Jurnal Kecerdasan Buatan dan Teknologi Informasi
Vol. 5, No. 3, September 2026, pp. 608–622
e-ISSN: 2964-2922, p-ISSN: 2963-6191

Open access

Original Research

Design and Development of a Web-Based Disaster Health Information System Prototype for Medical Record and Health Information Students

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ABSTRACT

Disaster-response documentation requires rapid linkage of victim, health-service, logistics, and reporting data, while Medical Record and Health Information students have limited access to disaster-specific learning environments. This study designed a web-based Disaster Health Information System prototype as an educational simulation for disaster health information management. Requirements were synthesized from disaster-documentation needs, policy and standards, prior literature, and intended student learning workflows; the study did not report interview-, focus-group-, or questionnaire-based requirements elicitation and did not conduct respondent usability testing. An iterative prototype cycle covered quick design, DFD/ERD modeling, interface development, and scenario-based design verification with synthetic display data. The prototype established a role-based learning workflow that connects disaster events with victim records, health services, urgent logistics, dashboard summaries, and crisis reporting. Design verification confirmed traceability among major processes and seven core data entities, while interface evidence was strongest for login and dashboard functions; other modules were verified at the design-traceability level. The educational novelty is the structured simulation workflow linking patient-level documentation with event-level logistics and reporting, rather than the individual use of dashboards, DFDs, ERDs, or role-based access. The prototype demonstrates a coherent learning-oriented design but does not establish usability, performance, interoperability, or operational effectiveness.

How to Cite:
M. A. Darmawan, P. A. Fernanda, and I. A. Sari, "Design and Development of a Web-Based Disaster Health Information System Prototype for Medical Record and Health Information Students," *J. Kecerdasan Buatan dan Teknol. Inf.*, vol. 5, no. 3, pp. 608–622, 2026.
Doi: `https://doi.org/10.69916/jkbti.v5i3.571`

KEYWORDS

Disaster health information system
Electronic medical record
Health information management
Prototype
Student learning simulation
Educational simulation

ARTICLE INFO

Received: July 3, 2026
Revised: August 15, 2026
Available Online: September 1, 2026

1. INTRODUCTION

Disasters place pressure on health systems because casualty identification, triage, service delivery, referral, logistics, and reporting must be conducted under limited time and unstable field conditions. The Health Emergency and Disaster Risk Management framework emphasizes preparedness, readiness, response, and recovery as interrelated functions that must protect health before, during, and after emergencies [1]. Global disaster databases also show that disaster events are not isolated clinical incidents; they affect populations, infrastructure, health service continuity, and public decision-making [2]. For educational institutions that train Medical Record and Health Information students, this condition creates a need for learning media that can simulate the complexity of disaster health documentation rather than only ordinary clinical registration.

Digital health systems are increasingly positioned as part of health system strengthening. The World Health Organization global strategy on digital health highlights the need for digital solutions that are appropriate, accessible, sustainable, and capable of supporting health service transformation [3]. In disaster contexts, the value of digital information is not limited to storing data. Digital platforms can accelerate the conversion of field data into information for action, including victim condition summaries, service utilization, unmet logistics needs, and reports required by coordinators or health authorities.

Previous global work has developed and promoted standardized health data collection tools for emergencies, including the Emergency Medical Team Minimum Data Set, the Early Warning Alert and Response System, and post-emergency surveillance tools [4]. The first large-scale activation of the WHO Emergency Medical Team Minimum Data Set in Cyclone Idai demonstrated that standardized daily reporting could support coordination across teams despite field challenges [5]. In Indonesia, disaster health data standardization has also been linked to the SATUSEHAT platform through Fast Healthcare Interoperability Resources, showing the relevance of interoperability when disaster profiles are connected with national electronic medical record infrastructure [6].

Recent studies have shown the feasibility of electronic records in humanitarian and disaster settings. The Fast Electronic Medical Record system was developed for humanitarian emergencies, disaster response, and conflict zones, illustrating how an open-source electronic health record can operate in resource-limited environments [7]. An Indonesian study on an IT-based disaster medical record prototype in South Kalimantan reported that a web-based disaster medical record system was acceptable and feasible after usability evaluation [8]. A scoping review on health management information systems used in health emergencies also emphasized that emergency systems should capture actionable, practical, accessible, and user-friendly knowledge [9]. These studies indicate the state of the art: disaster health information systems increasingly combine electronic records, standardized data, usability concerns, and operational decision support.

A different problem appears in health information education. Simulation-based electronic health record training has been reviewed as a method for improving practical documentation competencies, although studies still vary in learning goals, feedback methods, and evaluation quality [10]. Academic electronic health records have also been used in undergraduate health education to strengthen informatics learning and computerized documentation skills [11]. A systematic review of medical record-keeping educational interventions found that documentation education can improve skills and attitudes, but also noted continuing gaps in the quality and rigor of learning interventions [12]. These findings suggest that students need realistic, structured, and competency-oriented information system simulations.

