

# Monitoring and evaluation of Lean implementation in pediatric pharmacy: A study of mother and child hospital in Jakarta

Acim Heri Iswanto<sup>1</sup>, Sari Dewi Rosady<sup>2</sup>

<sup>1</sup>Associate Professor on Public Health, Faculty of Health Science, Universitas Pembangunan Nasional Veteran Jakarta, Indonesia

Email: [h.iswanto@upnvj.ac.id](mailto:h.iswanto@upnvj.ac.id)

<sup>2</sup>Chief Executive Officer, RSIA Grand Family

Email: [sari.rosady@yahoo.com](mailto:sari.rosady@yahoo.com)

## ABSTRACT

Lean is a method of quality improvement that has been successfully implemented in healthcare context, including in the South East Asia. Lean promises inventory cost reduction if it is implemented in pharmacy department at hospital. This research assessed the successful lean implementation at children's outpatient pharmacy of mother and child hospital in Jakarta, Indonesia. The hospital that was used as the research location had 20 outpatient policlinics and 63 beds. The implementation was performed by a cross-disciplinary team which had been trained in lean philosophy and implementation. The main procedure of lean implementation was 5S followed by kaizen. After one month of implementation, evaluation was performed on the inventory cost. It was reimplemented on the 2<sup>nd</sup> and 3<sup>rd</sup> month. The results showed that inventory cost reduces from US\$ 22.494 to US\$ 15.128 monthly. The components of cost that drastically reduced was medicine. Total saving in three months was US\$ 22.097, while the implementation cost was US\$ 3.733. Therefore, the benefit to cost ratio reached 592%. This research suggested that lean should be implemented in various pharmacy units of hospital by considering the availability of medicine supply for unexpected cases in the future. The results of the research also have socio-economic implications if it is implemented in a broad-scale of hospitals in developing countries. However, this research was still limited in terms of research location that was conducted at big city only and one parameter in determining the output. The future research should be conducted in underdeveloped areas with limited medicine supply and measuring output with several relevant parameters.

**Keywords:** lean implementation, waste reduction, developing countries, medicine, children's pharmacy.

## Correspondance:

Acim Heri Iswanto<sup>1</sup>

<sup>1</sup>Associate Professor on Public Health, Faculty of Health Science, Universitas Pembangunan Nasional Veteran Jakarta, Indonesia

Email: [h.iswanto@upnvj.ac.id](mailto:h.iswanto@upnvj.ac.id)

## INTRODUCTION

At this competitive era, hospitals are developing but they have to face challenges to achieve their goals. The decreasing payment rate, decreasing clinical resources, aging population, and poor clinical quality require healthcare industry to make a dramatic transformation (Bercaw, 2013). This transformation is required in the form of collaboration in health care management to find suitable solutions, techniques, and methods to fulfill all requirements and targets (Kovacevic, Jovicic, Djapan, & Zivanovic-Macuzic, 2016). In line with this issue, many health care improvement quality methods focusing on safety, productivity, convenience, and patient satisfaction have been developed (Carlson & May, 2016). One of the methods that claim improving patient satisfaction is lean (Poksinska, Fialkowska-filipek, & Engström, 2017). This method is based on maximizing the value added level by removing all factors producing no value (Kanamori et al., 2015). Many books, papers, and reports have been

presented to review cases, methods, topics, and context of lean implementation in health care (Andreamatteo, Ianni, Lega, & Sargiacomo, 2015). In general, we can find many successful practices of lean implementation since its introduction to health care context in 2001 (Aij, 2015). Lean has been widely implemented in developing countries, including South East Asia (Habidin, 2017), and also Indonesia (Iswanto, 2019a; Iswanto, 2019b, Iswanto, 2019c; Iswanto & Koesoemo, 2019). Lean is also used in pharmacy context (Scioli, 2017). Lean is known to reduce the cycle time of drug-dispensation in inpatient pharmacy (Kanamori et al, 2015). Implementation in the pharmacy also makes medicine supply in order and reduces the stock that relates to significant cost reduction (Kovacevic et al, 2016). Moreover, lean is also implemented in various health care for children. In this context, lean is known to improve the efficiency of operation and increase value for the patient (Merguerian et al., 2015). Besides, lean can reduce medication error, improve patient safety, reduce

operating cost (Trakulsunti & Antony, 2018). Literature review by Flynn *et al.*, (2018) on many research of lean implementation in the context of pediatric shows that lean is potential to become a sustainable and expanding quality improvement method.

