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Prototype Design of Event Chronological Information System to Support External Cause Coding of Emergency Room Patients

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Abstract. *Chronological records of events in the Emergency Department (IGD) are often unstructured, resulting in incomplete data and External Cause coding errors (ICD-10). This research aims to develop a prototype of a web-based information system to facilitate the chronological recording of events in a standardized manner, thereby improving the accuracy of codification. The development method uses the Waterfall model with the stages of needs analysis, design (context diagram, DFD, ERD), implementation (HTML, Bootstrap, Flask, SQLite), and Blackbox testing. As a result, the system provides a structured interface for the input of incident data (accidents, violence) and generates automated PDF reports that are ready for codefinition. Functional testing shows all modules (data inputs, filters, generated reports) are operating as expected. The system has the potential to reduce coding errors based on related literature studies, while supporting integration with Electronic Medical Record (EMR). Recommendations for advanced research include clinical trials and the development of artificial intelligence features for automated code recommendations.*

Keywords: *Health information systems, chronology of events, Codification external cause, ICD-10, emergency department*

1. Introduction

Health information systems play a very important role in improving the efficiency and effectiveness of services in the Emergency Installation (IGD). The emergency room is a vital part of the hospital that handles emergency and critical cases, where speed and accuracy in decision-making greatly determine patient safety (Restiani et al., 2023). In this context, a good information system can help in managing patient data, speeding up the diagnosis process, and improving accuracy in medical treatment. One of the important aspects of the information system is the External Cause codification, which serves to document the causes of events that lead to treatment in the emergency room. Proper codification is not only important for administrative purposes, but also for better epidemiological analysis and health planning (Coleska et al., 2025).

In the Emergency Installation (IGD) service, chronological recording of events is an important aspect that supports the diagnosis process and medical decision-making quickly and appropriately (Lorenzetti et al., 2018). This information is not only needed by medical personnel, but is also a key element in the process of coding external causes as regulated in the ICD-10 disease classification system (Chan et al., 2024).

The process of chronological recording of events mostly in hospitals or clinics is still carried out manually, usually through forms or free records that do not have a standard structure. This makes it difficult for coders to interpret the events underlying the patient's condition, especially in emergency cases such as traffic accidents, work injuries, or acts of

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violence (Molina et al., 2023). When the information needed is not clearly listed, the risk of providing inappropriate coding becomes even greater despite the importance of the information system and External Cause codification in the emergency room, there are still various challenges faced in its implementation. One of the main problems is the inaccuracy and incompleteness of the data generated during the coding process (Rasp et al., 2024).

Information systems are a system that can be defined by collecting, processing, storing, analyzing, and disseminating information. Like any other system, an information system consists of inputs (data, instructions) and outputs (reports, calculations) (Saputra Mokoagow et al., 2024). In the context of Emergency Installations (IGD), an effective information system is essential to support patient data management and External Cause codification, so that it can improve the quality of health services (Setiatin et al., 2023).

Bootstrap is one of the HTML, CSS, and JavaScript frameworks that is quite widely used by web developers (Liang et al., 2024). Bootstrap provides a means to build page layouts easily, and can be modified on the basic HTML view to make the developed web page conform to other components. The use of Bootstrap in the development of information systems in emergency departments is expected to result in a responsive and easy-to-use interface for medical personnel (Kruse et al., 2016).

Thus, this study aims to design a Prototype of an Event Chronological Information System to Support the Completeness and Accuracy of External Cause Codification in Emergency Room Patients at Hospital X, by utilizing the Waterfall approach.

The information system in hospitals is an integration of information technology components used to manage patient data, administration, finance, medical services, and overall hospital management (Fajriani, 2021). According to Kristanti & Ain, 2021 Information Systems are a combination of interintegrated procedures, hardware, software, communication networks, and databases to support operational activities and decision-making. In the context of hospitals, information systems function not only to record patients' medical data, but also as a tool in improving service quality and operational efficiency (Apriani & Ulfah, 2023).

The chronology of events in the emergency room medical records plays an important role as an initial source of information to determine diagnosis, medical measures, as well as the process of codifying diseases and External Causes (Kennedy et al., 2025). Complete chronological documentation allows doctors and co-ordinators to understand the mechanism of the incident, the type of accident, as well as the risk factors involved, which then becomes the basis for establishing the appropriate External Cause code. Lack of information in the chronology of events can lead to misdecoding impacting insurance claim inaccuracy, and interfering with the validity of hospital epidemiological data (Rahmaliani et al., 2023).

External Cause Codification refers to the official classification published by WHO through the International Classification of Diseases (ICD). In ICD-10, External Causes are listed in the V01-Y98 category, which includes external causes such as traffic accidents, falls, injuries due to violence, and other environmental events (Fung et al., 2020). External Cause coding is more detailed, allowing for more accurate identification of the mechanism of the event. Accuracy in coding is crucial for morbidity reporting, accident prevention planning, and disease burden analysis at the national and international levels (Harrison et al., 2021).

In the development of information systems, there are various methodologies, Waterfall is used because of the efficient and sequential work structure in system development. The Waterfall model is a linear approach that requires each stage to be

completed sequentially before moving on to the next stage, such as analysis, design, implementation, and testing (Maulana et al., 2021).

2. Methods

2.1 Types of Research

This research uses a system engineering approach with the Research and Development (R&D) method, using the Waterfall method system development model. This method was chosen because of its structured and systematic nature, allowing each stage of development to be carried out sequentially with complete documentation (Madiah et al., 2024).

Data collection techniques used in data collection include interviews with medical officers, medical coder, and medical record staff related to chronological recording of events. Observation of the flow of chronological recording in the emergency room. A documentation study on the format of medical records and the results of the External Cause codification that is already running.