The Indonesian policy environment further supports the need for electronic medical record competence. Minister of Health Regulation Number 24 of 2022 requires medical records to be organized electronically in health service facilities [13]. SATUSEHAT is described by the Ministry of Health as an individual health data integration platform designed to support standardization and interoperability across facilities [14]. HL7 FHIR Release 5 provides a health data exchange specification that can guide future integration of patient, service, observation, and supply-related resources [15]. These regulatory and technical references make disaster health information learning relevant to both academic competence and national digital health transformation.

The research gap addressed in this article is the absence of a disaster-specific learning prototype for Medical Record and Health Information students that integrates event context, victim-level documentation, health-service records, urgent logistics, and crisis reporting in one structured simulation. The novelty is therefore not the isolated use of dashboards, DFDs, ERDs, or role-based access, which are standard system-development components, but their use to support a sequenced educational workflow in which students can connect patient-level records with event-level response information and reporting. As summarized in Table 1, prior work has focused on operational humanitarian electronic records, usability-tested disaster medical records, emergency HMIS knowledge attributes, or national FHIR interoperability; the present study is positioned specifically as a design-verified educational simulation and does not claim operational readiness or user usability. Accordingly, the study objectives were to (1) design an integrated disaster health information learning workflow and relational data structure and (2) verify the internal traceability of the prototype through interface inspection and scenario-based design checks.

Table 1. Comparison of Prior Studies and Positioning of the Present Prototype

Prior study	Main focus/evaluation	Position relative to this study
Draugelis et al. [7]	Operational fEMR for humanitarian/disaster care; repeatedly deployed in field settings.	Demonstrates operational EHR feasibility. The present prototype is a classroom-oriented design and adds an explicit event-logistics-report learning workflow, but is not field-deployed.
Asih et al. [8]	Web-based disaster medical record prototype; usability tested with 32 medical-record staff using SUS.	Provides empirical usability evidence. The present study targets student learning and does not claim usability because no respondent testing was conducted.
Faisal and Nakayama [6]	WHO/ASEAN EMT Minimum Data Set mapped to FHIR/SATUSEHAT disaster profiles.	Provides interoperability architecture. The present prototype uses future interoperability as a design direction; FHIR/SATUSEHAT mapping is not implemented.
Burmen et al. [9]	Scoping review of 13 HMIS used in health emergencies and their practical, accessible, user-oriented knowledge attributes.	Provides design rationale for actionable information. The present prototype operationalizes these ideas in an educational interface, without validating effectiveness.

2. RESEARCH METHODS

2.1. Research Design

This study used a prototype development design because the expected functions had to be visualized, checked for data-process consistency, and refined before any full implementation or classroom evaluation. ISO/IEC 25010:2023 [16] and ISO 9241-11:2018 [17] were used only as conceptual quality lenses, not as evidence of standards compliance or usability certification. Table 2 operationalizes the characteristics that were relevant to this design-verification stage and explicitly identifies the characteristics that were not empirically tested. The iterative sequence followed requirements synthesis, quick DFD/ERD and interface design, prototype representation, scenario-based design verification, and revision/refinement, as illustrated in Figure 1. This use of iteration is consistent with prototype development as a means of translating requirements into visible system behavior before full-scale deployment [18].

Table 2. Quality Characteristics and Design-Verification Indicators

Quality lens	**Operational indicator in this study**	**Evidence and limitation**
Functional suitability	Required learning tasks are represented and traceable to interface/process/data components.	Checked through module completeness and scenario-to-DFD/ERD traceability; not a production acceptance test.
Usability / context of use	Navigation, labels, hierarchy, and readability can be inspected in the prototype screens.	Visual inspection only; effectiveness, efficiency, satisfaction, SUS, and task-completion measures were not collected.
Reliability	Data relationships and expected process paths are internally consistent.	Structural consistency only; no uptime, recovery, concurrency, or fault-tolerance testing.
Security	Role-based access and credential fields are represented in the design.	No penetration testing, access-control audit, encryption implementation test, or security certification.
Maintainability	Processes and data entities are separated into modular components.	Assessed conceptually through DFD/ERD organization; no code maintainability metric.
Portability	The interface is conceived as web-based.	No browser matrix, mobile-device, offline, or deployment-environment testing.