However, there are only a few of research that examine lean implementation in the context of children's pharmacy. Among these few research, Redmond (2019) evaluated the efficiency of batch production operation in the pediatric pharmacy and found that lean could optimize batch production operation of pediatric pharmacy. (Croop (2018) examined lean implementation to improve the quality of golden hour protocol for preterm infants. In this research, children's pharmacy department is part of cross-disciplinary lean team, along with radiology department and NICU. The results of the research show that there is an improvement in short-term outcome using lean approach, even though in the long term, there is no significant differences with the previous. ASHP-PPAG recommended lean implementation in pharmacy practice model, including children's pharmacy (Eiland *et al.*, 2018).

The few number of research on lean implementation has led the researcher to evaluate it in this context. The following section of this research is organized into 6 parts. In the second part, the researcher discusses the theoretical framework and explanation of lean and its implementation. The next section presents the methodology. At the fourth part, the research draws the main findings. Theoretical, practical, and specific implications are presented at the fifth part. At last, the researcher presents the limitation of the study and suggestion for future research.

### Lean Healthcare

Lean is "a management system based on the systematic identification and elimination of waste, defined as any activity that does not add no value from the standpoint of the customer" (Blackmore & Kaplan, 2016). The lean concept was firstly introduced in 1988 by Krafcik to describe the successful Japanese manufacturing production system (Krafcik, 1988). This concept was later developed by Womack *et al.* in 1990 in their book "The Machine that Changed the World" (Womack, Jones, Roos, & Carpenter, 1990) and further developed in 1992 in "Lean Thinking" (Womack & Jones, 2003). These books describe the philosophy of lean including the philosophy of management covering all organization aspects (Daultani, Chaudhuri, & Kumar, 2015).

In 2005, Institute for Healthcare Improvement (IHI) reported that lean is a management practice suitable to be implemented in hospitals and it proves to improve efficiency, reduce waste, and increase value for the customer (IHI, 2005). However, there are many skeptical assumptions about lean due to its difficult implementation in healthcare system, not to mention its rare success in the implementation in particular macro problems or issues such as in politics, regulation, profession, etc. (Willis, 2018).

Lean Enterprise Institute proposed five main principles of lean: specification of value from the standpoint of the customer, identification of all steps in the value stream and elimination of steps that do not create value, making steps that flow smoothly toward the customer, and beginning the process again until it reaches a state of perfect (LEI, 2019). The center of this principle is customer value and waste elimination (Moraros, Lemstra, & Nwankwo, 2016). In the context of customer value, lean identifies three kinds of value: value-adding activities, non-value adding

activities but required, and non-adding activities (Deniz & Ozcelik, 2018). Non-adding value activities should be eliminated from the system. There are seven types of activity that do not add value, that are waiting, defects, over-production, transportation, inventory, unnecessary motion, and over-loading (Ohno, 1988). Eliminating those wastes depends on the suitability in choosing the effective tools or techniques and human factor, including organizational culture as the actor of implementation (Hallam & Contreras, 2018).

Tools and techniques to eliminate wastes vary and develop as the complexity of waste increases. Review by Hallam and Contreras (2018) identified 15 lean tools and techniques: VSM (visual stream mapping), Kaizen, 5S, DMAIC (define, measure, analyze, improve, and control), standardized work, Gemba, PDCA (plan-do-check-act), 5 Why's, Kanban, Process mapping, A3 report, SMED (single-minute exchange of dies), spaghetti map, workload balancing, and run chart.

From theoretical perspective, the success and failure of lean can be described by bounded rationality theory. According to this theory, actors have incomplete information and are more likely to make decisions using heuristics or using information that falls within their management and authority (Hallam & Contreras, 2018; Radner, 1996). Bounded rationality makes lean implementation impossible if it is not using multidisciplinary mechanism that brings together a number of people from different background as a team. Bounded rationality from each member will expand to be optimum, covering the whole system and providing an overall overview for a transparent system.

### Method

#### Research Location

This research was conducted at RSIA Grand Family, a hospital in Jakarta, Indonesia. It is specialized in mother and child care. It has 10.000 m<sup>2</sup> to house five floors, 20 outpatient polyclinics, and 63 beds (RSIA Grand Family, 2019). This hospital was established in 2007. The research location was specifically at pediatric outpatient pharmacy.

#### Lean Implementation Process

The purpose of implementation in this research focused on inventory reduction in children's pharmacy. Before beginning the implementation, management established a lean team consisted of practitioners including pediatrician, nurse, pharmacist, household team, manager, administrative, and consultant. The team joined a training on philosophy, principles, and tools of lean. On day-2, the team began the implementation process.

