Lean Hospital Management Implementation in Health Care Service: A Multicase Study

Indrianawati Usman

Dept. management of Economic and Business Faculty of Airlangga University
E-mail: indrianawati-u@feb.unair.ac.id

ABSTRACT
Lean hospital play a crucial role in the hospital service performance. It has been proved that implementing lean hospital management concept enhance the quality of hospital services. The purpose of this article is to investigate the waste and its causal factors. This paper is based upon a multi case study of lean hospital management practice of emergency unit in two generalhospital. Data collected by semi structured interview, document analysis andobservation. Value stream mapping is used to analyze hospital service process. Results of the analysis shows that waste identified on hospital services such as waiting times, defect in administrative services, inappropriate processes mainly due to lack coordination of officers, lack of

thorough and administrative errors. Originality of this paper is analyzing thelean hospital management practice of integrated process of clinical and administrative process.
Keywords: Healthcare service, Lean hospital, Lean management, value stream mapping, waste

Correspondence:
Indrianwati Usman
Department Management of Economic and Business
Faculty of Airlangga University
E-mail: indrianwati-u@feb.unair.ac.id

INTRODUCTION

Lean is a set of operating philosophies and methods that help create a maximum value for patients by reducing waste and waits.(Lawal et al., 2014). Lean management is a term used bythe industry to improve production capacity and eliminate wastes in processes andworkflows. Through the success of this management approach, these managerial principleswere also used Leanmanagement consists of five principles, its guideline and how to use it which guides eachcompany or organization providing goods or services toward creating a sustainable anddynamic system. The elimination of production wastes is the most important principle ofLean thinking.(Mousavi Isfahani, Tourani, & Seyedin, 2019). Lean principles are known around the world and applications reach well beyond theproduction of goods to service and healthcare delivery.The precise date of the first application of lean in healthcare is uncertain.

Incidents and quality problems are a prime cause why health care leaders are calling to redesign health care delivery. (Joosten, Bongers, & Janssen, 2009).Lean Hospital is needed in order to be able to meet patient needs optimally, to be able to provide health services as much as possible to patients by reducing waste, to create added value for the Hospital. This research is a qualitative research with a multi case study approach. The tools used to identify waste are big picture mapping which describes all activities and lead time schematically.The use of lean techniques has been carried out for service companies, including hospital services. There are several benefits of lean service companies, namely to upgrade quality, clarify process flow, revise equipment and process technology, level of facility load and eliminate unnecessary activity.This study aims to identify waste that occurs in the health care process along with the administration process, especially in the services in the emergency unit of two hospitals.This study focused on the flow of service processes in the emergency department.The analysis used to identify the causes of waste is to use value stream analysis tools. Value stream analysis tools can identify waste by knowing where waste occurs and where waste can be eliminated by various

factors of consideration. In addition, the value stream mapping is used to identify more clearly the waste that occurs in the value stream.Value stream analysis is the main tool in lean that helps to see business processes as a whole, so that we can visualize the entire business processes, which are very efficient, without any or minimum of waste.

LITERATURE REVIEW

The premise of "Lean" starts from the concept of Just in time (JIT) production which was applied by Toyota as its pioneer.(Chase.R.B, 2018)states thatlean Production is an integrated activities designed to achieve high-volume, high quality production using minimal inventories or raw materials, work in process and finished good. Lean is a continuous effort to eliminate waste and increase the value added (value added) of goods and services to provide customer value.The key concept in lean thinking is 'value'. Value is definedas the capability to deliver exactly the customized product or service a customer wants with minimal time between the moment the customer asks for that product or service andthe actual delivery at an appropriate price. (Womack, James. P and Jones, 2000). Goal of Lean Management is to create value without producing waste (Rauch, Damian, Holzner, & Matt, 2016).Here are the five principles of lean thinking(Joosten et al., 2009).

