

CODING AUDIT APPLICATION TO SUPPORT DIAGNOSTIC CODE QUALITY

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ABSTRACT

Coding audits in healthcare are crucial for maintaining the quality of diagnostic and treatment coding. Current challenges related to coding audits include the lack of electronic instruments to assist in the implementation of clinical coding audits. Most audits are performed manually, which is time-consuming and prone to high human error. Therefore, an application that generates periodic reports is needed to maintain coding quality and generate data quickly and easily, resulting in accurate and timely information. This research method is qualitative. The design method used is the waterfall approach: Requirements Analysis, System Design, Implementation, Testing, and Maintenance. The population in this study was a secondary care hospital in Boyolali Regency. The sampling technique consisted of six auditors. Data collection methods included interviews and observations. The system was tested using the PIECES technique. The audit coding application results can assist coding audit staff in generating audit results, including code accuracy, timeliness of filling, and compliance. The information generated is faster, more accurate, and can generate periodic reports according to the hospital's needs. The assessment results concluded that the application is suitable for use in healthcare services. The Performance score was 100% strongly agree, with scores for Information 66.6%, Economics 83%, Control 66.6%, Efficiency 83%, and Service 66.7%. The Audit Coding application can assist coding audit staff in conducting analyses to obtain precise and accurate information. Reports can be printed at any desired period, ensuring the quality of disease and procedure coding. Reports are generated in the form of percentages of code accuracy, timeliness of filling, and compliance.

Keywords: audit coding application; coding audits; coding quality; PIECES technique

INTRODUCTION

The Audit Coding application can assist coding audit staff in conducting analyses to obtain precise and accurate information. Reports can be printed at any desired period, thus maintaining the quality of disease and procedure coding. Reports are generated in the form of a percentage of code accuracy, timeliness of entry, and compliance. Coding audits in healthcare are crucial because they affect the accuracy of medical information, hospital finances, and the overall quality of healthcare services (Mirhashemi et al., 2020). The accuracy of medical information significantly impacts the quality of diagnosis codes (Fu et al., 2025). Coding quality in healthcare in Indonesia still faces several challenges, despite progress with digitalization and government regulations. Many diagnoses are incomplete or inconsistently documented, complicating the accurate coding process (Heltiani et al., 2024). Research (Raekha et al., 2022) indicates that 100% of medical record documents are incomplete. Coding audits are not yet routine practice in most hospitals and community health centers, especially in rural areas, and audits are often conducted solely for claims purposes, rather than for a comprehensive evaluation of medical data quality (Hut-Mossel et al., 2021).

Furthermore, coding quality in Indonesia is characterized by high levels of diagnosis code inaccuracy. Based on a literature review from research (Ganesha, n.d.), the percentage of accuracy of diagnostic codes for heart cases reached 14% (Utami et al., 2022). Research (Mirhashemi et al., 2020) consistency in writing diagnoses is one of the quality measurement indicators for ICD-10 codes. In addition to the accuracy of diagnostic codes, suboptimal code quality is indicated by overcoding, which occurs when a more severe diagnosis is coded than the actual clinical condition, potentially leading to fraud or excess

claims (Drabiak & Wolfson, 2020). Fraud increases the loss ratio because claims paid exceed premiums received. This results in losses for insurance companies. Therefore, professional coders and audit staff are needed to maintain code quality so that it continues to produce accurate information and does not cause negative impacts on health services (Coder et al., n.d.). A coder must be able to maintain quality based on several qualitative aspects to maintain coding quality. A coding audit is a qualitative review to ensure that the results of coding diagnoses and actions or procedures by clinical coders are accurate, consistent, and timely. Audit activities are carried out by looking at four elements of coding quality: validity, reliability, completeness, and timeliness.

The implementation of Coding Audits still faces several obstacles, namely the lack of competent human resources in the field of coding, both in terms of quantity and ability (Shariat Panahy et al., 2013). Many auditors do not have official training or certification related to disease classification systems such as ICD-10 or ICD-11, which results in inconsistent code interpretation (Chomutare et al., 2024). In addition, medical documentation from healthcare workers is often incomplete, unclear, or even illegible, making the verification process and determining appropriate codes difficult (Otero Varela et al., 2024). High workloads are also a inhibiting factor, because auditors must review many documents in a limited time, which risks reducing accuracy (Erawati et al., 2022). Equally important, the lack of support from management and minimal communication between the audit team, coders, and medical personnel often result in audit results not being followed up optimally (Yu et al., 2024).