On the second day, the team carried out the value stream mapping. Value stream mapping (VSM) contains two maps illustrating the current state and future state of value stream maps of a service (Hallam and Contreras, 2018). Value stream map in the pharmacy context may be in the form of how the prescription is received, read, handle, to the process medical equipment and medicines are handed to the patient and healthcare personnel.

From the results of value stream mapping of children's pharmacy, the team formulated the steps using A3 reports and run chart. A3 reports are one single sheet of A3 paper for documenting problems, problem-solving steps, person in charge, the steps taken, and the expected output after implementation. Meanwhile, run chart is a diagram describing the progress of indicators in a certain period. For this purpose, run chart was made to describe the inventory cost from January 2019 (four months prior to

implementation) to July 2019 (three months after implementation). Based on the value stream mapping, the team decided to choose 5S procedure as lean tools. 5S stands for sort, set in order, shine, standardize, and sustain. 5S model allowed orderliness in the work environment, smooth motion, and easy access of medicine and medical equipment (Kanamori *et al.*, 2015). Firstly, medical equipment, medicines, and other items were sorted which one that were needed, not needed at this time but might be needed in the future, and unwanted at all because of too many in number or irrelevant. Afterwards, the items needed at this moment and in the future were organized in such a way so that it could be found and reached easily. The unwanted items were removed and stored safely and they would be disposed and not restocked if expired, unless there were changes in consideration. If possible, medicine and medical equipment would be returned to the supplier. Next, the pharmacy room was thoroughly cleaned and organized. Better rules were implemented for the standard and applied to the personnel. They were also required to perform monthly evaluation to consider for maintaining, adding, or reducing the existing stock.

After one week implementation of 5S, the team carried out kaizen procedure for the sustainability of the process. Kaizen refers to activities which involve all employees and that continuously improve all and functions and processes through waste of waste (Kovacevik *et al.*, 2016). Kaizen was performed as the sustain form of 5S procedure. After one month implementation, evaluation was conducted on the existing inventory and the cost that could be reduced from children's pharmacy. The researcher also calculated cost-benefit ratio to determine whether the program was beneficial or detrimental to the children's outpatient pharmacy. Implementation was evaluated on month-2 month-3 as well, that was on June 2019 and July 2019.

**Results**

The inventory in children's pharmacy before implementation tended to increase even though not significant ( $R^2 = 3.5\%$ ). The average inventory cost in the first three-month in 2019 was US\$ 22,494. After lean implementation, it significantly decreased ( $R^2 = 38.2\%$ ). The average inventory cost during the three months of lean implementation was US\$ 15,128. It indicates that there is a nearly half cost reduction (49%).

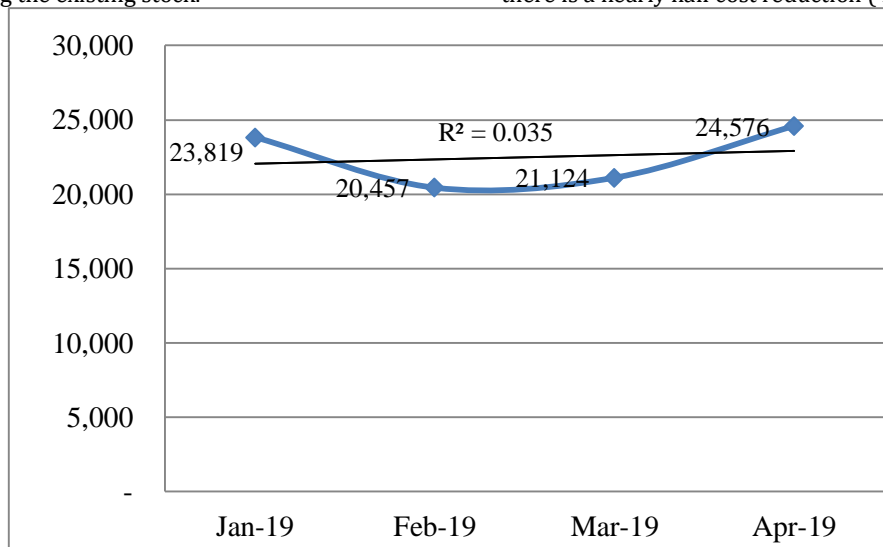


Figure 1. Inventory Cost in the Last Four Months before Lean Implementation (in US\$, 1 US\$ = Rp 14,142)

