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Implementation of Business Intelligence for Hospital Performance Evaluation Based on Minimum Service Standards (SPM) at YK Madira Hospital Palembang

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Abstract

The use of information technology has become a crucial component in hospital management to enhance operational effectiveness and service quality. However, at YK Madira Hospital Palembang, the Hospital Management Information System (SIMRS) currently serves only as a data entry and reporting tool, with data typically exported in Excel format, making it difficult for management to analyze information efficiently. This study aims to develop and implement a Business Intelligence (BI) system using Microsoft Power BI to evaluate hospital performance based on the Minimum Service Standards (SPM) established by the Ministry of Health (Kementerian Kesehatan) of the Republic of Indonesia. The SPM indicators analyzed include Bed Occupancy Rate (BOR), Average Length of Stay (ALOS), Bed Turn Over (BTO), Turn Over Interval (TOI), Net Death Rate (NDR), and Gross Death Rate (GDR). The research employed a quantitative descriptive approach, supported by data from 2017–2020 obtained from the hospital's SIMRS. The system was designed through a data warehouse model and visualized using Power BI dashboards. The results demonstrate that the BI system enables dynamic visualization and analysis of hospital performance data, facilitating faster and more accurate decision-making. The study concludes that implementing BI significantly enhances the effectiveness of performance monitoring and compliance with the Ministry of Health's service standards.

Keywords

Business Intelligence, Power BI, Hospital Management Information System, Service Quality, Minimum Service Standards

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Introduction

Hospitals are complex organizations that operate at the intersection of healthcare delivery, administration, and technology. Their primary function is to provide medical services that demand precision, speed, and coordination among multiple departments. The ability to deliver high-quality healthcare services depends not only on medical expertise but also on the efficiency of data management systems that support hospital operations. As hospitals generate large volumes of clinical, financial, and operational data daily, the need for integrated information systems becomes increasingly critical in ensuring timely and evidence-based decision-making.

In this regard, the Hospital Management Information System (Sistem Informasi Manajemen Rumah Sakit—SIMRS) plays a pivotal role as the technological backbone of hospital administration. According to Sepdela & Tania (2020), SIMRS functions as a comprehensive platform designed to manage medical records, resource allocation, and financial transactions in a unified framework. By centralizing information, SIMRS helps hospitals streamline workflows, minimize administrative errors, and enhance transparency in reporting. It provides structured data that can be utilized for decision-making, monitoring performance, and ensuring accountability in healthcare delivery.

However, despite its widespread adoption, many hospitals, including YK Madira Hospital Palembang, have yet to fully exploit the analytical potential of their SIMRS. Currently, the system is primarily used for data recording and exporting, with reports generated manually through Excel spreadsheets. This limited utilization results in fragmented information and hinders management's ability to gain a holistic understanding of hospital performance. Without proper analytical tools, valuable insights—such as patterns in patient admissions, service efficiency, or financial trends—remain hidden within the system's raw datasets. Consequently, decision-making becomes reactive rather than strategic, limiting opportunities for continuous improvement and resource optimization.

To overcome these challenges, hospitals require a more advanced solution that not only collects data but also transforms it into actionable insights. One such solution is Business Intelligence (BI), a data-driven analytical framework designed to process, visualize, and interpret information in real time. As explained by Silvana & Akbar (2017), BI systems leverage dashboard and visualization tools to monitor Key Performance Indicators (KPIs) dynamically. Through BI, hospital administrators can identify operational inefficiencies, track service quality, and make evidence-based decisions. By integrating BI with SIMRS, healthcare institutions can move beyond data storage toward data intelligence, enabling predictive and strategic management.

In Indonesia, the effectiveness of hospital performance is formally evaluated through the Minimum Service Standards (Standar Pelayanan Minimal—SPM) established by the Ministry of Health (Kementerian Kesehatan Republik Indonesia). According to Iswara, Setiadi, & Wijayanto (2020), these standards encompass critical indicators such as Bed Occupancy Rate (BOR), Average Length of Stay (ALOS), Bed Turn Over (BTO), Turn Over Interval (TOI), Net Death Rate (NDR), and Gross Death Rate (GDR). Each metric serves as a quantitative benchmark for assessing hospital efficiency, resource utilization, and patient care quality. Accurate monitoring of these indicators is essential for regulatory compliance and for identifying areas that require managerial intervention or process improvement.

