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Daily Inpatient Census Data Analysis on Healthcare Service Quality to Support Minister of Health Regulation No. 6 of 2026 at Hospital X

Mery Dian Lestari[1], Ribka Emanuela Tambunan[2], Amelia Kartika Pratiwi[3], Reka Dwi Syaputra[4]
[1,2,3,4] Medical Records and Health Information, STIKes Sapta Bakti Bengkulu, Bengkulu, Indonesia

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ABSTRACT

Objective: *This study aims to analyze the inhibitors of SHRI reporting accuracy and timeliness, and to design a web-based integrated automation information system to enhance efficiency and the accuracy of quality indicator recapitulation.* ***Method:*** *This research utilizes a mixed-methods/qualitative descriptive approach with the Plan-Do-Check-Act (PDCA) method and the Waterfall system development model. Data were collected through observations, interviews, and documentation studies of census reporting workflows.* ***Results:*** *The findings indicate that a radical shift from manual systems to web-based automation significantly reduces data entry errors to 0% and accelerates daily report processing time by more than 85% compared to conventional methods. The web-based system integrates data from various wards in real-time and provides notification features for incomplete data.* ***Novelty:*** *The web-based system integrates data from various wards in real-time and provides notification features for incomplete data.*

INTRODUCTION

Inpatient care is one of the primary components and a vital unit within a hospital's healthcare delivery system. Efficient management of inpatient bed facilities is a crucial factor in ensuring patient accessibility, accelerating service workflows, reducing waiting times, and minimizing the risk of nosocomial infections. The efficiency level of inpatient services cannot be adequately evaluated using raw data alone; instead, it must be processed into standard hospital statistical indicators, namely Bed Occupancy Rate (BOR), Average Length of Stay (ALOS/AvLOS), Turn Over Interval (TOI), and Bed Turn Over (BTO).

The primary foundation for calculating these efficiency indicators is the Daily Inpatient Census (SHRI). However, in actual practice at healthcare facilities, the implementation of SHRI reporting and medical record governance still faces various operational challenges. Manual paper-based or statically semi-computerized SHRI reporting frequently yields invalid, inaccurate, and delayed data. This issue is exacerbated by low compliance and delays in the return and completion of medical record files by healthcare professionals (physicians and nurses), incomplete medical discharge summaries, and insufficiently detailed Standard Operating Procedures (SOPs). Delays and inaccuracies in census data directly impede the recapitulation of quality indicators, delay insurance/BPJS claims, and slow down strategic decision-making by hospital management.

Research on inpatient service efficiency and SHRI management has been conducted from various perspectives. Mendrofa and Pasaribu [1] analyzed bed utilization efficiency per ward at Santa Elisabeth Hospital Medan based on Ministry of Health standards and discovered inefficiencies caused by excessively high ALOS values in specific wards alongside high variations in BOR values due to unbalanced patient lengths of stay.

Wardhina and Rahmadiliyani [2] evaluated factors causing delays in returning inpatient medical record files at Mawar General Hospital Banjarbaru using the 5M framework (Man, Material, Method, Machine, Money), identifying that physician/nurse discipline (Man), incomplete medical resume forms (Material), incomplete SOPs (Method), and the absence of a reward budget (Money) were primary triggers hindering inpatient data processing. Marsim et al. [3] evaluated bed management at Hospital X Lampung in 2024 using the Barber Johnson Graph method and found that although BOR (75.91%) and BTO (95.56 times) fell within the efficient zone, AvLOS (2.91 days) and TOI (0.92 days) fell below ideal standards, indicating high bed turnover that risks increasing nosocomial infection rates and medical staff burnout. Furthermore, Syaputra et al. [4] designed and implemented an integrated web-based SHRI recapitulation automation system using the PDCA approach and Waterfall model, proving that digital transformation can cut indicator recapitulation time by more than 50% while minimizing human error.

Although prior studies have extensively evaluated inpatient efficiency indicators (BOR, ALOS, TOI, BTO) and qualitatively identified administrative barriers in medical records, most remain passively analytical without offering a real-time integrated systemic solution. Moreover, previous research has not explicitly linked Barber Johnson Graph-based bed management efficiency with digital transformation interventions in web-based SHRI reporting systems within the latest regulatory framework. The novelty of this study lies in integrating the analysis of operational constraints in SHRI recording (input-process factor analysis) with the design of an integrated web-based automated information system to support compliance with healthcare service quality standards under Minister of Health Regulation (Permenkes) No. 6 of 2026 [5].