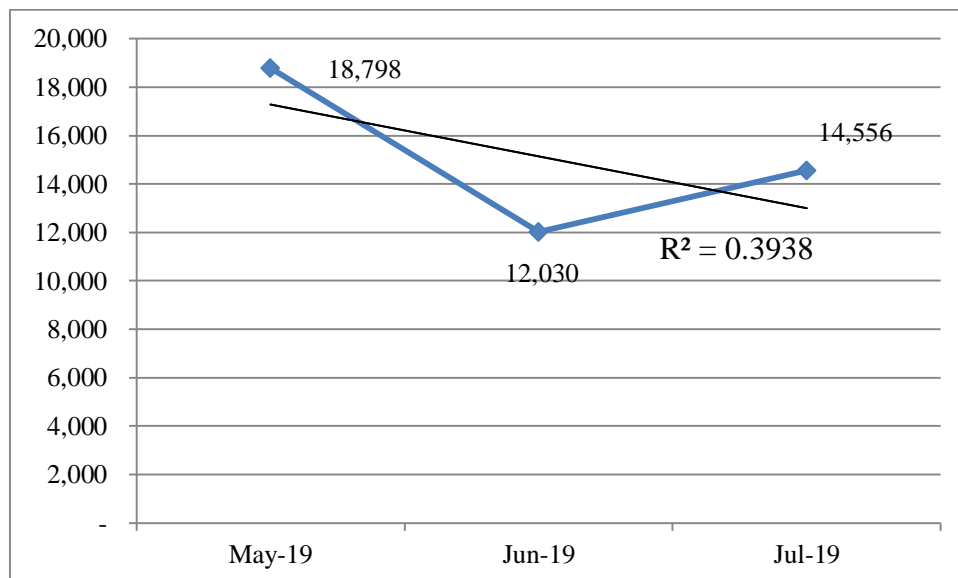


Figure 2 Inventory Cost after Three Months of Lean Implementation (in US\$, 1 US\$ = Rp 14,142)

During the implementation process, lean team had maintained 72 items, reduced 476 items, and added 198 new items. If it is seen per component, there is no change in cost components. Medicine was always within 94% from the total cost, while

the remaining 6% was health equipment. However, the graph shows that there is a continuous reduction on medicine cost with a confidence level of 40.1%. Medical equipment does not significantly decrease and does not convince ( $R^2 = 12.1\%$ ).

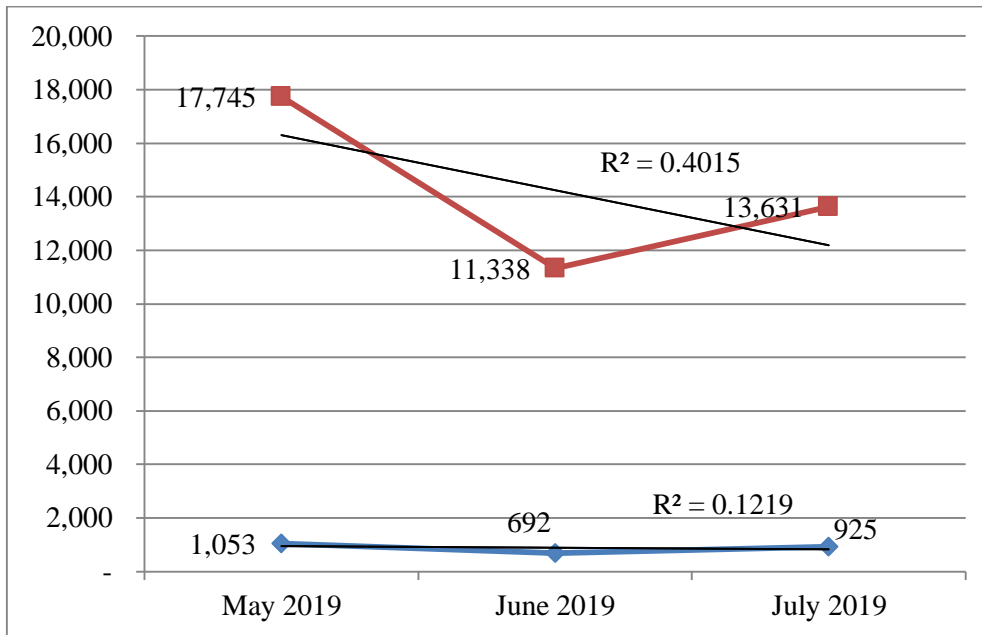


Figure 3. Declining Trend of Inventory Cost Component

During the implementation process, the team had spent US\$ 3.733 consisted of administration component (1%), general cost (65%), housekeeping (31%), and consumption (2%). On the other hand, during that three months, with the assumption

that the average inventory cost without lean implementation is US\$ 22.494, then the total cost saved is US\$ 22.097. Therefore, benefit/cost ratio from lean implementation is US\$ 22.097/US\$ 3.733 = 592%.