Based on these considerations, this study aims to design and implement a Business Intelligence dashboard that visualizes hospital performance data derived from SIMRS, using SPM indicators as key evaluation metrics. The proposed BI system will provide hospital management with a real-time, interactive analytical platform capable of enhancing accuracy, transparency, and responsiveness in decision-making. Ultimately, the integration of BI and SIMRS is expected to strengthen hospital governance, improve operational performance, and ensure alignment with national health standards mandated by the Ministry of Health.

Methodology

Research Method

This research utilized a quantitative descriptive approach, which aims to describe and analyze factual data patterns to identify relationships among variables (Camila, Akbar, Sutria, Suri, & Chairunnissa, 2018). The process involved data collection, system modeling, data transformation, and visualization development.

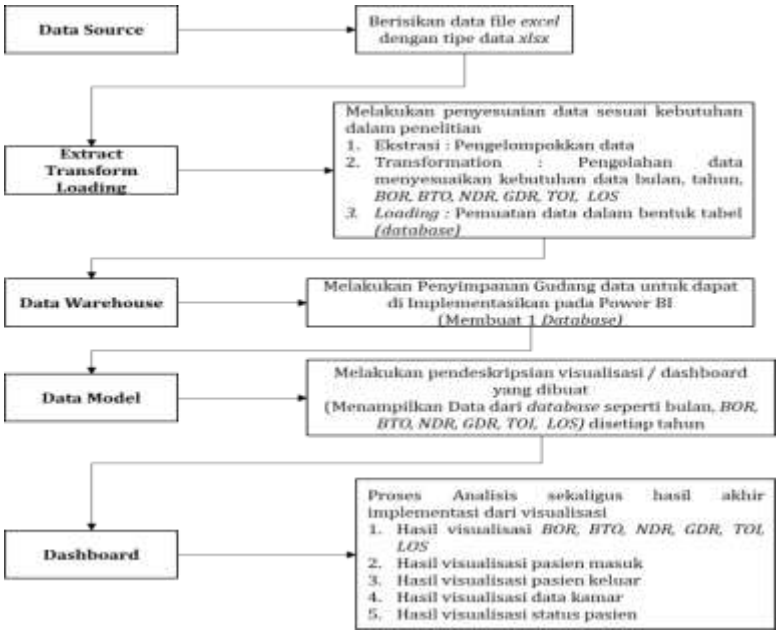

Figure 1. Research Framework

Data collection and analysis

Data collection was carried out using the following techniques:

1. Observation: Direct observation at YK Madira Hospital was conducted to examine existing SIMRS workflows and data management processes.
2. Interview: Semi-structured interviews were conducted with hospital management and IT staff to identify challenges in current data reporting and analytical processes.

3. Documentation: Hospital performance data from 2017–2020, including patient admissions, discharges, deaths, and room availability, were collected from SIMRS records.
4. Literature Review: Supporting references were gathered from academic journals, books, and Ministry of Health guidelines on hospital information systems and performance indicators.

Minimun Service Standards (SPM)

According to the Ministry of Health (DepKes, 2007), SPM indicators are quantitative measures that assess hospital service performance and efficiency. The six core SPM indicators are as follows:

No	Indicator	Description	Ideal Standard
1	**BOR (Bed Occupancy Rate)**	The percentage of bed use within a certain period.	60–85%
2	**ALOS (Average Length of Stay)**	The average length of patient hospitalization.	6–9 days
3	**BTO (Bed Turn Over)**	The frequency of bed use per year.	40–50 times/year
4	**TOI (Turn Over Interval)**	The average number of days a bed remains unoccupied.	1–3 days
5	**NDR (Net Death Rate)**	Deaths occurring after 48 hours of admission per 1,000 discharged patients.	< 25
6	**GDR (Gross Death Rate)**	Total deaths per 1,000 discharged patients.	< 45

System Design And Development

A data warehouse was designed using a star schema model to organize and integrate hospital data from SIMRS. The model includes several dimension tables (e.g., time, room, class, and SPM indicators) and one fact table that records the cumulative values of each indicator.

