

## AN OVERVIEW OF INPATIENT SERVICE EFFICIENCY AT SUMBER WARAS HOSPITAL CIREBON REGENCY 2022–2026 USING THE BARBER–JOHNSON METHOD

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### Abstract

**Background:** The efficiency of inpatient care, particularly in bed utilization, is a key factor in improving the quality of hospital services. Efficiency is measured using the Barber Johnson method, which includes four main parameters: BOR (Bed Occupancy Rate), AVLOS (Average Length of Stay), TOI (Turn Over Interval), and BTO (Bed Turn Over). Based on medical records from Sumber Waras Hospital in 2025, inpatient care indicators show results that do not yet meet the ideal standards set by the Ministry of Health, where the AVLOS value of 2,8 days and the BOR of 55.35% remain below the standard, while the BTO value of 70,81 times actually exceeds the ideal limit. This study aims to describe the efficiency of inpatient services at Sumber Waras Hospital for the 2022–2026 period using the Barber-Johnson method. **Methods:** This study employs a quantitative method with a descriptive design and utilizes secondary data from inpatient medical records for the 2022–2026 period. **Results:** The BOR for 2022–2026 ranges from 51.95% to 55.61%, AvLOS ranges from 2.67 to 3.16 days, TOI ranges from 2.30 to 2.77 days, and BTO ranges from 18.06 to 70.81 times. **Conclusion:** The utilization of inpatient beds at Sumber Waras Hospital for the 2022–2026 period is not yet efficient. Of the four indicators, only the TOI meets the ideal standard, while the BOR, AvLOS, and BTO all fall short of the standard. The Barber-Johnson chart shows that the intersection points for 2022–2026 all lie outside the efficiency zone.

**Keywords:** Barber Johnson, Efficiency, Hospitalized

### Introduction

Every individual has the right to obtain safe, high-quality, and affordable health services, as well as equal access to health resources.<sup>1</sup> To support this, the Indonesian government continues to implement various efforts to improve healthcare quality through health system reform, as reflected in Law Number 17 of 2023 concerning Health, which emphasizes quality improvement, accessibility, and efficient utilization of resources in healthcare facilities. The implementation of this policy relies heavily on healthcare service facilities, including hospitals as advanced healthcare providers that play a crucial role in improving public health status.<sup>2</sup>

According to Minister of Health Regulation Number 3 of 2020 concerning Hospital Classification and Licensing, a hospital is a healthcare institution that provides comprehensive individual health services, including inpatient, outpatient, and emergency care.<sup>3</sup> One of the essential services provided by hospitals is inpatient care, which functions in observation, diagnosis, treatment, and nursing care for patients who are admitted to the hospital.<sup>4</sup>

To maintain and improve service quality, hospitals require measurable indicators to ensure continuous quality improvement at every level of care. Hospital management also utilizes inpatient census data for planning, budgeting, and human resource management purposes. Inpatient census data reflects the number of patients treated at a healthcare facility within a certain period and forms part of hospital statistics derived from medical records.<sup>5</sup> These data are processed into inpatient service indicators that describe utilization levels, quality, and efficiency of services.

The significant role of inpatient units in hospital service systems requires effective and efficient management to ensure optimal patient care. Efficiency is a critical indicator in hospital management because it relates to resource utilization, bed occupancy, and overall service performance. Inefficient management may lead to various administrative problems and potentially reduce public trust in healthcare services.<sup>6</sup>

Inpatient statistical indicators used to assess utilization, quality, and efficiency of hospital services consist of Bed Occupancy Rate (BOR), Average Length of Stay (AvLOS), Turn Over Interval (TOI), and Bed Turn Over (BTO).<sup>7</sup> According to the Indonesian Ministry of Health's ideal standards, BOR should range between 60%–80%, AvLOS between 6–9 days, TOI between 1–3 days, and BTO between 40–50 times.