Table 1 Benefit and Cost of Lean Implementation

	Implementation Cost		Cost Reduction	
1	Administration	40	May 2019	3.696
2	General Cost	2.444	June 2019	10.464
3	House Keeping	1.176	July 2019	7.937
4	Consumption	73		
	Total	3.733		22.097
	Benefit/Cost Ratio	592%		

**Discussion**

This research highlighted the significance of lean in saving inventory cost of children’s pharmacy. This research explored how lean implementation can reduce the inventory and thus, saving some inventory cost of the pharmacy. Only the essential and required medicine and medical equipment that were kept and stored. Nearly half of the total cost was reduced after lean step was implemented using the effective tools to solve the problems.

Many previous researches have shown that cost reduction is one of the benefit of lean implementation. A research at children’s pharmacy in Seattle showed a cost reduction to 41% (Merguerian et al., 2015). A study at two hospitals in Brazil revealed a cost reduction to 78% in the sterile service department (Costa, Filho, Rentes, Bertani, & Mardegan, 2017).

In line with many studies on lean (Leite, Bateman, & Radnor, 2016a; Ruiz & Ortiz, 2016), the researcher also found problems in implementing lean. Literature classifies lean implementation problems into two groups of technical aspect (processes, technology and tools, training, and resources) and cultural aspect (strategy and alignment, leadership, and behavior and involvement) (Leite, Bateman, & Radnor, 2016b). In this research, the researcher found four types of

problem including poor performance of suppliers, poor development of HR, lack of strategic perspectives, and pessimistic attitude towards lean. Suppliers for pharmacy were not familiar with lean and therefore they felt uncomfortable with the changes due to decreasing demand of medical equipment and medicines. Meanwhile,

some members of the lean team had not fully understood its philosophy and technique, so they should be supervised and assisted during the implementation phase. These are the technical problems. The poor performance of suppliers can be solved by sustainable improvement (Zimmermann & Bollbach, 2015) so they can perceive the benefit of lean for an integrated performance with the pharmacy. The poor development of HR demands intensive HR trainings as well as their engagement in lean principles and methods (Al-Balushi *et al.*, 2014).

The latter problems are cultural problems. The hospital was not familiar with lean management, so in-depth explanation was required to accept lean as a featured management program at the hospital. The lack of strategic perspectives can be solved through a clear vision of lean implementation (Bhasin, 2013).

In addition, pessimistic attitude towards lean was shown by the view of some parties outside the team that lean is merely a work method that adds workload without real benefits for both organization and employees. It can be solved by involving more external parties into the internal parties to implement lean, so that they will understand the benefits and advantages of lean (Bhasin, 2012).

### **General/ Managerial Implication**

Managers must pay attention to the significance of shared understanding of the relevant parties, including top managers and suppliers, about the philosophy and practice of lean in healthcare sector. In the long term, organization must place lean as one of the strategic tools to improve the quality of healthcare service in hospital. It is reasonable to develop policies, standard model application, and complete database when lean is implemented continuously for a longer timeframe in an organization, after a successful pilot test (Bailey, 2016).

Moreover, before implementing lean management, a more intensive training than that of used in research, is required. The training provides knowledge and technical skills that are essential in guiding lean implementation (Leite *et al.*, 2016b). This training will also give opportunities to discuss lean from critical perspectives so that people who are in doubt of lean, even those who are not involved in it, will understand more about the strengths and weaknesses of lean implementation (McCann, Hassard, Granter, & Hyde, 2015). Furthermore, training provides new scopes and dimensions from the existing organizational structure (Bäckström & Ingelsson, 2015) since it involves all parties, including the household department which is usually not being involved, into a team with equal position to achieve the common goal, that is improving service quality. It engages understanding among the parties that rarely interact in daily work.

Beside the quantity of the training, quality should be improved as well. Previous research found that lean training were mostly focusing on theory, partial, and based on poor lesson plan (Semeniuk, 2017). A good training should be based on balance experience between inside and outside classroom training, and based on the competence rather than theory. The models presented in the training must be based on real life situation in the context of healthcare, instead of analogy or model from irrelevant sector. The training must be performed from top to bottom that is from executives and director, to the managers and staff.

### **Practical implication for healthcare sector**

The first imperative implication is the significance of healthcare institution to use lean as a tool to reduce cost.

This research shows that lean implementation can reduce children's pharmacy cost to nearly half. The previous research also shows that cost reduction is a benefit from lean implementation.

