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Design of A Dekstop-Based Chronological Form Information System to Improve BPJS Claims Using The Waterfall Method

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Abstract: *Implementing information system technology in hospitals is a crucial step toward making work faster and more accurate. The chronological form is a medical record document used to record—in detail—the time, location, and description of incidents affecting a patient prior to or during their care in the Emergency Department (ED). This document is typically used for accident and trauma cases or for patients covered by BPJS (Social Security Agency on Health). Currently, these forms are filled out manually on paper, creating a risk of delays and recording errors. This study aims to design a chronological form information system for the BPJS claims process to enhance staff performance effectiveness. The Waterfall method was employed as the software development approach. Data collection involved interviews, observations, and a review of existing paper-based chronological forms. The system was developed using Microsoft Visual Studio 2012 for programming and Microsoft Access for the database. The results indicate that the development of a computerized chronological form application is expected to reduce delays, minimize recording errors, and increase staff work speed. With this system in place, staff should be able to complete chronological forms more quickly and accurately.*

Keywords: *Information System, Chronological Form, BPJS Claim, Medical Records, Waterfall.*

INTRODUCTION

Under BPJS Health Regulation No. 1 of 2018, Health Care Facilities (Fasyankes) are required to conduct accurate and complete administration in accordance with the provisions of the National Health Insurance Program (JKN). Advances in information and communication technology in the healthcare sector have been proven to improve the quality of medical services, as explained by (Effendy et al., 2024). According to (Ramadhani et al., 2022), in the era of digitalization, the transition from manual to computerized systems has already begun in hospitals. Electronic Medical Records (EMR) manage medical information in digital form by utilizing computer technology to replace manual processes such as medical histories, laboratory test results, or medication prescriptions, enabling efficient access and management of care records through the system, as stated by (Mahdani et al., 2023). (Amin et

al., 2021) found that one technological advancement that plays a role in improving the quality and efficiency of hospital services is the implementation of electronic medical records, which can reduce the likelihood of human error.

The significant role of information technology development supports the use of computer-based systems in various fields, including the development of information systems and healthcare services. This is achieved through the use of Electronic Medical Records (EMR), which can improve services by accelerating data access and reducing recording errors, thereby supporting better service quality, as stated by (Latipah et al., 2021). It states that implementing EMR can improve the security, confidentiality, and integrity of medical records. The use of technology can help accelerate access to medical information, improve diagnostic accuracy, and enhance the efficiency of information management (Intansari et al., 2023).

(Umamah & Setiatin, 2024) explains that BPJS Kesehatan is a legal entity that administers the National Health Insurance Program (JKN). In practice, the BPJS claims process at hospitals depends on the completeness and accuracy of medical records. Incomplete documentation can lead to delays or even claim rejections, making robust and systematic data management essential for an effective claims process.

Presidential Regulation (Perpres) No. 82 of 2018 stipulates that in the BPJS claims process, several important documents are required. At the Emergency Department (ED), the Patient Chronology Form is a key supporting document in BPJS Health claims, particularly for emergency cases resulting from traffic accidents or workplace accidents. The primary function of this chronological document is to provide details of the incident and ensure that treatment costs can be claimed in accordance with applicable regulations, which often involve coordination with other insurers such as Jasa Raharja or BPJS Ketenagakerjaan (Ministry of Health Regulation (Permenkes) No. 3 of 2023).

Based on research conducted, particularly in Emergency Departments (EDs), medical record services are now fully electronic. However, the process of filling out chronological forms is still done manually on paper. This is highly prone to causing writing errors, inconsistent information, and incomplete data, which will impact the accuracy of claims and increase the risk of claims being delayed or rejected (Presidential Regulation (Perpres) No. 64 of 2020). This is the reason for designing the chronological form to produce complete and accurate data.

Based on the identified issues, the author employed a *Research and Development (R&D)* approach combined with software engineering to develop a desktop-based chronological form system. The implementation of this system is expected to facilitate medical recorders in processing chronological forms, reducing the time required compared to manual data entry, ensuring greater accuracy and consistency, and enabling its application in the BPJS claims process.

Numerous studies have indicated that the implementation of information systems can enhance the efficiency of healthcare services. Advances in information technology support digital systems in healthcare administration to reduce input errors and improve data consistency. Advances in information technology offer numerous opportunities to improve the management of chronological documents through an integrated information system. The chronological form system is expected to help provide more consistent and easily accessible data, thereby enhancing the accuracy of claims submitted to BPJS. The digitization of chronological forms can also improve the work efficiency of staff in managing health information.