Measurement of inpatient service efficiency can be conducted using the Barber–Johnson method, developed by Barry Barber and David Johnson in 1973. This method is advantageous because it presents the four indicators simultaneously in a single graph, allowing for a comprehensive visual analysis of the relationship between indicators. The Barber–Johnson method is also used as part of hospital accreditation assessment standards by the Hospital Accreditation Commission (KARS) to evaluate service quality.<sup>4</sup>

Preliminary data from Sumber Waras Hospital shows that in 2025, the Average Length of Stay (AvLOS) value of 2.8 days is below the Ministry of Health's standard (6–9 days), Bed Occupancy Rate (BOR) is 55.35%, also below the standard (60%–85%), while Bed Turn Over (BTO) reaches 70.81 times, exceeding the ideal standard (40–50 times). Based on interviews with the Head of Medical Records, the short length of stay is influenced by physicians' decisions to discharge patients too early, resulting in high bed turnover rates, but patients may not be fully recovered upon discharge.

In addition, inpatient visit reports for the fourth quarter of 2025 show an increase in 30-day readmission cases, namely October (319), November (491), and December (501). This condition indicates a decline in service efficiency because resources used during treatment do not produce optimal service outcomes. Early discharge may lead to incomplete recovery, requiring patients to be readmitted, which ultimately increases hospital resource burden and unnecessary costs.

Furthermore, the hospital has not yet conducted efficiency analysis using the Barber–Johnson graphical method. So far, inpatient service evaluation at Sumber Waras Hospital has been primarily based on a financial approach by comparing patient admissions with hospital revenue. As a result, efficiency indicators such as BOR, AvLOS, TOI, and BTO have not been optimally utilized, and a comprehensive picture of inpatient service efficiency has not been achieved.

Based on these findings, a more comprehensive evaluation of inpatient service efficiency is needed. Therefore, this study aims to determine the description of inpatient service efficiency at Sumber Waras Hospital for the period 2022–2026 using the Barber–Johnson method.

## Method

This study employed a quantitative research approach, which is systematically structured from the beginning to the end of the research process<sup>28</sup>, with a descriptive design aimed at providing an objective overview of variables without manipulation<sup>29</sup>. The research was conducted at Sumber Waras Hospital, located at Jl. Urip Sumoharjo No. 5, Ciwaringin, Cirebon Regency, West Java, from January to May 2026. The population consisted of secondary data derived from the monthly recapitulation reports of inpatient daily census for the period 2022–2026, including inpatient days (HP), length of stay (LD), number of beds (TT), and the number of discharged patients (alive and deceased) (D)<sup>30</sup>. A total sampling technique was applied, meaning all population data were used as the research sample<sup>29</sup>. The variables studied were inpatient service efficiency indicators, namely Bed Occupancy Rate (BOR), Average Length of Stay (AvLOS), Turn Over Interval (TOI), and Bed Turn Over (BTO). Operationally, BOR represents the percentage of bed utilization, AvLOS indicates the average length of patient stay, TOI reflects the average duration a bed remains unoccupied, and BTO measures the frequency of bed usage, all calculated using secondary medical record data processed through the SIBARSON application and supporting tables.

Data were collected using documentation study and interviews. Documentation involved secondary data from inpatient census reports, which were processed using SIBARSON to obtain BOR, AvLOS, TOI, and BTO indicators<sup>33</sup>, while interviews were conducted with the Head of Medical Records to obtain supporting information<sup>28</sup>. The research instruments included supporting tables for recording data and the SIBARSON web-based application<sup>32</sup>. Data processing followed several stages, namely editing, data entry, and data presentation in the form of Barber–Johnson graphs<sup>33</sup>. Data analysis used univariate (descriptive) analysis to describe the distribution of indicators, which were then plotted into Barber–Johnson graphs to assess inpatient service efficiency<sup>34</sup>.

## Results

### Inpatient Service Efficiency in All Inpatient Wards of Sumber Waras Hospital (2022–2026) Based on Indicator Calculations (BOR, AvLOS, TOI, and BTO)

The four Barber–Johnson indicators were calculated based on the 2005 Ministry of Health standards, namely BOR 60%–85%, AvLOS 6–9 days, TOI 1–3 days, and BTO 40–50 times. These indicators were used as benchmarks to assess inpatient service efficiency.