In addition, some secondary health services still carry out few clinical coding audit activities (Coding et al., 2025). This is because there are no system-based instruments that can be used to assist in the implementation of clinical coding audits. Most audits are carried out manually, which takes a long time with a high level of human error (Temitayo et al., 2021). This problem is exacerbated by hospital information systems that are not yet optimally integrated, as well as the continued use of manual systems that are time-consuming and prone to errors (White & Jawad, 2020). As a result, the resulting reports are inaccurate and there are no periodic reports on the percentage of code accuracy, timeliness of filling and suitability. Therefore, a coding audit information system is needed to facilitate processing and produce coding quality information quickly and accurately.

This system can help coders determine the percentage of code accuracy and the timeliness of code entry. Based on several literature studies conducted by previous researchers (Manuscript & Manuscript, 2024)(Sitorus et al., 2023), there was no information system for coding audits. Coding audits were conducted manually using simple instruments. This is a novelty in this research. The research resulted in an information system product to improve the quality of disease and procedure coding. The purpose of this research is to develop an electronic-based coding audit instrument capable of producing complete, accurate, and timely information. Coding audits can help improve the overall quality of healthcare services. By ensuring that the codes used are accurate and compliant with medical record documentation, medical personnel can provide more appropriate and effective care.

METHOD

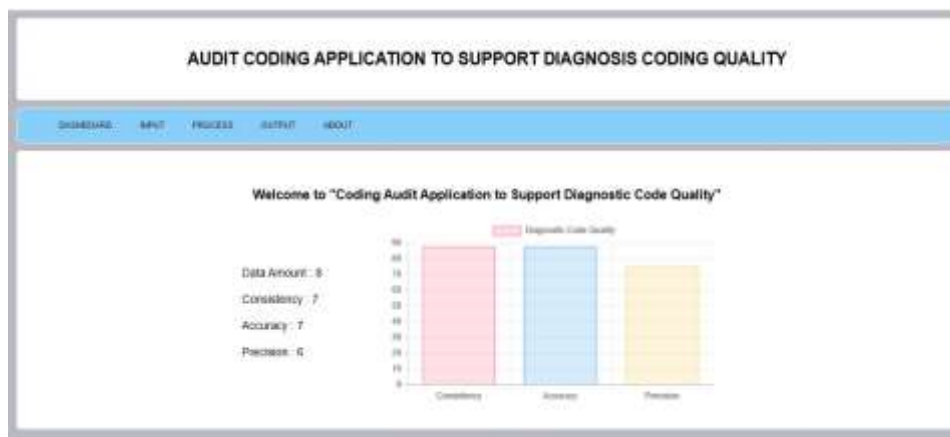
This research design uses the waterfall method. The waterfall system design method consists of needs analysis, system design, implementation, testing, and maintenance (Pradita, 2024): 1) Requirements Analysis: Researchers conduct an in-depth analysis of system or product requirements. The goal is to clearly understand the needs of secondary health services in Boyolali Regency, 2) System Design: Once the needs are understood, a system design is created. This design includes the software architecture, database structure, and user interface, 3) Implementation: At this stage, researchers develop software code based on the approved design. During system implementation or installation, a user socialization

session is conducted. The purpose of this socialization is to familiarize users with the system. Participants were 6 coding auditors, 4) Testing: After development is complete, the system is tested to ensure that the software functions as intended and is free from bugs or other issues. The system testing uses the PIECES method. The testing phase is carried out with a system success indicator if the minimum system test score for each indicator is >60, 5) Maintenance: After the software is released and tested, maintenance is performed to fix any issues that may arise and update the system as needed.