Moreover, the critics over cost reduction that it is not a service indicator in healthcare can be understood (Anuar, Saad, & Yusoff, 2018). The objective of healthcare is providing health benefits to the patient. Cost reduction may become a problem due to saving purpose, it makes the patient does not get the medicine they need. In fact, patient's needs may occur promptly and if the medicine is not available due to lean implementation, then the cost reduction backfires. Therefore, lean management especially in pharmacy, needs the basic medicine to be available at all times and if necessary, adding the stock even though it means adding the cost. Lean team must understand whether an item in the stock is rare and vital for immediate need in the future, or it is a complementary item that can be reduced or removed.

### **Socio-economic implication**

In addition to managerial and practical implications, this research also highlights its socio-economic implication, particularly in Indonesia. Recently, Indonesia has to face a crisis in government healthcare insurance that cannot handle the high claims and the low insurance premium from the community. It leads to the increase of premium rates and the community cannot afford it.

One of the problems leading to the incapability of the government insurance to cover healthcare cost comes from the expensive healthcare cost, which in turn forcing the hospital to cover the high operating cost. Inventory cost is a component of operating cost. By using lean, this inventory cost can be reduced and therefore, reducing the operating cost. As the result, the compulsory insurance premium rate from the government is stable and might be decreased as many healthcare institutions implementing lean in their operations.

### **Limitation and Future Research**

This research has some limitations. It is a longitudinal study since the data was collected in several time frame. Nevertheless, the data cannot be fully guaranteed as a manifestation of successful lean implementation. Cost reduction may occur due to other reasons, such as no prompt demand in children's pharmacy. Future research is suggested to be conducted in a longer period to ensure that cost reduction is sustainable and resistant to prompt demand.

Moreover, this research is limited to a private hospital in Jakarta. The results might be different if it is conducted in an undeveloped area with limited medicine supplies. Jakarta is the capital of Indonesia. Medicine supply is accessible and therefore the cost reduction carried out by the lean team has a lower risk in the case that the medicine is needed in the future. If the medicine is needed but not available in the pharmacy, there are other drugstores or suppliers to be contacted for supplying the item. It would be a different case for regional hospitals in which medicine supply is important and considering cost reduction would be a difficult issue that needs in-depth decision making. At this situation, cost reduction is unlikely to be taken compared to the decision in this research. Indeed, it must be confirmed later by further research at those locations. In addition, this research only focuses on one output that is inventory cost. There are other outputs that can be evaluated comprehensively in broader context. The output may be in the form of patient satisfaction, time to look for

and provide medicine and medical equipment when needed, waiting time, or time for preparing medicine. These outputs are relevant to children's pharmacy context. Future research may use these outputs to measure lean implementation in the pharmacy.

## CONCLUSION

This research is an exploration to identify the effects of lean implementation related to children's outpatient pharmacy. The purpose is to prove whether lean implementation can reduce waste in terms of inventory cost of children's pharmacy. The implementation was carried out using value stream map, A3 reports, run chart, 5S, and kaizen. The results were examined three month after implementation. It shows that the cost is drastically reduced from the average of US\$ 22.494 into US\$ 15.128. Moreover, it shows a declining trend with a confidence level of 38.2%, better than the previous of 3.5%. Even though there is a considerable amount of cost reduction, this research had problems in strategic vision, mission, pessimistic attitude, untrained HR, and unprepared suppliers. Therefore, it is suggested that quality and intensive trainings should be held in developing vision and engaging more stakeholders. However, lean implementation in pharmacy must be run carefully to avoid improper elimination of essential medicine for cost reduction purpose. Future research is recommended to cover a longer research period, should be conducted in remote areas where medicine supply and medical equipment is limited, and using more output indicators.