**Table 1. Bed Occupancy Rate (BOR) of Sumber Waras Hospital 2022–2026**

| Year | Patient Days | Number of Beds | Period | BOR (%) |
|------|--------------|----------------|--------|---------|
| 2022 | 49,499       | 261            | 365    | 51.95%  |
| 2023 | 50,977       | 261            | 365    | 53.51%  |
| 2024 | 52,980       | 261            | 366    | 55.61%  |
| 2025 | 52,726       | 261            | 365    | 55.34%  |
| 2026 | 12,499       | 261            | 90     | 53.59%  |

Source: Inpatient Census Report, Sumber Waras Hospital

The BOR values from 2022 to 2026 ranged between 51.95% and 55.61%, which are below the Ministry of Health standard (60%–85%). This indicates that bed utilization in the hospital was still not optimal, even though a slight increase was observed until 2024, followed by relatively stable but suboptimal performance.

**Table 2. Average Length of Stay (AvLOS) of Sumber Waras Hospital 2022–2026**

| Year | Total Length of Stay | Discharged Patients (Alive + Dead) | AvLOS (days) |
|------|----------------------|------------------------------------|--------------|
| 2022 | 50,561               | 16,486                             | 3.06         |
| 2023 | 51,861               | 17,333                             | 2.99         |
| 2024 | 53,588               | 16,946                             | 3.16         |
| 2025 | 53,415               | 18,484                             | 2.80         |
| 2026 | 12,590               | 4,715                              | 2.67         |

Source: Inpatient Census Report, Sumber Waras Hospital

The AvLOS values ranged from 2.67 to 3.16 days, which are below the ideal standard of 6–9 days. This condition indicates that patients tend to have short hospitalization periods, which may reflect early discharge policies or case management patterns that reduce length of stay.

**Table 3. Turn Over Interval (TOI) of Sumber Waras Hospital 2022–2026**

| Year | Beds | Patient Days | Period | Discharged Patients | TOI (days) |
|------|------|--------------|--------|---------------------|------------|
| 2022 | 261  | 49,499       | 365    | 16,486              | 2.77       |
| 2023 | 261  | 50,977       | 365    | 17,333              | 2.55       |
| 2024 | 261  | 52,980       | 366    | 16,946              | 2.51       |
| 2025 | 261  | 52,726       | 365    | 18,484              | 2.30       |
| 2026 | 261  | 12,499       | 90     | 4,715               | 2.33       |

Source: Inpatient Census Report, Sumber Waras Hospital

The TOI values ranged from 2.30 to 2.77 days, which are still within or slightly above the ideal range (1–3 days). This shows that the bed vacancy interval is relatively short, indicating fast bed turnover; however, it also reflects pressure on service flow due to high turnover.

**Table 4. Bed Turn Over (BTO) of Sumber Waras Hospital 2022–2026**

| Year | Discharged Patients (Alive + Dead) | Beds | BTO (times) |
|------|------------------------------------|------|-------------|
| 2022 | 16,486                             | 261  | 63.16       |
| 2023 | 17,333                             | 261  | 66.40       |
| 2024 | 16,946                             | 261  | 64.92       |
| 2025 | 18,484                             | 261  | 70.81       |
| 2026 | 4,715                              | 261  | 18.06       |

Source: Inpatient Census Report, Sumber Waras Hospital

The BTO values in 2022–2025 were above the ideal standard (40–50 times), indicating very high bed utilization frequency. However, in 2026, BTO dropped significantly to 18.06 times, which indicates a decline in patient turnover and service utilization.

#### **Inpatient Service Efficiency Based on Barber–Johnson Graph (2022–2026)**

The calculated indicators were plotted using the SIBARSON application to produce Barber–Johnson graphs for each year.

### Barber–Johnson Graph Sumber Waras Hospital (2022)



Figure 1. Barber–Johnson Graph 2022

In 2022, the intersection point of BOR, AvLOS, TOI, and BTO was outside the efficiency area. This indicates that inpatient service performance had not yet reached the ideal efficiency level.

