

Optimization of the Use of the Barber-Johnson Chart on the Efficiency of Bed Management in the Kabupaten Kediri Hospital

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ABSTRACT

The level of efficiency in bed use in hospitals using 4 (four) parameters, namely Bed Occupancy Ratio (BOR), Average Length of Stay (AvLOS), Internal Turnover (TOI), and Bed Turnover (BTO). Hospitals that do not utilize the Barber-Johnson Chart will have difficulty describing inpatient performance, comparing rooms, and even being unable to control reporting errors. Hospitals use Barber Johnson charts to conduct evaluations to improve efficiency in hospitals. As one of the determining variables of the four parameters, bed capacity cannot be easily reduced or added due to regulations. Adjust the number of beds according to the class needed by the patient; for example, if the patients at the Hospital of Kabupaten Kediri are mostly National Health Insurance class I and class III participants, then the ratio of the number of beds in class I and class III is more than class II, and so on. The BOR value has increased from year to year, along with the number of patients, treatment days, and length of treatment. The AvLOS and TOI scores have met the ideal figures, so the quality of health services at the Hospital of Kabupaten Kediri is good.

Keywords: Efficiency, Jonhson-Barber Chart, National Health Insurance

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INTRODUCTION

The central, local, and private governments can establish hospitals. Hospitals established by the central government and local governments must be in the form of Technical Implementation Units from Agencies in charge of the health sector or certain agencies with the management of the Public Service Agency or Regional Service Agency. Hospitals established by the private sector must be in the form of legal entities, can be non-profit legal entities or legal entities with profit objectives in the form of limited liability companies or companies, all of which must follow the provisions of laws and regulations (Kemenkes RI, 2020).

Hospitals play a role in curative and rehabilitative efforts to restore a person's health status and change sick conditions to healthy while carrying out preventive and promotive health activities. One of the curative and rehabilitative efforts of the Hospital is to organize an inpatient installation, which treats sick patients and restores their health. Inpatient installations have a critical role in the health sector because they can monitor patients 24

hours a day and are ready to handle emergencies related to life safety. Hospitals should provide quality services following existing standards. Availability of the number of beds, because inpatients need beds as a means of treatment, affects the quality of inpatient services. Hospitals must optimize existing facilities in providing services, so they must pay attention to the placement of beds so that there is no overload or emptiness. If the Hospital is overloaded, the quality of medical services will decline, and crowded room conditions can reduce sanitation. Conversely, if beds are unused, the Hospital will waste costs due to the low level of bed utility. These two conditions threaten the efficiency of medical services because hospitals waste money without getting the appropriate results (Jukistra, 2022).

Hospital statistics process health service data to produce factual information or knowledge about the health service (Lorena Sitanggang & Yunengsih, 2022; Nisaa, 2019). The team collects daily inpatient statistical data to monitor inpatient care over daily, weekly, monthly, and yearly periods and then uses the data to create reports (Sudarman, 2019). (Lorena Sitanggang & Yunengsih, 2022; Wirajaya, 2023). One of the statistics used is the inpatient service indicator, which refers to hospital health services where patients stay or stay for at least one day based on referrals from health service providers or hospitals that provide these services.

One of the Hospital's curative and rehabilitative efforts is implementing inpatient services, which intend to care for and restore patients' health. Inpatient services of a hospital have an essential role in hospital management because most of the Hospital's income comes from the services provided by the Inpatient Unit. Patients who use the Inpatient Unit service facilities for each medical case must receive intensive treatment. Thus, patients must get treatment at the Hospital. One of the indicators that must be the concern of hospital management in improving hospital services is the efficiency of inpatient services, namely the utilization of beds. The bed capacity in inpatient services influences the Hospital's efficiency in using the beds. Thus, patients must get treatment at the Hospital. Evaluation of the efficiency level of bed use in hospitals using 4 (four) parameters, namely Bed Occupancy Ratio (BOR), Average Length of Stay (AvLOS), Internal Turnover (TOI), and Bed Turnover (BTO) (Valentina, 2019), Bed Occupancy Ratio (BOR) or the percentage of bed use at any given time. Average Length of Stay (AvLOS) determines how many days each patient gets treated on average in a given time. Internal Turnover (TOI) to determine how many days each bed is, on average, unused in a given time. Bed Turn Over (BTO) to calculate the use of each bed a certain number of times in a given time (Hosizah & Maryati, 2018).