Principle 1: Provide the value customers actually desire
Principle 2: Identify the value stream and eliminate waste
Principle 3: Line up the remaining steps to create continuousflow
Principle 4: Pull production based on customersconsumption
Principle 5: Start over in a pursuit of perfection 'the happysituation of perfect value provided with zero waste'

The application of the lean manufacturing approach creates an advantage of lower production costs, increased output and shorter production lead times. Lean

manufacturing implementation is used to solve a problem with continuous improvement in the production process. Lean manufacturing has the main principle of suppressing seven wastes to increase customer satisfaction, (Liker & Morgan, 2006).Today Lean Management is applied in many different areas and belongs to the most important and mostpopularmanagement technics at all. For instance, it is used in the administration, healthcare, construction, maintenance, product development and many more.(Rauch et al., 2016).

Lean Hospital
Lean Hospital is a rule that is a management system and also a philosophy that can change the perspective of a hospital to be more organized and organized by improving the quality of services for patients by reducing errors and reducing waiting time (Graban, 2009). Lean methods used by hospitals to improve the quality of service for patients by reducing the two main problems, namely reducing errors and waiting time. Waste is any activity that does not reflect assistance in the healing process of patients. Lean provides a formal framework to describe waste in 8 key categories (Graban & Prachand, 2010).The following table-1 shows 8 types of waste.

Table 1. Eight Tyeps of Waste

1. Defect (Correction, rework)	5. Inventory
2. Over Poduction	6. Motion
3. Transportation	7. Overprocessing
4. Waiting	8. Human Talent
NOTE: Adapted from Graban, Mark. Lean Hospitals: Improving Quality, Patient Safety, and Employee Satisfaction. Productivity Press, New York, 2008. From Lean Hospitals: Improving Quality, Patient Safety and Employee Satisfaction, by Mark Graban; copyright 2009, CRC Press, Taylor and Francis Group	

Lean hospital also has a number of ways to encourage employees to be motivated to do better work by constructively giving respect to patients, employees, doctors, and all stakeholders in the hospital and its environment. Waste is any action taken without producing value. (Womack, James. P and Jones, 2000).

Waste in Hospital
Problems and disturbances that arise constantly, which interfere with work and patient service are called waste or waste (Graban n.d.,2009). Mark Graban also stated that hospital employees typically produce a high percentage of their time in wasteful activities such as a medical nurse in a hospital in the world using only 25-50% of their time in direct service to patients such as checking status patients, administering medication, answering patient questions, and providing medical guidance.

Table 2. Waste in Hospital

1.Overproduction	Waste overproduction in the outpatient and inpatient care process issues the results of repeated laboratory tests with the same information.
2. *Waiting*	Waste waiting occurs when the patient waits for the next process in the waiting room to wait for the doctor to wait for the administrative process to wait for the test results in the laboratory, wait for documents, specimens waiting to be tested, wait for drug payments, wait for pharmaceutical drugs.
3.*Unnecessary Transportation*	Unnecessary transportationdalampelayanananrawatjalandanrawatinapmeliputi, perpindahanpasien yang berlebihdanmengambilberkas yang letaknyajauhyaknipengirimanberkasrekammedisketempatperiksa.
4.*Overprocessing*	Overprocessing on outpatient and inpatient installations, namely recording patient identity is done repeatedly, namely in medical record documents, register books, control cards, and computers.
5.*Unnecessary Inventory*	Unnecessary Inventory that occurs is an excess supply of drugs, supplies of excessive laboratory equipment, documents that are still being processed, namely the accumulation of patient documents, and excessive supply of hospital equipment, namely the unused medical record card.
6. Unnecessary Motion	Unnecessary motion that occurs is looking for medical record documents, collecting medical equipment, movements that are not needed in the information and registration section to reach items such as finding receipts for stationery or looking for drugs.
7. Defect	Defects occur both in hospitalization and in the emergency department, such as giving the wrong medication, the doctor replacing the prescription that has been made to the patient because the previous prescription drug is not in the pharmacy, incomplete patient needs for administration, and the patient is taken to the wrong examination room.
8. Underutilized abilities of people	Waste underutilized abilities of people, namely doctors, do not provide education to patients, nurses in Emergency Services do not provide optimum attention to patients.