### Barber–Johnson Graph Sumber Waras Hospital (2023)

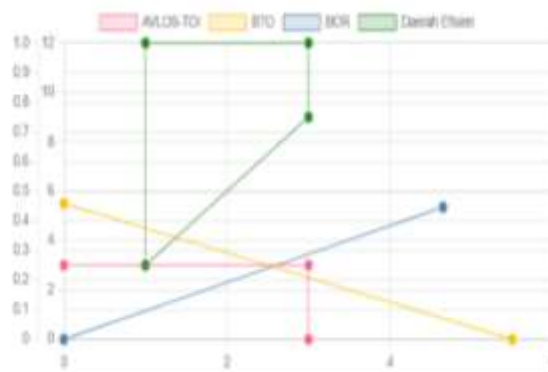


Figure 2. Barber–Johnson Graph 2023

In 2023, all indicators remained outside the efficiency zone, showing no significant improvement in overall inpatient efficiency.

### Barber–Johnson Graph Sumber Waras Hospital (2024)



Figure 3. Barber–Johnson Graph 2024

In 2024, the condition remained similar, where the indicator intersection still did not enter the efficiency area.

#### Barber–Johnson Graph Sumber Waras Hospital (2025)

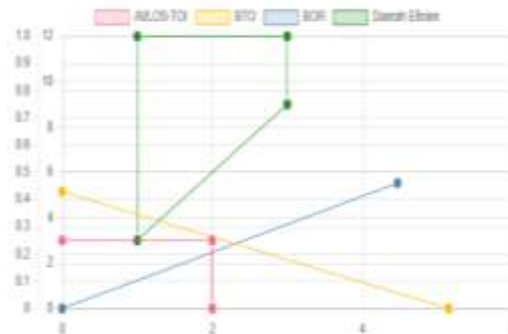


Figure 4. Barber–Johnson Graph 2025

In 2025, the intersection point of BOR, AvLOS, TOI, and BTO was outside the efficiency area. This indicates that inpatient service performance had not yet reached the ideal efficiency level.

#### Barber–Johnson Graph Sumber Waras Hospital (2026)



Figure 5. Barber–Johnson Graph 2026

In 2026, the intersection point of BOR, AvLOS, TOI, and BTO was outside the efficiency area. This indicates that inpatient service performance had not yet reached the ideal efficiency level.

## Discussion

### Inpatient Service Efficiency at Sumber Waras Hospital Based on Indicators BOR Indicator (2022–2026)

Bed Occupancy Rate (BOR) is an indicator that describes the percentage of hospital bed utilization within a certain period and is used to assess the effectiveness of inpatient bed usage (Ministry of Health of Indonesia, 2005)<sup>1</sup>. A higher BOR value indicates better utilization of inpatient facilities, whereas a low BOR reflects underutilization of hospital resources.

The results of this study show that BOR values at Sumber Waras Hospital during the period 2022–2026 were consistently below the ideal standard of 60%–85% set by the Ministry of Health. The BOR values recorded were 51.95%<sup>1</sup> in 2022, 53.51%<sup>2</sup> in 2023, 55.61%<sup>3</sup> in 2024, 55.34%<sup>4</sup> in 2025, and 53.59%<sup>5</sup> in 2026. Although there was a gradual increase from 2022 to 2024, the trend declined slightly afterward, indicating instability in bed utilization performance.

The consistently low BOR indicates that a large number of hospital beds remain unoccupied for extended periods. Based on interviews with the Head of Medical Records, this condition is influenced by limited hospital facilities and infrastructure, which affects patient interest in choosing inpatient services at Sumber Waras Hospital. Patients tend to prefer healthcare facilities with more complete diagnostic and therapeutic services, which ultimately reduces inpatient admission rates.

This finding is supported by Sihombing (2025), who reported that hospital facilities significantly influence BOR values with a significance level of  $0.000 < 0.05$ <sup>35</sup>. Hospitals with limited infrastructure tend to experience lower occupancy rates because patients prefer more complete healthcare services elsewhere. Similarly, Salim et al. (2023) found that inadequate supporting facilities such as diagnostic equipment limitations and ongoing renovation processes contribute to decreased BOR values, as patients are referred to other hospitals with better facilities<sup>36</sup>.