The profile Hospital of Kabupaten Kediri in 2023 has used these four parameters but not the Barber-Johnson Chart. As is known, the benefits of the Barber-Johnson Chart are to describe the comparison of inpatient performance over a while in a hospital, monitor activities, describe comparisons between inpatient rooms in the Hospital, research after a policy, and control reporting errors (Hosizah & Maryati, 2018; Sudra, 2017). Hospitals that do not utilize the Barber-Johnson Chart will have difficulty describing comparisons of inpatient performance and between rooms and may be unable to control reporting errors.

Bed management is essential in assessing hospital services' efficiency and effectiveness. The availability and optimal use of beds reflect the Hospital's ability to meet patient needs and directly impact the quality of services. Efficiency is one of the parameters/performance indicators that theoretically underlies the entire performance of an organization, in this case, a hospital. Without efficient supervision, problems can arise from the management side that can cause deviations (Wirajaya, 2023). Hospital management uses the Barber-Johnson Chart as one method to measure the level of efficiency. This chart utilizes hospital statistics and explains using four parameters as efficiency indicators in hospital management (M Luthfi Fauzi et al., 2021). In this context, hospital administrators can use the Barber-Johnson Chart

as an analytical tool to evaluate bed management efficiency. This tool allows hospital managers to visualize the relationship between bed occupancy rate (BOR), average length of stay (ALOS), patient turnover interval (TOI), and discharge rate (Rd. Sekar Putri Defiyanti et al., 2021).

The Hospital of Kabupaten Kediri, as one of the leading referral health facilities in the region, faces challenges in effective bed management. With the growing population and the increasing need for health services, the Hospital must ensure that available resources, including beds, are optimally utilized to meet the community's needs. However, preliminary data showed significant variations in bed occupancy rates, patient wait times, and patient flow in and out. This shows the need for a more in-depth evaluation of bed management using a structured and data-based approach.

The Hospital of Kabupaten Kediri faces several significant challenges in bed management, including the Uneven Bed Occupancy Rate. Data shows fluctuations in bed occupancy rates, with some service units experiencing excess capacity while others have many unused beds. This imbalance can hinder the flow of patient services. Non-Standard Average Length of Stay: Some patients have ALOS that is longer than it should be, which can be caused by delays in the enforcement of diagnosis, treatment, or administration. High Turnover Interval: A high TOI indicates a significant time lag between a discharged patient and a subsequent patient using the same bed (Rachman et al., 2023; Sukawan & Putri, 2024; Zulva Fitriani et al., 2024). This suggests a lack of efficiency in cleaning, preparing, or administratively managing the bed. Data and Technology Limitations: Manual or poorly integrated patient and bed data management makes performing real-time analysis and data-driven decision-making difficult. These challenges demonstrate the importance of efforts to optimize bed utilization through a more structured approach. Barber-Johnson chart can be an effective tool in identifying areas of improvement and formulating strategies to improve bed management efficiency at the Hospital of Kabupaten Kediri.

Suboptimal bed management efficiency can result in various problems, such as long waiting times for inpatients, decreased service quality, and waste of resources. On the other hand, efficient bed management can increase patient satisfaction levels, speed up the healing process, and support the sustainability of hospital operations (Pradnyantara, 2022; Valentina, 2019). Therefore, implementing the Barber-Johnson Chart as a tool for evaluating and optimizing bed management is very relevant, especially for the Hospital of Kabupaten Kediri, a referral hospital with a high rate of patient visits.

Purpose

Analyze the factors that cause the non-utilization of the Barber-Johnson Chart in a supervisory effort for the efficiency of bed management at the Hospital of Kabupaten Kediri and determine the right strategy to overcome this by using SWOT analysis.

METHODS

Community Service activities began by reviewing the data presented in the 2023 Hospital of Kabupaten Kediri Profile Report, starting from facility data and budget to performance. The performance report in the inpatient room displays four parameters of bed utilization, namely BOR, AvLOS, TOI, and BTO, from 2020 to 2023. Still, the parameter data does not use the Barber-Johnson Chart. The Barber-Johnson chart is a tool to view or compare the efficiency level of bed utilization over time. To determine and evaluate the calculation's correctness.

The team started the first step by analyzing the Fishbone Diagram. This diagram often called the Effect Diagram, has a shape resembling a fishbone and is used to show the cause-and-effect relationship of a problem. The team identified the main factors that affect quality through the Fishbone Diagram, namely 5M + 1E: Machine, Man, Method, Material,

Measurement, and Environment. This diagram helps the team identify various potential causes of an effect or problem by analyzing them through a brainstorming session.