2.2. Object and Prototype Dataset

The object of this study was a web-based Disaster Health Information System prototype intended for disaster health information learning. The intended simulation roles were admin/lecturer, student, and simulation officer. No real patient data were used, and the manuscript does not report participant-derived requirements data or respondent usability testing. The prototype used synthetic, illustrative values to demonstrate entry fields, dashboard summaries, relational structure, and reporting logic. The revised dashboard snapshot contains three recent disaster-event entries, an aggregate victim count of 128, a health-service summary value of 18, and 15 unmet urgent needs; these values are interface mock data rather than a fixed database sample or performance dataset. Because no physical database population was executed as part of the reported verification, a single database-level record count is not applicable. Table 3 provides more than one example value for each data object.

Table 3. Object and Prototype Dataset

Data object	Main fields	Purpose in prototype	Example value
Disaster event	Event name, type, date, location, description	Records incident identity and disaster context	Flash flood - Semarang Regency; earthquake - Salatiga City
Victim	Name, age, gender, condition, status, address, event ID	Records affected persons and casualty condition	Moderate injury, alive; severe injury, referred
Health facility	Facility name, type, address, contact, coordinates	Represents referral or service locations	Community health center; district hospital
Medical service	Victim ID, facility ID, date, service type, diagnosis, treatment	Documents health services delivered to victims	General examination; wound care and referral
Logistics need	Event ID, item, quantity, unit, priority, status	Tracks urgent medical and public health needs	Clean water, high priority; emergency medicines, critical priority
Report	Report type, period, description, file path, generator	Produces recap and crisis reports for simulation	Daily crisis summary; event casualty and logistics recap

2.3. Development Stages

The development stages consisted of five iterative activities. First, functional requirements were synthesized from disaster health documentation tasks, the policy and standards cited in this manuscript, prior disaster/EHR literature, and intended Medical Record and Health Information learning activities [4–15]. No interviews, focus groups, or questionnaires with students or lecturers were reported for requirements elicitation; therefore, no participant-derived elicitation dataset is analyzed in this article. Second, a quick design was prepared through page-layout sketches, dashboard components, DFD Level 1, and ERD. Third, a web-interface prototype was prepared for login, dashboard, disaster event, victim, health service, logistics, report, user, and setting functions. Fourth, the relational design was mapped into seven core entities: `users`, `disaster_events`, `health_facilities`, `victims`, `medical_services`, `needs_logistics`, and `reports`. Fifth, scenario-based design verification applied black-box-style input-output logic to check whether the specified input, expected interface response, and data-model path were mutually consistent [19]. The study artifact consisted of web-interface screens plus DFD/ERD and synthetic scenarios; production server configuration, programming framework, DBMS performance, mobile runtime, and live interoperability endpoints were outside the evaluated environment and are not claimed as tested technologies.

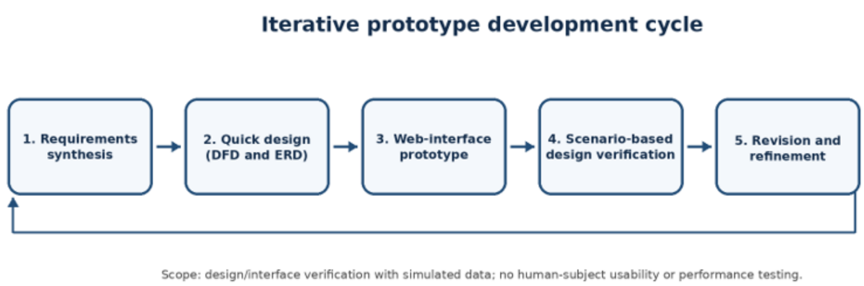

Figure 1. Iterative prototype development cycle used in this study

2.4. Functional Requirements

Table 4. User-Role Functional Requirements

User role	Core access	Main activity	Expected output
Admin/Lecturer	Login, user management, report request, dashboard monitoring	Manage accounts, review data, and generate recaps	Validated account data and crisis reports
Student	Login, disaster event input, victim data input, event review	Practice disaster documentation and victim registration	Structured event and victim records
Simulation officer	Needs input, service needs, report request	Record health service needs and logistics shortages	Needs list, logistics status, and report information

Table 5. System and Database Requirements

Requirement	Design response	Verification indicator
Authentication and role control	Users entity and role-based navigation separate lecturer/admin, student, and simulation-officer functions.	Login/role pathway visible; implementation security not penetration-tested.
Event-victim traceability	`victims` references `disaster_events` and the recording user.	ERD relationship and scenario path are present.
Service traceability	`medical_services` links victim, health facility, date/type of service, and handling user.	ERD relationship and service scenario are present.
Logistics traceability	`needs_logistics` links requested items and priority/status to a disaster event.	ERD relationship and dashboard logistics summary are present.
Reporting and aggregation	Reports are generated conceptually from event, victim, service, and logistics information.	DFD/report path is traceable; file export is not implemented/tested.