### AvLOS Indicator (2022–2026)

Average Length of Stay (AvLOS) refers to the average number of days a patient is hospitalized, which reflects efficiency and quality of inpatient care. According to Ministry of Health standards (2005), the ideal AvLOS ranges between 6–9 days<sup>1</sup>. The AvLOS values at Sumber Waras Hospital were consistently below the ideal range, recorded at 3.06 days<sup>1</sup> in 2022, 2.99 days<sup>2</sup> in 2023, 3.16 days<sup>3</sup> in 2024, 2.8 days<sup>4</sup> in 2025, and 2.67 days<sup>5</sup> in 2026. This indicates that patients tend to have relatively short hospitalization periods across all years of observation.

The low AvLOS values may reflect several conditions. First, most patients admitted to the hospital have mild or uncomplicated diagnoses that do not require long-term care. This is supported by Sari (2022), who found that low AvLOS is often associated with low severity cases requiring shorter hospitalization periods<sup>37</sup>. Second, early discharge behavior also contributes significantly to reduced AvLOS. Nursyarifa et al. (2025) explained that patients who request early discharge (self-discharge) are often not fully recovered clinically, which can potentially worsen health outcomes and increase the risk of complications<sup>38</sup>.

Third, systemic factors such as the INA-CBGs payment system also influence hospital behavior. Under this system, hospitals are encouraged to optimize efficiency by reducing unnecessary length of stay, since longer hospitalization may reduce bed availability for other patients (Lena et al., 2025)<sup>39</sup>. However, this efficiency-driven approach may have clinical implications, as premature discharge may increase readmission risk. Hidayah et al. (2022) further confirmed that patients with LOS  $\geq 4$  days have a 1.33 times higher risk of readmission within 12 days ( $p < 0.05$ )<sup>40</sup>. This indicates that balancing efficiency and clinical safety remains a major challenge in inpatient care management.

### **TOI Indicator (2022–2026)**

Turn Over Interval (TOI) measures the average number of days a hospital bed remains empty before being occupied by the next patient. It reflects the efficiency of bed turnover management in hospitals (Ministry of Health of Indonesia, 2005)<sup>1</sup>. The TOI values at Sumber Waras Hospital were 2.77 days<sup>1</sup> in 2022, 2.55 days<sup>2</sup> in 2023, 2.51 days<sup>3</sup> in 2024, 2.30 days<sup>4</sup> in 2025, and 2.33 days<sup>5</sup> in 2026. All values fall within the ideal standard range of 1–3 days, indicating efficient bed preparation and turnover management.

A TOI within the ideal range indicates that hospital beds are neither idle for too long nor excessively rushed in turnover, allowing sufficient time for cleaning and preparation. According to Kurniawa et al. (2024), a TOI value around 2 days indicates optimal hospital bed utilization efficiency<sup>41</sup>. Similarly, Wirajaya et al. (2023) reported consistent TOI values within the efficient range over several years, indicating that hospitals with structured inpatient management systems tend to maintain stable bed turnover performance<sup>42</sup>. Thus, despite inefficiencies in BOR and AvLOS, Sumber Waras Hospital demonstrates good performance in bed turnover management.

### **BTO Indicator (2022–2026)**

Bed Turn Over (BTO) reflects the frequency of bed usage by different patients within a certain period. A higher BTO indicates frequent bed utilization, while a lower value reflects reduced patient turnover. The BTO values at Sumber Waras Hospital were 63.16 times<sup>1</sup> in 2022, 66.40<sup>2</sup> in 2023, 64.92<sup>3</sup> in 2024, 70.81<sup>4</sup> in 2025, and 18.06<sup>5</sup> in 2026. According to Ministry of Health standards (2005), the ideal BTO range is 40–50 times per year<sup>1</sup>.