The Extract, Transform, and Load (ETL) process was carried out using Pentaho Data Integration, which cleansed and integrated raw hospital data into the data warehouse. Data visualization was then performed using Microsoft Power BI to create dynamic, interactive dashboards.

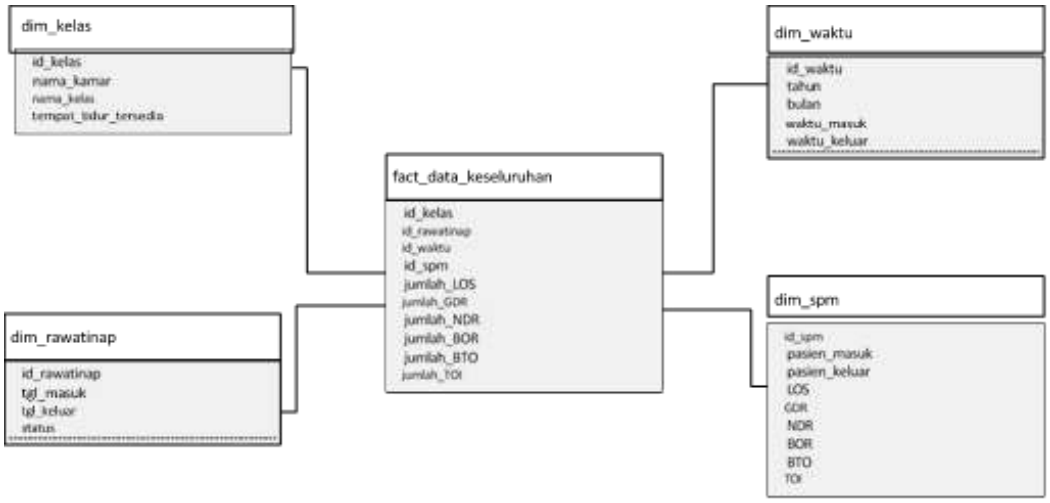

Figure 2. Star Schema Design

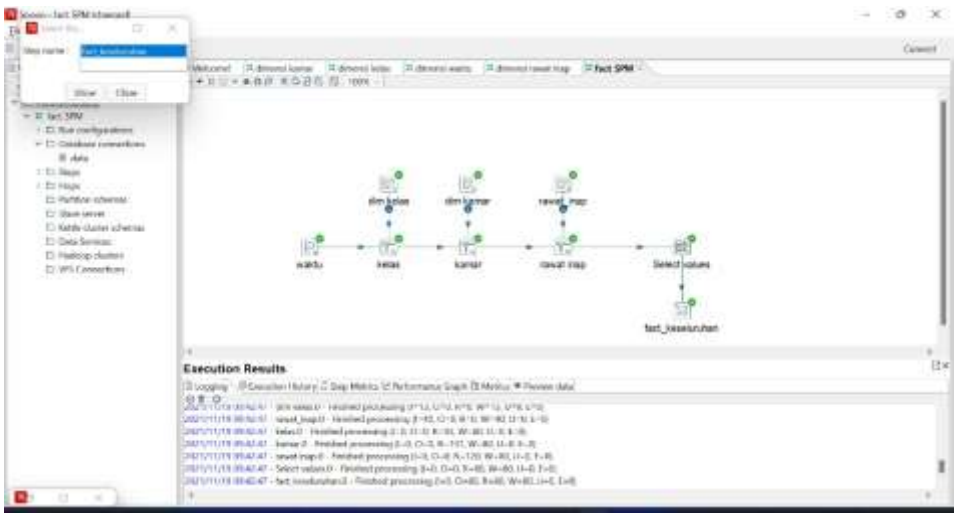

Figure 3. ETL Process Flow

Results

Data Warehouse Structure

The data warehouse integrates four years of SIMRS data (2017–2020) and organizes it by year, month, inpatient class, and room capacity. Key metrics for each indicator BOR, ALOS, BTO, TOI, NDR, and GDR are aggregated within the fact_data_keseluruhan table for analysis and visualization.

