

## **Literature Review: The Application of Lean Healthcare to Waste in Healthcare Sectors**

**Hanin Tsimar Andriyani<sup>1</sup>, Bambang Suhardi<sup>2\*</sup>, Iksan Widiantoro<sup>3</sup>, Niken UtamiTyastuti<sup>4</sup>**

<sup>1,2,3,4</sup>*Department of Industrial Engineering, Faculty of Engineering, Universitas Sebelas Maret, Surakarta, Indonesia.*

**Abstract:** This paper is an overview of the application of lean healthcare to waste in healthcare services which aimed to determine the relationship between lean healthcare and waste. A literature review of 30 journals obtained through Google Scholar was used as the method. The journals that were used as research data were accredited national journals that had been published in the previous ten years. The review's findings revealed that implementing lean healthcare in healthcare settings such as clinics, health centers, and hospitals was able to reduce waste and increase service time efficiency. In conclusion, the application of lean healthcare has an effective effect on waste minimization.

**Keywords:** Lean healthcare, waste, health services.

---

### **1. Introduction**

The service industry is struggling to reduce operational costs and improve service quality as it aims to provide consumer satisfaction. In addition to the intense competition and inability to serve an ever-increasing number of patients, health care providers must constantly improve the services they provide. Its goal is to meet the needs of patients, which include quick, accurate, low-cost, and friendly service. However, many patients do not receive these services as expected. Patients frequently express their dissatisfaction with the length of their wait and the length of the queue. Long wait times have a negative impact on patient perceptions and can even heighten feelings of illness, which is the leading cause of dissatisfaction with health care services (Naidoo and Mahomed, 2016). Overproduction, defects, unnecessary inventory, inappropriate processing, excessive transportation, waiting, and unnecessary motion are seven types of waste that must be identified using lean tools (Costa & Filho, 2016; Green, Crawford, Bresnen, & Rowe, 2015; Sigalingging, Tama, & Riawati, 2014). The goal of waste identification is to figure out how to get rid of it (Radnor, Holweg, & Waring, 2012). In hospitals, waste removal is very complex because it involves a lot of regulation and the power of professional groups (Hasle, Nielsen, & Edwards, 2016). By controlling quality and production costs, resources saved through waste elimination can increase profitability (Sigalingging et al., 2014).

Lean is a continuous effort to eliminate waste and increase the added value of a product, both goods and services to provide value to customers (Gaspersz, 2011). Lean focuses on the goal of continuously turning waste into value from the customer's perspective. Lean is a systematic approach that is appropriate for process improvement, error proofing, and reducing waste (Kim et al, 2006).

In the field of health care, the Lean concept has resulted in positive changes (Akdag et al, 2018). According to the Lean philosophy, activities that add value are those that directly contribute to meeting customer needs, whereas all processes that do not add value are considered waste (Waring and Bishop, 2010). The health service process at the hospital can focus more on meeting patient needs by eliminating waste. Improvements were made as a result to provide a framework for cost reduction and better measuring service utilization

requirements (Langell et al., 2016). In this case, the solution is to change the hospital's organizational management vision and culture. According to Gaspersz and Fontana (2011), lean aims to increase customer value through continuous improvement of the value-to-waste ratio. Lean methods implemented in hospitals are often referred to as lean healthcare.

Lean healthcare is defined as the elimination of waste in all areas of the business to lower inventory, service cycle times, and costs so that high-quality patient care can be delivered in an efficient, effective, and timely manner while maintaining the organization's economic value (Doss et al. Orr, 2007). Gaspersz (2002) defines waste as "all work activities that do not add value to the transformation of inputs into outputs." In this case, waste should be reduced or eliminated to the greatest extent possible. To address inefficiencies in health care, several methodologies have been proposed. Lean is one of the methodologies that can be used. Lean is a continuous effort to eliminate waste and increase the added value of products, both goods, and services to provide value to customers (Kim et al, 2006).