The population is a set of characteristics determined by the researcher (Akbar & Fauzi, 2023). The population in this study was 6 coding auditors. The sample was based on the same characteristics that represent the population (Hossan et al., 2023), namely 6 auditors. The sampling technique was total sampling, using the entire population as the sample (Shukla, 2020). Data Collection Technique, was conducted through observation. In addition, the researcher conducted interviews with audit officers. Research Instrument used instruments in the form of interview guidelines and an observation checklist related to the analysis of system development needs. Data Analysis Technique, The system usability analysis used the PIECES method (Performance, Information, Economics, Control, Efficiency, Service) (Rahim, 2008), consisting of a functional and non-functional system evaluation analysis conducted with users.

RESULT AND DISCUSSION

During the system implementation phase, the application was implemented at a hospital in Boyolali. A workshop on application usage was also conducted for hospital administrators. The audit coding application consists of a login, dashboard, input menu, transactions, and reports. The following are the results of the audit coding application:



Picture 1 Dashboard

The dashboard menu displays input, process, output, consistency percentage, accuracy percentage, and coding timeliness. Admins can view the overall percentage of each coding audit indicator. This makes it easier for officers to understand the audit overview and assess code quality.

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Dashboard Input Process Output About

Input Patient Data

Medical Record Number:

Patient Name:

Gender:

Date of Birth:

Complete Address:

Number	No. Medical Record	Patient Names	Gender	Date of Birth	Complete Address	Action
1	25080001	Khonul	Man	1990-12-10	Karanghongan, Ngagongan, Boyaket	change / delete
2	25080002	Intan	Woman	1991-05-21	Sukoharjo	change / delete
3	25080003	Mudofa	Man	1998-12-01	Sukakarta	change / delete
4	25080004	Berhara	Woman	2017-05-08	Pookarto, Sukoharjo	change / delete

Picture 2. Input Patient Data

This patient data input serves as the primary data source for determining the audit coding percentage. The input consists of the patient's medical record number, name, gender, date of birth, and complete address.

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Dashboard Input Process Output About

Evaluation

Medical Record Number:

Patient Name:

Patient Admission Date:

Patient Discharge Date:

Consistency:

Accuracy:

Precision:

No. Process	No. Medical Record	Patient Names	Patient Admission Date	Patient Discharge Date	Consistency	Accuracy	Precision	Action
1	25080001	Khonul	2025-08-04	2025-06-06	consistent	accurate	precise	change / delete
2	25080002	Intan	2025-07-28	2025-07-30	consistent	accurate	precise	change / delete
3	25080003	Mudofa	2025-07-02	2025-07-15	consistent	accurate	precise	change / delete

Picture 3. Transaction / Evaluation

The audit coding application transaction consists of the items RM Number, Patient Name, Admission Date, Discharge Date, Consistency, Accuracy, and Precision. In this menu, the officer manually inputs audit data into the application to automatically generate the audit coding percentage for each period as needed.

AUDIT CODING APPLICATION TO SUPPORT DIAGNOSIS CODING QUALITY							
DASHBOARD INPUT PROCESS OUTPUT ABOUT							
Diagnostic Code Audit Report							
Number	No. Medical Record	Patient Names	Patient Admission Date	Patient Discharge Date	Consistency	Accuracy	Precision
1	25080001	Rheni	2025-08-04	2025-08-06	consistent	accurate	precise
2	25080002	Irhan	2025-07-28	2025-07-30	consistent	accurate	precise
3	25080003	Muslita	2025-07-29	2025-07-31	consistent	inaccurate	precise
4	25080004	Bernara	2025-07-30	2025-08-01	consistent	accurate	precise
5	25080005	Kusumawati	2025-07-31	2025-08-02	inconsistent	accurate	precise
6	25080006	Kaila	2025-08-01	2025-08-03	consistent	accurate	precise
7	25080007	Warno	2025-08-02	2025-08-04	consistent	accurate	imprecise
Download pdf							

Picture 4. Report

The audit coding system can also display reports that auditors use to evaluate and obtain information more quickly and accurately. These reports serve as a basis for evaluating disease coding staff and taking action to improve coding quality.