2.5. Data Flow Diagram and Entity Relationship Diagram

The DFD Level 1 was used to describe how external actors interact with five system processes: login and user management, disaster event management, victim or patient data management, health service needs management, and report recapitulation. The ERD was used to define the relational database structure that supports these processes. The DFD ensured that no major process operated without input or output, while the ERD ensured that disaster events could be connected to victims, services, logistics needs, health facilities, users, and reports.

2.6. Evaluation Procedure

The prototype was evaluated at a limited design-verification level through (1) visual inspection of interface completeness, (2) traceability between user scenarios, DFD processes, and ERD entities, and (3) black-box-style scenario checks that compared specified input, expected behavior, and available interface evidence. No human respondents, questionnaire, SUS score, task-completion time, statistical criterion, physical database performance test, mobile-device test, security test, or FHIR/SATUSEHAT transaction test was conducted. During iterative verification, one concrete mock-data inconsistency was identified on the dashboard: the total disaster-event card initially displayed 2 while the recent-event panel displayed 3 entries. The card was corrected to 3 in the revised prototype image. A second verification-specification issue was also corrected: the earlier scenario matrix treated the presence of DFD/ERD structures as observed prototype output. The revised matrix separates visible interface evidence from structural traceability and avoids labeling unexecuted functions as fully passed. Consequently, the findings should be interpreted as design verification rather than evidence of usability, implementation effectiveness, or operational readiness.

3. RESULTS AND DISCUSSION

3.1. Overall Prototype Implementation

The prototype produced a web-based Disaster Health Information System with a public login interface and an authenticated role-based dashboard. The design uses a disaster-response visual identity, card-based summaries, and module navigation to structure the sequence from event registration to victim documentation, health-service recording, logistics monitoring, and reporting. For student learning, this sequence is important because it frames documentation as a connected information cycle rather than a set of independent forms: data are first captured at event and victim level, then linked to services and resource needs, and finally interpreted through summaries and reports. Figures 2 and 3 show the two interface screens that are directly evidenced in this manuscript.

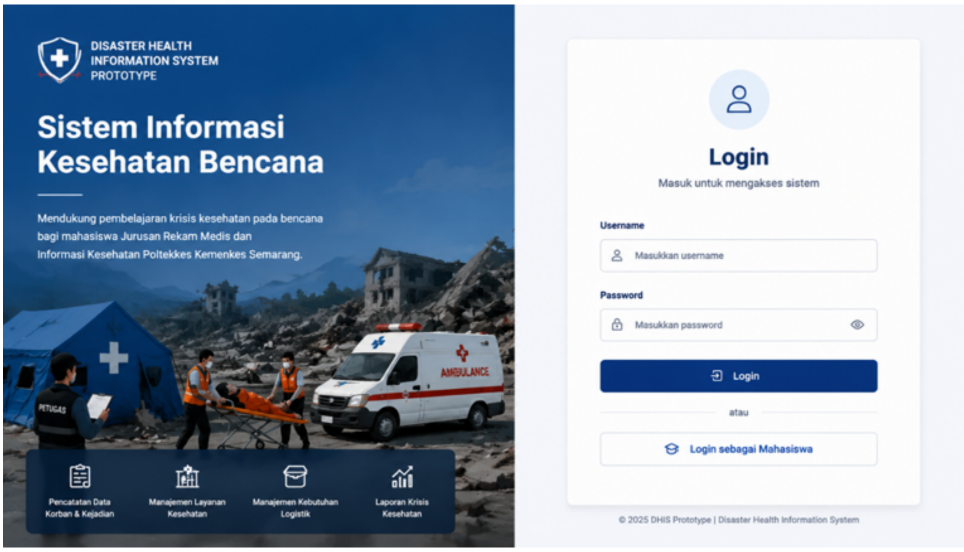

Figure 2. Role-based login interface for the DHIS learning prototype

Figure 2 presents the public login interface of the prototype, which serves as the entry point to the system. The left panel communicates the system's identity and purpose: it displays the disaster-health branding, states the prototype's role in supporting crisis-health learning for students of the Medical Records and Health Information Department of Poltekkes Kemenkes Semarang, and previews the four core modules—victim and incident recording, health service management, logistics needs management, and health crisis reporting—against a disaster-response visual backdrop of rescue personnel, an ambulance, and a field tent. The right panel contains the authentication mechanism, consisting of username and password fields for role-based access and an alternative "login as student" option that allows learners to enter the system for educational use. Together, these elements position the login screen not merely as a security gate but also as an initial orientation to the scope and learning context of the system.