2.2 System Development Methods

The waterfall model is implemented through several stages as follows:

1. Needs Analysis
   Identify system needs based on observation and interview results.
2. System Implementation
   The app's development uses HTML for page structure, CSS and Bootstrap for a responsive interface, and JavaScript for dynamic functionality. On the server side, applications are built with Python Flask as the back-end framework and SQLite as the database management system. The combination of these technologies allows for the creation of efficient web applications with an adaptive interface and optimal performance (Aslam et al., 2015).
3. System Testing
   Conduct internal testing to ensure all functions are running as needed.
4. Maintenance
   Provide improvement recommendations based on test results and initial user feedback.

2.3. Tools and Supporting Devices

In the development of this system, several supporting tools are used, namely Visual Studio Code (VSCode) as the main Integrated Development Environment (IDE) and Python Flask as the server-side development framework. For database management, SQLite is used which is integrated directly with the system. The user interface design was developed using Bootstrap to ensure a responsive and mobile-compatible display, while interactive functionality was implemented via JavaScript. The process of designing system diagrams (such as context diagrams, DFD, and ERD) is done using Draw.io. Furthermore, the functionality and interface display tests are carried out through various web browsers to verify the overall compatibility and performance of the system (Abdussalaam & Ramdani, 2023).

3. Results and Discussion

3.1. System Needs Analysis

Overview of the Chronological Process of Current Events in the Emergency Room Based on the results of observations at the Emergency Installation (IGD) of Hospital X, the

process of recording the chronological record of current events is carried out manually through a medical record form. Medical officers record events based on patient or family confessions, but there is no standard format that systematically guides chronological content. Some of the problems identified include chronological data that are often incomplete or only contain brief information. The absence of a standard format makes important information often overlooked. Medical personnel have difficulty remembering all the elements necessary for the codification of External Cause. Errors or incompleteness of information have an impact on inaccuracies in the process of codification and insurance claims. These findings confirm the need for an information system that can guide chronological records in a structured manner and support the need for codification.

3.2. System Planning

1. Diagram context

The context diagram depicts the system as a unit that receives patient data input and patient chronological data, and then produces an output in the form of a chronological report for codification (Sanjaya et al., 2019).

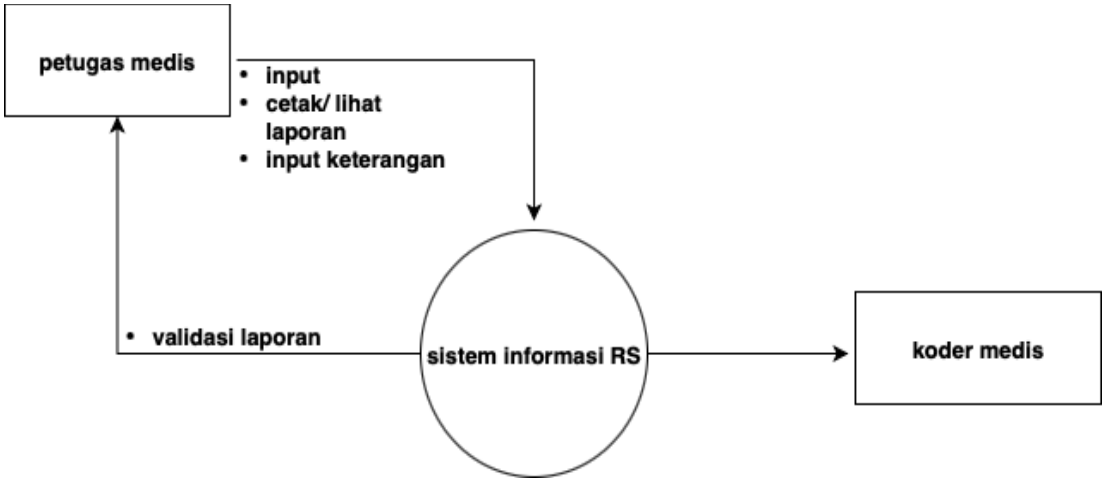


Figure 1. System context diagram

2. DFD (Data Flow Diagram)

DFD Level 0 details the processes into sub-processes, such as patient data input, chronological event input, and data access by medical coding.

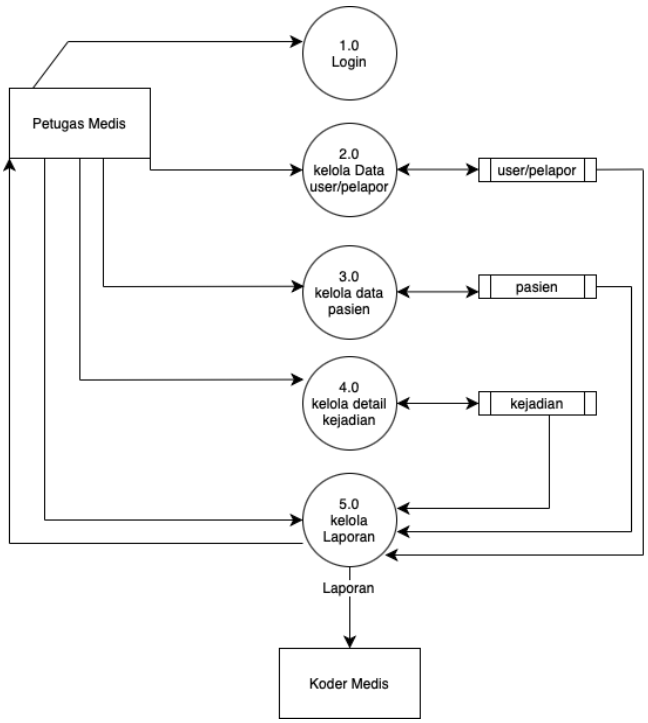


Figure 2. DFD level 0 system

3. ERD (Entity Relationship Diagram)

The main entities designed include, Patient: store the patient's identity (patient id, name, date of birth, gender). Event Chronology stores data about events (event id, time of event, place of occurrence, cause of event, detailed chronology). External Cause: stores the External Cause code that is set based on chronological data (Abdussalaam & Oktaviani, 2020).

