Design of a Web-Based Internal Claim Audit Application in the Casemix Unit in a Hospital to Minimize Pending Claims

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ABSTRACT

The Casemix Unit plays a strategic role in the submission and reimbursement of healthcare service claims for BPJS Kesehatan participants. Nevertheless, many hospitals continue to experience pending claims due to administrative errors, incomplete documentation, coding inaccuracies, prolonged verification processes, policy changes, and limited integration of information systems. This study aimed to design and evaluate a web-based internal claim audit application to improve verification effectiveness and reduce pending claims in the Casemix Unit. This research adopted a Research and Development (R&D) approach using the Borg and Gall model and was conducted over one year at RSU Prof. Dr. M. A. Hanafiah Batusangkar, where an increasing number of pending claims was identified in 2024. System evaluation was carried out through usability assessment, and comparative observation of the claim audit process before and after prototype implementation. The results demonstrated that all application features functioned according to system requirements. Implementation of the application contributed to improved operational efficiency, enhanced accuracy in document and coding verification, and faster claim review time compared to the previous manual process. The application includes document completeness verification, coding validation, claim status monitoring, and AI-assisted early detection of potential errors with corrective recommendations. These findings indicate that the system is feasible and capable of supporting a more structured and consistent internal audit process. The study concludes that the application has strong potential to improve claim management quality and support hospital financial sustainability. Future studies should conduct broader implementation, integrate the system with hospital information systems and BPJS platforms, and perform long-term quantitative evaluations of its effectiveness.

Keywords: BPJS; Casemix; Coding Audit; Pending Claims; Web-Based System.

INTRODUCTION

Pending claims from BPJS Kesehatan represent a significant issue that affects hospital operations, particularly in financial performance and healthcare service quality. BPJS Kesehatan claims refer to the process of submitting reimbursement for healthcare services provided to participants of the National Health Insurance (Jaminan Kesehatan Nasional/JKN), which hospitals submit monthly to BPJS Kesehatan. If claim documents are complete and compliant with regulations, the claims are approved and paid. However, discrepancies in documentation or administrative errors result in claims being returned (pending) for correction and resubmission in subsequent periods(1). In this process, the Casemix Unit plays a strategic role, as it is responsible for patient data verification, completeness of claim documentation, and administrative management of healthcare claims(2).

Pending claims directly disrupt hospital cash flow due to delays in reimbursement from BPJS Kesehatan. This condition causes hospitals to experience financial difficulties in meeting operational obligations, including salary payments for healthcare personnel, procurement of medicines and medical equipment, and other operational expenses(3). Furthermore, delays in claim payments have the potential to reduce healthcare service quality, affecting effectiveness, efficiency, patient safety, and comfort . Administrative workload also increases, as Casemix staff must repeatedly verify, revise, and resubmit pending claims, thereby reducing work efficiency and service productivity(4).

Previous studies indicate that the main causes of pending claims include incomplete medical record documentation, errors in diagnosis and procedure coding, limited coder understanding of BPJS Kesehatan regulations, and suboptimal implementation of internal coding audits within the Casemix Unit(5). Additionally,

limitations in non-integrated information systems and weak continuous monitoring make it difficult to identify potential claim errors at an early stage(6). Consequently, hospitals tend to adopt a reactive approach by correcting claims only after they are declared pending by BPJS Kesehatan, rather than implementing systematic preventive measures through internal control mechanisms(7).

The current state of the art in BPJS Kesehatan claim management indicates that previous studies have mainly focused on improving human resource competencies, strengthening standard operating procedures, and optimizing administrative claim information systems(3). Several studies report that coding inaccuracies, incomplete documentation, and weak internal verification processes remain major contributors to pending claims, indicating that existing approaches have not fully addressed the problem(8). However, these studies generally emphasize managerial and procedural improvements and provide limited discussion on the development of integrated technology solutions for internal claim audits(9). Therefore, the novelty of this study lies in the design of a web-based internal claim audit application specifically developed for the Casemix unit, which enables systematic and early detection of potential claim discrepancies before submission. In addition, this study proposes the integration of structured validation features and artificial intelligence (AI)–supported decision assistance to enhance the effectiveness and efficiency of the internal audit process, thereby contributing a more comprehensive technological approach to minimizing pending claims in hospitals(10).