METHODS

Research Method

This study employs a scientific approach to collect data for specific purposes. The research is conducted systematically and rationally to gather and analyze information and resolve issues based on the conclusions from (Tampubolon, 2023). *Research and development* (R&D) is a research method aimed at producing a product and testing its effectiveness. The R&D process is carried out systematically through stages of needs analysis and product development, as well as field trials or revisions, so that the resulting product meets quality and effectiveness standards and can be widely used (Okpatrioka, 2023).

Data Collection Method

Data collection in this study was conducted using a qualitative approach. Data collection techniques included observation, interviews, and document analysis. During the observation phase, the researchers directly observed the process of filling out and managing BPJS claim chronological forms at the study site to understand the workflow and identify any issues that arose. Interviews were conducted with relevant parties, such as claims administrators and emergency room registration staff, to obtain information regarding system needs and constraints. The final stage involved documentation, which entailed collecting and analyzing relevant documents as the basis for system development. These data collection techniques are an essential component of qualitative research to obtain data (Septiana & Khoiriyah, 2024).

System Development Method

The Waterfall Method is a structured and sequential software development model. In this method, the system development process is carried out through several systematic stages, starting from requirements analysis, system design, implementation, testing, to maintenance. Each stage must be completed before proceeding to the next. The Waterfall Method is a phased system development model where each stage must be completed before moving on to the next. This model emphasizes a systematic process, thereby facilitating the management and development of information systems (Wahid, 2020).

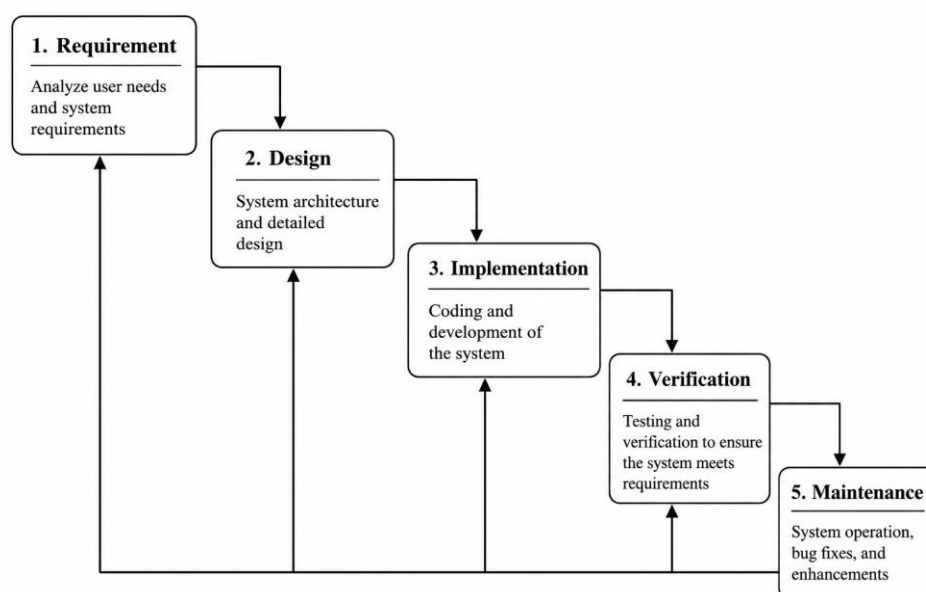


Figure 1. Waterfall Method

Requirement

In the initial stage of system development, communication is required to identify the software needs of the users. Information is obtained through interviews, observations, and direct observation. The information obtained is then analyzed to determine the data required by users according to (Wahid, 2020). Observational research and interviews are used to determine the system requirements by identifying issues aligned with user needs, thereby helping to define the objectives.

Design

Design involves creating a system blueprint that includes data structures and user interface layouts tailored to user needs. Proper system design is crucial for addressing data management challenges and enhancing the efficiency of the information system, as explained at (Nur, 2019) (Nur, 2019).

Implementation

Implementation is part of the System Development Life Cycle (SDLC) and aims to transform the design into a functional application system that users can utilize, as described at (Maulida, 2022). At this stage, the system is first created and developed.

Verification

System testing and evaluation are crucial to ensure the effectiveness of the research used in the development of the information system, as stated by (Syaputri et al., 2024). This testing is conducted to verify that the system operates in accordance with the requirements.