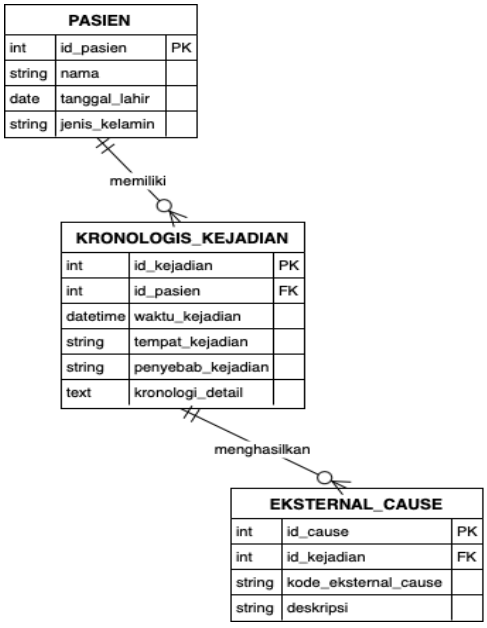


Figure 3. Chronological system ERD

The relationships between the tables are arranged to ensure the integrity of the data and facilitate the process of searching for information by medical coders (Abdussalaam & Badriansyah, 2021).

4. Information Systems workflow

The system's workflow includes three main parts: new patient registration, chronological record of events, and a dashboard for medical coding. Each module has specific stages that ensure patient and event data is recorded accurately, can be updated, and is ready to be codified by the medical coder. This system is designed to improve efficiency and accuracy in the management of patient data in hospitals, especially in emergency rooms.

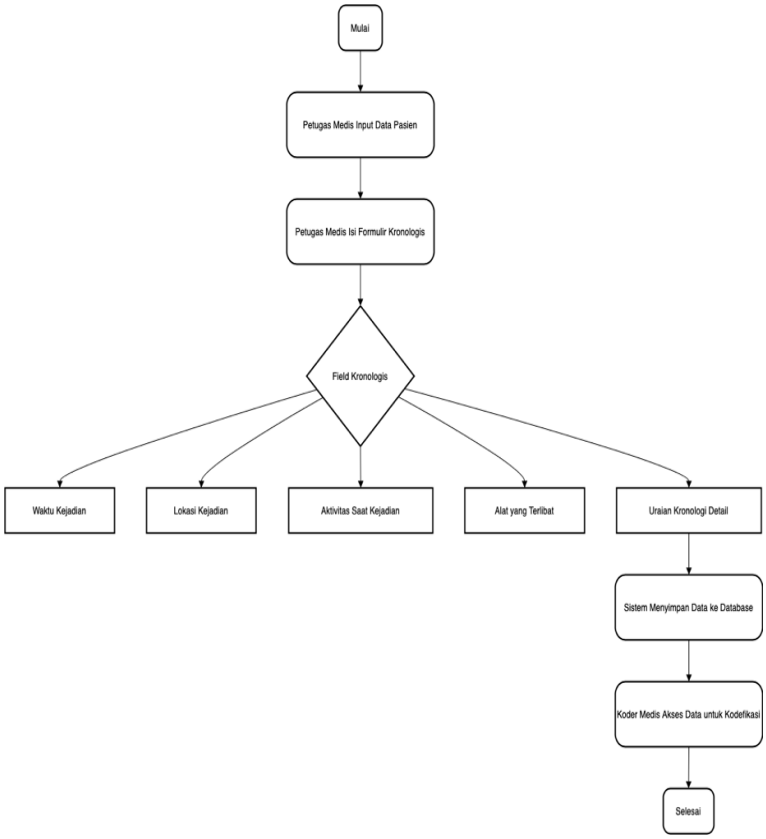


Figure 4. Charging flow and how the system works

The system's interface (UI) is designed to be simple and user-friendly using HTML, Bootstrap, and JavaScript. The main view includes a new patient registration form, a chronological event form, and a dashboard for medical coding. The System Mechanism in Assisting External Cause Codification provides a structured chronological summary that makes it easier for medical coders to select the most appropriate External Cause code based on the ICD-10 standard (Aslam et al., 2015).

3.3. Implementation

1. Chronology of Events

This page displays a list of incident reports recorded in the Emergency Room of Hospital X. Main Features: The report list table contains the columns of Number, Date of Incident, Type of Incident, Patient Name, and Reporter. There are View (view report details), Delete (delete report), and PDF (download reports in PDF format) action buttons. The "Add New Data" button to enter the new incident report into the system.