Based on a preliminary survey conducted at RSU Prof. Dr. M. A. Hanafiah Batusangkar, it was identified that throughout 2024 the number of pending claims showed an increasing trend with monthly fluctuations(11). Observations also indicated that no application-based internal audit system had been implemented in the Casemix Unit, resulting in less optimal claim control and evaluation processes(12). To address this gap, this study employed a research and development (R&D) approach with a system design methodology, involving needs assessment, system modeling, prototype development, and functional testing of a web-based internal claim audit application. This methodological approach was used to systematically design and evaluate a technological solution as a preventive strategy to reduce pending claims(13).

The novelty of this study lies in the design of a web-based internal claim audit application integrated with the BPJS Kesehatan claim management workflow and equipped with artificial intelligence features to detect potential coding errors, document inconsistencies, and incomplete claim data at an early stage. This application not only serves as an administrative verification tool but also functions as a quality control and continuous evaluation instrument by providing historical data, performance indicators, and system-based improvement recommendations(14).

Based on the above considerations, this study aims to design a web-based internal claim audit application to improve the efficiency and accuracy of claim verification processes, accelerate BPJS Kesehatan claim payments, and support hospital operational sustainability through systematic and continuous prevention of pending claims.

METHODS

The research method used in this study is the Research and Development (R&D) method. The development design adopted is based on the Borg and Gall model, which consists of ten stages(15). This research was conducted through systematic and continuous stages to produce a web-based internal claim audit application for the Casemix unit in hospitals. The initial stage began with information gathering through literature studies, interviews, and field observations to identify problems related to pending claims and to analyze the existing claim submission system(16). This was followed by the planning stage, which included determining system specifications, designing user requirements, preparing software requirement documents, and defining the features and architecture of the internal claim audit application(17). Based on the planning results, the initial product was developed in the form of a web-based application prototype, encompassing interface design, process modeling, as well as database and audit function design. The initial product was then tested through limited trials to assess functionality, validity, security, and system performance, which subsequently served as the basis for revisions in the preliminary product revision stage(18). After that, a main field test was conducted to evaluate the effectiveness of the application in supporting the claim audit process and minimizing pending claims in the Casemix unit, followed by operational product revisions based on user feedback. The operational testing stage was carried out to ensure that the application could operate optimally under real conditions before final refinements were made to produce the final product(19). The final stage of the research was dissemination and implementation, which included deploying the application in the Casemix unit, conducting user training, and preparing system documentation, with outputs consisting of a web-based internal claim audit application, user documentation, scientific publications, research reports, and intellectual property rights(20). The following flowchart illustrates all stages of the research, from the planning phase to the evaluation of the research outcomes:

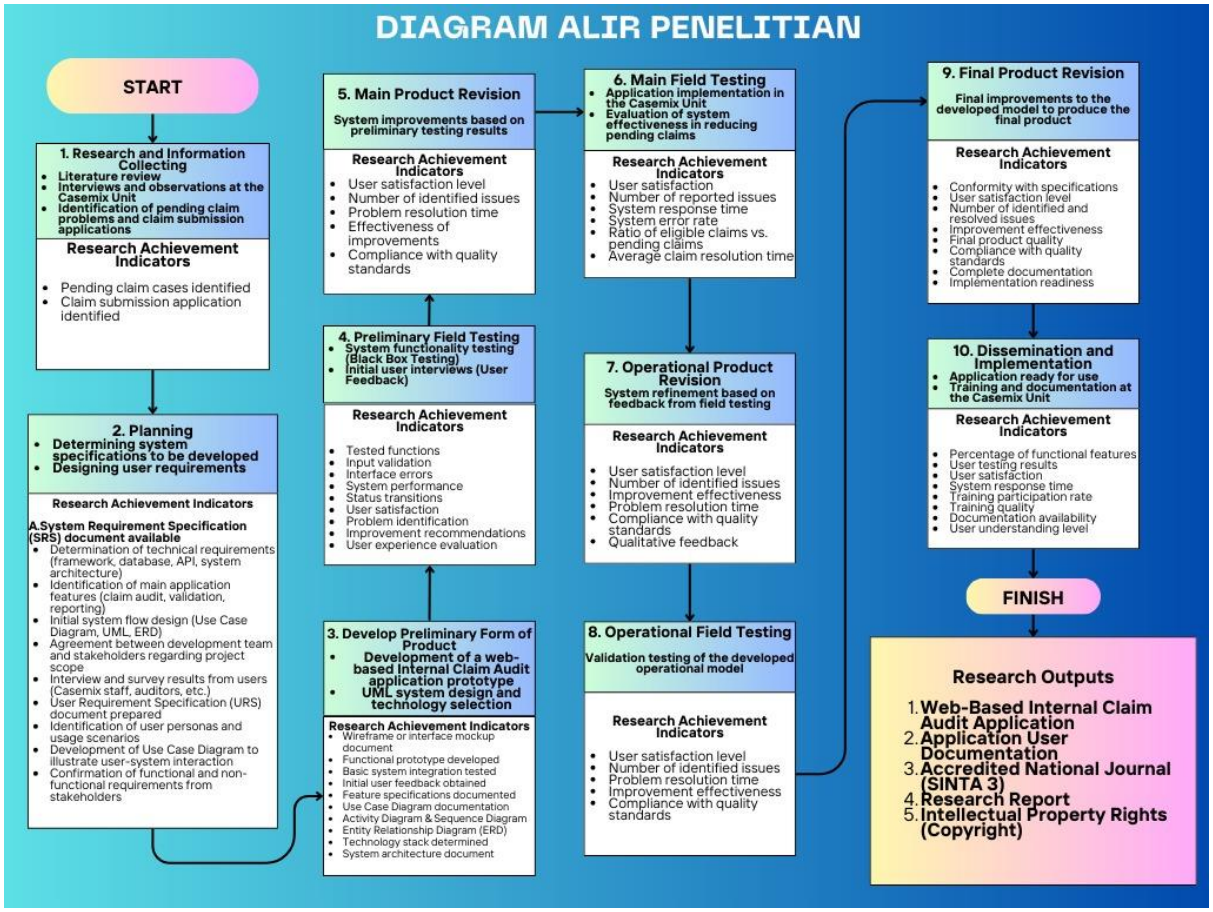

Figure 1. Research Flowchart

RESULTS

Number of Pending Claim Cases at RSUD Prof. Dr. M.A. Hanafiah Batusangkar in 2024.

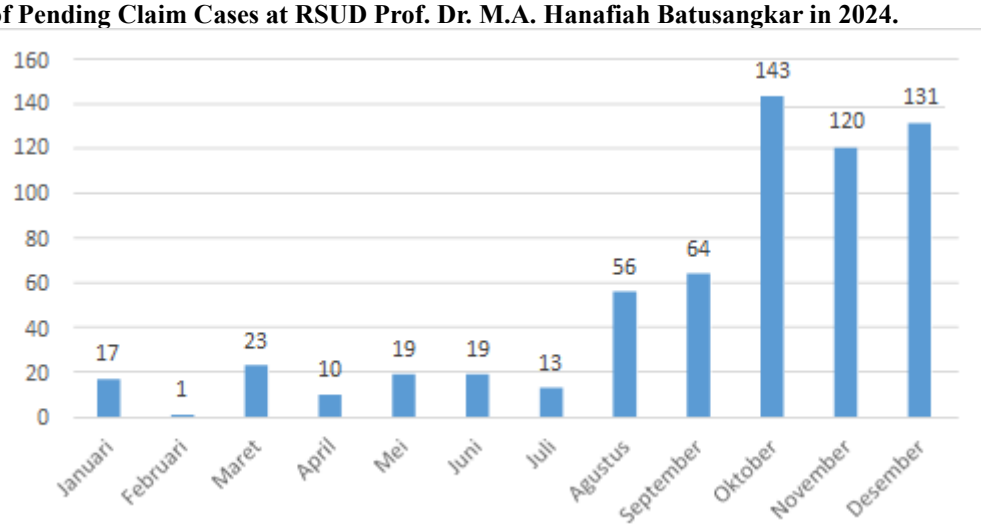

Figure 2. Number of Pending Claim Cases in 2024.

Based on the figure above, it is found that the highest number of pending claim cases occurred in October, totaling 143 cases. From the coding aspect, the main causes of pending claims include errors in coding diagnoses and medical procedures, incomplete medical documents required for claim submission, and coding that has followed the guidelines but is still not accepted by BPJS (Social Security Administering Agency for Health). These issues result in pending claims and delays in the claim submission process.