Visualization Of Hospital Room Distribution

The hospital's inpatient department comprises 51 rooms, including 5 VVIP rooms, 6 VIP rooms, 8 Class I, 6 Class II, and 9 Class III rooms. The dashboard enables administrators to monitor bed usage by class and availability across periods.

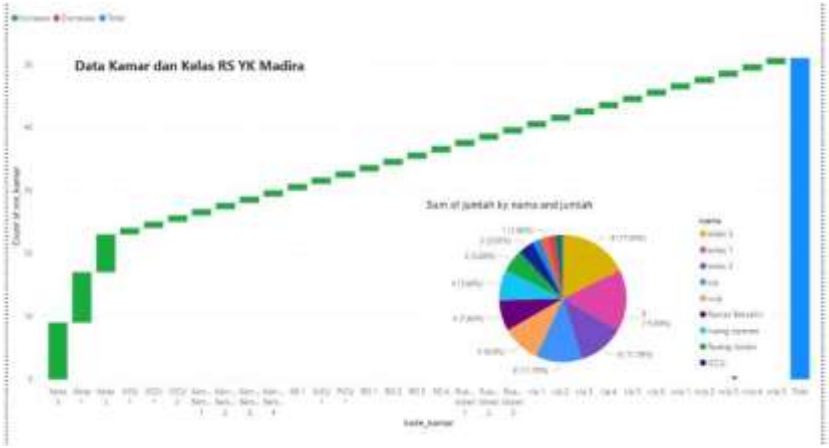

Figure 4. Room Distribution Visualization

Visualization Of Patient Data

Between 2017 and the first quarter of 2020, YK Madira Hospital recorded an average patient survival rate of 95.13% and a mortality rate of 4.87%. These data are displayed in a Power BI dashboard, allowing management to observe trends in patient outcomes.

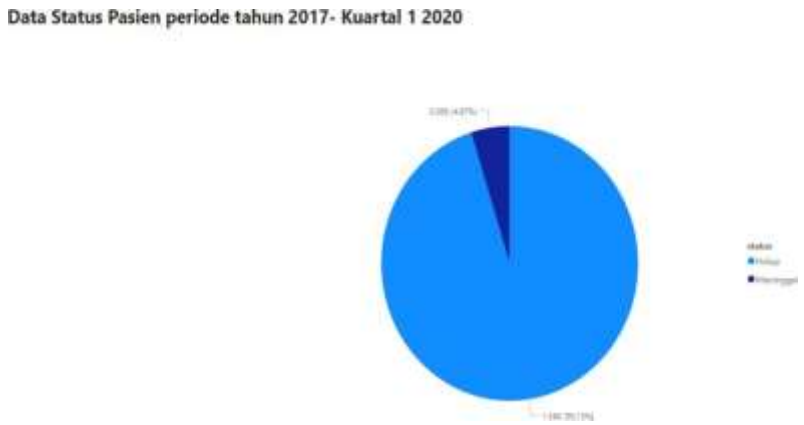

Figure 5. Patient Status Visualization

Visualization of SPM Indicators (2017–2020)

Each year's performance was analyzed and visualized as follows:

1. 2017: BOR peaked at 70% in September; BTO highest in June.
2. 2018: BOR reached 78% in September; ALOS averaged 3 days; TOI was 4 days.
3. 2019: BOR achieved 79% in May; ALOS averaged 5 days; TOI 5 days in November.
4. 2020: BOR and BTO reached 78% and 8 times, respectively, in September; ALOS averaged 7 days.

Overall, while BOR, ALOS, and mortality indicators (NDR, GDR) met Ministry standards, BTO did not meet the monthly target but satisfied the annual threshold.