This study aims to identify the relationship between lean healthcare and waste or waste in health care settings.

## 2. Method

The method used was the study of literature towards 30 journals obtained through Google Scholar. The journals that were used as research data were accredited national journals that had been published in the previous ten years. This research was conducted by identifying the results of previous studies related to the title, namely the effectiveness of the application of lean healthcare to waste in health care settings. The journals obtained are from health and industrial engineering journals.

## 3. Findings and Discussion

Thirty journal sources were obtained from various accredited Indonesian publishers after a search of national and international journals related to the effectiveness of applying lean healthcare to waste in healthcare settings. The objectives of implementing lean healthcare and what solutions are offered to the existing problems are then analyzed and researched using these selected journal sources. The journals studied and their publications are listed below.

Table 1. List of Journals and Publications

No	Journal Title	Publication	No.	Journal Title	Publication
1	Lean Healthcare Analysis to Minimize Waste in Children's Disease Polyclinics	JISI (Journal of Industrial System Integration)	16	Lean Hospital Approach to Minimize Waste In The Outpatient Pharmacy Installation at Pandan Arang Regional General Hospital Boyolali	Journal of Health Research" VOICE FORIKES"
2	Waste Analysis on Patient Referral Flows for Poned Services at Halmahera Health Center Semarang City through Lean Healthcare Approach	Journal of Public Health	17	Analysis of Chemotherapy Services for Participants in the Social Security Administering Body in Carnation Care for Carnation Cancer Hospital "Dharmais" Using the Lean Method in 2015	Indonesian Journal of Hospital Administration

3	Lean Healthcare Approach and Simulation to Minimize Outpatient Service Time at X Regional General Hospital	Journal of Industrial Services	18	Identification of Waste in Patient Discharge Process Flow with Lean Hospital Approach in Karanganyar Regency Hospital	National Seminar on Industrial Engineering Universitas Gadjah Mada 2017
4	Lean Healthcare Approach To Minimize Waiting Time For Outpatient Services In Health Facilities	JAPTI (Journal of Industrial Engineering Science Applications)	19	Optimizing the Implementation of Lean Hospital in the Outpatient Unit of Tugu Ibu Hospital, Depok	Journal of Health Management Foundation RS. Dr. Soetomo
5	Lean Hospital Approach for Continuous Improvement in Hospital Pharmacy Installation Service Process	Journal of Pharmaceutical Management and Services	20	The Use of Lean Concepts to Improve Efficiency of Outpatient Pharmacy Installation Services at Anna Medika Hospital Bekasi	Indonesian Journal of Hospital Administration
6	The Effect of Waste based on Lean Hospital Approach on Quality and Production Cost Control	Journal of Health Management Foundation RS. Dr. Soetomo	21	Process Improvement In Outpatient Installation Rsud Dr. Soediran Mangun Sumarso Using Lean Hospital Approach	IOP Conference Series: Material Science and Engineering
7	Improving the Efficiency of Hospital Patient Service Lines Using a Lean Healthcare Approach	INOBIS (Indonesian Journal of Business Innovation and Management )	22	implementation of Lean Healthcare in BPJS Patients Outpatient at Bethesda Hospital Yogyakarta	National Seminar on Industrial Engineering, Universitas Gadjah Mada
8	Health Center Service Improvement Design through Lean Healthcare Approach and Simulation at Jombang Health Center	Journal of Industrial Engineering	23	Lean Healthcare Tools for Evaluation Process: An Integrative Review	International Journal of Environmental Research and Public Health · July 2021