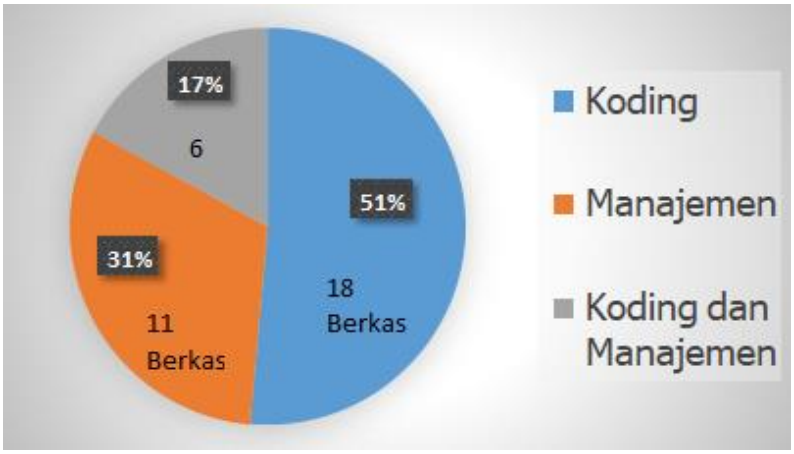

Figure 3. Number and Percentage of Inpatient Pending Claim Cases

Based on the figure above, it is known that the highest number and percentage of pending claim cases are caused by coding aspects, with a total of 18 claim submission files, accounting for 51%.

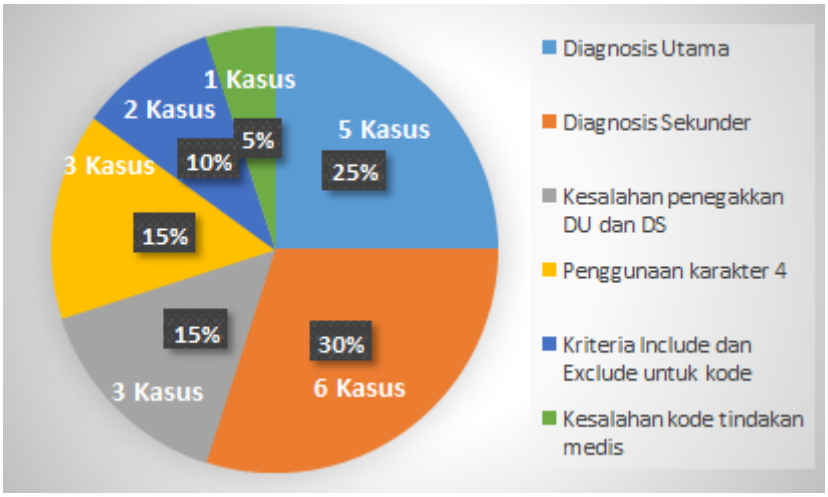

Figure 4. Number of Pending Claim Cases Based on Coding Issues.

Design of a Web-Based Internal Audit Application to Minimize Pending Claims in the Casemix Unit of RSUD Prof. Dr. M.A. Hanafiah Batusangkar.

The implementation results indicate that the internal coding audit application can minimize errors in the submission of BPJS Health claims, thereby reducing the occurrence of pending claims, as evidenced by the application testing that has been conducted(21). Major issues such as pending claims can be addressed through the implementation of internal audits using the developed application. The following section presents the results of the design of the web-based internal claims audit application(22).

The research was conducted through a comprehensive research and development process in which all stages were successfully completed. The study began with research and information collection through literature review, observations, and interviews in the Casemix Unit to identify problems, user needs, and system requirements related to pending claims(23). The planning stage produced system specifications, user requirements, and initial design models. Subsequently, a preliminary form of the product was developed in the form of a prototype web-based internal claim audit application, followed by preliminary field testing using functional testing and user feedback. Improvements were then carried out through the main product revision stage to ensure the system met user needs, performance standards, and usability aspects(24).

