The Effect of Lean Approach on Hospital Service Quality and Inpatient Satisfaction

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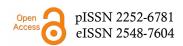
Article Info

Abstract

Measurement of the service quality is very important, especially to improve the quality and obtain loyal customers in a private hospital. Therefore, this study aims to determine the effect of a lean approach based on waste variables of overproduction, waiting time, transportation, excess processing, inventory, motion, and satisfaction defects. A quantitative method was used with a cross-sectional design. The population consists of patients who were treated in the inpatient ward of Malahayati Hospital, Medan, Indonesia. The sample size was 110, and it was determined using the Rao formula. The participants were selected using the purposive sampling technique with inclusion criteria of patients who were hospitalized for more than three days in March 2021. Data obtained were then analyzed with the logistic regression tests. The results showed that all variables have a significant effect on inpatient satisfaction, including overproduction (p=0.019), followed by waiting time (p=0.012), transportation (p=0.011), excess processing (p=0.017), inventory (p=0.010), motion (p=0.015), and satisfaction defects (p=0.010). Based on multivariate analysis, hospital service quality affects inpatient satisfaction, where inventory (4.567 times) and transportation (2.786 times) have the highest and lowest influence, respectively. Furthermore, this study has strongly suggested that hospital management must reduce overproduction and other waste variables to improve service quality.

INTRODUCTION

One of the methods to improve hospital service performance is the application of lean concepts in hospital management. Furthermore, the lean concept is a systematic approach to identifying and eliminating non-value-added tasks while decreasing waste through continuous improvement. This approach allows the flow of products with a pull system from the customer's perspective to achieve perfect satisfaction (Mark Graban, 2018). It has also improved patient flow and efficiency in inpatient care by concentrating on decreasing the non-value-added tasks (Zepeda-Lugo, 2020). A previous study reported that the application of lean principles reduced waiting time in the Veteran Affairs Department at Palo Alto Health Care System, CA, United States (Vashi, 2019). Lean Six Sigma and workforce management have a considerable influence on Malaysian hospitals' quality performance, but senior management commitment has been reported to have a negligible association with qua-

lity performance (Ahmed, 2018). Several studies revealed that lean can increase the operational effectiveness of healthcare. Developing explicit definitions for healthcare-related lean language has the potential to enhance practice, particularly episodic care and service quality (Hallam and Contreras, 2018). Based on the literature review, the primary advantages of implementing this approach include (a) reductions in waiting time, costs, length of hospital stay, patient flow, and procedure times, and (b) improvements in patient satisfaction, efficiency, productivity, standardization, relationships, safety, quality, as well as cost savings. Furthermore, the multidisciplinary integration of managers and work teams frequently produces positive results. (Souza et al., 2021). Service quality in a public hospital is closely related to the satisfaction index of inpatients or outpatients as well as employees (Agiwahyuanto et al., 2021). Previous studies revealed that inpatient staff performance is strongly influenced by organizational culture (Atmojo, Purnomo and Muljono, 2018).

Several studies on lean concepts have been carried out in Indonesia. A study reported five indicators of service satisfaction at hospitals in quadrant group 1, which are the main priorities for improvement to exceed patient expectations. The indicators include the availability of adequate waiting room facilities (2.5), the waiting room environment and good lighting (77.50), the availability of easily accessible information facilities (2.9), services for patient complaints are carried out quickly and responsively (2.9), as well as the officer receiving advice from the patient (2.9) (Wirawan and Yunita, 2018). A study discovered that inpatients were dissatisfied with long wait times for appointments, last-minute appointments, a lack of flexibility when scheduling appointments, and extended periods before being evaluated by a doctor (Pini et al., 2014). The results also showed that there was no statistically significant association between overall satisfaction with demographics and other characteristics. However, service evaluations appeared to be impacted by patient health condition, education, and gender.