The role of Lean Hospital is to increase customer value through the value to waste-ratio. Lean Hospital application has produced many benefits, such as reducing patient waiting time, improving the quality of service for patients, increasing the value of employee involvement and can detect waste that occurs in hospitals so as to minimize operational costs. Here are some examples of the success of lean in increasing the effectiveness and efficiency of performance in hospitals, (Graban, 2009). (1). Decreased turnaround time for clinical laboratory results by 60% at Alegent Health, Nebraska. (2). Decreasing decontamination and equipment cycle sterilization time up to 70% at Kingston General Hospital, Ontario (3). The reduction in patient mortality is associated with 95% of blood vessel infections at Allegheny Hospital, Pennsylvania. (4). The reduction in patient waiting time for orthophedic surgery from 14 weeks to 31 hours, at Theda Care, Wisconsin. (5). Surgical revenue increase of $ 808,000 per year, in Ohio Health, Ohio. (6). LOS reduction was 29% and avoided $ 1.25 million in the construction of a new emergency unit, at Avera Mc Kennan, South Dakota. (7). Save $ 7.5 from the Lean Rapid Improvement Event in 2004 and reinvest in patient care at Park Nocollet Health Service, Medical.

Value Stream

Value Stream Analysis Tools is a tool developed by to facilitate understanding of the value streams that have been created and help in the process of improving waste(Hines, P., & Rich, 1997). Value stream mapping (VSM) is a tool (diagram) that is used to help in seeing and understanding the flow of material and information on a product in the value. Value stream analysis can identify three types of actions throughout the value stream, namely:

　　a. Value-Added, Activities or processes that produce value.

　　b. Necessary but Non Value-Added, Phase that does not produce value but can not be avoided with existing technology and resources.

　　c. Non Value-Added, Phase that does not produce value and can be avoided.

Value stream mapping has seven tools (Hines, P., & Rich, 1997), namely:1. Process Activity Mapping, This tool provides an overview of physical flow and information, the time needed for each activity, the distance traveled and the level of product inventory in each stage of production. Ease of identification of activities occurs because of the classification of activities into five types, namely, operations, transportation, inspection, delays, and storage. 2. Supply Chain Response Matrix, this tool is a diagram that illustrates the relationship between inventory and lead time on distribution channels, so that it can be seen that there is an increase or decrease in inventory levels and distribution time in each area in the supply chain. This tool can also be used as a management consideration for estimating stock requirements when associated with short lead time achievements. 3. Production Variety Funnel, this Tool is a visual mapping technique by plotting a number of products produced in each manufacture.This tool can be

used to identify which parts of a generic product are processed into specific products. And this tool can also be used to find out the bottleneck area of process design. 4. Quality Filter Mapping, This tool is used to identify the location of quality defect problems in the supply chain. Evaluation of the loss of quality that often occurs is done for short-term development. These quality problems are product defects, scrap defects, and service defects.5. Amplification Demand This tool is used to visualize changes in demand in the supply chain at certain time intervals. The resulting information is used to make decisions and carry out further analysis to anticipate changes in demand, regulate fluctuations, and evaluate inventory policies. 6. Decision Point Analysis This tool shows a variety of different production system options, with a trade off between the lead points of each choice with the inventory level needed to cover during the lead time process. 7. Physical Structure, this tool is used to understand supply chain at the production level.

RESEARCH METHOD

This research is an exploratory study, using a qualitative multi-case research approach. The object of research is in the process of hospital services, especially in the emergency department.There are two cases hospitals as the object of research. Data collected by interviewing the director and head of the emergency unit. Data about the service process was collected through questionnaires and secondary data in the form of hospital records, as well as direct observation in the emergency unit at two hospitals.Triangulation is conducted by using data from respondents, documents, and observations as well. While the analytical techniques used to identify waste, are big picture mapping and value stream analysis tools, as well as fish-bone diagrams to identify the cause of waste.Lean hospital is intended to provide a waste elimination solution.