The analysis is in the form of an analysis of the features or menus needed in creating an audit coding application. The needs analysis was also conducted to generate information related to the obstacles and problems encountered so far in implementing audit coding. Based on the results of interviews with coding and audit officers totaling 6 auditors, the results showed that most had not yet conducted audits due to limited instruments in conducting audits. The next obstacle was that they had already conducted audits but were still using manual methods so that they did not require a long time to calculate the percentage related to the audit results. Therefore, an audit coding application is needed to produce audit result information more quickly, accurately and effectively. The menus and features needed are reports on the percentage of code accuracy, timeliness of filling and conformity that can be generated or printed periodically. This is in accordance with the audit coding indicators which consist of reliability, completeness, timeliness, accuracy, definition, relevance, and legibility (Rahmi et al., 2024), (Kurniawati et al., 2025).

The system design stage in the coding audit application includes several important steps that focus on how the system will be built technically and functionally to effectively carry out the coding audit process. In the system design stage of the study, database design, interface design, dashboard design, patient input design, login design, transaction design, and reporting design were carried out. All designs were adjusted to the required features. The language used was web-based programming. The dashboard menu was designed with information about the application, input, process, and output. In addition, it also contained information needed in the form of consistency, accuracy, and precision. This system design stage is in line with the research (Aufa et al., 2023).

This menu generates patient demographic data to serve as the basis for the patient database. Patient demographic data for coding audits is crucial for auditing. Patient input data will be recalled as a database to fill in the audit percentages in the transaction menu. The patient's medical record number serves as the primary key for identifying the patient. This is consistent with research (Putri et al., 2020) that demographic data is crucial for understanding patient characteristics and therefore must be completed by healthcare workers. These results are very important because they provide an objective picture of how well the code meets the aspects of consistency, accuracy, and precision. They are also used for auditing

disease and action coding in the context of medical records and health information systems, particularly in the areas of claims management, reporting, and improving the quality of hospital services (Susilowati et al., 2022).

The testing phase was conducted by application users, namely audit administrators at six hospitals in Boyolali. The testing phase involved asking several questions about effectiveness using the PIECES method (Performance, Information, Economics, Control, Efficiency, Service). The resulting application can display code audit results more quickly based on the period desired by the officer. Reports are presented as percentages and can be printed at any time. This report allows audit officers to access data more easily, quickly, and accurately. This is evident in the following respondent responses:

Table 1.

The report allows audit officers to access data more easily, quickly, and accurately

No	Aspect	Assessment		
		Strongly Agree (%)	Agree (%)	Degree (%)
1	<i>Performance</i>	100	0	0
2	<i>Information</i>	66,6	33,4	0
3	<i>Economics</i>	83	17	0
4	<i>Control</i>	66,6	33,4	0
5	<i>Efficiency</i>	83	17	0
6	<i>Service</i>	66,7	33,3	0

Based on the data above, most respondents strongly agreed with the application resulting from the study. The score for Performance strongly agreed was 100%, Information 66.6%, Economics 83%, Control 66.6%, Efficiency 83%, and Service 66.7%. The assessment results can be concluded that the application is suitable for use in healthcare services. The application assessment used PIECES as a tool for system analysis. A detailed and comprehensive system will receive special attention, so that the system's strengths and weaknesses can be identified (Azzolini et al., 2019).

The audit coding application produced in this study is very helpful in producing faster and more accurate results. However, this application still has shortcomings, namely, it is not directly integrated with electronic medical records. The application is still separate from the electronic medical records used by hospitals. Therefore, for future researchers conducting similar research, this study can be used as evaluation material and input for the development of coding applications integrated with electronic medical records. System maintenance is carried out by each hospital's audit and IT staff to ensure system continuity. The goal of this maintenance is to ensure that the audit application continues to run smoothly, optimally, and without disruption. This function is crucial in the world of information technology to ensure the continuity and effectiveness of a system's operations (Wulandari & Tambotoh, 2022)

CONCLUSION

The Audit Coding application can assist coding audit officers in conducting analyses to obtain precise and accurate information. Reports can be printed at any desired period to maintain the quality of disease and procedure coding. Reports are generated in the form of a percentage of code accuracy, timeliness of filling, and conformity. The results of the system trial showed that users strongly agreed with the application developed in terms of Performance, Information, Economics, Control, Efficiency, and Service. A weakness of this system is that it has not been integrated with the hospital's electronic medical records. Therefore, for further research, a feature is needed to be able to integrate the application with electronic medical records.

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