Furthermore, the application underwent main field testing to evaluate its effectiveness in supporting early detection of claim discrepancies and reducing pending claims. Based on the evaluation results, operational product revisions were performed and continued with operational field testing to validate system performance in real

workflows. The final product revision confirmed that the application met system feasibility, functionality, and quality standards. The research concluded with dissemination and implementation, including user training and documentation. Overall, the study successfully produced a functional web-based internal claim audit application that improves claim verification processes, enhances user satisfaction, and contributes to minimizing pending claims in the hospital Casemix Unit(25).

Based on the figure above, it can be identified that pending claims caused by coding aspects are primarily due to errors in secondary diagnosis coding. A study conducted by revealed(6) that the factors contributing to pending BPJS Health claims for inpatient services are largely related to administrative aspects. These include discrepancies between the Eligibility Participant Letter (SEP) and the uploaded data, the absence of supporting documents such as billing statements, medical resumes, diagnostic examination results, surgical or procedural reports, inpatient admission orders (SPRI), chronological reports for accident cases, the lack of supporting clinical management recorded in billing data, and cases of patient readmission. In addition, coding errors may also affect the claims process, as research has shown that inaccurate coding can lead to claim delays and administrative issues (26).

Further findings by Wulandari F.(27) indicate that inpatient claims experiencing pending status are generally caused by incomplete claim documentation, both in terms of administrative service verification and healthcare service verification. These issues are often accompanied by errors in diagnosis coding and incomplete medical resumes. Moreover, a study by Meiningtyas(28) found that the frequency distribution of pending National Health Insurance (JKN) claims at Pertamina Central Hospital consisted of 40% pending claims and 60% eligible claims. The study identified several contributing factors to pending claims, including coding accuracy (94%), completeness of medical resumes (95.3%), completeness of medical supporting documents (92.3%), and completeness of administrative documents (84.7%). Based on these findings, it can be concluded that the completeness of administrative documentation plays the most significant role in causing pending claims.