The team breaks down the problem into categories: man, material, machine, method, money, and environment. During the brainstorming, the team noted all the difficulties that might have been the leading causes. The team writes the main problems on the fish head. It lists its spines covering aspects such as 6M (man, method, money, material, mother nature, machine) or 5S (surroundings, suppliers, systems, skills, safety) based on the approach described by (Widnyana et al., 2022).

The team analyzed the priority order using Urgency, Seriousness, and Growth (USG) to finalize it. The team determines the issue's urgency, seriousness, and development level by giving a value between 1-5 or 1-10. The issue with the highest total score will be the top priority. Urgency measures how quickly the team must resolve the issue related to time availability. The more urgent the issue, the higher the value the team gives. The team must discuss this issue by considering the time available and the time pressure to resolve it (Naser et al., 2022). Seriousness measures how seriously the team finds the issue and the impact it will have if the team does not fix it promptly. The team considers this issue more serious if it can cause more problems than the problem itself. Growth relates to how quickly the issue is growing. The faster the issue is growing, the higher the growth rate. The situation will worsen if the team does not resolve this issue.

The team uses SWOT analysis as a strategic planning method to evaluate strengths, weaknesses, opportunities, and threats. This method has proven effective, efficient, and fast in identifying opportunities related to innovations in the business world. This analysis assumes that an effective strategy will maximize strengths and opportunities and minimize weaknesses and threats. If the team applies it correctly, this simple assumption will significantly impact successful strategy design. The environmental analysis provides the information needed to identify opportunities and threats in the company's environment (Mashuri & Nurjannah, 2020).

RESULTS

Identifying the problem of not using the Barber-Johnson chart in the performance report of the Inpatient Installation at the Hospital of Kabupaten Kediri is categorized using 5M: man, measure, machine, method, and mother nature.

1. Man

There is still a lack of understanding among medical records Staff regarding the importance of the Barber-Johnson Chart.

2. Measure

Manual calculation of Barber-Johnson Chart parameters

3. Machine

The Staff have not utilized computers optimally

4. Method

The Staff haven't found an easy method to understand Barber-Johnson's Chart

5. Mother nature

There is not enough time for medical records staff to perform analysis using the Barber-Johnson Chart

Determination of Priority Solving Problems Barber-Johnson Chart Not Used in Bed Management Efficiency Analysis at the Hospital of Kabupaten Kediri with USG Analysis (Urgency, Seriousness, Growth)

Table 1. Issue Priority Table

No.	Indicator	U	S	G	UxSxG	Rangkin g
1.	Understanding of medical record staff related to the importance of the Barber-Johnson Chart unevenly distributed	5	4	5	100	1
2	Parameter calculation of Barber-Johnson Chart manually	4	3	5	60	2
3	The Staff have not utilized computers optimally	4	2	5	40	3
4	The Staff Haven't found an easy method to be able to understand the Barber-Johnson Chart	4	3	5	60	2
5	There is not enough time for recording staff medical to conduct analysis using Barber-Johnson Charts	2	3	5	30	4

Based on the priority analysis using USG, the main priority is to improve understanding and equity related to the Barber-Johnson Chart, utilizing computers to perform calculations so that it will have an impact on working time by medical records staff to analyze the performance of inpatient units.

The Barber-Johnson Chart is a simple but effective tool for evaluating bed management efficiency. This chart integrates three key indicators, namely BOR, AvLOS, and TOI, into a single Chart that provides a comprehensive picture of the performance of hospital bed management. In this chart, the Hospital is ideally in the optimal area, where the BOR is 75-85%, the AvLOS follows the medical service standards, and the TOI is close to zero. If a hospital is outside the optimal area, further analysis is needed to identify the cause of the inefficiency. Based on the ultrasound study in the table above, increasing the understanding of medical record staff about the Barber-Johnson Chart needs to be improved

Strategies to Solve the Problem of Increasing Barber-Johnson Chart Problems Not Used in Bed Management Efficiency Analysis at the Hospital of Kabupaten Kediri with SWOT Analysis (Strength, Weakness, Opportunity, Threats)