Figure 3. Authenticated dashboard showing disaster, victim, service, and urgent-logistics summaries

Figure 3 presents the authenticated role-based dashboard, shown here from the admin/lecturer perspective, which consolidates the system's information cycle into a single operational overview. At the top, four summary cards report the current state of the response: three registered disaster events, 128 recorded victims, 18 health services delivered, and 15 urgent needs that remain unfulfilled. Below them, a donut chart classifies victims by condition—mild (48.4%), moderate (29.7%), severe (14.1%), and deceased (7.8%)—while adjacent panels list the most recent disaster events, the most urgent logistics needs with their priority and fulfillment status (for example, a clean-water need of 5,000 liters against 1,200 liters available, flagged as high priority and insufficient), and a summary of health services provided to victims. The sidebar navigation gives access to the underlying modules—disaster events, victim data, health services, logistics needs, reports, and user management—mirroring the documentation sequence from event registration through to reporting. Taken together, the dashboard demonstrates how the prototype transforms field-level records into interpreted summaries, giving both decision-makers and students a connected picture of disaster health management rather than a set of disconnected forms.

3.2. Login and Role-Based Access

The login module functions as the entry point for authenticated simulation users and separates standard username-password access from the student pathway. In an educational context, this role separation supports controlled task allocation: lecturers or administrators can review aggregate information and account settings, while students can be restricted to documentation activities that are relevant to the learning scenario. The `users` entity stores username, password credential, full name, role, email, phone, and creation time. At the present stage, role separation is a design feature only; the study did not test password security, authorization bypass, or other security controls.

3.3. Dashboard as Crisis Information Summary

The dashboard module was designed as the main crisis-information summary. In the revised mock dataset, the disaster-event card displays 3 to match the three recent-event entries, while the same screen also displays an aggregate victim count of 128, a health-service summary value of 18, and 15 unmet urgent needs. Victim-condition categories, recent events, logistics gaps, and service summaries are presented together so students can practice moving from individual documentation to situation-level interpretation. This design choice matters educationally because Medical Record and Health Information work in disasters includes secondary use of data for coordination and prioritization, not only data entry. The dashboard values remain synthetic interface examples and should not be interpreted as measured response outcomes.

3.4. Disaster Event and Victim Data Modules

The disaster-event module records event name, type, date, location, and description, and the victim module records identity, age, gender, condition, status, address, event identifier, recording date, and recording user. Making the disaster event the parent context is analytically important because the same victim-level fields have different meaning when aggregated by incident, location, and response period. For students, this relationship demonstrates how casualty records can support event-specific counts, referrals, morbidity summaries, and subsequent reporting. The design therefore extends ordinary visit-oriented documentation by explicitly preserving the disaster context needed for population-level interpretation.

3.5. Health Service and Logistics Modules

The health-service module links a victim with a health facility and records service date, service type, diagnosis, treatment, referral destination, and handling user. The logistics module separately records event-related needs such as clean water, food, medicines, quantity, unit, priority, date, and requester. Keeping service and logistics structures distinct but connected to the same disaster context helps students differentiate clinical documentation from resource-management information while still understanding how both contribute to a coordinated response. In simulation, this enables a learning task in which a student can trace why a shortage shown on the dashboard matters for documented services and referrals, although the present study did not measure whether the prototype improves such decision-making.

3.6. Report and Recapitulation Module

The report module is designed to recapitulate event, victim, service, and logistics information using report type, period, description, file path, generator, and creation time. This is relevant to Medical Record and

Health Information education because it links primary data capture with secondary data use for monitoring and institutional reporting. The DFD shows how a report request retrieves information from the relevant data stores, while the ERD defines the relationships needed for traceable aggregation. At the current prototype stage, this represents reporting logic rather than a validated export function; PDF/Excel/CSV export and digital signatures remain future implementation tasks.