## REFERENCES

1. Aij, K. H. (2015). *Lean Leadership Health Care: enhancing peri-operative processes in a hospital*. Universiteit Amsterdam.
2. Al-Balushi, S., Sohal, A., Singh, P., Al Hajri, A., Al Farsi, Y., & Al Abri, R. (2014). Readiness factors for lean implementation in healthcare settings - a literature review. *Journal of Health Organization and Management*, 28(2), 135-153. <https://doi.org/10.1108/JHOM-04-2013-0083>
3. Andreamatteo, A. D., Ianni, L., Lega, F., & Sargiacomo, M. (2015). Lean in healthcare: A comprehensive review. *Health Policy*. <https://doi.org/10.1016/j.healthpol.2015.02.002>
4. Anuar, A., Saad, R., & Yusoff, R. Z. (2018). Operational Performance and Lean Healthcare in the Healthcare Sector : Review on the Dimensions and Relationships Operational Performance and Lean Healthcare in the Healthcare Sector : Review on the Dimensions and Relationships. *International Journal of Academic Research in Business and Social Sciences*, 8(4), 276-292. <https://doi.org/10.6007/IJARBS/v8-i4/4014>
5. Bäckström, I., & Ingelsson, P. (2015). Is there a relationship between Lean Leaders and healthy co-workers? *Quality Innovation Prosperity*, 19(2), 123-136. <https://doi.org/10.12776/QIP.V19I2.609>
6. Bailey, R. (2016). *Exploring the Process of Lean Training in the Healthcare Industry*. Walden University.
7. Bercauw, R. G. (2013). *Lean Leadership for Healthcare: Approaches to Lean Transformation*. Boca Raton: CRC Press.
8. Bhasin, S. (2012). Prominent obstacles to lean. *International Journal of Productivity & Performance Management*, 61(4), 403-425.
9. Bhasin, S. (2013). Analysis of whether Lean is viewed as an ideology by British organizations. *Journal of Manufacturing Technology Management*, 24(4), 536-554. <https://doi.org/10.1108/17410381311327396>
10. Blackmore, C. C., & Kaplan, G. S. (2016). Lean and the perfect patient experience. *BMJ Quality & Safety*, 1-2. <https://doi.org/10.1136/bmjqs-2016-005273>
11. Carlson, S., & May, M. (2016). *Mistake Proofing for Lean Healthcare*. Boca Raton: CRC Press.
12. Costa, L. B. M., Filho, M. G., Rentes, A. F., Bertani, T. M., & Mardegan, R. (2017). Lean healthcare in developing countries: evidence from Brazilian hospitals. *The International Journal of Health Planning and Management*, 32(1), e99-e120.
13. Croop, S. E. W. (2018). *Implementation of a Golden Hour Protocol for Extremely Premature Infants*. University of North Carolina at Chapel Hill.
14. Daultani, Y., Chaudhuri, A., & Kumar, S. (2015). A Decade of Lean in Healthcare: Current State and Future Directions. *Global Business Review*, 16(6), 1082-1099. <https://doi.org/10.1177/0972150915604520>
15. Deniz, N., & Ozcelik, F. (2018). Improving healthcare service processes by lean thinking. *Pamukkale University Journal of Engineering Sciences*, 24(4), 739-748. <https://doi.org/10.5505/pajes.2017.89814>
16. Eiland, L. S., Benner, K., Gumpfer, K. F., Heigham, M. K., Meyers, R., Pham, K., & Potts, A. L. (2018). ASHP - PPAG Guidelines for Providing Pediatric Pharmacy Services in Hospitals and Health Systems. *Journal of Pediatric Pharmacology Therapy*, 23(3), 177-191. <https://doi.org/10.5863/1551-6776-23.3.177>
17. Flynn, R., Newton, A. S., Rotter, T., Hartfield, D., Walton, S., Fiander, M., & Scott, S. D. (2018). The sustainability of Lean in pediatric healthcare: a realist review. *Systematic Reviews*, 7(137), 1-17.
18. Habidin, N. F. (2017). The Development of Lean Healthcare Management System (LHMS) for Healthcare Industry. *Asian Journal of Pharmaceutical and Clinical Research*, 10(2), 97-102.
19. Hallam, C. R. A., & Contreras, C. (2018). Lean healthcare: scale, scope and sustainability. *International Journal of Health Care Quality Assurance*, 31(7), 684-696. <https://doi.org/10.1108/IJHCQA-02-2017-0023>
20. IHI. (2005). *Going Lean in Health Care* (IHI Innovation Series white). Cambridge. Retrieved from <http://www.ihl.org/resources/Pages/IHIWhitePapers/GoingLeaninHealthCare.aspx>
21. Iswanto, A.H. (2019). Lean implementation; The journey from Yoseph 1 Pavillion at RK Charitas Hospital, Palembang. *International Journal Technology Research*, 8 (10), 652-654
22. Iswanto, A.H. (2019). Lean implementation; The journey from From Theresia 2 Pavillion at RK Charitas Hospital, Palembang. *International Journal Technology Research*, 8 (10), 2801-2803
23. Iswanto, A.H. (2019). Lean Implementation and Its Advantage In Fransiskus Pavilion At RK Charitas Hospital, Palembang. *International Journal Technology Research*, 8 (10), 668-670
24. Iswanto, A.H. & Koesoemo, G.S. (2019). Implementing Lean In Operating Room Medical Supplies of RSIA Grand Family. *International Journal Technology Research*, 8 (10), 1382-1387
25. Kanamori, S., Sow, S., Castro, M. C., Matsuno, R., Tsuru, A., & Jimba, M. (2015). Implementation of 5S management method for lean healthcare at a health center in Senegal: a qualitative study of staff perception. *Global Health Action*, 8(1), 27256.