9	Suggestions for Improving the Quality of Health Services Using a Lean Healthcare Approach at the Gynecology Polyclinic and Children's Polyclinic	JISI (Journal of Industrial System Integration)	24	Implementation of Lean Hospital in Improving Outpatient Services of Internal Medicine Polyclinic (Case Study at Hospital "X" Indonesia)	Performance: Journal of Personnel, Financial, Operations, Marketing and Information Systems
10	Analysis of Hospital Medicine Management Process in East Java Using Lean Hospital Approach	Journal of Pharmacy Management and Services	25	Lean Healthcare Analysis To Identify Waste In Hospital Gynecology Polyclinic X	JIMEA: MEA Scientific Journal (Management, Economics, and Accounting)
11	Waiting Time Efficiency Of Outpatient Poly Service with Lean Healthcare Method at Dr. M. Suherman Pratama Clinic Jember	Proceedings (National Seminar on Research Results 2017)	26	Application Of Lean Healthcare Methodology In A Urology Department Of A Tertiary Hospital As A Tool For Improving Efficiency	Asociation Espanola De Eurologia. (English Edition), 42(1), 42-48.
12	Simulation of Outpatient Service Flow Improvement with Lean Hospital Approach at Tangerang District General Hospital	JITMI (Scientific Journal of Industrial Engineering and Management )	27	Lean-Healthcare Approach To Reduce Costs In A Sterilization Plant Based On Surgical Tray Rationalization	Taylor and Francis Online: Production and Planning Control
13	Analysis of the Process Flow of Inpatient Admission at Hospital "X" 2015 Using a Lean Hospital Approach	ARSI Journal (Indonesian Hospital Administration)	28	Application Of Lean Management Principles In The Identification Of Wastes And Improving Waiting Time At A Hospital Pharmacy	International Journal of Public Health and Clinical Sciences e-ISSN: 2289-7577. Vol. 8: No. 4 July/August 2021
14	Efforts to Reduce Waiting Time for Outpatient Drugs with Lean Hospital Analysis at the Outpatient Pharmacy Installation of Atma Jaya Hospital	ARSI Journal (Indonesian Hospital Administration)	29	Implementation Of Lean Services And Facility Layout To Improve Health Clinical Service Processes	IOP Conference Series: Materials Science and Engineering

15	Implementation of Lean Healthcare and Root Cause Analysis in Reducing Service Time for the Outpatient Unit at RSKB Diponegoro Dua Satu Klaten	Industrial Engineering Online Journal	30	Lean Hospital Approach To Identify Critical Waste In The Outpatient Pharmacy Instalation of Islamic Hospital of PKU Muhammadiyah Pekajangan	JMMR (Journal of Medicoeticole gal and Hospital Management) , 6(2):163-173, July 2017
----	---	---------------------------------------	----	---	---

The application of Lean healthcare in the health sector has a positive impact in all aspects. Hermining (2021) studied lean healthcare in pediatric clinics and found that 80.7 percent of waste occurred during the process of providing services to the pediatric outpatient polyclinic, including waste overproduction, waiting, transportation, excess processing, inventory, motion, and defects. Full storage space, a lack of discipline, doctors who are frequently late, patients who are too lazy to read or look around for service information, and medical officers who forget to put data or files are all factors that influence the occurrence of critical waste. Several recommendations for improvement were made based on this analysis, including training and implementing SOPs, creating a schedule for visual checks, implementing safety stock, and enforcing medical staff discipline with rewards and punishments.

Febianti, et al. (2018) researched lean healthcare approaches and simulations to minimize outpatient service time at RSUD X. From this study, the highest NVA values were obtained in cardiac, eye, and ENT polyclinics. The longest activities based on the Pareto diagram are waiting for drugs at the pharmacy, examining the ENT and cardiac polyclinic, calling for examination, and registration. The proposed improvement is alternative 3 proposal, namely by creating a display indicating the location of a polyclinic for the heart, eye, and ENT, creating a display indicating the location of an outpatient pharmacy, reducing waiting time to take queue numbers at the pharmacy, reducing waiting time to take drugs by adding pharmacist counters and reducing drug collection time by eliminating the activity of filling in biodata.