The values from 2022 to 2025 exceeded the standard, indicating high bed rotation frequency. This condition is influenced by a patient “boarding system” where patients are temporarily placed in higher-class rooms due to overcrowding in class III and then returned within a maximum of three days, as regulated by Ministry of Health Regulation No. 28/2014<sup>43</sup>. However, in 2026, BTO dropped significantly to 18.06, indicating a sharp decline in patient admissions. This is attributed to lower patient visits and a shorter reporting period of only 90 days, resulting in reduced bed utilization. Rahmi et al. (2022) explained that low BTO values are strongly associated with low inpatient admissions, which leads to underutilization of hospital beds and reduced turnover efficiency<sup>44</sup>.

### **Barber Johnson Graph Analysis**

The Barber Johnson graph integrates four key indicators: BOR, AvLOS, TOI, and BTO to evaluate inpatient service efficiency comprehensively. The efficiency zone is defined as BOR 75%–85%, AvLOS 3–12 days, TOI 1–3 days, and BTO  $\geq 30$  (Ministry of Health of Indonesia, 2005)<sup>1</sup>. The analysis shows that all intersection points of the four indicators from 2022–2026 fall outside the efficiency area. This is mainly caused by low BOR and AvLOS values, which significantly shift the balance of the Barber Johnson graphical intersection. This finding aligns with Sukawan & Putri (2024), who reported that low inpatient occupancy rates result in inefficiency despite improvements in other indicators<sup>45</sup>. Similarly, Dewi et al. (2025) found that most hospitals’ inpatient units fall outside the efficiency zone due to low BOR values and suboptimal patient admission rates<sup>46</sup>.

To address this issue, hospitals need to implement strategic improvements, including service optimization and digital-based marketing strategies. Social media platforms such as Instagram and TikTok have been proven effective in increasing hospital visibility and patient visits (Pasak et al., 2024)<sup>47</sup>. Digital health communication strategies also improve public trust and engagement, as stated by Qodariyah & Yuliaty (2025)<sup>48</sup>. These platforms allow hospitals to disseminate educational content, service information, and promotional materials effectively. In addition, service expansion such as MRI Tesla technology, ERACS surgery, 4D ultrasound, and hypnosis therapy introduced in 2025 plays an important role in increasing service attractiveness. Aulia et al. (2025) stated that service completeness

enhances patient trust and utilization rates<sup>49</sup>, while Putra et al. (2024) emphasized that technological advancement improves service efficiency and patient satisfaction.

## Conclusion

Based on the calculation of the four Barber–Johnson indicators at Sumber Waras Hospital during 2022–2026 using the Ministry of Health (Depkes RI, 2005) standards, the results show that most indicators did not meet efficiency criteria. The Bed Occupancy Rate (BOR) values ranged from 51.95% to 55.61%, all below the ideal standard of 60%–85%, indicating low bed utilization. Similarly, the Average Length of Stay (AvLOS) ranged from 2.67 to 3.16 days, which is below the ideal standard of 6–9 days, reflecting short hospitalization periods. In contrast, the Turn Over Interval (TOI) values ranged from 2.30 to 2.77 days, all within the ideal standard of 1–3 days, indicating relatively efficient bed turnover intervals. However, the Bed Turn Over (BTO) values showed inefficiency, with values from 63.16 to 70.81 times in 2022–2025 exceeding the ideal standard (40–50 times), while the 2026 value (18.06 times) fell far below the minimum standard. Furthermore, the Barber–Johnson graph analysis revealed that the intersection point of the four indicators in all observed years was outside the efficiency zone, indicating that inpatient bed utilization at Sumber Waras Hospital during this period was not yet efficient.

Based on these findings, several recommendations can be proposed. For educational institutions, this study can serve as a reference to enhance understanding of inpatient service efficiency using the Barber–Johnson method. For future researchers, this study is expected to be a basis for further research with broader data coverage and longer observation periods to obtain more comprehensive results. For the hospital, the findings should be used as input in decision-making, particularly in optimizing bed management to achieve efficiency according to Barber–Johnson standards. Additionally, medical record staff are encouraged to routinely develop Barber–Johnson graphs annually as an evaluation tool for inpatient bed utilization and as a foundation for future strategic planning.

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