This study aims to analyze the factors inhibiting the accuracy and timeliness of Daily Inpatient Census (SHRI) reporting, design and implement an integrated web-based SHRI automation information system, and evaluate its impact on the efficiency and accuracy of healthcare service quality indicator recapitulation (BOR, ALOS, TOI, BTO) at Hospital X.

RESEARCH METHODS

This study employed a mixed-methods and qualitative descriptive approach combined with the Plan-Do-Check-Act (PDCA) method for process quality evaluation and the Waterfall model for web-based information system development. The research population encompassed all Daily Inpatient Census (SHRI) recapitulation data, discharged patient reports (alive and deceased), and inpatient medical record files at Hospital X. Research informants included the Head of the Medical Records Installation, Head of Inpatient Wards, and nurses responsible for census entry.

Sampling was conducted using total sampling for daily census document data over a one-year operational period, alongside purposive sampling to select qualitative informants. Inclusion criteria comprised all active daily inpatient census data recorded in the ward operational system and discharged patient recapitulation data during the study period. Exclusion criteria included damaged census forms or medical records, severely incomplete (missing) files, and outpatient data.

Data collection was carried out through a combination of direct observation, in-depth interviews, documentation studies/database extraction, and system testing instruments based on black-box testing. Data analysis was performed through inpatient

efficiency indicator calculations (BOR, ALOS, TOI, BTO), Barber Johnson Graph mapping, and descriptive qualitative analysis.

This research received ethical approval (Ethical Clearance) from the Health Research Ethics Committee of STIKes Sapta Bakti Bengkulu under Ethical Approval Certificate Number: No. 048/KEPK-STIKES/SB/II/2026.

RESULTS AND DISCUSSION

Results

A. Evaluation of Inpatient Bed Utilization Efficiency Indicators

Bed utilization efficiency was evaluated based on inpatient service operational data before and after the intervention of the web-based SHRI automation system. The calculation results for the four primary inpatient service efficiency indicators are presented in Table I.

Table 1. Comparison of Bed Management Efficiency Indicators Before and After System Intervention at Hospital X

Service Indicator	Ideal Standard (MoH / Barber Johnson)	Pre-Intervention (Manual)	Post-Intervention (Web System)	Efficiency Category
Bed Occupancy Rate (BOR)	60% – 85%	45.80%	78.45%	Efficient
Average Length of Stay (ALOS)	6 – 9 Days (or 3 – 12 Days)	5.00 Days	6.20 Days	Efficient
Turn Over Interval (TOI)	1 – 3 Days	5.91 Days	1.70 Days	Efficient
Bed Turn Over (BTO)	40 – 50 Times/Year	22.84 Times	46.12 Times	Efficient

Based on the mapping of these four efficiency parameters onto the Barber Johnson Graph coordinates, a notable shift occurred in the intersection point. Prior to the system intervention, the coordinate intersection of BOR (45.80%), ALOS (5.00 days), TOI (5.91 days), and BTO (22.84 times) fell outside the efficiency zone (the Barber Johnson area). Following the integration of the web-based SHRI automation system, the coordinate intersection moved squarely into the efficiency zone of the Barber Johnson Graph.

B. Analysis of Operational Barriers in SHRI Reporting

Factors affecting the timeliness and accuracy of SHRI reporting prior to implementing the web-based system were analyzed using the PDCA method. The

mapped barrier factors are summarized in Table II.

Table 2. Identification of Shri System Barriers

No.	Problem Domain (PDCA)	Specific Field Findings	Impact on Quality Reporting
1	**Human Resources (Plan)**	Lack of ward staff understanding regarding the operational definitions of BOR, LOS, and TOI.	Inconsistencies in filling out columns for patients admitted and discharged on the same day.
2	**Operational Procedures (Do)**	SHRI SOPs had not been updated since 2018 and lacked digital reporting procedures.	Reporting workflows were non-uniform and relied heavily on individual nurse initiative.
3	**Media & Infrastructure (Check)**	Paper SHRI forms were frequently lost, torn, or misplaced during patient transfers.	Loss of historical inpatient data, requiring manual reconstruction.
4	**Control Mechanisms (Act)**	Absence of instant cross-validation between ward data and the medical records unit.	Incomplete data were only identified during month-end recapitulation.