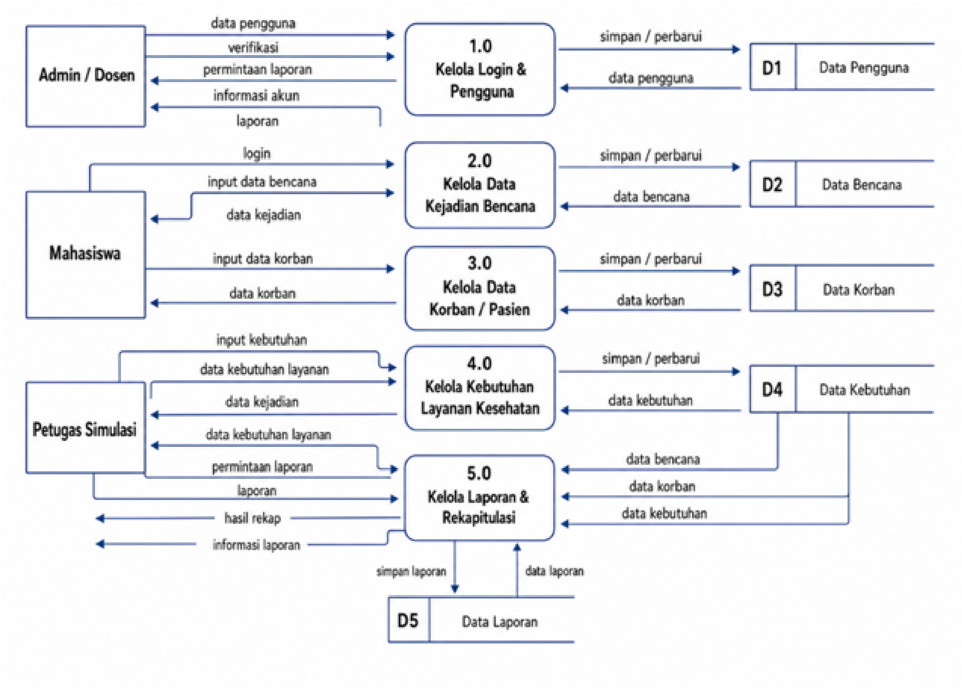

Figure 4. DFD Level 1 showing simulation actors, core processes, and data stores

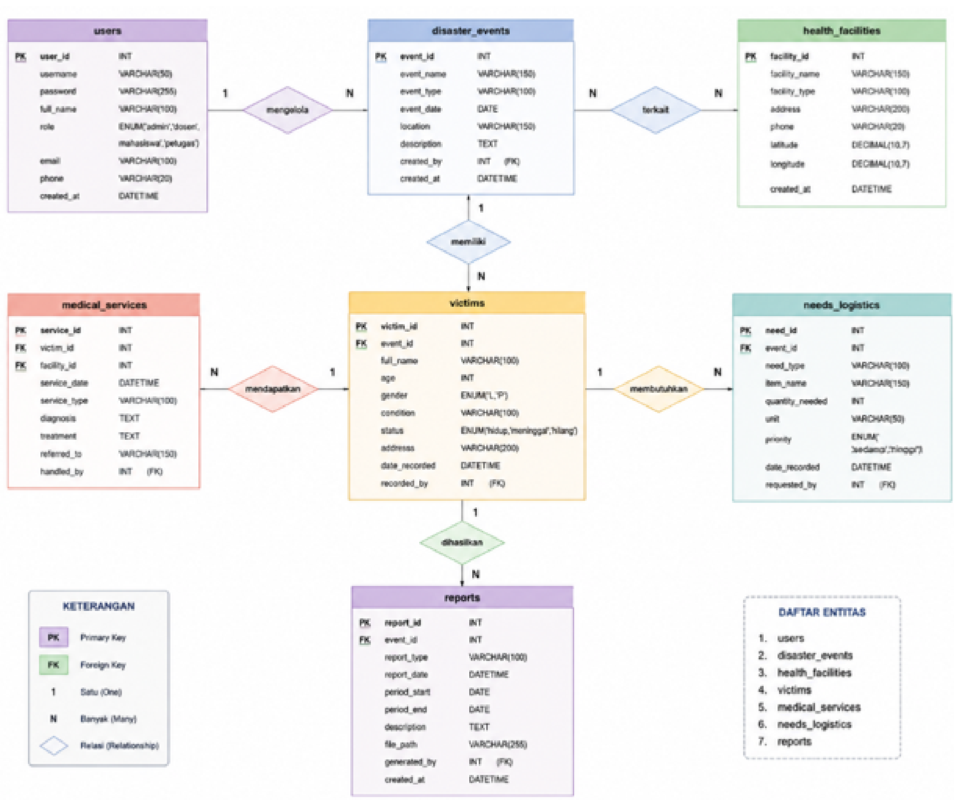

Figure 5. Entity Relationship Diagram linking users, events, victims, facilities, services, logistics needs, and reports

3.7. Database Design and Data Traceability

The ERD contains seven main entities: `users`, `disaster_events`, `health_facilities`, `victims`, `medical_services`, `needs_logistics`, and `reports`. The design makes `disaster_events` the contextual anchor for victim and logistics information, while `medical_services` links victims with health facilities and handling users. This structure matters for learning because students can follow a traceable chain from who recorded an item, to which event and victim it belongs, to which service or logistics need it contributes. Such traceability is a prerequisite for credible aggregation and later interoperability mapping, but the present study did not test database constraints, query performance, or data-quality error rates in a physical DBMS.

3.8. Process Design Based on DFD Level 1

The DFD Level 1 contains three external actors, admin/lecturer, student, and simulation officer, and five logical data stores for user, disaster, victim, needs, and report data. The processes separate authentication/user management, disaster-event management, victim management, health-service/needs management, and report recapitulation. For students, this process model makes the origin and destination of data explicit and can be used by instructors to discuss responsibility, hand-offs, and the consequences of incomplete data. The DFD therefore serves as a process-learning artifact as well as a software model; however, the diagram alone is not treated as proof that a function executed successfully.