Maintenance

Maintenance is the process of maintaining software after it has been used to fix errors and improve system performance, as explained at (Wahid, 2020) (Wahid, 2020). This phase aims to ensure the system continues to operate effectively in line with evolving needs.

RESULTS AND DISCUSSION

Results

Requirement

Based on the results obtained by collecting system requirement data through observations and interviews with staff at the Emergency Department (ED), it was found that the manual process of filling out chronological forms has the potential to cause inconsistent data errors, thereby slowing down the claims process with BPJS. Therefore, the required system must enable staff to manage patient information and document the chronology of events in a digital format.

Design

The design was carried out by creating a blueprint of the system before its development. The design process included the creation of a flowmap, context diagram, Data Flow Diagram (DFD), and Entity Relationship Diagram (ERD). These diagrams were used to illustrate how the system operates, the relationships between data, and the data processing procedures within the system.

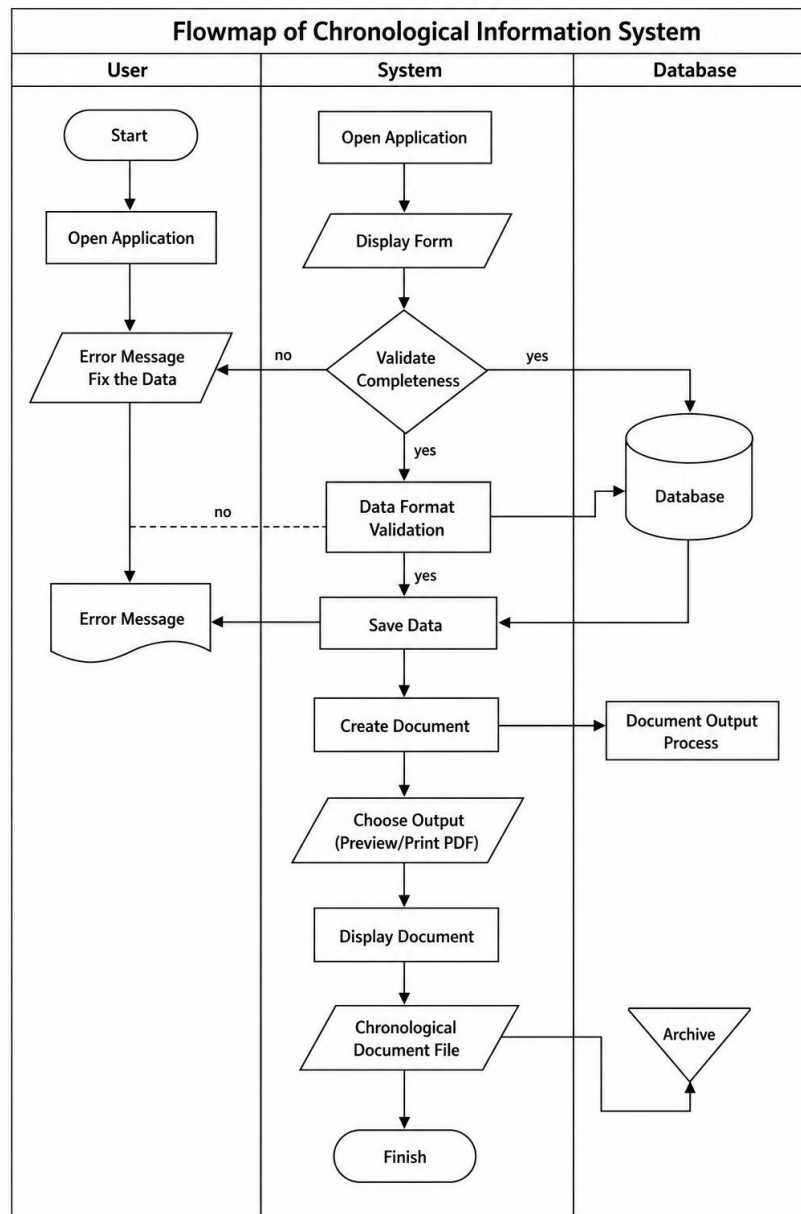


Figure 2. Flowmap

Figure 2 shows the *flowchart* for the chronological accident report form system. This *flowchart* illustrates the data processing workflow, starting from the user and ending with the generation of a chronological report that is ready to be printed or saved as a file. The process begins when the user accesses the application, at which point the system displays the data input form. At this stage, the user will input data regarding the medical staff and the patient, as well as signatures (from the patient's family or an eyewitness to the incident) or the chronological account of the incident. After the data is entered, the system performs a data completeness validation process. If the entered data is incomplete, the system displays a warning, and the user will be prompted to revise the data. If the data is complete, the system proceeds to the data format validation stage to ensure the input is correct. If all data is valid, the system will save the data to the database. The saved data is then further processed during the creation of the chronological statement document. Next, the user can choose an output option such as a document preview or printing the document as a PDF file. The process concludes by displaying the final document to the user so that it can be used as needed.