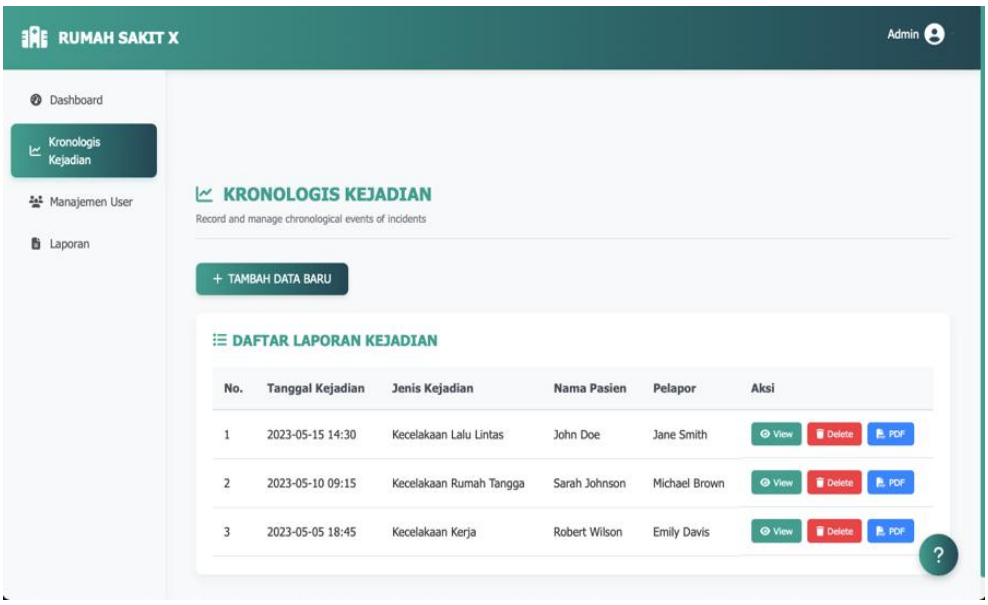


Figure 5. Chronological page of events

Reports recorded include traffic accidents, domestic accidents, and work accidents. The filling of the form for the completeness of the coding support can be done by pressing a button, adding new data, and the data form can be in the form of filling in that must be filled in by the medical officer without anyone being left behind. The form data is presented in table 1.

Table 1. Specification of the chronological form data of the event

Field	Data Type	Validation	Information
Reporter's Full Name	Text (varchar 255)	Must be filled in, letters only	Full name of the person reporting
Patient Relations	Text (varchar 100)	Required	For example: family, friends, neighbors
Complainant's Mobile Number	Text (varchar 20)	Required, valid phone number format	To be contacted when needed
Patient Name	Text (varchar 255)	Required	Name of the patient who experienced the incident
Date of Birth	Date	Required, date format	To calculate the age of the patient
Patient Address	Text (varchar 500)	Required	Patient's residential address
Origin City	Text (varchar 100)	Optional	Patient's hometown
Gender	Radio Button (Male/Female)	Must be selected	Choice of one
Experiencing Events	Dropdown / Select	Must be selected	Options: Household, Work, Traffic, Other
Date & Time of Occurrence	Datetime Picker	Required	Date and time format event

Field	Data Type	Validation	Information
Scene of Incident	Text (varchar 255)	Required	Location of the scene
Full Story of the Incident	Textarea (varchar 2000)	Required, minimum 50 characters	Detailed chronology
Wounds / Bruises / Fractures on Parts	Textarea (varchar 1000)	Optional	Injured areas of the body

2. Main Dashboard

This dashboard is the main display to monitor incident reports in the emergency room. At the top, there's a button to add a new report. Right below it, there are some important information such as the total reports that are received, how many are complete, how many need action, and how long the average handling time is. In the middle, there's a graph showing the trend of the report over the last 30 days, so we can see when the report is a lot or a little bit. Next to it, there is a pie chart that shows the status of the completeness of the report, whether it is complete, incomplete, or still needs to be checked again. At the bottom, there is a list of recent reports that can be viewed directly or opened via the "View All" button.

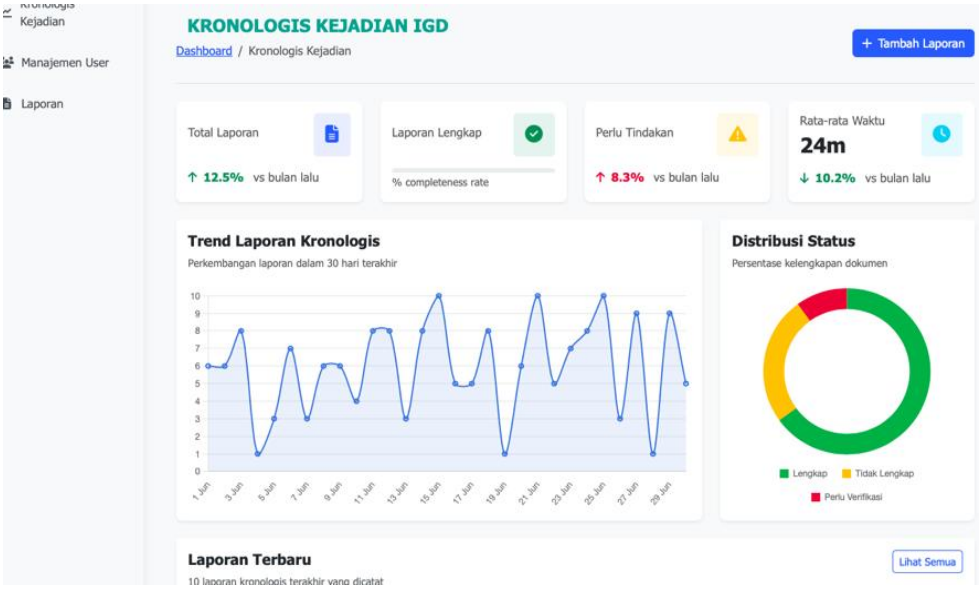


Figure 6. Dashboard page

Overall, this dashboard is made so that users can quickly understand the situation of reports in the emergency room without having to open one by one. The display is simple, the data is easy to read, and the navigation is also clear.

3. User Management

The user management page is used for the management of system user data, including admins, doctors, and nurses. Key Features: User Filter features search users by name or username. User Data Table: Displays information about No, Name, Username, Email, Role, Status, and Action Buttons such as edit or delete.