3.9. Scenario-Based Functional Verification

Scenario-based design verification used synthetic values and black-box-style logic to check whether specified inputs, expected behavior, visible interface evidence, and data-model traceability were mutually consistent. The revised interpretation intentionally distinguishes direct interface evidence from structural design evidence. Login and dashboard behavior can be inspected directly in Figures 2 and 3. For event, victim, service, logistics, and report scenarios, the manuscript provides design fields, DFD/ERD links, and expected behavior but does not provide execution logs or screen-by-screen test evidence; these scenarios are therefore classified as design-traceability verified rather than simply Passed. Table 6 also records the dashboard count inconsistency that was identified and corrected during iteration.

Table 6. Scenario-Based Design Verification

Scenario	Input	Expected behavior	Observed prototype/design evidence	Status
Login	Username and password	Opens pathway according to user role	Login interface and separate student pathway are visible in Figure 2.	Interface-design verified
Dashboard summary	Synthetic event, victim, service, and logistics values	Displays aggregate cards and summaries	Figure 3 shows cards, chart, recent events, logistics gaps, and service recap. Event count was corrected from 2 to 3 to match the three recent-event entries.	Verified after correction
Disaster event entry	Event name, type, date, location	Stores/represents event within disaster context	Required fields and event-to-child relationships are specified; no execution log is reported.	Design-traceability verified
Victim entry	Identity, age, gender, condition, status, event ID	Links victim to disaster event	Victim fields and `victims`→`disaster_events` relationship are specified; no execution log is reported.	Design-traceability verified
Health service entry	Victim ID, facility ID, service type, diagnosis, treatment	Links service to victim and facility	`medical_services`→`victims/health_facilities` relationships are specified; no execution log is reported.	Design-traceability verified
Logistics need entry	Item, quantity, unit, priority, event ID	Links unmet need to event and summary	`needs_logistics`→`disaster_events` relationship and dashboard logistics representation are specified.	Design-traceability verified
Report generation	Report period and report type	Retrieves relevant data for recap	Report process and report entity are traceable; actual file export is not demonstrated.	Partially verified; export not tested

3.10. Discussion

The present prototype occupies a different evidence level from the Fast Electronic Medical Record (fEMR) described by Draugelis et al. [7]. fEMR was designed for real humanitarian clinical operations and has been repeatedly deployed, demonstrating operational feasibility and the value of electronic records for both patient care and population-level information. By contrast, the present DHIS is not an operational EHR. Its contribution is educational: it organizes disaster-event context, victim documentation, health services, urgent logistics, dashboard interpretation, and reporting into one simulation sequence for Medical Record and Health Information students. This broader learning workflow is an advantage for teaching integrated information management, but the absence of field deployment is a major limitation relative to fEMR.

The South Kalimantan prototype reported by Asih et al. [8] provides a second important comparison. That study involved 32 medical-record staff and obtained an average System Usability Scale score of 79.31, providing empirical evidence of user acceptability. The current study does not provide equivalent usability evidence and therefore should not be interpreted as showing that students or lecturers find the interface easy to use. Its narrower contribution is the design of a student-oriented simulation environment that explicitly connects clinical documentation with logistics visibility and crisis reporting. A subsequent study should test whether this educational integration produces acceptable usability and measurable learning benefits.

Faisal and Nakayama [6] addressed a different layer of the disaster-information problem by mapping WHO and ASEAN Emergency Medical Team minimum datasets to FHIR resources for SATUSEHAT. Their work demonstrates how standardized disaster data can be represented for interoperability. The present prototype has not implemented FHIR profiles, an API, or SATUSEHAT transactions; therefore, interoperability remains a future design target rather than a result. The current ERD can nevertheless serve as a teaching bridge for explaining why local entities and fields must eventually be mapped to standardized resources before cross-system exchange is possible.

The scoping review by Burmen et al. [9] highlights practical, accessible, user-oriented, and decision-supporting characteristics of HMIS used during health emergencies. The dashboard and role-based workflow in the present prototype were designed to expose students to these information needs by converting event, victim, service, and logistics data into summaries that can be interpreted for coordination. This alignment is conceptual, not empirical: the study did not measure whether the prototype improves decision quality, response speed, or knowledge retention. The revised verification scope therefore separates design plausibility from demonstrated effectiveness.

From an educational perspective, the prototype may support competencies in disaster-event registration, victim-level documentation, linkage of services and facilities, recognition of logistics gaps, data aggregation, and crisis-report preparation. These potential learning outcomes are consistent with literature on simulation-based and academic electronic health record training [10–12], but they were not measured in the present study. A rigorous educational evaluation should compare students using the prototype with students using paper or spreadsheet documentation and assess documentation accuracy, task completion, time on task, interpretation of dashboard summaries, and reporting quality.