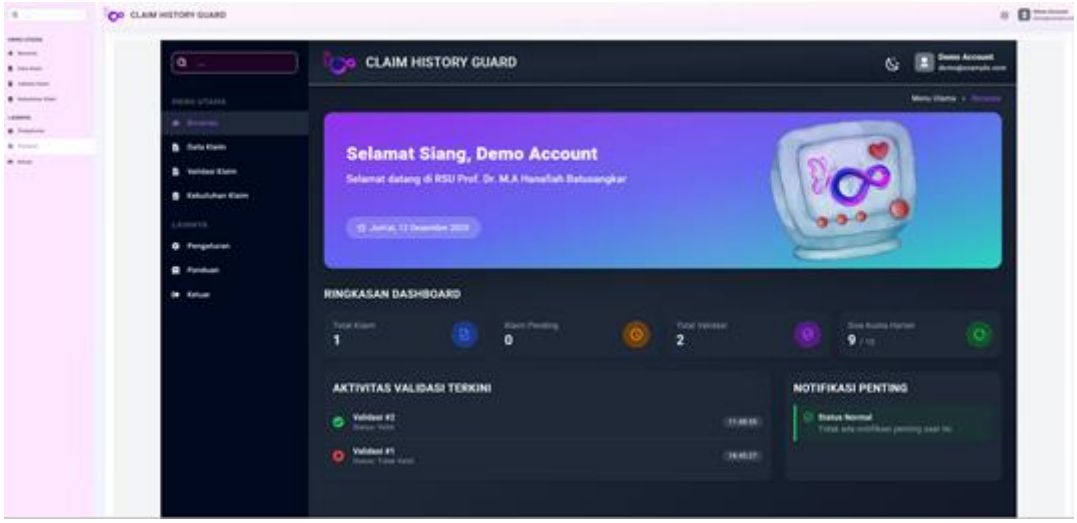

Figure 5. Dashboard Display of the Internal Claim Audit Application

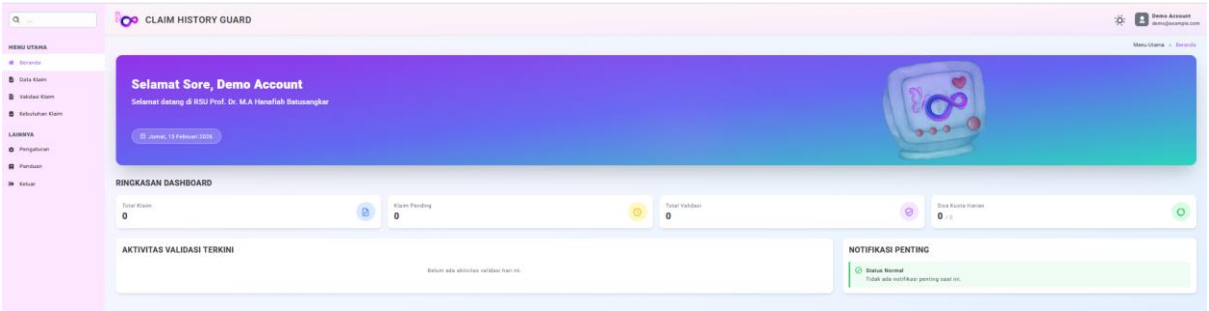

Figure 6. Menu Display of the Claim Audit Application

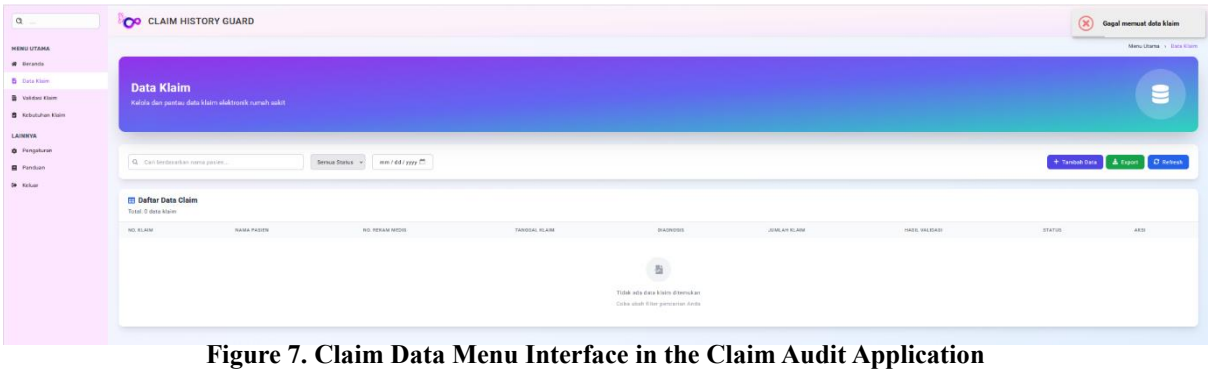

Figure 7. Claim Data Menu Interface in the Claim Audit Application

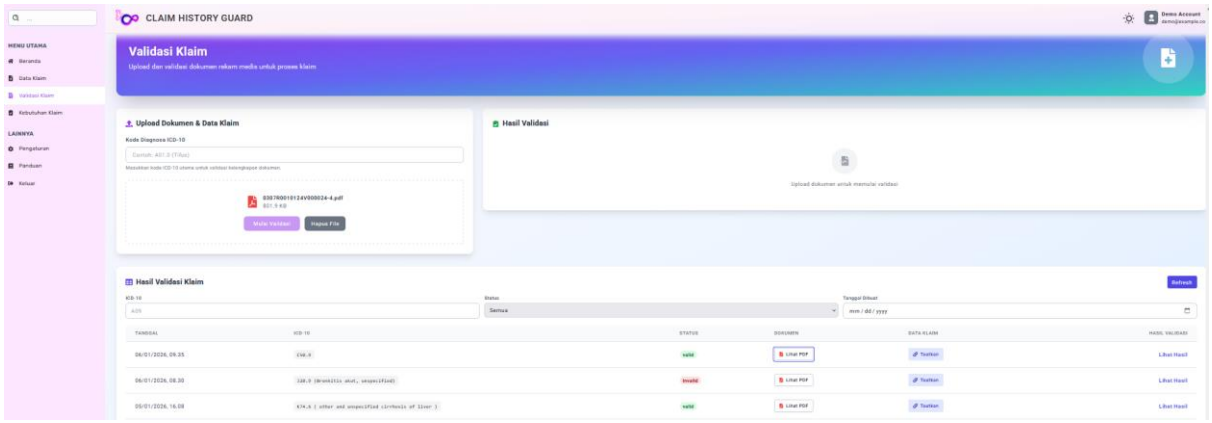

Figure 8. Claim Verification Menu Interface in the Claim Audit Application

Based on the results of the design and implementation of the web-based internal claims audit application for the Casemix Unit, the application was developed to facilitate a systematic and integrated claims auditing process. The user interface includes menus for claims data management, document completeness verification, audit results, and BPJS Health claim status. Information is presented in the form of tables, notifications, and claim status indicators, enabling Casemix officers to monitor the claims process in real time. These features indicate that the interface design has been aligned with the hospital's claims workflow, thereby improving efficiency and accuracy in the internal audit process.(29)