- <https://doi.org/10.3402/gha.v8.27256>
26. Kovacevic, M., Jovicic, M., Djapan, M., & Zivanovic-Macuzic, I. (2016). Lean Thinking in Healthcare: Review of Implementation Results. *International Journal for Quality Research*, 10(1), 219–230.
  27. Krafcik, J. (1988). Triumph Of The Lean Production System. *Sloan Management Review*, 30(1), 41.
  28. LEI. (2019). Principles of Lean. Retrieved November 1, 2019, from <https://www.lean.org/WhatsLean/Principles.cfm>
  29. Leite, H., Bateman, N., & Radnor, Z. (2016a). A classification model of the lean barriers and enablers: a case from Brazilian healthcare. In *23rd EurOMA Conference*. Trondheim, Norway.
  30. Leite, H., Bateman, N., & Radnor, Z. (2016b). Lean implementation and sustainability: a classification model of the main organizational barriers and enablers. In *Production and Operations Management Society Conference* (pp. 1–10).
  31. McCann, L., Hassard, J. S., Granter, E., & Hyde, P. J. (2015). Casting the Lean Spell: The Promotion, Dilution and Erosion of Lean Management in the NHS. *Human Relations*, 68(10), 1557–1577. <https://doi.org/10.1177/0018726714561697>
  32. Merguerian, P. A., Grady, R., Waldhausen, J., Libby, A., Murphy, W., Melzer, L., & Avansino, J. (2015). Optimizing value utilizing Toyota Kata methodology in a multidisciplinary clinic. *Journal of Pediatric Urology*, 11, 228.e1–228.e6. <https://doi.org/10.1016/j.jpuro.2015.05.010>
  33. Moraros, J., Lemstra, M., & Nwankwo, C. (2016). Lean interventions in healthcare : do they actually work ? A systematic literature review. *International Journal for Quality in Health Care*, 28(2), 150–165. <https://doi.org/10.1093/intqhc/mzv123>
  34. Ohno, T. (1988). *Toyota Production System: Beyond Large-Scale Production*. Portland, Oregon: Productivity Press.
  35. Poksinska, B. B., Fialkowska-filipek, M., & Engström, J. (2017). Does Lean healthcare improve patient satisfaction?: A mixed-method investigation into primary care. *BMJ Quality & Safety*, 26(2), 95–103.
  36. Radner, R. (1996). Bounded Rationality , Indeterminacy , and the Theory of the Firm. *The Economic Journal*, 106(438), 1360–1373.
  37. Redmond, S. E. (2019). *Evaluation of Operational Efficiencies in Pediatric Pharmacy Batch Production*. University of Houston College of Pharmacy.
  38. RSIA Grand Family. (2019). About Us. Retrieved November 1, 2019, from <https://www.rsiagrandfamily.com/id/tentang-kami/rsia-grand-family>
  39. Ruiz, E., & Ortiz, N. (2016). Lean Healthcare: Barriers and Enablers in the Colombian Context. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 10(5), 1650–1656.
  40. Scioli, A. G. (2017). *Leadership Strategies for Addressing U . S . Pharmaceutical Drug Shortages and Supply Chain Disruptions*. Walden University.
  41. Semeniuk, D. (2017). *Lean and In-between : Culture and Discourse in a Health-Care System Improvement Story*. Royal Roads University.
  42. Trakulsunti, Y., & Antony, J. (2018). Can Lean Six Sigma be used to reduce medication errors in the health-care sector? *Leadership in Health Services*, 31(4), 426–433. <https://doi.org/10.1108/LHS-09-2017-0055>
  43. Willis, M. A. (2018). *Improving Lean Healthcare Effectiveness*.
  44. Womack, J. P., & Jones, D. T. (2003). *Lean Thinking*. London: Simon and Schuster.
  45. Womack, J. P., Jones, D. T., Roos, D., & Carpenter, D. S. (1990). *The Machine that Changed the World*. New York: Rawson Associates.
  46. Zimmermann, A., & Bollbach, M. F. (2015). Institutional and cultural barriers to transferring Lean production to China : Evidence from a German automotive components manufacturer. *Asian Business and Management*, 14(1), 53–85. <https://doi.org/10.1057/abm.2014.18>