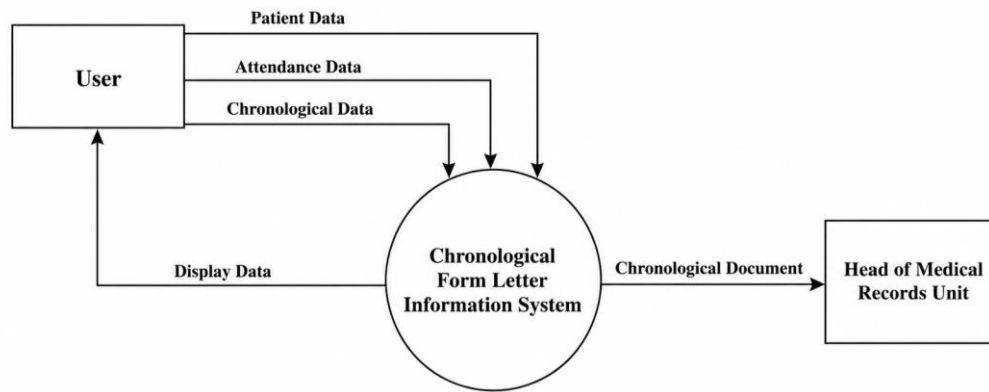


Figure 3. Context Diagram

Figure 3, the *Context Diagram* for the chronological accident statement form system, illustrates the relationships between the system and external entities involved in the data processing workflow. In this diagram, there are two main entities: the user (officer) and the Head of the Emergency Room (ER). The officer acts as the system user who enters data and manages the document creation process. The Head of the ER is responsible for receiving the results of the chronological statement. Incoming data flows into the system include patient data, signature data, and chronological event data obtained from the patient's family or witnesses through the officer. Staff members also issue commands to the system to perform processes such as data input, storage, and document generation. Data output from the system consists of processed chronological accident statements that can be displayed or printed by staff members. This *Context Diagram* demonstrates that the system functions effectively as a data processor that receives input from external entities and generates output in the form of chronological documents.

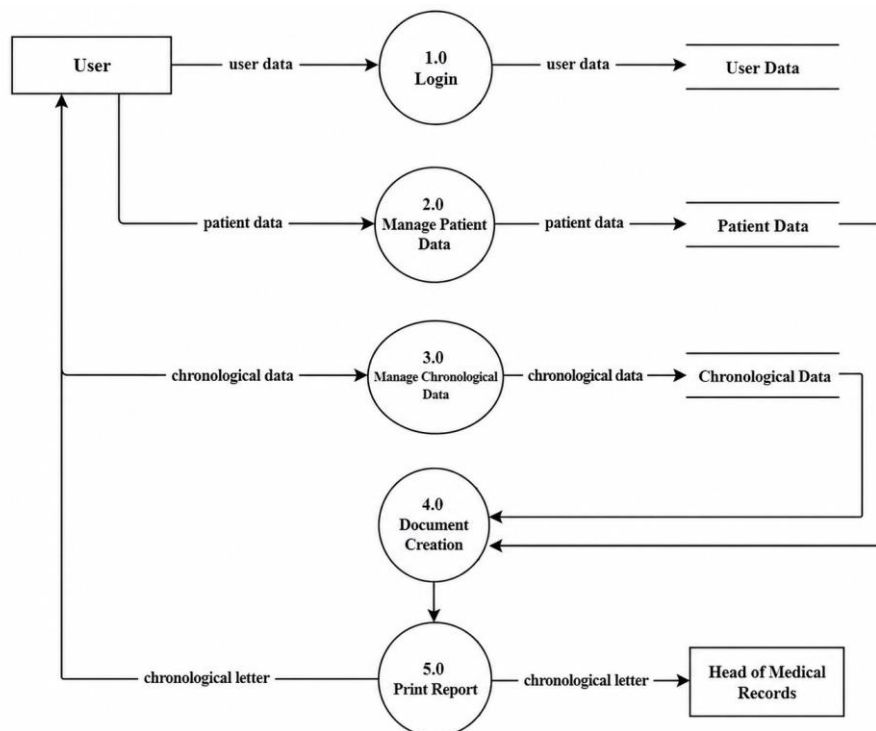


Figure 4. Data Flow Diagram (DFD)