Table 2. Internal Factor Evaluation Matrix

No	Internal Factors	Weight	Rating	Score
Strength				
1	The need for human resources at the Medical Records Installation of the Hospital of Kabupaten Kediri has met the qualifications.	0.10	2.67	0.26
2	The Hospital of Kabupaten Kediri has calculated BOR, AvLOS, TOI, BTO	0.09	2.47	0.22
3	There is already data on the Daily Census of inpatient services	0.10	2.73	0.27
4	All Staff support digitalization programs	0.15	2.67	0.41
Strength Values		0.44		1.77
Weakness				
5	The number of human resources does not meet	0.14	3.73	0.51

	the needs of the Medical Records Installation of the Hospital Kabupaten Kediri			
6	Calculate BOR, AvLOS, TOI, and BTO manually	0.14	3.8	0.53
7	Obtaining Daily Census Data for inpatient services through manual collection of forms	0.15	4.07	0.61
8	Medical Records Staff's understanding of the benefits of Barber-Johnson's Chart is uneven	0.13	3.53	0.46
Weakness Value		0.56		2.11
IFE (Strength – Weakness) values		1		-0.94

Table 3. External Factor Evaluation Matrix

No	External Factors	Weight	Rating	Score
Opportunity				
1	The Ministry of Health supports hospital digitalization efforts	0.19	4.20	0.78
2	The Kediri Chart Government's support for Hospital Information System repair is very high	0.17	3.80	0.64
3	Information and Electronic Transactions Law number 19 of 2016 supports the implementation of electronic transactions in hospitals	0.17	3.87	0.66
Opportunity Value		0.53		2.08
Threat Factor				
4	Competition between hospitals in providing health services is very high	0.17	1.53	0.26
5	Changes in regulations from the government and/or the Ministry of Health affect visits and opinions of the Hospital of Kabupaten Kediri	0.15	1.60	0.24
6	Changes in rules from National Health Insurance affect visits and income of the Hospital of Kabupaten Kediri	0.16	1.60	0.25
Threat value		0.47		0.75
EFE (Opportunity – Threats) values		1		1.33

Based on the SWOT analysis carried out, shows that the development strategy is in quadrant 3, namely the defensive strategy. According to the excellent online Indonesian dictionary, defensive means to be defensive. This situation shows great opportunities hospitals face, but there are also big internal problems, so a more in-depth study is needed to solve internal problems. The right strategy is to minimize weaknesses and maximize the Hospital's opportunities by defending itself.

Table 4. Problem-Solving Strategy Matrix

Internal Factors	STRENGTH	WEAKNESS
External Factors	- Human Resources (HR) qualifications met	- Understanding of medical record staff related to the importance of the Barber-Johnson Chart
	- Complete BOR, AvLOS, TOI, and BTO data	- unevenly distributed
	- There is a daily census	- Calculate BOR,
	- All Staff support	AvLOS, TOI, and BTO

	digitalization programs	manually
		- Daily Census data is still manual
		- Understanding of the benefits of Barber-Johnson's Chart is uneven
OPPORTUNITY	SO STRATEGY	WO STRATEGY
- The Ministry of Health supports hospital digitalization efforts	- Perform BOR, AvLOS, TOI and BTO calculations using the Hospital Information System	- Improving Medical Records staff knowledge about Barber Johnson Charts
- The Kediri Regency Government's support for Hospital Information System repair is very high	- Daily Census using Hospital Information System	- Improve the skills of Medical Records Staff in using computers to be able to analyze Barber-Johnson Charts
- Information and Electronic Transactions Law number 19 of 2016 supports the implementation of electronic transactions in hospitals		
THREAT	ST STRATEGY	WT STRATEGY
- Competition between hospitals is very high	- Improving the competence of human resources who already have qualifications as a Medical Recorder and Health Information Technician	- Socializing the management of the use of the Barber-Johnson Chart can not only correct calculation errors but also determine the position of bed management efficiency, especially in inpatient visits
- Changes in regulations from the government and/or the Ministry of Health affect RSKK visits and income in 2020 - 2023	- Utilizing the Barber-Johnson chart in analyzing the efficiency of bed management and inpatient visits	
- Changes in rules from National Health Insurance affect visits and income at the Hospital of Kabupaten Kediri		

From the SWOT analysis matrix, the strategy that the Hospital of Kabupaten Kediri must take is to increase the knowledge of Medical Record staff regarding the Barber-Johnson Chart and improve the skills of Medical Records staff in using computers to be able to analyze the Barber-Johnson Chart.