Furthermore, the application supports the implementation of internal audits prior to claim submission to BPJS Health by providing features for administrative completeness checks and validation of diagnosis and procedure coding. Through the availability of audit forms and error or discrepancy indicators, officers can promptly make corrections before the claim submission process. This approach has the potential to reduce the number of returned or pending claims, as common issues such as incomplete documentation, data inconsistencies, and coding errors can be identified at an early stage through the application.(26)

Overall, the results of the interface design of this web-based internal claims audit application demonstrate that the utilization of information technology within the Casemix Unit plays a crucial role in minimizing pending BPJS Health claims. The application functions not only as a data recording tool but also as an internal control system that supports the quality of claims management. With a user-friendly interface and a clearly defined audit workflow, the application is expected to enhance the quality of claim submissions, accelerate the reimbursement process, and support the long-term financial stability of the hospital(30).

One of the main challenges faced by hospital Casemix units is the high rate of pending claims, namely claims that are returned or delayed by BPJS Health or insurance providers due to administrative or clinical discrepancies(31). This condition significantly disrupts cash flow and increases the administrative workload as a result of repeated verification and correction processes. The primary causes of pending claims often include incomplete medical documentation, inconsistencies between diagnosis codes (ICD-10) and procedures, and errors in completing INA-CBGs claim forms(32). Therefore, a system capable of conducting automated and comprehensive internal audits prior to claim submission is required to ensure that all claims meet the established requirements.

The design of a web-based internal claims audit application represents an innovative solution that can be integrated into the Casemix unit's workflow. The application is developed with a rules engine programmed

according to the latest BPJS Health regulations and INA-CBGs coding guidelines. The system automatically scans and validates claim data, including the consistency of diagnosis and procedure codes, the completeness of supporting documents (such as laboratory and surgical reports), and the validation of tariffs and complications(33). Its web-based interface enables multi-user access across related departments, including medical records, nursing, and clinical services, allowing real-time collaborative corrections(34).

The application is designed with core features such as a real-time monitoring dashboard displaying claim statuses, analytical reports to identify recurring error patterns, and an automated notification system that alerts relevant staff to claims requiring correction. In addition, the application includes a learning module that records all types of errors and revisions, serving as a knowledge base for staff training and continuous data quality improvement. Secure integration with the existing Hospital Information System (HIS) is also a key consideration in the system architecture design, as it helps prevent duplicate data entry and minimizes errors(34).

The implementation of this web-based internal audit application is expected to significantly reduce the number of pending claims, thereby accelerating the reimbursement process and enhancing the hospital's financial stability. Beyond its financial impact, the application also promotes standardization and improves the accuracy of clinical data, ultimately contributing to improved service quality. Therefore, the development of this application addresses not only administrative challenges but also represents a strategic investment in digital transformation toward more efficient, accountable, and sustainable hospital governance(35).

DISCUSSION

Despite the promising results, this study has several limitations that should be considered when interpreting the findings. First, the developed web-based internal claim audit application was implemented and tested in a single hospital setting, which may limit the generalizability of the results to other hospitals with different workflows, information systems, and organizational policies. Second, the system currently relies on structured input data and predefined validation rules, so its performance is influenced by the completeness and accuracy of the data entered by users. Third, although the application includes decision-support features, the level of artificial intelligence (AI) utilization is still limited to rule-based assistance and has not yet incorporated advanced predictive analytics or machine learning models. In addition, the evaluation period was relatively short, so the long-term impact on claim acceptance rates and operational efficiency could not be fully measured(36).