A Data Flow Diagram (DFD) describes data logic to show the origin of data, the destination of data output from the system, storage locations, and the processes involved in generating or linking stored data with the processes used (Paillin & Widiatmoko, 2021).

Table 1. Data Flow Diagram

No.	Data Diagram	Flow	Explanation
1.0	Login	User Data	Staff members enter <i>their username</i> and <i>password</i> into the system to access the application. This login data is processed and stored in the staff member's profile
2.0	Manage Patient Data	Patient Data	Staff members enter patient data. The entered patient data is then saved to the patient database.
3.0	Manage Chronological Data	Chronological Data	Staff enter chronological event data based on information from the patient's family or witnesses. The data entered includes the signatory's identity. All of this data is then saved into the chronological data.
4.0	Document Creation	Chronological Document	The system processes the stored patient data and chronological data to generate a chronological document. The generated document can then be viewed as a preview or printed.
5.0	Print Reports	Patient Data & Chronological Data	The system prints chronological reports in physical form.

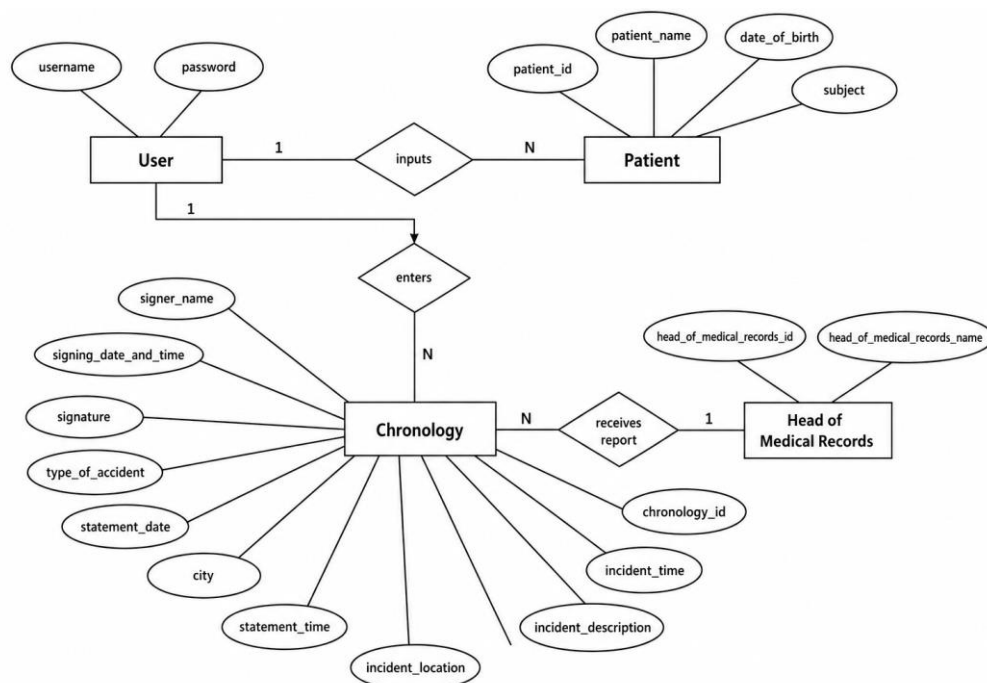


Figure 5. Entity Relationship Diagram (ERD)

Table 1, the DFD explanation, illustrates the process flow in the chronological accident statement form system, starting from login and data management through to

document generation as the system's final output. Figure 5 shows the Entity Relationship Diagram (ERD) for the chronological accident statement form system, used to illustrate the relationships between entities within the system. The ERD illustrates the data structure used in the data processing workflow to generate the chronological document. This system consists of three main entities: user (officer), patient, and chronology. The officer entity is used to store data on the user operating the system, with the attributes username and password. The patient entity is used to store identity data. The chronology entity is the main entity that stores all incident data, including data containing signature information. This entity relates to the officer as the party inputting the data and to the patient as the subject of the incident.