Hospital services also include the flow of the admission and discharge process for patients. Dewi, P. K. (2018) conducted a study on the process flow of inpatient admission at Hospital "X" in 2015 based on a lean hospital approach and formed short, medium, and long-term proposals. The results showed that there were 31 total activities with a value-added process time of 44.9% at this time while in the new or ideal process flow, the number of activities became 25 with a value-added process time of 92.4% for short-term improvements. In the medium/long-term improvement, the number of activities is reduced to 23 with the percentage of value-added processing time increasing to 94.4%. So based on the results of these studies, the application of lean hospital is very appropriate to overcome the problems that occur in the process flow of inpatient admissions at the hospital.

In the case of patient discharge, Rakhmawati, Y. S., et al. (2017) conducted a study using a lean hospital approach to identify waste in the flow of the patient discharge process. The flow of the repatriation process is mapped using value stream mapping in this study. Then, a fishbone diagram is used to determine the source of the problem, while improvements are performed by using a Failure Mode Effect Analysis (FMEA). The waste with the highest value, transportation waste of 400, occurs in the ward, 280 of waiting waste occurs in the pharmacy, and 250 defect waste occurs at the cashier, according to the RPN obtained from the Failure Mode Effect Analysis (FMEA). Recommendations for improvements to the waste that occurs are the recruitment of inpatient administrative officers, providing education by the management, and adding communication tools. The adoption of lean healthcare also affects quality and production cost control. Nugroho, T., et al. (2019) researched the relationship between these aspects and gave the result that the higher the waste, the more likely it is to improve quality control and production costs. The better the quality cost control caused by the lower waste, the more likely it is to increase production cost control, although the decrease is not significant. Fogliatto, F. S., et al. (2020). Researching the application of lean healthcare that can reduce sterilization costs,

based on the results of research using the kaizen method and cluster analysis, obtained an annual savings of US\$285,756.00 for the cost of the sterilization process.

Anggraini, W., and Ilhamda, AN (2020) found that waste that caused the waste delay was unnecessary movement waste and lost opportunities to retain or win customers in their study on improving the efficiency of hospital patient service lines using a lean healthcare approach. This works out to 22.11 percent. Individual factors of hospital employees and managers are at the root of the waste problem that occurs in the service line. To test the proposed improvement, a future state value stream mapping simulation was run using ARENA. The expected PCE value was 36.18 percent, implying that the proposed improvement increased the efficiency of the patient service line at Tulip Poly by 19.33 percent.

Lean healthcare also includes the pharmacy department in a health care facility. Suryana, D. (2018) conducted a study in the outpatient pharmacy installation of Atma Jaya Hospital to reduce waiting times for outpatient drugs using lean hospital analysis. In the preparation of non-concoction drugs, non-value-added activities can reach up to 85%, while value-added activities are only 15%, according to Root Cause Analysis (RCA), operational research methodology, in-depth observations, and interviews. Meanwhile, it is around 68 percent for non-value-added compound drugs and 32 percent for value-added compound drugs. These figures show that there was a waste. Replacement of a new RS SIM and activation of the Quality Control Team function in the Pharmacy Installation are two proposed improvements to reduce waste. When these changes are made, it is hoped that the Outpatient Pharmacy Installation will become more efficient and that patient satisfaction will improve.

T. Yunganingsih, et al. (2021) investigated the lean hospital approach to reduce waste in pharmaceutical facilities. Critical waste in the form of overproduction waste was 63.33 percent, waiting waste was 23.07 percent, and inventory waste was 39.35 percent, according to the findings. Inefficient information related to the recipe service flow is the source of waste overproduction, while limited human resources are the source of waste waiting. Meanwhile, waste inventory is caused by doctors' practice hours not matching the predetermined hours, resulting in patient queues. The proposed improvement for waste overproduction is by adding acrylic that shows service providers at the registration counter or queue number taking counter to make the process more efficient. Improvements to waste waiting are carried out by leveling employees, namely creating a middle system where additional human resources are needed. The suggestion to improve the waste inventory is to arrange a doctor's practice schedule, one of which is a shift system.