Future development should focus on expanding system interoperability with hospital information systems and BPJS claim platforms to enable seamless data exchange and reduce manual input. Further research is also recommended to integrate more advanced AI approaches, such as predictive models for claim rejection risk and automated coding validation, to enhance decision support capabilities(37). Multi-site implementation studies with larger samples and longer observation periods are needed to evaluate scalability, cost-effectiveness, and long-term impact. Additionally, future iterations of the system should incorporate enhanced user experience features, real-time analytics dashboards, and continuous feedback mechanisms to support sustainable adoption and continuous quality improvement in claim management processes(38).

Efficience and accurate management of healthcare claims remains a significant challenge within the National Health Insurance (JKN) system, particularly in hospitals implementing case-mix mechanisms such as INA-CBGs. A substantial proportion of claims are delayed due to a combination of administrative discrepancies, poor medical record quality, and clinical coding errors, which collectively hinder the reimbursement process(39). A recent scoping study identified five main themes contributing to pending claims: inaccurate diagnostic coding, incomplete claim documentation, limited information system capabilities, low human resource competency, and inconsistencies in standard operating procedures across healthcare units(40).

The development of a web-based internal claim audit application offers a structured solution to detect and correct potential errors prior to claim submission to BPJS Kesehatan. Information technology–based systems are able to support verification workflows more effectively than manual audit processes(41). Research findings indicate that claims subjected to internal verification have higher acceptance rates, as both clinical and administrative elements are reviewed at an early stage of the claim process(42).

The internal audit approach in hospital settings is also reflected in the significant role of internal verifiers in reducing the proportion of pending claims(43). An evaluation of internal verifier performance at a Muhammadiyah hospital demonstrated that the assignment and training of internal verifiers successfully reduced the number of pending claims, despite an increase in claim volume(44).These findings emphasize that effective auditing is not solely dependent on information technology but also on human resource management and continuous training for coders and verifiers.

Inter-unit coordination among Casemix teams, medical record units, and hospital information systems (SIMRS) is another critical factor in accelerating claim verification(45). A study conducted within the Casemix team of Hospital X found that although claim quality indicators are influenced by various factors, including system connectivity and data quality, effective coordination remains the primary determinant of successful claim

verification(46).This integration aligns with information system theory, which views interoperability as a key driver of efficiency in healthcare services.

Internal claim audits must also address fraud prevention and regulatory compliance, as administrative errors and fraudulent practices pose risks to hospital financial sustainability(47). A literature review suggests that internal audit initiatives often face communication and training barriers, although they generally improve claim verification outcomes(48).Therefore, an effective audit framework should incorporate feedback mechanisms, monitoring capabilities, and real-time data integration between hospital information systems and BPJS claim platforms to maximize audit effectiveness(49).

Overall, the design of a web-based internal audit application equipped with integrated verification modules, clinical coding training support, and inter-unit coordination workflows demonstrates strong potential to reduce pending claims, accelerate claim verification, and enhance hospital financial performance(50). These findings are consistent with international literature emphasizing the importance of advanced health information systems in supporting claim management and improving clinical data quality (Health Informatics Journal; BMJ Health & Care Informatics), as well as relevant primary research at the national level.

CONCLUSION

Based on the system development and evaluation results, it can be concluded that the web-based internal claim audit application developed for the Casemix Unit functions effectively as a tool to support the claim verification process. System testing was conducted through functional testing using the black-box method, which demonstrated that all main features including document completeness checks, coding validation, audit tracking, and claim status monitoring operated according to the specified requirements without critical errors. In addition, user acceptance evaluation indicated that the application was considered easy to use and helpful in supporting daily claim audit activities. These results indicate that the system is functionally feasible and capable of supporting early detection of potential claim discrepancies.

The implementation of this application shows potential to improve efficiency, consistency, and accuracy in the internal audit process, thereby contributing to efforts to minimize pending BPJS Kesehatan claims. Nevertheless, this study has several limitations, including testing conducted within a single hospital environment and evaluation focusing primarily on functional and usability aspects rather than long-term effectiveness or quantitative measurement of claim reduction. Therefore, future research is recommended to conduct broader implementation across multiple hospitals, perform quantitative effectiveness testing (such as measuring reductions in pending claim rates and processing time), and integrate the system with hospital information systems and BPJS platforms. Continuous system refinement and periodic evaluation are also necessary to ensure adaptability to evolving regulations and to enhance the sustainability of the application in supporting hospital claim management.

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