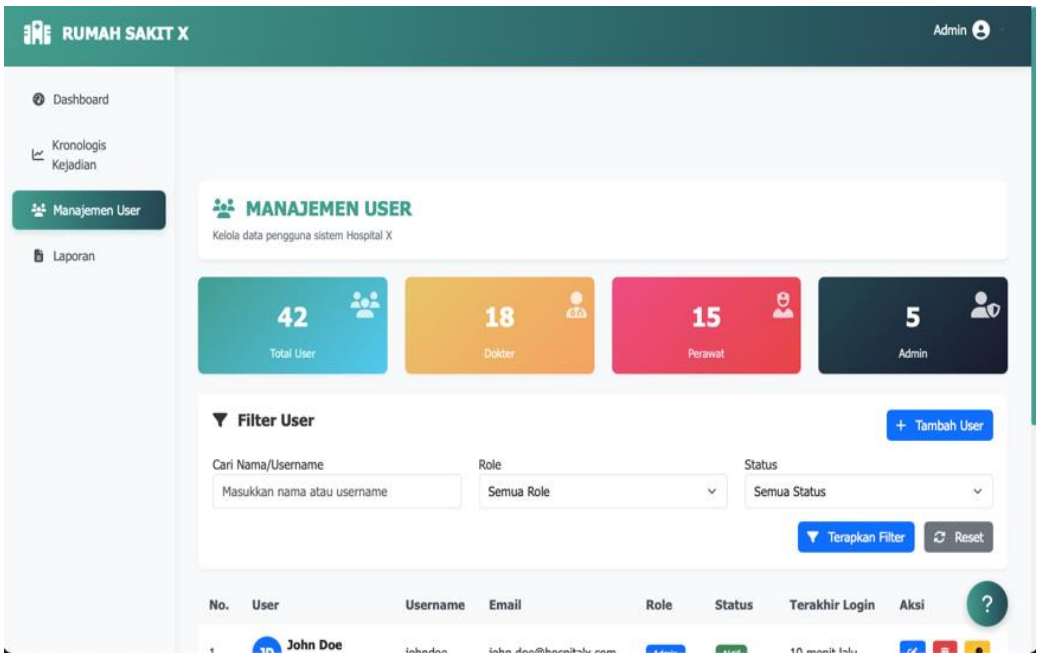


Figure 7. User management page for user control

4. Chronological Report of Events

This page is used to monitor the progress of incident reports and the distribution of events by type. Key Features of Stats Card Total Reports (24), Reports in Progress (8), High Priority Reports (3), and Completed Reports (13). Pie chart Displays the distribution of event types, even if some category labels are not yet fully populated. The Monthly Trend Chart presented will help with data visualization.

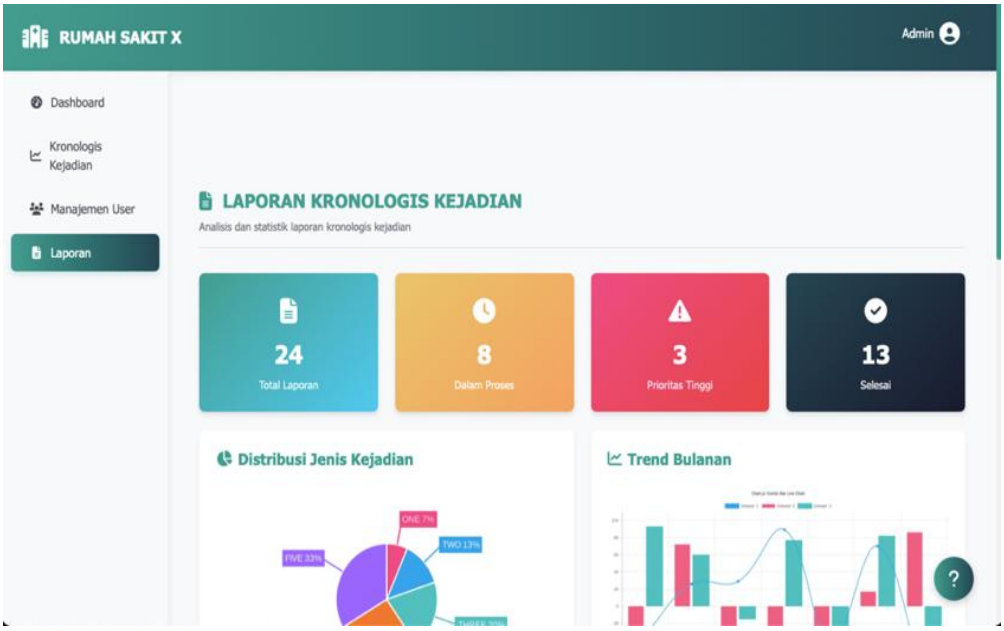


Figure 8. Report page

5. Filter and List of Reports

This feature is used to make it easier to search and filter reports based on certain criteria. Key Features: Filter Forms users can choose filters based on Date Range, Event Type, and Report Status. The Report table displays details such as No, Date, Report No., Patient

Name, Event Type, Location, Status, and Action Button (Details/PDF). Sample Data: Contains an event report with a status of varying such as "Completed", "Processed", or "New".