Discussion

The implementation of the Business Intelligence (BI) system at YK Madira Hospital has significantly enhanced the accessibility, integration, and analytical capability of hospital data. Prior to this development, data generated by the Hospital Management Information System (SIMRS) were stored as static records, which limited their strategic value for performance evaluation. Through the integration of BI—specifically using Power BI as the visualization platform—hospital management can now access real-time dashboards that display critical performance metrics and operational trends in an intuitive, interactive format. This transition marks a fundamental shift from traditional manual reporting toward an evidence-based management system that supports informed decision-making and continuous improvement.

The Power BI dashboard aggregates and visualizes data based on key indicators outlined in the Minimum Service Standards (SPM) set by the Ministry of Health (Kementerian Kesehatan Republik Indonesia). These indicators include the Bed Occupancy Rate (BOR), Average Length of Stay (ALOS), Bed Turn Over (BTO), Turn Over Interval (TOI), Net Death Rate (NDR), and Gross Death Rate (GDR) (Iswara, Setiadi, & Wijayanto, 2020). Each metric

provides specific insights into hospital performance and service efficiency. For instance, BOR reflects hospital capacity utilization, ALOS indicates the efficiency of patient care and discharge processes, while BTO and TOI illustrate patient flow and bed management. Meanwhile, NDR and GDR serve as indicators of clinical quality and mortality management.

Analysis results reveal that the overall performance of YK Madira Hospital aligns closely with national SPM benchmarks. The hospital demonstrates stable levels in BOR, ALOS, TOI, and mortality indicators, suggesting effective patient care and operational consistency. However, fluctuations in the Bed Turn Over (BTO) rate were observed, primarily due to limited bed capacity and unequal distribution of patient loads across different service classes. This imbalance points to an operational challenge that requires strategic resource reallocation and optimization of scheduling and admission management. Addressing these issues would enable the hospital to maximize capacity utilization while maintaining service quality across departments.

The integration of BI technology transforms SIMRS from a passive data repository into an active analytical engine capable of generating real-time insights. This transformation is consistent with Silvana & Akbar (2017), who emphasized that BI systems improve the accuracy and responsiveness of organizational decision-making through automated analysis and visualization. In YK Madira Hospital, the BI dashboard allows administrators to detect anomalies, monitor service performance, and identify emerging trends without the need for manual data processing. For example, management can instantly visualize monthly BOR fluctuations or detect departments with prolonged patient stays, facilitating quicker interventions and data-driven policy formulation.

Moreover, the adoption of BI aligns with the principles of Sepdela & Tania (2020), who argue that an integrated information system must not only support administrative functions but also serve as a decision-support tool. The system's interactive features—such as filtering by department, time range, and service category—empower decision-makers to conduct multi-dimensional analyses. This capability enhances transparency and accountability within hospital operations, promoting a culture of continuous quality improvement. In addition, by automating reporting and visualizing SPM indicators, the system reduces human error, accelerates data retrieval, and supports compliance with Ministry of Health regulations.

Overall, the developed BI dashboard has proven instrumental in improving hospital management effectiveness at YK Madira. It enables data-driven governance, enhances monitoring accuracy, and fosters a proactive approach to performance management. The integration of BI with SIMRS demonstrates how healthcare institutions can leverage digital transformation to achieve both operational excellence and regulatory compliance. Future system development could include predictive analytics to forecast patient admission rates or resource utilization trends, thereby extending the hospital's analytical capabilities beyond performance monitoring toward strategic decision support for sustainable healthcare management.

Conclusion and Recommendations

The implementation of a Business Intelligence dashboard at YK Madira Hospital effectively facilitates hospital performance evaluation in accordance with the Ministry of Health's Minimum Service Standards (SPM).

Key outcomes include:

1. Improved visualization and monitoring of six SPM indicators (BOR, ALOS, BTO, TOI, NDR, and GDR).
2. Enhanced management understanding of operational performance trends from 2017–2020.
3. Strengthened decision-making capacity through real-time, data-driven insights.

Overall, the BI dashboard enables the hospital to meet national health service standards more efficiently while supporting continuous improvement in hospital management and service delivery.

Disclosure Statement

The authors declare no conflict of interest related to the research, authorship, or publication of this article.

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Biographical Notes

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