The preliminary study was carried out in Malahayati Islamic Hospital, Medan City, North Sumatra Province, during the 1st and 2nd quarters of the year 2020. The questionnaire's results of 15 inpatients showed that 69.48% of them were satisfied, while the remaining 30.52% were unsatisfied. These preliminary studies motivated this current study to explore more about inpatient satisfaction and its correlation with the lean approach. Malahayati Islamic Hospital represents healthcare facilities in North Sumatra Province

that need to apply the lean approach. Some supervision is also needed in the facility to improve inpatient satisfaction. Studies on customer satisfaction are critical in assisting the management of Malahayati Islamic Hospital to understand the true desires of patients. They can also help in planning actions, investments, management, making decisions, and providing quality and competitive services locally and globally.

Therefore, this study aims to measure hospital service quality by applying a lean approach. Based on findings, this is most likely the first report on lean approach using waste variables of overproduction, waiting time, transportation, excess processing, inventory, motion, and defects in a private hospital in Medan, North Sumatra Province.

The terms of all waste variables have been widely used and established in the context of Lean Hospital Management (Zidel, 2006; Usman, 2020). Based on the 8 Types of Waste Theory by Mark Graban (2018), the variables include defects (activity done incorrectly), overproduction (production done faster or more than needed), transportation (unnecessary movement of material), waiting (delay), inventory (unnecessary stored material), motion (unnecessary movement of staff), excess processing (unnecessary activity), and human potential (dissonance between duties and competencies) (Graban, 2018).

METHOD

This is a quantitative study with a cross-sectional design, where the Rao formula was used to determine the sample size, namely 110 patients selected using purposive sampling. Furthermore, the sample population consisted of 312 patients who were treated for more than three days between March 9th to 17th 2021 in each room.

Data collection was carried out using the closed-type questionnaire, which was distributed to each individual who met the criteria. The questionnaire contained several questions in terms of seven types of waste or inefficiencies in hospital management (Graban, 2018), including overproduction (4 questions), waiting (6 questions), transportation (3 questions), excess processing (4 questions), inventory (3 questions), motion (3 questions), and satisfaction defects (10 questions). Measurements were carried out in ordinal scales with scores of strongly agree (5 points), agree (4 points), neutral (3 points), don't agree (2 points), and strongly don't agree (1 point). Furthermore, the good category was assigned only if the value was <10 points and Not Good indicated >10 points. The numerical scale of these me-

asurements depicted the level of hospital service quality. The used terms "Good" and "Not Good" indicated the good quality and the bad quality of hospital service, respectively.

The operationals definitions in this study included; (1) overproduction waste showed that the multiple procedures, repeated tasks, and informations were ineffective at the same time (2) waiting waste indicated the inconsistency and undisciplined schedule, and this caused increased number of patients in the hospital, thereby leading to longer waiting time, (3) transportation waste referred to the inefficiency of movement due to the long distance of check point and medical record, as well as the unclear procedural guideliness along the way, (4) excess processing was the inefficient operational procedure due to the repeated examination and records on the patient, (5) inventory waste referred to overcapacity of storage of unused documents and the medical stocks was more than the prescription frequency, (6) motion waste referred to in-ergonomic spatial and unorganized documents, which made the medical staff run around in search of something (7) satisfaction defects referred to patients complaining and unsatisfied with the medical services provided by the hospital management as well as procedures, diagnosis, hospitality and medical records.

Statistical data analysis was carried out using the chi-square test to determine the relationship between the independent variables, namely overproduction, waiting, transportation, excess processing, inventory, motion, and defects,

which correlated with the dependent variable of inpatient satisfaction. Furthermore, multivariate analysis with logistic regression was performed to examine the relationship of more than one independent variable with one dependent. Data processing was carried out using SPSS software version 20.0.

RESULTS AND DISCUSSION

The majority of respondents were aged 31-40 years old (59.0%), and the minority were 41-50 years old (13.7%). Based on gender, the sample population consisted of 63.6% males and 36.4% females. Furthermore, data on educational background showed that the majority of the respondents were D3 graduates (81.8%), and the minority were S2 graduates (1.8%). Based on job characteristics, all the 110 patients included in this study had jobs (100%). The characteristics of the respondents are presented in Table 1.

