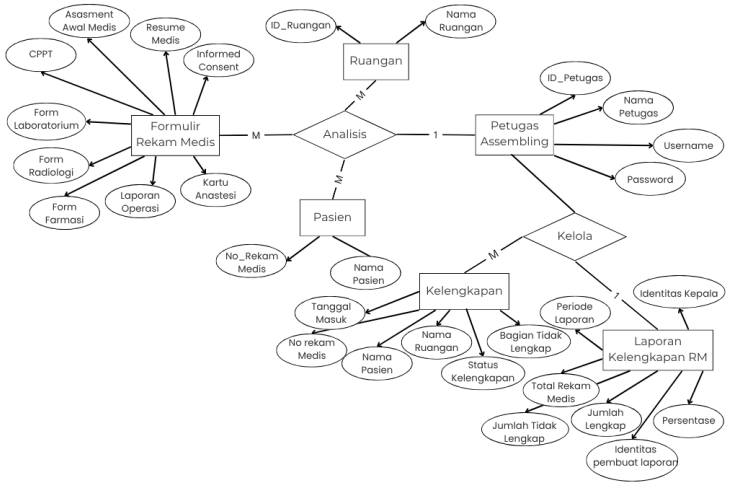

Figure 5. Entity Relationship Diagram (ERD) of the Medical Record Completeness Report

Referring to the journal written by Musyarrofah et al. (2021), an Entity Relationship Diagram explains the relationships among entities that are interrelated. Figure 5 illustrates the relationships among entities involved in the analysis and report-management processes.

The program testing method used was Black Box Testing, and the data analysis technique employed was thematic analysis, carried out through three stages. The first stage was data reduction, in which the researcher sorted and simplified the field findings. The second stage, data presentation, involved the researcher attempting to eliminate the manual reporting system and replace it with web-based reporting. The third stage, conclusion drawing, established that the medical record completeness report absolutely requires a program to accelerate report-processing time and minimize calculation errors.

The type of data used in this study is qualitative, with primary data obtained from interview results and secondary data obtained from digital forms within the electronic medical record and paper-based manual report forms.
This research was conducted at Tk. II Dustira Hospital, specifically within the medical record unit's data analysis and reporting division. The research required approximately two months to complete.

Table 1. Black Box Testing Results

No	Feature Tested	Test Scenario	Expected Result	Test Result	Remarks
1	Login	Correct username and password input	System displays the main menu	As Expected	Valid
2	Login	Incorrect username and password input	System displays an error message	As Expected	Valid
3	Assembling Data	Manage (add, edit, and delete) Assembling data	Assembling data is saved in the system	As Expected	Valid
4	Search Medical Record Number	Search data by medical record number	Medical record number is found	As Expected	Valid
5	Completeness Report Data	Manage reports by admission date	Report data is displayed automatically	As Expected	Valid
6	Manage Report Maker Identity	Update the identity and staff ID of the report maker and head of medical records	Identity is saved and signature is updated	As Expected	Valid
7	Manage report archiving and printing	Save archive, delete, and print	Archive is saved and report is printed	As Expected	Valid

RESULTS AND DISCUSSION

The results of developing the medical record analysis and reporting information system are as follows:

1. Login Page

Figure 6. Login Page

This login page provides access for two types of users the assembling user and the head user differentiated by access rights. The page is equipped with a captcha code as a security feature in addition to the username and password fields.

2. Main Menu Page

Figure 7. Main Menu Page

The main menu page displays a summary of medical record completeness data, comprising the number of complete records, incomplete records, total records, and completeness percentage, and is equipped with a chart. This data updates automatically to reflect the most current information.

3. Assembling Display Page

Figure 8. Assembling Display Page

This page is accessible only to the assembling user. It displays the results of the analysis performed by the assembling officer, providing not only data input but also edit, delete, and detail actions, along with a medical record number search field.

4. Add Assembling Data Display

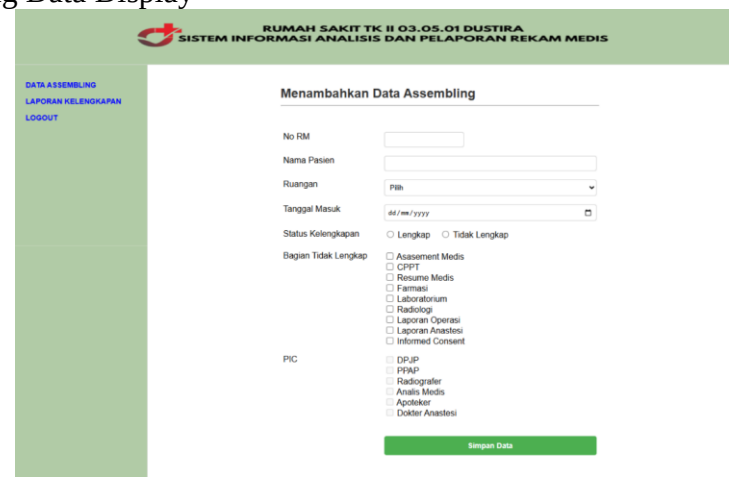

Figure 9. Add Assembling Data

On this page, the assembling officer can add analysis results, where the incomplete-section and PIC (person-in-charge) fields can only be filled in if the selected completeness status is “incomplete.”