Implementation

At this stage, the system began to be developed into an application using *Microsoft Visual Studio 2012* as the primary tool for application development. *Visual Studio* was chosen because it supports a structured application development process and facilitates the creation of data processing interfaces, according to (Yani et al., 2022). This system uses a *Microsoft Access* database to store data in an integrated manner, thereby simplifying the data entry process. The application is equipped with core functions to enter patient and staff data, as well as chronological event records, and subsequently generates printable chronological documents.

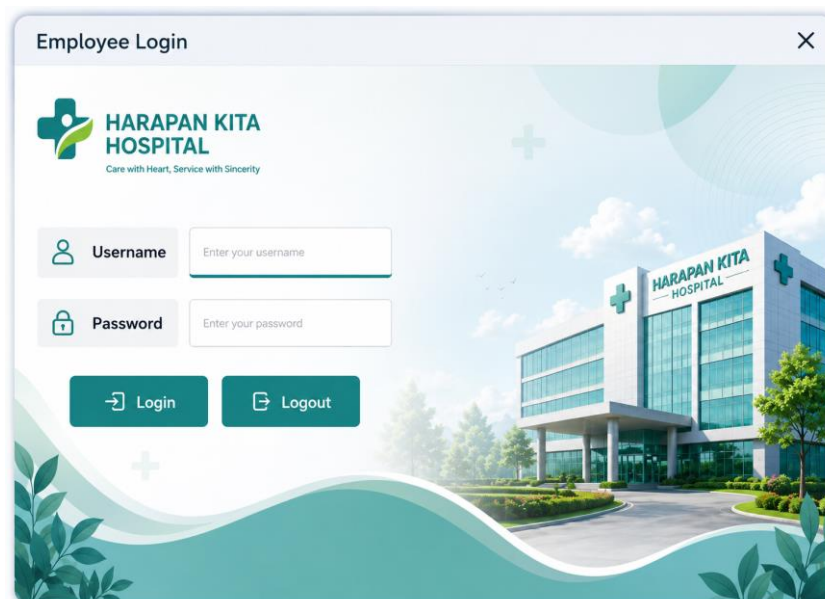


Figure 6. Staff Login

Figure 6 shows the initial stage of the system displaying the login page used by staff to access the application. Staff are prompted to enter their username and password. The system then validates the entered data. If the data is correct, the staff member successfully logs into the system. If an error occurs during entry, the system displays a warning message and the staff member is asked to repeat the login process.

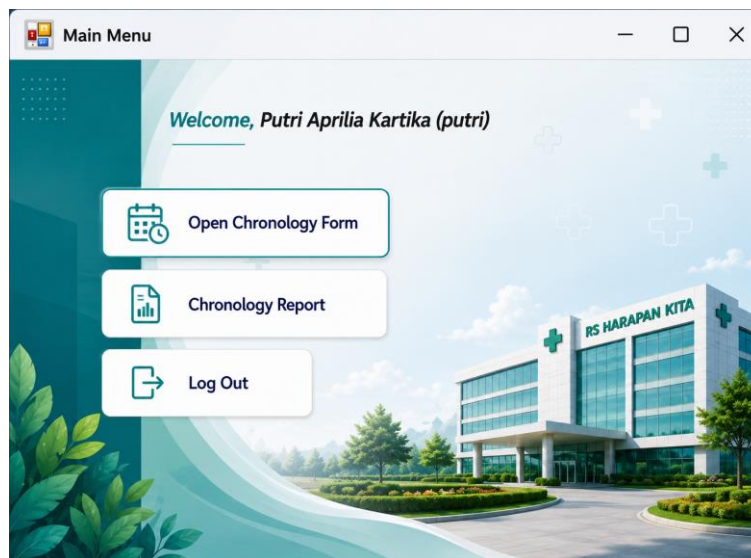


Figure 7. Main Menu

In Figure 7, the user is directed to the menu page. This screen displays information about the currently active user as well as several accessible menu options. The main menu serves as a navigation hub for accessing system features such as opening the accident chronology form, viewing the chronological report, and logging out. Staff members can select the appropriate menu option to proceed with data processing.

Figure 8. Chronological Accident Statement Display

In Figure 8, at this stage, the officer will input the accident chronology data via the provided form. The data entered includes the identity of the signatory (the patient's family or a witness) and patient data, as well as incident information such as time, location, and a description of the incident. Staff also select the type of accident that matches the circumstances. The system also provides a digital signature feature for the patient's family or a witness and the staff member as a form of validation and reinforcement of the document.