ANALYSIS AND RESULT

This research conducted in two hospital. The First case Hospital-A has a medical facilities consist of emergency room, outpatient installation consist of 25 poly, inpatient instalations, central of surgical, ICU, Medical Rehabilitation Installation, Radiology, Laboratory, Pharmacy, Stroke center, Trauma center, hemodealisa center, Lactaton center, Spiritual clinic and ambulance unit. The Second caseHospital B has medical facilities consistof emergency rooms, outpatient installations consisting of 11 poly and inpatient installations, operating rooms, obstetric rooms, pharmacy rooms, x-ray rooms, laboratory, radiology and ambulance units. Emergency of Hospital-B has 5 doctors, 10 nurses. Has 3 working hours shift.

The research conducted only focuses on the service process that starts from patients coming to the emergency unit who are carried by ambulance or come alone with the family, until the patient leaves. The emergency unit service process for two cases, both at hospital-A and Hospital-B, was relatively have the same process.The patient service flow

starts from the patient coming, then the nurse performs triage (the process of determining the severity of the disease in the patient), to determine the emergency status of the patient. Triage is divided into scale 1, scale 2, scale 3, scale 4, scale 5. Patient identified as scale 1 to scale 3 is directly referred to the ICU.While patient at scale 4 and scale 5 are referred to general poly.Next step the doctor diagnosing to the patient, while the patient's family register in FO (Front Office).Then a tratment is performed to the patient. After a the treatment conducted, the patient can be immediately discharged from the hospital, or referred to another designated hospital. Then the patient's family completes the payment.Big Picture Mapping is used to find out which activities are included in value added activity and non value added activity. The research conducted only focuses on the service process that starts from patients coming to the emergency room until the patient leaves the emergency unit, comes home or goes to the inpatient room. The activities of patients handling from arrival until exiting the emergency room are as follows:
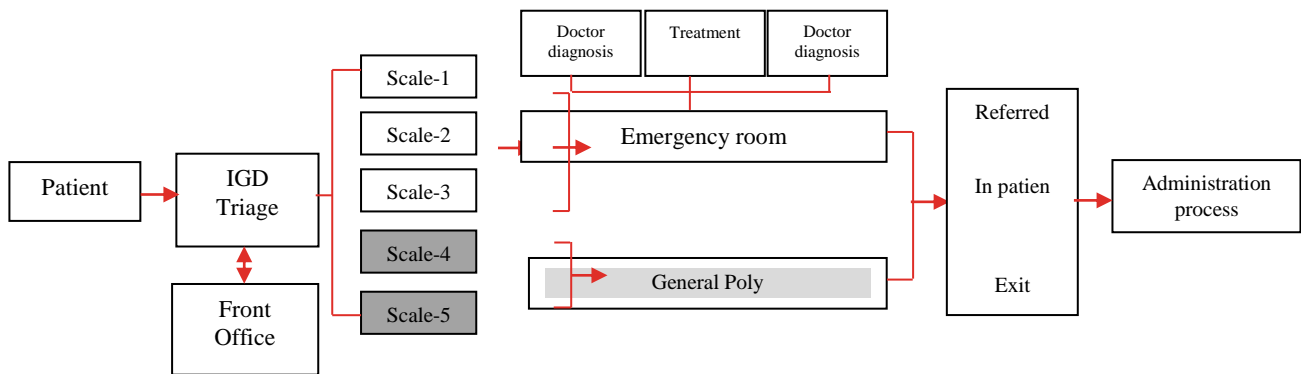

Figure-1. The activities of patients handling from arrival until exiting the emergency room

Based on the analysis with Big Picture Mapping from the process of handling patients in the ED at two hospitals, activities that are classified as value added and non value added can be identified and activities classified as waste.

Value Added is an activity that truly provides benefits to the product for the customer and makes the price of the product. While Non Value Added is an activity that does not provide added value for customers

Table 3. Service Activity process in Emergency unit

Code		Actvity Type	Activity Type of Hospital A			Acivity Type of Hospital B		
			VA	NVA	NNVA	VA	NVA	NNVA
1		The nurse determines the triage of patients who come to the emergency room.				X		
2		Diagnosis from a doctor on duty				X		
2. A		The patient's family fills in the patient administration list.				X		
3		Examination and treatment				X		
3. A		Transfer of patient to another installation (laboratory or radiology)			X			X
	3.B	Waiting for results from other installations (laboratory or radiology)		X			X	
3. C		The doctor keeps explaining the results from the laboratory or radiology to the patient		X			X	
3. D		Waiting for medicine from the pharmacy		X			X	
	3.E	The nurse provides a detailed list of drugs and equipment used by the patient to the administration				X		
4		The patient waits to be allowed to go home or move to the room		X			X	