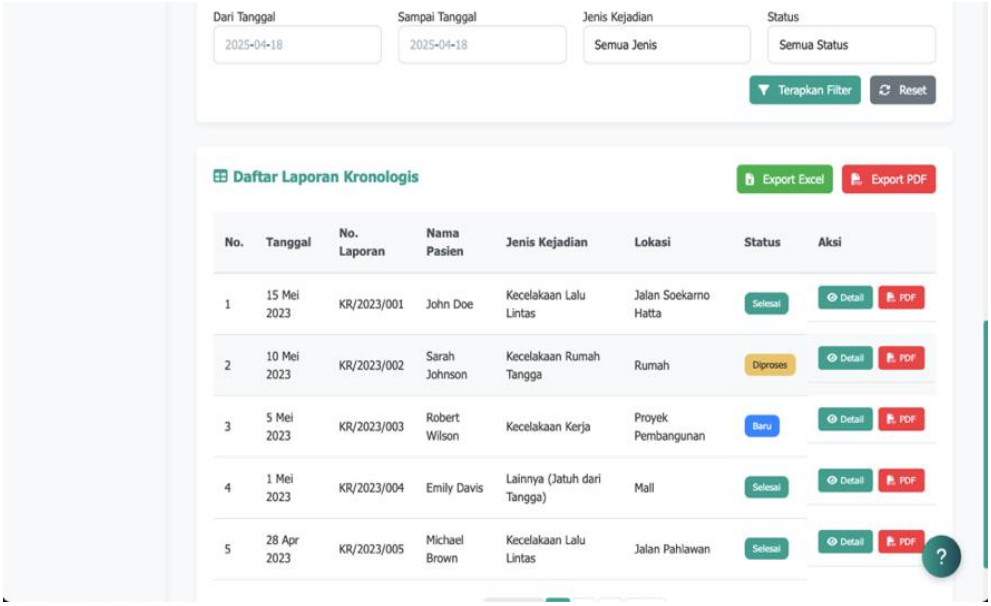


Figure 9. Chronological report page

Table 2. The module features the featured chronological system of events.

Module	Main Functions	Featured Features
Chronology of Events	View a list of event reports	Report table, View/Delete/PDF button, Add New Data
Dashboard Utama	Provides a summary of current statistics and activities	Stats cards, event trend graphs, recent activity logs
Incidence Statistics	Analysis of event data in a given period	Monthly event chart, recent report table, event type distribution
User Management	Manage system user data	User filters, user data tables, role and status management
Chronological Report of Events	Monitoring the progress of incident reports	Report status statistics, event distribution pie chart, monthly trends
Filter and List of Reports	Filter reports based on specific criteria	Form filter (date, event type, status), filter results table, Detail action/PDF

This table is a feature available in the chronological information system of events and this is expected to be appropriate and can fully support the codification of accuracy and suitability for other supporting data.

6. Results of Prototype Output of Chronological Information System Events

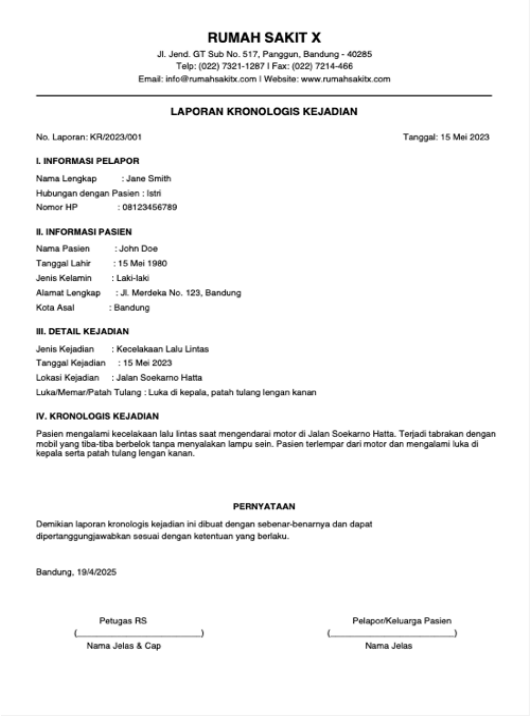
As a result of the process of designing and implementing the prototype of the chronological event information system, the system successfully generates an automatic chronological report document based on input filled in by the medical officer or the patient's family.

Table 3. Event chronological system output fill description

Report Section	Description Information
Instance header	Hospital name, full address, phone number, fax, email, and hospital website.
General Information	Unique report number (e.g. KR/2023/001) and date of report creation.
I. Reporter Information	The full name of the complainant, the relationship between the complainant and the patient, and the complainant's cellphone number.
II. Patient Information	The patient's name, date of birth, gender, full address, and city of origin.
III. Incident Details	Type of incident (traffic accident, household, work, or others), date of incident, location of incident, and description of injuries/bruises/fractures.
IV. Chronology of Events	A complete narrative of the incident experienced by the patient based on the complainant's statement.

7. Overview of information system output results

One example of a report generated by the system shows data on traffic accident incidents, with details of the accident narrative, patient identity, and injuries suffered. The report is systematically compiled and ready to be used for the needs of internal hospital administration, ICD-10 External Cause coding, and health insurance claims.



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LAPORAN KRONOLOGIS KEJADIAN

No. Laporan: KR/2023/001 Tanggal: 15 Mei 2023

I. INFORMASI PELAPOR

Nama Lengkap : Jane Smith
Hubungan dengan Pasien : Istri
Nomor HP : 08123456789

II. INFORMASI PASIEN

Nama Pasien : John Doe
Tanggal Lahir : 15 Mei 1980
Jenis Kelamin : Laki-laki
Alamat Lengkap : Jl. Merdeka No. 123, Bandung
Kota Asal : Bandung

III. DETAIL KEJADIAN

Jenis Kejadian : Kecelakaan Lalu Lintas
Tanggal Kejadian : 15 Mei 2023
Lokasi Kejadian : Jalan Soekarno Hatta
Luka/Memar/Patah Tulang : Luka di kepala, patah tulang lengan kanan

IV. KRONOLOGIS KEJADIAN

Pasien mengalami kecelakaan lalu lintas saat mengendarai motor di Jalan Soekarno Hatta. Terjadi tabrakan dengan mobil yang tiba-tiba berbelok tanpa menyalakan lampu sein. Pasien terlempar dari motor dan mengalami luka di kepala serta patah tulang lengan kanan.

PERNYATAAN

Demikian laporan kronologis kejadian ini dibuat dengan sebenar-benarnya dan dapat dipertanggungjawabkan sesuai dengan ketentuan yang berlaku.