5. Report Display Page

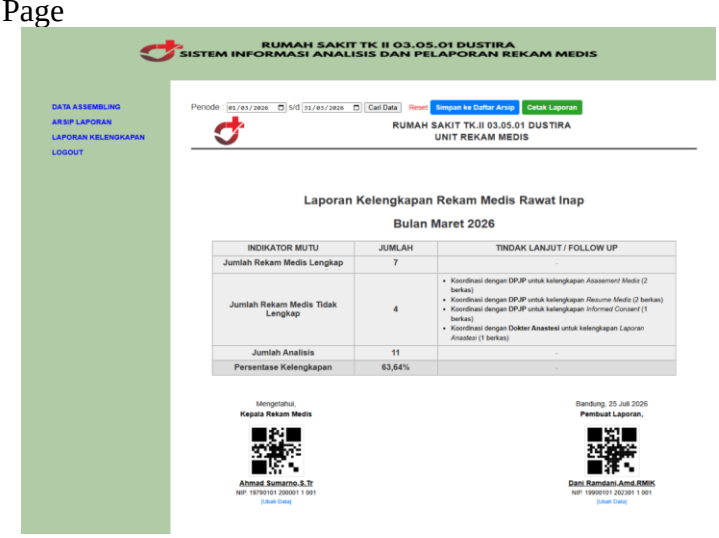

Figure 10. Report Display Page

This page can be accessed by both users; however, the medical record completeness data — comprising the number of complete and incomplete medical records, the number analyzed, the percentage, and the follow-up action — is automatically populated based on the assembling data for the selected period. The identities of the report maker and the head of medical records can be edited, which also updates the associated QR-code signature. The report can be printed directly or downloaded as a PDF and can also be saved to the report archive.

6. Report Archive Page

Figure 11. Report Archive Page

This page functions to store reports that have been created within the system; data in the report archive can be deleted, printed, or downloaded as a PDF.

7. Medical Record Completeness Report Printing Page

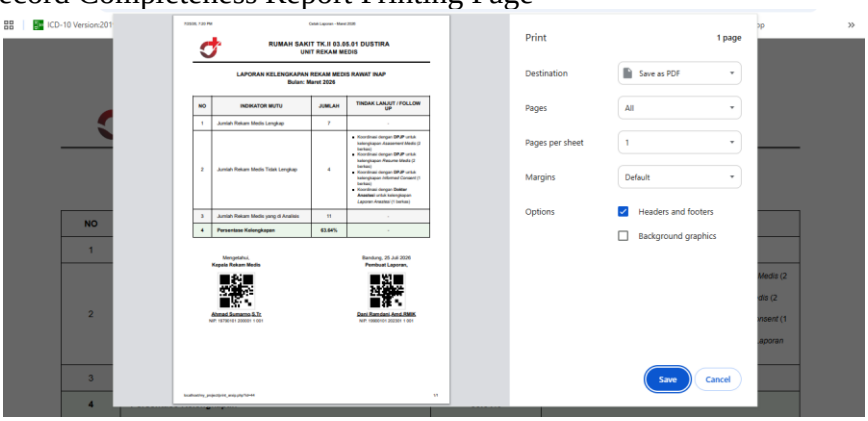

Figure 12. Report Printing Page

This page displays the report ready for printing and allows it to be downloaded as a PDF for subsequent submission to the hospital's quality committee. Once finished, the officer can leave the page directly by selecting “logout.”

Interview results with operational staff indicated that the design created by the author was well received, and that the input display adequately represented the manual form previously used. Staff also welcomed the development of this program, as it was considered convenient, and the barcode signature feature was seen as substantially improving the appearance of the report. Staff also expressed their willingness to implement the program and recommended that similar programs be developed for other types of reports.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the analysis and implementation of the inpatient medical record completeness reporting information system at Dustira Hospital, it can be concluded that the system operates effectively, as evidenced by its ability to accelerate the report-preparation process, save time, and provide convenience for staff; staff also expressed hope that the system could be further developed to improve efficiency and effectiveness. For assembling, analysis, and reporting

staff, this program simplifies data entry and real-time report generation, and the barcode signature feature has successfully reduced report-preparation time.

Limitations

This study also has limitations, particularly regarding data integration, due to constraints in access, as well as data privacy and security. These limitations should be taken into account when interpreting the findings, which are specific to the context of Dustira Hospital.

Recommendations

These limitations create opportunities for future research, such as the development of a mobile-based system that would allow reports to be directly approved and accessed by the head of medical records through a smartphone. It is further recommended that hospital management, if implementing this system, prepare a Standard Operating Procedure for its use, and that the IT team continue to carry out ongoing system maintenance.

Author Contributions

All authors made significant contributions to this study. Endang Wahyuni was responsible for research conceptualization, data collection, system design and development, and manuscript preparation. Irda Sari and Adhita Arif Setyawan contributed to the analysis and interpretation of results and to the critical review and revision of the manuscript. All authors have read and approved the final version of the article for publication.

Acknowledgment

The authors would like to thank the management and staff of the medical record assembling and analysis unit at Dustira Hospital, Cimahi, for their cooperation and support during the data collection process of this study

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