The frequency distribution of respondents' opinions on the seven waste variables observed in the hospital is presented in Table 2. Furthermore, their opinions in the specific questions were represented as strongly agree (5 points), agree (4 points), neutral (3 points), don't agree (2 points), and strongly don't agree (1 point). A Good score was given only if the value was <10 points and Not Good >10 points. The used terms "Good" and "Not Good" indicated the good quality and bad quality of hospital service, respectively. Based on Table 2, the majority of respondents revealed that the waste of waiting variable has the highest good rating (96.3%), followed by motion, defect,

Table 1. Characteristics Distribution of Respondents

Characteristics	N	%
Age		
21-30 Years	30	27.2
31-40 Years	65	59.0
41-50 Years	15	13.7
Total	110	100
Gender		
Male	70	63,6
Female	40	36.4
Total	110	100
Education		
D3	90	81.8
S1	23	20,9
S2	2	1.8
Total	110	100
Job	110	100
Total	110	100

Table 2. Frequency distribution of respondents on waste variables that represent the hospital quality service (in percentage)

Waste Variables	Total	Percentage (%)
Overproduction		
Not good	45	40.9
Good	65	59.1
Total	110	100
Waiting Time		
Not good	4	3.7
Good	106	96.3
Total	110	100
Transportation		
Not good	31	28.2
Good	79	71.8
Total	110	100
Excess Processing		
Not good	54	49.1
Good	56	50.9
Total	110	100
Inventory		
Not good	36	32.7
Good	74	67.3
Total	110	100
Motion		
Not good	18	16.4
Good	92	83.6
Total	110	100
Defects		
Not good	36	28.2
Good	74	71.8
Total	110	100

transportation, inventory, and overproduction.

Furthermore, a bivariate analysis was carried out to determine the correlation between each waste variable and inpatient satisfaction, as shown in Table 3.

Table 3 shows that the lean approach was effective and significant on all waste variables regarding improving inpatient satisfaction (p<0.05). The waste of inventory and defects mostly corresponded to inpatient satisfaction (p=0.010).

To compare all the independent variables and one dependent variable, multivariate logistic regression was carried out in a one-step analysis. Furthermore, the comparison showed their influence on inpatient satisfaction, as shown in Table 4.

Based on Table 4, the lean approach to waste of inventory has the highest influence on inpatient satisfaction (4.567 times), while the lowest was transportation (2.786 times).

Waste variable analyses were based on data obtained from Table 2, 3, and 4. The descriptive analysis of each variable was explained independently as follows:

a. Overproduction

Overproduction can be in the form of data input that was carried out repeatedly while issuing laboratorium test results with the same information (Lestari, Suryawati, and Sugiarto, 2020). The results showed that overproduction has a good response by 59.1 % of respondents with a confidence interval of 95% (1.253 ± 8.547) with a p-value of 0.019, indicating statistical significance.

The lab staff gave a date sample and bundled the idle time test results file for service preparation, while the information officer made compounded drugs. A study showed that the average length of service time received by patients from the period of arrival to the collection of

Table 3. Correlation between waste variables and inpatient satisfaction

Waste Variables	Inpatient Satisfaction				Total		p – value
	Good		Not Good				
	f	%	f	%	f	%	
Overproduction							
Not good	13	11.8	8	7.3	21	19.1	0.019*
Good	80	72.7	9	8.1	89	80.9	
Total					110	100	
Waiting Time							
Not good	16	14.5	8	7.3	24	21.8	0.012*
Good	64	58.1	22	20	86	78.2	
Total					110	100	
Transportation							
Not good	18	16.4	19	17.3	37	33.6	0.011*
Good	64	58.2	9	8.2	73	66.4	
Total					110	100	
Excess Processing							
Not good	27	24.5	19	17.3	46	41.8	0.017*
Good	55	50	9	8.1	64	58.2	
Total					110	100	
Inventory							
Not good	23	20.9	14	12.7	37	33.6	0.010*
Good	62	56.4	11	10	73	66.4	
Total					110	100	
Motion							
Not good	23	20.9	16	14.5	39	35.5	0.015*
Good	64	58.1	7	6.4	71	64.5	
Total					110	100	
Defects							
Not good	18	16.4	11	10	29	26.4	0.010*
Good	74	67.3	7	6.4	81	73.6	
Total					110	100	