Bandung, 19/4/2025

Petugas RS
(_____)
Nama Jelas & Cap

Pelapor/Keluarga Pasien
(_____)
Nama Jelas

Figure 10. System output results

With this, it is hoped that the Medical Coder can quickly identify the external causative factors of the incident. The External Cause coding process becomes more accurate and efficient. The validity of data for reporting JKN/BPJS claims and hospital epidemiological statistics has increased. Black Box testing is done by focusing on verifying the functionality of the system without paying attention to the internal code structure.

Table 4. Blackbox test system results

Module	Test Scenarios	Input	Expected Output	Test Results
Whistleblower Data Input Form	Populate all fields with valid data	Name, Relationship, Mobile Number	Data saved successfully	Succeed
Patient Data Input Form	Fill in all patient information correctly	Name, Date of Birth, Address, City, Gender	Patient data is stored in the database	Succeed
Event Detail Input	Select the type of event, fill in the location and complete timeline	Type of Incident, Location, Story of the Incident	Chronological data is stored completely	Succeed
Validation of Blank Forms	Submit forms without filling in data	Empty field	The system displays an error warning on the required field	Succeed
Cellphone Number Format	Input of mobile number does not match the format	Letters/characters other than numbers	Error message 'Invalid number format' appears	Succeed
Button 'CANCEL'	Click the CANCEL button when entering	Click CANCEL	Blank form and return to the home page	Succeed
Button 'GENERATE PDF'	Click the button to create a PDF file of the report	Completed form data	The system generates a PDF file of an incident report	Succeed
Report Data Filter	Use date and event type filters	Date range, event type	The report table displays results according to the filter	Succeed
'Save' button	Click the button to save the form	Completed form data	Saved to the database	Succeed
User Access Rights	Medical code accesses chronological data	Access medical coder roles	Can view chronology details for codification	Succeed
Check Database Storage	Save new event input	Forms are filled out and saved	Data entered into the database correctly	Succeed

The test approval criteria are determined based on the suitability of the output produced with the expected results in all test scenarios. For testing purposes, several main tools were used, namely the latest version of the Chrome Browser for interface testing, Local

Development Server Flask as a test environment, and manual testing methods on input forms to validate user interaction (Chauhan et al., 2019).

Conclusions

Based on the research conducted, a prototype of the chronological information system of events has been successfully developed by adopting the Waterfall method through the stages of needs analysis, context diagram design, DFD, ERD, and user interface implementation. The development of the system utilizes web technology (HTML, CSS Bootstrap, JavaScript) with the Python Flask Backend and SQLite database, resulting in a prototype that is able to improve the chronological recording flow of events in the emergency room of Hospital X. This system presents more structured recording, facilitates centralized electronic data storage, and simplifies the process of External Cause codification by medical coders.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Abdussalaam, F., & Badriansyah, B. (2021). Perancangan Sistem Informasi Pemeriksaan Barang Berbasis Web Menggunakan Metode SSAD. *Expert*, *11*(2), 174–183. https://doi.org/10.36448/expert.v11i2.2167

Abdussalaam, F., & Oktaviani, I. (2020). Perancangan Sistem Informasi Nilai Berbasis Web Menggunakan Metode Prototyping. *Jurnal E-Komtek (Elektro-Komputer-Teknik)*, *4*(1), 16–29. https://doi.org/10.37339/e-komtek.v4i1.213

Abdussalaam, F., & Ramdani, A. (2023). Perancangan Sistem Informasi Manajemen Praktek Kerja Lapangan Berbasis Web Menggunakan Metode Agile. *INFOKOM (Informatika & Komputer)*, *10*(2), 33–43. https://doi.org/10.56689/infokom.v10i2.950

Apriani, W., & Ulfah, A. (2023). … Kelengkapan Formulir Asesmen Awal Medis Instalasi Gawat Darurat (Igd) Guna Menununjang Mutu Rekam Medis Di Rsau Lanud …. *Jurnal Kesehatan Tambusai*, *4*, 5449–5457. http://journal.universitaspahlawan.ac.id/index.php/jkt/article/view/19137%0Ahttp://journal.universitaspahlawan.ac.id/index.php/jkt/article/download/19137/15842

Aslam, F. A., Gulamgaus, H. N. M. J. M. M. M. M. A., & Lokhande, P. P. S. (2015). Efficient Way Of Web Development Using Python And Flask. *International Journal of Advanced Research in Computer Science*, *6*(2), 54–57. www.ijarcs.info

Chan, D. Z. L., Kerr, A. J., Tavleeva, T., Debray, D., & Poppe, K. K. (2024). Validation Study of Cardiovascular International Statistical Classification of Diseases and Related Health Problems, Tenth Edition, Australian Modification (ICD-10-AM) Codes in Administrative Healthcare Databases (ANZACS-QI 77). *Heart, Lung and Circulation*, *33*(8), 1163–1172. https://doi.org/https://doi.org/10.1016/j.hlc.2024.03.015

Chauhan, N., Singh, M., Verma, A., Parasher, A., & Budhiraja, G. (2019). Implementation of database using python flask framework. *International Journal of Engineering and Computer Science*, *8*(12), 24894–24899. https://doi.org/10.18535/ijecs/v8i12.4390

Coleska, A., Meeker, M. A., Kopp, J. W., Rice, P. L., Huckins, D. S., Smith, K. L., Nentwich, L. M., Raja, A. S., & Baugh, J. J. (2025). Evaluating Billing Code Distributions in the Emergency Department Following the Implementation of the New Documentation Guidelines. *JACEP Open*, *6*(2), 100034. https://doi.org/https://doi.org/10.1016/j.acepjo.2024.100034