Table 5. The Hospital Performance Data Table in 2020-2023

Y	Numbe	Num	The	Be	Da	Aver	BOR	AvL	TOI	BTO
ea	r of	ber	numb	d	y	age		OS		
r	patient	of	er of			Bed				
	s	Days	long			filled				
	dischar	Treat	stays							
	ged	ed	in							

treatm ent													
A	B	C	D	E	F	G	75- 95 %	x	y	3-12 hr	1-3 hr	40- 50	x, y
							(C/F)	(G/ E)			(GxF) / B	((E- G)x F) / B	B/E
2 0 2 0	15,769	60,14 4	72,46 6	27 2	36 5	164.3 3	60. 41	3. 96	6. 04	3.81	2.50	57. 97	6. 3 1
2 0 2 1	14,538	59,81 6	54,87 1	29 5	36 5	163.8 8	55. 55	4. 44	5. 56	4.11	3.29	49. 28	7. 4 1
2 0 2 2	20,016	71,92 4	67,17 6	29 5	36 5	197.0 5	66. 80	3. 32	6. 68	3.59	1.79	67. 85	5. 3 8
2 0 2 3	23,778	77,79 3	73,79 3	28 2	36 5	213.1 3	75. 58	2. 44	7. 56	3.27	1.06	84. 32	4. 3 3

The BOR value allows hospital management to know the level of bed utilization. The team used this parameter to see the high and low levels of bed usage in hospitals (Wirajaya, 2023). At the Hospital of Kabupaten Kediri in 2020–2023, the BOR value was 55–75%, while the ideal standard, according to Barber-Johnson, is 75–85%. According to Sekar Putri (2019), a high BOR value reflects a high level of bed utilization and vice versa. If the BOR value is below 75%, it does not meet the Barber Johnson standard. However, according to the Ministry of Health standard (ideal BOR of 60–80%), in 2020, the Hospital of Kabupaten Kediri met the standard with a BOR of 60.41%. In 2021, the BOR value decreased to 55.55%. The low BOR value causes hospital financial management to be less efficient due to reduced income.

The AvLOS figure at the Hospital of Kabupaten Kediri in 2020–2023 showed a decline. The highest AvLOS figure was recorded in 2021 at 4.11 days, while the lowest was 3.27 days in 2023. The decrease in the AvLOS figure indicates the efficiency of health services in hospitals. Based on discussions with the Hospital, the increasingly small AvLOS is related to the National Health Insurance (JKN) service and the AvLOS standard for each patient care and non-surgical delivery care. To maintain the AvLOS value according to the ideal Barber Johnson standard, a policy from hospital management that focuses on improving the quality of service is needed. The lower the AvLOS value, the better the results, but the team must still pay attention to the quality of service provided. Factors supporting achieving the ideal LOS value in hospitals include cooperation between doctors, nurses, and other medical personnel in providing health services according to hospital standards and indicators.

The decreasing BOR figure will affect the TOI (Afriana, 2017; Lesiangi, 2019). The TOI trend at the Hospital of Kabupaten Kediri in 2020 - 2023 experienced an increase and

decrease, the highest increase in 2021 with a value of 3.29 days and the lowest in 2023 with a value of 1.06. Based on the Barber-Johnson Chart, the ideal limit in 2020 - 2023 is 1-3 days. A decrease in TOI increases the demand for beds because the lower the TOI, the shorter the time the bed is empty before a new patient uses the bed. This provides economic benefits to hospital management.

The BTO value at the Hospital of Kabupaten Kediri in 2020 - 2023 was unstable, with the highest value in 2023, which was 84.32 times, and the lowest value in 2021 of 49.28 times, so the value has not yet reached the ideal value because at Barber-Johnson in a year the standard value is 30 patients. The lower the BTO value, the more unused beds there are because only a few patients use the bed, but conversely, if the BTO value is higher, the more often the bed is used because the bed is used more often by patients alternately. This condition can threaten patient safety. Hospital management needs to evaluate the use of beds by relocating beds to wards or classes in high demand.