VA : *Value Added Activity* ;NVA : *Non Value Added Activity* ; NNVA : *Necessary Non Value Added Activity*

Waste Identification

Information about wasteoccurs in the patient's service process is obtained from questionnaires. There are seven types of waste identified from the service process, namely: overproduction, waiting, exsive transportation, inappropriate processing, unnecessary inventory, unnecessary motion, and defects. The definition of each waste from the patient's service process are:

1. Overproduction, too much or too fast activity in the inspection service process exceeds what is needed and causes buildup. Example: medical records or laboratory results printed many times.
2. Waiting, there are conditions that make patients wait from one process to the next and there is no activity. Example: waiting time to receive action from staff, waiting for medication.
3. Exsesive Transportation
   Movements made to customers, material or document information that is excessive or too far away so that it causes a waste of time and energy. Example: medical records that must be sent to the emergency department
4. Inappropriate Processing
   There is a discrepancy between work procedures that should be with the conditions that occur. Example: recording patient identity carried out repeatedly in medical records
5. Unnecessary Inventory
   Storage of documents and tools and materials or information that is excessive and unnecessary. Examples: drug buildup, medical device buildup, accumulation of patient medical records.
6. Unnecessary Motion, Actual activities are not needed in a process that causes waste of time and energy. Example: Finding medical equipment.
7. Defect, Errors from activities that cause certain process failures or defects. So it requires reworking. Example: the doctor gave the wrong medicine.
   The results of the scoring of the questionnaire will be included in the value stream mapping tools table. In both hospital cases, the activity mapping process gets the highest value.

Tabel 4. Valuestream mapping

No	Value Stream Mapping Tools	Hospital A		Hospital B	
		Total Weight	Ranking	Total Weight	Ranking
1	Process Activity Mapping	65.07	1	82.40	1
2	Supply Chain Response Matrix	19.24	3	45.10	2
3	Production Variety Funnel	10.60	5	13.30	5
4	Quality Filter Mapping	3.24	6	3.80	6
5	Demand Amplification Mapping	22.37	2	28.50	3
6	Decision Point Analysis	15.61	4	19.90	4
7	Physical Structure Mapping	2.74	7	3.05	7

Next the mapping tool can be used, and table -3 shows the detailed mapping of the value stream, and categorize the value added and non value added activity.

Table 5. Process Activity Mapping

No.	Activity	Flow	Time (menute)	Activity Category Hospital A			Time (menute)	Activity Category Hospital B		
				VA	NVA	NNVA		VA	NVA	NNVA
1	The nurse determines the triage of patients who come to the emergency room.	O	1	1			1	1		
2	Doctor's diagnosis is guarded.	O	2	2			2	2		
3	The patient's family fills in the patient administration list.	O	1	1			1	1		

No	Activity									
4	Examination and treatment	O	19	19			19	19		
5	The patient moves to another installation (laboratory or radiology)	T	5			5	5			5
6	Waiting for results from other installations (laboratory or radiology)	D	6		6		6		6	
7	The doctor keeps explaining the results of the laboratory or radiology to the patient	O	2		2		2		2	
8	Waiting for medicine from the pharmacy	D	13		13		14		14	
9	The nurse provides a detailed list of drugs and equipment used by the patient to the administration	I	3	3			3	3		
10	The patient waits to be allowed to go home or move to the room.	D	10		10		12		12	
	Total Time		62	26	31	5	65	26	34	5
	Percentage		100%	42%	50%	8%	100%	40%	52%	8%

Note: (O) = Operations; (I) = Inspection; (T)= Transportation; (D) = Delay s (VA) = Value added activity ; NVA= Non Value Added activity.

In the activity mapping process, waiting is detected as a waste indicated by the delay activity. Hospital A and Hospital B delay having a presentation equal to and greater than 50% of the total time spent on patient care. The waste that has the next high weight is defect.