C. Performance and Accuracy Evaluation of the Web-Based SHRI Automation System

Operational testing of the web-based SHRI information system was conducted to measure time efficiency in data recapitulation and calculation accuracy for hospital statistical indicators. The measurement outcomes are presented in Table III.

Table 3. Shri Data Processing Performance Parameters Before and After System Digitalization

Performance Parameter	Manual System (Paper / Spreadsheet)	Web-Based Automation System	Performance Improvement Rate
Daily Recapitulation Time	180 – 240 Minutes/Day	15 – 30 Minutes/Day	>85% Time Efficiency

Performance Parameter	Manual System (Paper / Spreadsheet)	Web-Based Automation System	Performance Improvement Rate
Monthly Report Generation Time	3 – 5 Working Days	Real-time (Instant)	100% Speed Increase
Calculation Error Rate (Human Error)	12.4% Error Rate	0.0% Error Rate	100% Calculation Accuracy
Timeliness of File Return	54.2% On-Time	94.8% On-Time	+40.6% Compliance Increase

Application functionality testing using the black-box testing method demonstrated that all modules—patient data entry, automated BOR/ALOS/TOI/BTO calculation, Barber Johnson Graph visualization, and integrated report export—functioned 100% in accordance with user requirement specifications without any program logic errors.

Discussion

A. Interpretation of Results and Achievement of Inpatient Service Efficiency

The findings of this study indicate that prior to the web-based SHRI automation system intervention, bed utilization efficiency at Hospital X was suboptimal. An initial BOR of 45.80% indicated that more than half of the inpatient bed capacity was not being utilized effectively. This condition was accompanied by a high TOI (5.91 days) and a low BTO (22.84 times), signifying that beds remained vacant for excessively long durations between consecutive patients. While the initial ALOS of 5.00 days appeared efficient at a glance, when paired with a very low BOR, it reflected underutilization of hospital facilities and weak operational resource allocation.

Implementing the integrated web-based SHRI automation system significantly transformed the hospital's efficiency profile. BOR increased to 78.45%, falling precisely within the ideal Ministry of Health standard and Barber Johnson Graph parameters (60% – 85%). This increase in BOR was balanced by a reduction in TOI to 1.70 days (ideal standard: 1 – 3 days) and an increase in BTO to 46.12 times/year (ideal standard: 40 – 50 times/year). ALOS stabilized at 6.20 days, demonstrating that patients received adequate care duration without unnecessarily prolonged stays. The simultaneous shift of all indicator coordinates directly positioned Hospital X's bed management within the efficiency zone of the Barber Johnson Graph, empirically confirming the hypothesis that digital transformation of the SHRI system improves bed management efficiency and reporting accuracy.

B. Comparison with Previous Studies

The outcomes of this study align with and reinforce the findings of Syaputra et al. [4], who proved that implementing web-based SHRI recapitulation automation using the Waterfall model and PDCA approach drastically reduces data processing time and eliminates human calculation errors. Cutting daily recapitulation time from 180–240

minutes down to 15–30 minutes confirms that digitalizing census reporting is a critical instrument for enhancing medical record management responsiveness.

These findings also offer a compelling comparative perspective against the study by Marsim et al. [3]. In Marsim et al.'s research at Hospital X Lampung, BOR (75.91%) and BTO (95.56 times) fell within efficient limits, whereas AvLOS (2.91 days) and TOI (0.92 days) were critically below minimum standards—posing risks of staff fatigue and heightened nosocomial infection due to overly rapid bed turnover without adequate sanitization intervals. Conversely, the system intervention in the present study successfully balanced all parameters (BOR 78.45%, ALOS 6.20 days, TOI 1.70 days, and BTO 46.12 times), ensuring that achieved efficiency did not compromise patient safety standards or bed sanitation maintenance times.

Regarding operational barriers, the 5M analysis in this study corroborates the findings of Wardhina and Rahmadiliyani [2] at Mawar General Hospital Banjarbaru. Human factors (Man), such as discipline in completing medical records, and methodological factors (Method), such as insufficiently detailed SOPs, were confirmed as major obstacles in manual recording. However, this study advances beyond the work of Wardhina and Rahmadiliyani [2] and Mendrofa and Pasaribu [1], which stopped at problem identification and passive statistical analysis. This research introduces novelty by delivering a direct information technology solution in the form of an integrated web application capable of simultaneously resolving weaknesses across both Machine and Material elements.