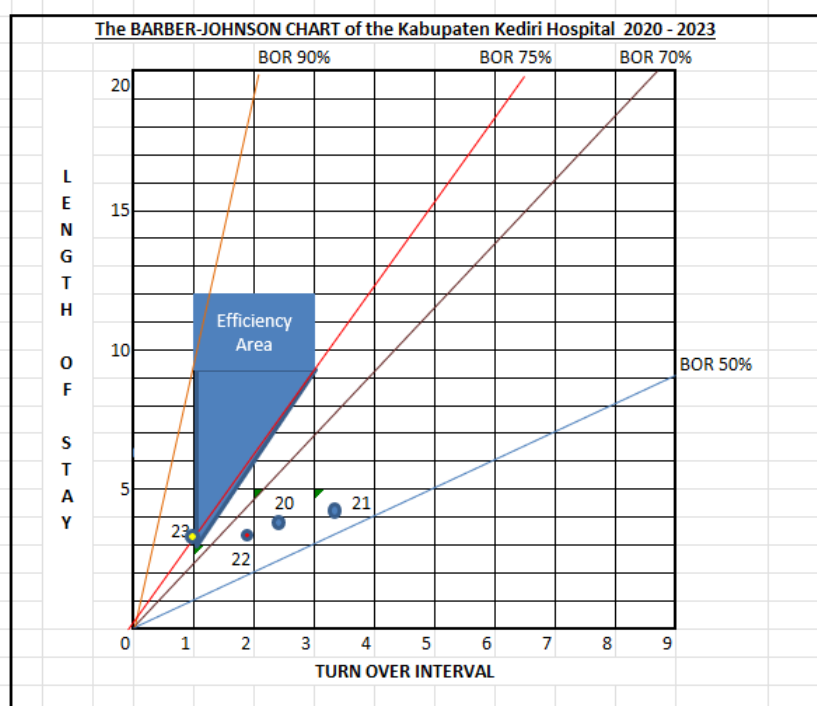


Figure 1. Barber-Johnson Chart the Hospital of Kabupaten Kediri

In the figure above, from 2020 to 2023, the chart shows a positive direction towards the efficiency area. Inpatient performance in bed management has improved from year to year. In 2023, it entered the efficiency area and should be maintained.

DISCUSSION

The Barber-Johnson chart measures the efficiency of hospital bed management by combining four parameters at one point. This chart was invented by Barry Barber and David Johnson in 1973 (Nisak, 2020). Barber-Johnson charts to make comparisons or as a tool to analyze, present, and make decisions related to determining the number of beds in the inpatient unit. From the Barber-Johnson Chart results, the Hospital of Kabupaten Kediri can see that bed capacity is one of the determining variables of the four parameters. Regulations do not allow Kediri District Hospital to add or reduce beds quickly. Arranging the number of beds according to the class needed by the patient; for example, if the patients at the Hospital of Kabupaten Kediri are mostly BPJS class I and class III participants, then the ratio of the number of beds in class I and class III is more significant than class II, and so on is the best

way to solve the bed problem. The BOR value has increased from year to year, along with the number of patients, treatment days, and length of treatment. The AvLOS and TOI scores have met the ideal figures, so the quality of health services at the Hospital of Kabupaten Kediri is good.

The following benefits of the implementation of the Barber-Johnson Chart in bed management at The Hospital of Kabupaten Kediri (Khasanah et al., 2024; Rahmawati & Saputra, 2024; Valentina, 2019):

1. **Improves Operational Efficiency:** Hospitals can optimize the utilization of available beds by identifying and addressing areas of inefficiency.
2. **Improve Service Quality:** Efficient bed management can reduce patient waiting times and ensure that every patient receives adequate services.
3. **Supports Decision Making:** Barber-Johnson Chart provides data visualizations that are easy for hospital management to understand, making evidence-based decision-making easier.
4. **Reduced Financial Burden:** Hospitals can reduce unnecessary operating costs and increase revenue by improving bed management efficiency.

Optimizing the Barber-Johnson Chart to improve bed management efficiency at the Hospital of Kabupaten Kediri is a strategic step that can improve operational performance and the quality of hospital services. Hospitals can identify and address areas of inefficiency through a data-driven approach and structured analysis, thereby providing better services to the community. This implementation also requires technological support and commitment from all parties in the Hospital to achieve optimal results.

CONCLUSIONS

The Hospital used Barber-Johnson charts to conduct evaluations and improve efficiency. The Barber-Johnson Chart can be used for comparison in a specific hospital, evaluating an activity to take corrective actions faster. For example, if the parameter value does not meet in one point, it means that there is an error in the existing parameter value. Optimizing the Barber-Johnson Chart to improve bed management efficiency at the Hospital of Kabupaten Kediri is a strategic step that can improve operational performance and the quality of hospital services. Hospitals can identify inefficiencies and implement appropriate corrective measures with a data-driven approach. This implementation requires the support of technology, information systems, and commitment from all hospitals to achieve optimal results. Through this effort, the Hospital of Kabupaten Kediri will provide more effective and efficient services to the community and support the sustainability of hospital operations.

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