CONCLUSION

The results of identification of Waste in the process of patient care in the ED are waiting, defect and inappropriate process. The highest weight of the three wastes is waste because of waiting. Waste caused by waiting has an average score of 2, then defects have an average score of 1.8 and defects with an average score of 1.6.Based on the results of the process activity mapping, the total activity in the patient service process is 10 activities. It consists of 5 value added activities, 4 non value added activities, and 1 necessary non value added activity.The total leadtime of the patient service process at Hospital-A is 62 minutes consisting of 26 minutes of value added activities, 31 minutes of non value added activities, and 5 necessary no value added.Whereas at Hospital-B is 65 minutes consisting of 26 minutes of value added activities, 34 minutes of non value added activities, and 5 necessary no value added.

Based on the analysis of two hospital cases using valuestream mapping showed similar results. The existence of waste arewaiting, errors in service (defect) and improper processes.The further analysis shows that the waste of waiting is caused by first, the number of patients that accumulate and there is no capability enough to help. Second, it is imposed by the length of time the drug is dispatched from the pharmacy. Finallythe third is caused by the length of results from the laboratory.

This research has a limitation, that is analysis of only capturing in waste identification of two hospitals, especially in emergency service processes. Based on observations in the field, it can be seen that the cause of waste is related to the inability of human resources to handle patients with large numbers and very varied service needs in the emergency unit. Further research can be done with the practice of lean six sigma or service supply chain of internal processes, with applied research through a participatory approach involving the hospital medical team.

REFERNCES

1. Chase.R.B, J. F. . and. (2018). *Operations and Supply Chain Management* (15th ed.). New York, NY 10121:

Mc.Graw-Hill Education International Edition.

2. Graban, M. 2009. (2009). *Lean Hospital : Improving Qualit, Patient Safety, and Employee Satisfaction*. New York: CRC Press.

3. Graban, M., & Prachand, A. (2010). Hospitalists: Lean leaders for hospitals. *Journal of Hospital Medicine*, *5*(6), 317–319. https://doi.org/10.1002/jhm.813

4. Hines, P., & Rich, N. (1997). The seven value stream mapping tools. International journal of operations & production management, *17*(1), 46–64.

5. Joosten, T., Bongers, I., & Janssen, R. (2009). Application of lean thinking to health care: Issues and observations. *International Journal for Quality in Health Care*, *21*(5), 341–347. https://doi.org/10.1093/intqhc/mzp036

6. Lawal, A. K., Rotter, T., Kinsman, L., Sari, N., Harrison, L., Jeffery, C., … Flynn, R. (2014). Lean management in health care: Definition, concepts, methodology and effects reported (systematic review protocol). *Systematic Reviews*, *3*(1), 1–6. https://doi.org/10.1186/2046-4053-3-103

7. Liker, J. K., & Morgan, J. M. (2006). The Toyota Way in Services: The Case of Lean Product Development. *Academy of Management Perspectives*, *20*(2), 5–20. https://doi.org/10.5465/amp.2006.20591002

8. Mousavi Isfahani, H., Tourani, S., & Seyedin, H. (2019). Lean management approach in hospitals: a systematic review. *International Journal of Lean Six Sigma*, *10*(1), 161–188. https://doi.org/10.1108/IJLSS-05-2017-0051

9. Rauch, E., Damian, A., Holzner, P., & Matt, D. T. (2016). Lean Hospitality-Application of Lean Management Methods in the Hotel Sector. *Procedia CIRP*, *41*, 614–619. https://doi.org/10.1016/j.procir.2016.01.019

10. Womack, James. P and Jones, D. T. (2000). *Lean Thingking: Banish Waste and Create Wealth in Your Corporation*. New York.

11. Esmail, M., Nilufar, D., Majid, G.-E., Reza, T.-N.M., Abolfazl, M. Prophylactic effect of amiodarone in atrial fibrillation after coronary artery bypass surgery; a double-blind randomized controlled clinical trail (2015) Journal of Cardiovascular Disease Research, 6 (1), pp. 12-17. DOI: 10.5530/jcdr.2015.1.2