Fajriani, A. (2021). Aplikasi ISO (Informasi Spesialite Obat) Indonesia Berbasis Web Menggunakan Metode Pencarian Binary Search. *Decode: Jurnal Pendidikan Teknologi Informasi*, *1*(1), 8–16. https://doi.org/10.51454/decode.v1i1.2

Fung, K. W., Xu Julia, & Bodenreider, O. (2020). The new International Classification of Diseases 11th edition: a comparative analysis with ICD-10 and ICD-10-CM. *Journal of the American Medical Informatics Association*, *27*(5), 738–746. https://doi.org/10.1093/jamia/ocaa030

Harrison, J. E., Weber, S., Jakob, R., & Chute, C. G. (2021). ICD-11: an international classification of diseases for the twenty-first century. *BMC Medical Informatics and Decision Making*, *21*, 1–10. https://doi.org/10.1186/s12911-021-01534-6

Kennedy, B., Lam, M., Kourouche, S., McCloughen, A., Casey, L., & Curtis, K. (2025). The Impact of HIRAID Implementation on the Accuracy of Emergency Nurse Documentation in Australian Rural Emergency Departments: A Multicenter Quasi-Experimental Study. *Journal of Emergency Nursing*. https://doi.org/https://doi.org/10.1016/j.jen.2024.12.004

Kristanti, yuliana erna, & Ain, R. Q. (2021). Informasi Manajemen Rumah Sakit. *Muhammadiya Public Health Journal*, *1*(3), 179–193.

Kruse, C. S., Kristof, C., Jones, B., Mitchell, E., & Martinez, A. (2016). Barriers to Electronic Health Record Adoption: a Systematic Literature Review. *Journal of Medical Systems*, *40*(12). https://doi.org/10.1007/s10916-016-0628-9

Liang, C., Wang, G., Li, N., Wang, Z., Zeng, W., Xiao, F., Tan, Y., & Li, Y. (2024). Accelerating page loads via streamlining JavaScript engine for distributed learning. *Information Sciences*, *675*, 120713. https://doi.org/https://doi.org/10.1016/j.ins.2024.120713

Lorenzetti, D. L., Quan, H., Lucyk, K., Cunningham, C., Hennessy, D., Jiang, J., & Beck, C. A. (2018). Strategies for improving physician documentation in the emergency department: A systematic review. *BMC Emergency Medicine*, *18*(1). https://doi.org/10.1186/s12873-018-0188-z

Madiah, M., Ng, K. X., Tan, Y. W., Tan, Z. H., Chong, Z. T., & Chan, J. X. (2024). Wix for Web Development and the Application of the Waterfall Model and Project Based Learning for Project Completion: A Case Study. *Journal of Informatics and Web Engineering*, *3*(2), 212–228. https://doi.org/10.33093/jiwe.2024.3.2.16

Maulana, F. I., Susanto, V., Shilo, P., Gunawan, J., Pangestu, G., & Raharja, D. R. B. (2021). Design and Development of Website Dr.Changkitchen Diet Catering Using SDLC Waterfall Model. *ACM International Conference Proceeding Series*, 75–79. https://doi.org/10.1145/3479645.3479652

Molina, M. F., Pantell, M. S., & Gottlieb, L. M. (2023). Social Risk Factor Documentation in Emergency Departments. *Annals of Emergency Medicine*, *81*(1), 38–46. https://doi.org/https://doi.org/10.1016/j.annemergmed.2022.07.027

Rahmaliani, I., Abdussalaam, F., Gunawan, E., & Soelistijaningrum, M. (2023). Tata Kelola Rekam Medis Berbasis Elektronik Dalam Pelaporan Mortalitas Pasien Rawat Inap Menggunakan Metode Agile Software Development. *INOVTEK Polbeng - Seri Informatika*, *8*(2), 343. https://doi.org/10.35314/isi.v8i2.3532

Rasp, E., Saavalainen, L., But, A., Gissler, M., Härkki, P., Heikinheimo, O., & Rönö, K. (2024). Psychiatric disorders and mortality due to external causes following diagnosis of endometriosis at a young age: a longitudinal register-based cohort study in Finland. *American Journal of Obstetrics and Gynecology*, *230*(6), 651.e1-651.e17. https://doi.org/https://doi.org/10.1016/j.ajog.2024.02.011

Restiani, D., Jundapri, K., & Susyanti, D. (2023). Kegawatdaruratan Primary dan Secondary Survey pada Pasien Congestive Heart Failure (CHF) di Rumah Sakit Tk II Putri Hijau Medan. *PubHealth Jurnal Kesehatan Masyarakat*, *2*(1), 30–47. https://doi.org/10.56211/pubhealth.v2i1.322

Sanjaya, G. Y., Lazuardi, L., Hasanbasri, M., & Kusnanto, H. (2019). Using Hospital Claim Data to Develop Referral Decision Support Systems: Improving Patient Flow from The Primary Care. *Procedia Computer Science*, *161*, 441–448. https://doi.org/https://doi.org/10.1016/j.procs.2019.11.143

Saputra Mokoagow, D., Mokoagow, F., Pontoh, S., Ikhsan, M., Pondang, J., & Paramarta, V. (2024). Sistem Informasi Manajemen Rumah Sakit dalam Meningkatkan Efisiensi: Mini Literature Review. *COMSERVA : Jurnal Penelitian Dan Pengabdian Masyarakat*, *3*(10), 4135–4144. https://doi.org/10.59141/comserva.v3i10.1223

Setiatin, S., Ningrum, I. S., & Aulia Zeta Andhani. (2023). Evaluasi E-Medrec pada Bagian Analisis Rekam Medis Kuantitatif Rawat Inap di Rumah Sakit TK II Dustira Cimahi. *Jurnal Ilmiah Perekam Dan Informasi Kesehatan Imelda (JIPIKI)*, *8*(2), 231–241. https://doi.org/10.52943/jipiki.v8i2.1379