Once all data has been fully entered, staff can preview the document to review the results before printing or saving.



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CHRONOLOGICAL STATEMENT OF ACCIDENT – ED

Signed below

Name : Christy
Date of Birth : 06/06/2000
Relationship to Patient : Sister
Contact Number : 012836417

Declare the chronology of the accident concerning

Subject : Mrs. Suami
BPJS Number : 56142361
Patient Name : Ronald
Patient Date of Birth : 16/02/1999
Patient Address : Jalan Letda Lukito, RT 01/RW 09, Jatiroke Village,
Jatinangor District, Sumedang Regency, West Java Province

With the following complete chronology

Day / Date : Tuesday, 28/07/2026
Time : 09:15
Location of Incident : Jalan Raya Bandung–Sumedang
Description of Incident : The patient was riding a motorcycle and was hit by a car from behind.
Type of Accident : Traffic Accident – Minor Injury

Thus, I make this statement truthfully.

Bandung, 29/07/2026 07:09 AM
Name of Staff: Putri Aprilia Kartika

Witness / Family Member,



(Christy)

Staff,



(Putri Aprilia Kartika)

Figure 9. Chronological Report Output

In Figure 9, after all data has been entered and processed, the system generates a chronological accident statement document in a structured format. This document contains all the information that has been entered, ranging from identities to the chronology of events. It is also accompanied by the signatures of the victim's family and the officer as a form of accountability for the accuracy of the data. The document can then be printed as a physical record or saved as a digital file for administrative and claims purposes.



CHRONOLOGICAL DATA REPORT
HARAPAN KITA HOSPITAL



No.	Date of Incident	Patient Name	BPJS Number	Signer	Contact Number	Location	Type of Accident	Staff
1	23/04/2026	Sankei A.	0192XXXX	Kipas A.	0192XXXX	Home	- Minor Injury	Putri A. K.
2	23/04/2026	Zyluc	123123	Racika	0999XXXX	School	- Minor Injury	Putri A. K.
3	22/04/2026	Tulip W.	0987XXXX	Sakura D.	0123XXXX	Jalan Raya Bandung	- Minor Injury	Putri A. K.
4	22/04/2026	Mineral D.	0127XXXX	Botol A.	0819XXXX	Depan RS	- Minor Injury	Putri A. K.
5	21/04/2026	Angela L.	0123XXXX	Santi M.	0237XXXX	Home	- Minor Injury	Putri A. K.
6	19/04/2026	Kiki S.	0128XXXX	Ika R.	0876XXXX	Jalan Raya Bandung	- Minor Injury	Putri A. K.

 View Data

 Print Report

 Back

Figure 10. Chronological Report Menu Display

Figure 10 shows the chronological report menu in the application. This menu displays the patient's chronological data previously entered in a tabular format, such as the date of the incident, the patient's name, BPJS number, signatures, and other incident details. This menu also includes a report printing feature that helps staff manage and compile chronological data more efficiently.



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CHRONOLOGICAL DATA REPORT

No.	Date	Patient Name	BPJS Number	Signer	Contact Number	Location	Type of Accident	Staff
1	23/04/2026	Sankei A.	0192XXXX	Kipas A.	0192XXXX	Home	Minor Injury	Putri A. K.
2	23/04/2026	Zyluc	123123	Racika	0999XXXX	School	Minor Injury	Putri A. K.
3	22/04/2026	Tulip W.	0987XXXX	Sakura D.	0123XXXX	Jalan Raya Bandung	Minor Injury	Putri A. K.
4	22/04/2026	Mineral D.	0127XXXX	Botol A.	0819XXXX	Depan RS	Minor Injury	Putri A. K.
5	21/04/2026	Angela L.	0123XXXX	Santi M.	0237XXXX	Home	Minor Injury	Putri A. K.
6	19/04/2026	Kiki S.	0128XXXX	Ika Ros.	0876XXXX	Jalan Raya Bandung	Minor Injury	Putri A. K.

Gambar 11. Hasil Cetak Laporan Kronologis

Figure 11 shows the chronological report printout generated by the system in PDF format. This report presents all chronological data in an easy-to-read format, making it suitable for archiving. This feature makes the report generation process more practical and reduces recording errors compared to manual systems.