3.11. Strengths and Limitations

Having examined the prototype's implementation and its alignment with the intended learning objectives, it is necessary to position both its contributions and the boundaries of its claims. The strengths and limitations of the prototype, organized according to the six aspects that guided its development and assessment—learning relevance, interface, data model, reporting, security, and interoperability—are summarized in Table 7.

Table 7. Strengths and Limitations

Aspect	**Strength**	**Limitation**
Learning relevance	Uses disaster-specific scenarios for Medical Record and Health Information student learning.	No human-subject usability or learning-effectiveness testing was conducted.
Interface	Provides role-based login, dashboard cards, charts, tables, and module navigation.	Only login/dashboard interface evidence is shown; mobile responsiveness and cross-browser behavior were not tested.
Data model	Uses relational entities and traceable event-victim-service-logistics-report relationships.	No physical database constraint, concurrency, or performance test was conducted.
Reporting	Connects data capture conceptually to crisis recapitulation.	Actual PDF/Excel/CSV export, digital signature, and report-output validation were not tested.
Security	Includes role separation as a design concept.	No penetration test, authorization audit, encryption verification, or audit-trail implementation test.
Interoperability	ERD provides a basis for future mapping to national/international standards.	FHIR mapping and SATUSEHAT integration were not implemented or tested.

Table 7 shows that the prototype's principal strengths lie in its pedagogical grounding and in a coherent, traceable information model that links events, victims, services, logistics, and reports, which together support its intended use as a learning artifact for Medical Record and Health Information students. Its limitations, by contrast, are concentrated in validation activities that lay beyond the scope of the present study, namely human-subjects usability and learning-effectiveness testing, database constraint and performance testing, implementation testing of report exports and security mechanisms, and standards-based interoperability with FHIR or SATUSEHAT. These limitations do not diminish the prototype's contribution; rather, they define the boundary within which the findings of this study should be interpreted and provide a concrete agenda for future work, including user testing with students, implementation of export, security, and audit-trail mechanisms, and incremental alignment with national and international health information standards.

3.12. Future Development

Future development should follow a phased roadmap. Phase 1 should conduct formal usability and learning evaluation with students and lecturers using validated instruments such as the System Usability Scale, direct task observation, task-completion rates, error counts, and time-on-task measures; an instructor guide with sample disaster scenarios, exercises, and assessment rubrics should accompany this phase. Phase 2 should implement responsive/mobile access, offline synchronization, stronger authentication and audit trails, backup/retention rules, and report export to PDF, Excel, or CSV. Phase 3 should map the data model to relevant HL7 FHIR resources, such as Patient, Encounter, Observation, ServiceRequest, and SupplyDelivery, and test an interoperability pathway with SATUSEHAT [15]. A comparative educational study should then evaluate whether students using the prototype outperform paper- or spreadsheet-based documentation in accuracy, speed, data integration, and interpretation of crisis summaries. Validation with disaster-response organizations or health facilities would further assess whether the simulated data model and report formats correspond to real operational requirements.

4. CONCLUSION

This study produced a design-verified web-based Disaster Health Information System prototype for Medical Record and Health Information student learning. The prototype organizes disaster-event recording, victim documentation, health-service information, urgent logistics, dashboard summaries, and crisis reporting within a role-based simulation workflow, while the DFD and ERD provide traceable process and data relationships. Its principal educational contribution is the integration of patient-level medical record concepts with event-level response information and reporting in one learning design. At the present evidence level, however, the study demonstrates internal design coherence rather than proven usability, learning effectiveness, database performance, mobile compatibility, security, or operational readiness. No human-subject usability testing, physical database performance testing, mobile/browser testing, or FHIR/SATUSEHAT integration was conducted. Future work should therefore validate the prototype with students and lecturers, implement and test the production technology stack, strengthen security and offline/mobile functions, and evaluate standards-based interoperability and comparative learning outcomes.

ACKNOWLEDGMENTS

The authors would like to acknowledge the support and facilitation provided by the Health Polytechnic of the Ministry of Health Semarang, which enabled the development and implementation of this research. Appreciation is also extended to the Disaster Health Information System (DHIS) prototype development team for their technical assistance and collaboration during the system design and testing process. The authors further acknowledge the disaster simulation data contributors and health service simulation environment, which served as the primary research object in this study.

DECLARATIONS

Author Contributions:

The authors contributed to the study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Funding:

The authors received no financial support for the research, authorship, and/or publication of this article.

Conflicts of Interest:

The authors declare that they have no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

AI Use Statement:

During the preparation of this work, the authors used ChatGPT to improve the language and readability of the manuscript. After using this tool, the authors reviewed and edited the content and take full responsibility for the final manuscript.

Additional Information:
No additional information is available for this paper.

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