Table 4. The one-step multivariate logistic regression of waste variables

Waste Variables	β	S.E.	Wald	Df	mean	95% CI	p
Overproduction	1.186	0.490	5.860	1	3.273	1.253 – 8.547	0.015*
Waiting Time	1.466	0.594	6.099	1	4.333	1.353 – 13.875	0.014*
Transportation	1.466	0.594	6.099	1	2.786	1.353 – 13.875	0.016*
Excess Processing	1.466	0.594	6.099	1	3.765	1.353 – 13.875	0.045*
Inventory	1.466	0.594	6.099	1	4.567	1.353 – 13.875	0.017*
Motion	1.466	0.594	6.099	1	3.330	1.353 – 13.875	0.013*
Defects	1.466	0.594	6.099	1	3.739	1.353 – 13.875	0.011*

drugs was 199.4 and 408.4 minutes for general and BPJS patients, respectively. Furthermore, during the polyclinic service process at RSUD Dr. Soeratno Gemolong, waste variables that occurred were waiting, excess processing, overproduction, inventory, motion, transportation, and human potential. This study proved that the application of the lean approach can identify and eliminate waste in outpatient services, shorten procedures in all outpatient service units to reduce waiting times, improve service quality, as well as increase job and patient satisfaction (Lestari,

Suryawati and Sugiarto, 2020). A previous study reported the use of Lean Sigma Tools with the DMAIC approach (Define, Measure, Analyse, Improve, Control), and it was significantly effective in reducing the length of stay of patients (Mandahawi et al., 2011).

b. Waiting Time

The lean approach is a philosophy to reduce activities in the form of waste, and it has been used by several companies to increase their effectiveness and efficiency (Gabrielle, 2021). The results showed that waiting time was the common response from 96.3 % of respondents with a confidence interval of 95% (1.353 ± 13.875) and p-value of 0.012, indicating statistical significance.

Problems occur when patients wait for the next process in the waiting room, such as examination by a doctor, administrative process, test results in the lab, documents, testing of specimens, drug payments, handover of pharmaceutical drugs, staff who are not working, non-functional laboratory equipment due to the absence of samples, and pharmacy staff who do not work before a doctor's prescription. Therefore, it is possible to implement the lean concept in healthcare providers. A study conducted by (Kharismawati and Herliansyah, 2016) revealed that the most critical waste was waiting time, occurring in the registration section, neurological disease, internal medicine, and the pharmacy section, hence, improvements must be prioritized in these areas.

c. Transportation

Waste in transportation occurred when moving an item or patient from one process to another, which caused additional time in the handling process (Lestari, Suryawati, and Sugiarto, 2020). The results showed that transportation has a good response by 71.8 % of respondents with a confidence interval 95% (1.353 ± 13.875) and a p-value of 0.011, indicating statistical significance.

The most common problem found was the displacement of excess patients and taking files to far places, namely, sending medical records to the checkpoint, as well as hospital services that have not been placed in an integrated and adjacent area. Furthermore, a previous study was carried out on the approach of lean transportation to improve the performance of Emergency Medical Processes (EMP) by adapting its main concepts to the main characteristics of the EMP environment (Villarreal et al., 2018). Several studies also reported that the Systematic Layout Planning (SLP) approach combined with the Lean Six Sigma method and tools potentially reduced the time of patient transport (Furterer and Kancharla, 2021).

d. Excess Processing

Excess processing problems often arise while repeatedly recording patient identities on medical record documents, register books, control cards, and computers (Graban, 2018). The results showed that excess processing has a good response by 50.9 % of respondents with a confidence interval of 95% (1.353 ± 13.875) and p-value of 0.017, indicating statistical significance.