Verification

This stage involves testing the system to ensure that the developed functions operate correctly. Testing is conducted by evaluating every feature of the application, from data input and storage processes to the printing of chronological documents. The test results will confirm that the system functions in accordance with user requirements.

Maintenance

This stage is the final stage in system development to ensure the application performs optimally. Maintenance involves fixing any errors found and adjusting features if user requirements change.

System Testing

The system, which has been fully developed through the *Waterfall* methodology, undergoes a testing process. This phase aims to ensure that the built system meets requirements and functions properly without errors. System testing is performed using *black-box testing*, which involves testing the system based on *inputs* and *outputs* without examining the source code. The testing focuses on the system's functional compliance with requirements. Through this testing, it can be determined that every feature within the system operates optimally and is capable of providing appropriate responses to various input conditions, whether valid or invalid.

Tabel 2. System Testing

No	Test Scenario	Implementation	Expected Result	Test Results	Conclusion
1	Username & password input	System Login	Go to the main menu	Main menu appears	Success
2	Open the chronological form	Access the form	Form displayed	Form successfully opened	Success
3	Enter signature and patient information	Fill in the data	Data saved	Data successfully entered	Success
4	Enter the chronology of events	Enter incident details	Data saved	Data successfully processed	Success
5	Select the type of accident	Select an option	Data displayed correctly	Data successfully displayed	Success
6	Signature input	Digital signature	Signature appears	The signature was successfully displayed	Success
7	Document preview	View results	Document displayed	Preview successful	Success
8	Print document	Print data	Document printed	Successfully printed	Success
9	Save to folder	Save file	File saved	Saved successfully	Success
10	Exit form	Close form	Back to menu	Back to menu	Success

Discussion

Based on research conducted at a hospital, it was found that the process of creating chronological documents is still done manually. Staff, along with the patient's family or witnesses, must fill out chronological forms using paper. This process takes a relatively long time and has the potential to cause various issues in data management. The use of manual methods tends to be less effective, particularly in terms of time efficiency and data accuracy. One common challenge is illegible handwriting, which can lead to errors in record-keeping. Storing documents in physical form also carries risks such as loss and damage, as well as difficulties in retrieving data when needed.

Given these issues, a system is needed to support the creation of chronological documents more effectively and efficiently. Designing a digital-based system is the

appropriate solution to address these problems. Through this system, staff can input data in a structured manner, thereby minimizing errors and improving data consistency. The system is also capable of automatically generating chronological documents in a neat and easy-to-read format. Additional features such as digital signatures and data storage in file format can also enhance security and ease of document management. The designed system is expected to help improve service quality and support staff performance in creating accurate chronological documents that align with the facts of the incident.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the research findings and the system design that has been implemented, it is concluded that the desktop-based chronological form system developed can help improve efficiency and effectiveness in the process of creating chronological accident documents. This system simplifies data entry for officers in a structured manner, reduces errors in record-keeping, and produces documents that are neater and easier to read. The developed system also supports BPJS claims by providing more accurate, complete, and consistent data. Testing results indicate that all features of this system are suitable for use as a solution to replace manual processes with computerized ones to improve service delivery.

Limitations

This study has several limitations. The developed system is a desktop application, which limits its accessibility to computers where the application is installed. In addition, the system uses Microsoft Access as the database management system, making it more suitable for small-scale implementation and less appropriate for multi-user environments with high data transaction volumes. Furthermore, the system has not yet been integrated with the Hospital Information System (HIS) or the BPJS e-Claim system, so the data exchange process is still performed separately.

Recommendations

Based on the findings of this study, hospitals are encouraged to implement the desktop-based Chronological Form Information System to improve the efficiency and accuracy of chronological document preparation for BPJS claims. Future development of the system is recommended to include integration with the Hospital Information System (HIS) and the BPJS e-Claim system to support a more efficient data exchange process. In addition, further studies are recommended to evaluate the system in different hospital settings and to develop a web-based or mobile-based version in order to improve accessibility and support multi-user implementation.

Author Contributions

The first author took primary responsibility for the research conceptualization, literature review, data collection, system analysis and design, system development, data analysis, and drafting of the manuscript. The second author contributed to the research methodology, supervised the research process, provided academic guidance, and critically reviewed and revised the manuscript. The third author contributed to the validation of the research, provided academic supervision, critically reviewed the manuscript, and approved the final version of the article for publication. All authors have read and approved the final version of the manuscript submitted for publication.

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