C. Practical, Professional, and Health Policy Implications

The findings of this study yield broad implications across three key dimensions:

1. **Practical Implications for Hospital Medical Record Unit Operations:**

Automating SHRI recording transforms the role of the Medical Records unit from clerical-reactive (spending hours collecting, matching, and manually tallying paper census sheets) to analytical-proactive. Real-time bed occupancy data enable admissions staff and ward heads to monitor available beds precisely, expedite patient placement from the Emergency Department (ED), and prevent patient bottlenecks.

2. **Implications for Health Information Management (HIM / PMIK) Professionals:**

Developing and deploying a web-based system reinforces the strategic role of HIM professionals as health data managers and clinical information analysts. Professionals are no longer burdened by error-prone manual indicator calculations and can instead focus on data quality validation, facility utilization trend analysis, and providing high-value clinical statistical insights to top management.

3. **National Health Policy Implications and Regulatory Compliance:**

This web-based digital transformation of SHRI directly supports the implementation of Minister of Health Regulation (Permenkes) No. 6 of 2026 [5] regarding healthcare service quality standards and the integration of the National Health Information System. Valid and accurately recapitulated daily census data streamline BPJS Kesehatan claims processing, accelerate periodic reporting to District/Provincial Health Offices and the Ministry of Health, and ensure hospital compliance with accreditation standards for inpatient quality indicators.

D. Research Limitations

This study has several limitations that should be acknowledged transparently. First, testing and implementation of the web-based SHRI automation information system were confined to Hospital X, which possesses specific operational characteristics and network

infrastructure; thus, generalizing these results to other hospital classifications or facilities in regions with limited internet connectivity requires further technical adaptation. Second, the system's impact on healthcare staff compliance in completing medical records was evaluated over a relatively brief post-implementation observation period (one operational year). Future studies are recommended to conduct longitudinal assessments to evaluate system sustainability and integrate Artificial Intelligence (AI) modules for predictive inpatient bed demand forecasting.

CONCLUSION

Fundamental Finding: The implementation of the integrated web-based Daily Inpatient Census (SHRI) automation information system significantly improves bed management efficiency and inpatient quality indicator reporting at Hospital X. System digitalization effectively overcomes operational barriers identified within the PDCA framework, reduces daily data recapitulation time by over 85%, eliminates hospital statistical calculation error rates to 0%, and improves the timeliness of medical record file returns. Post-intervention shifts in BOR, ALOS, TOI, and BTO parameters directly position the hospital's operational performance inside the efficient zone of the Barber Johnson Graph in compliance with Minister of Health Regulation No. 6 of 2026 [5]. **Implication:** This integrated approach provides a practical model for strengthening hospital information management, supporting evidence-based managerial decision-making, and improving the accuracy and timeliness of inpatient service reporting. **Limitation:** This study is limited to the development and evaluation of the integrated web-based Daily Inpatient Census (SHRI) automation information system at a single hospital, namely Hospital X. The evaluation focuses primarily on operational efficiency, data accuracy, reporting timeliness, and inpatient service indicators before and after implementation. Therefore, the findings may not fully represent the implementation challenges and outcomes in hospitals with different organizational structures, infrastructure, and information system capabilities. **Future Research:** Future research should examine the long-term effectiveness and sustainability of the integrated web-based SHRI automation system across multiple hospitals with different levels of infrastructure and operational capacity. Further studies should also explore the integration of SHRI with other hospital information systems, electronic medical records, and real-time dashboards to strengthen data interoperability and support evidence-based managerial decision-making. In addition, future research should assess the system's impact on patient care quality, hospital resource utilization, and the continuous improvement of inpatient services.

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***Mery Dian Lestari (Corresponding Author)**
Medical Records and Health Information, STIKes Sapta Bakti Bengkulu, Bengkulu, Indonesia
Email: merydianlestari25@gmail.com

Ribka Emanuela Tambunan
Medical Records and Health Information, STIKes Sapta Bakti Bengkulu, Bengkulu, Indonesia

Amelia Kartika Pratiwi
Medical Records and Health Information, STIKes Sapta Bakti Bengkulu, Bengkulu, Indonesia

Reka Dwi Syaputra
Medical Records and Health Information, STIKes Sapta Bakti Bengkulu, Bengkulu, Indonesia