A study in United Arab Emirates (UAE) reported that this problem was given the highest importance in public hospitals in UAE (Hussain and Malik, 2016). Furthermore, over-processing as one of the seven wastes was caused by the presence of unclear standards and specifications. Several operators often try to provide the best services, but are not always aware of factors that truly add value to the product. The fundamental cause of waste waiting was frequent medication vacancies due to delays in payment from the cooperating party to hospitals, as well as the limited service area (Atikah et al., 2021).

e. Inventory

Problems found in inventory were usually excess drug supplies, documents that are still being processed due to a buildup of the patients' records, laboratory supplies, and hospital equipment in the form of unused medical record cards (Usman, 2020). The results showed that inventory has a good response by 67.3 % of the respondents with a confidence interval of 95% (1.353 ± 13.875) and p-value of 0.010, indicating statistical significance.

Furthermore, a study reported that the applicating of a hybrid selective inventory control technique in a hospital can reduce the wasteful inventories related to expensive medical supplies. It can also help to save costs in providing affordable and accessible healthcare (Gurumurthy, Nair, and Vinodh, 2020). Based on a study, supply item vacancies are often caused by empty supplier goods, national drug shortages, or requests for goods that were not in accordance with the receipt of goods. A cause-effect and interrelationship diagrams were then used along with a lean approach to identify wastes as well as those that are dominant (Saleeshya et al., 2015).

f. Motion

Motion involves carrying out excessive movements to complete a job, which does not add value to the goods or services (Graban, 2018). The results showed that motion has a good response by 83.6 % of respondents with a confidence interval of 95% (1.353 ± 13.875) and a p-value of 0.015, indicating statistical significance.

This problem often occurs when looking

for medical record documents and collecting medical equipment. It is also caused by unnecessary movements in the information and registration section, such as looking for receipts, writing instruments, and drugs. The waste motion in this hospital showed that the patient's activities had to leave the room because the nutrition consultation section was located in another building. The complicated flow was caused by the patient's repeated motions to the cashier and insurance verification. Furthermore, a hospital is said to be efficient if it can use all its available resources to produce something without having to discard anything. A study by (Kusdarmadji, Pribadi, and Permana, 2021) reported that waiting (26%), motion (18%), and faults were the three most common wastes in Hemodialysis Installation (16 %). There was an issue of waste waiting created by a shortage of human resources. In this situation, the number of nurses and wasting motion was produced by the frequent movement of nurses to conduct examinations on patients and inspections that still use manual methods.

g. Defects

A Lean Six Sigma (LSS) approach is the best option in a healthcare environment for dealing with a critical patient. The LSS methodology can optimize the average reduction of a desired process (Ahmed, Manaf, and Islam, 2013). Waste defects often occur due to a lack of coordination, errors in filling out laboratory result forms, patient identity not matching, as well as officers who are not careful, do not check patients, and do not ensure drugs for patients (Graban, 2018). The results showed that service defects had a good response by 71.8 % of respondents with a confidence interval of 95% (1.353 ± 13.875) and a p-value of 0.010, indicating statistical significance.

A previous study revealed that based on the identification in value stream mapping, the common wastes include transportation, defects, excess processing, and motion. Therefore, hospital management is advised to parallelize BPJS patients with general patients for polyclinics, use electronic medical records, optimize the utilization of electronic prescriptions, add resources, and implement 5S (Vega and Setiawan, 2018). A recent study using Multi-Criteria Decision Making (MCDM) with a fuzzy analytical hierarchy process approach reported that waiting, transportation, motion, and defects were dominant in adopting lean approach among the seven wastes. The results of this study can guide hospital management in strategic planning to adopt a lean healthcare process (Bharsakade et al., 2021), thereby leading to continuous quality improvement

of health service (Clark, Silvester, and Knowles, 2013).

CONCLUSION

The service quality represented by inpatient satisfaction showed that 92.75% of customers were satisfied with the services provided at Malahayati Islamic Hospital in Medan City. Based on the lean approach, the management of the study location has shown its best performance in avoiding waiting-waste compared to other variables. However, hospital management must reduce excess processing, overproduction, defects, and motion by conducting several integrated programs to improve the quality and efficiency of health services as well as inpatient satisfaction. This study has provided a meaningful perspective on the improvement of healthcare quality by applying a lean approach to several waste variables. The results showed an increase in patient satisfaction at Malahayati Islamic Hospital.

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