Based on the results of research by de Barros, L. B., et al. (2021), the most effective tools used are DMAIC, VSM, SIPOC, Ishikawa Diagram, and 5S. Combining these tools allows researchers to obtain positive results, such as reduced time (processing, waiting, cycle, permanent and total), reduced costs, increased workload, and increased number of consultations. Based on studies in various journals above regarding the application of lean healthcare in various health services, it is known that measuring working time can solve many problems in improving health services. The implementation of lean healthcare can significantly provide positive results such as time reduction (processing, waiting, cycle, permanent and total), and cost reduction to increase productivity and effectiveness of services in the health sector from the patient admission process flow, patient discharge flow, pharmacy installations, etc. The application of lean healthcare is used to identify the waste contained in a process so that suggestions for improvement can be found to overcome these problems.

#### 4. Conclusion

Lean healthcare is used to identify waste in healthcare settings, such as waste overproduction, defects, unnecessary inventory, improper processing, excessive transportation, waiting, and unnecessary motion. Based on the findings of the literature review, several alternative solutions should be implemented including providing training and implementing SOPs, creating a schedule for visual checks, creating displays as instructions, adding counters or human workers, and rewarding and punishing health workers to motivate them to work harder.

## 5. References

1. Anggraini, W., & Ilhamda, A. N. (2020). Perbaikan Efisiensi Jalur Layanan Pasien Rumah Sakit dengan Menggunakan Pendekatan *Lean Healthcare* (*Improvement of Hospital Patient Service Flow Efficiency by Using Lean Healthcare Approach*). *INOBIS: Jurnal Inovasi Bisnis Dan Manajemen Indonesia*, 3(4), 509–521. <https://doi.org/10.31842/jurnalinobis.v3i4.155>
2. Boronat, F., Budia, A., Broseta, E., Ruiz-Cerdá, J. L., & Vivas-Consuelo, D. (2018). Application of Lean Healthcare methodology in a urology department of a tertiary hospital as a tool for improving efficiency. *Actas Urológicas Españolas (English Edition)*, 42(1), 42-48.
3. De Barros, L. B., Bassi, L. D. C., Caldas, L. P., Sarantopoulos, A., Zeferino, E. B. B., Minatogawa, V., & Gasparino, R. C. (2021). Lean Healthcare Tools for Processes Evaluation: An Integrative Review. *International Journal of Environmental Research and Public Health*, 18, 7389, 1-21
4. Devani, V., & Sari, S. N. (2018). Usulan Peningkatan Kualitas Pelayanan Kesehatan Dengan Menggunakan Pendekatan Lean Healthcare di Poliklinik Kandungan dan Poliklinik Anak (*Proposals to Improve the Quality of Health Services Using a Lean Healthcare Approach in Gynecological Polyclinics and Children's Polyclinics*). *Jisi: Jurnal Integrasi Sistem Industri*, 5(2), 63–70.
5. Dewi, P. K. (2018). Analisis Alur Proses Penerimaan Pasien Rawat Inap di Rumah Sakit "X" Tahun 2015 dengan Pendekatan Lean Hospital (*Flow Analysis of Inpatient Admission Process at Hospital "X" 2015 with Lean Hospital Approach*). *Jurnal Administrasi Rumah Sakit Indonesia*, 2(1), 1-16
6. Dima, Z. L. (2018). Penggunaan Konsep Lean untuk Meningkatkan Efisiensi Pelayanan Instalasi Farmasi Rawat Jalan di Rumah Sakit Anna Medika Bekasi (*Using the Lean Concept to Improve the Efficiency of Outpatient Pharmacy Services at Anna Medika Hospital, Bekasi*). *Jurnal Administrasi Rumah Sakit Indonesia*, 2(1), 29-42
7. Fatma Hermining Astuti, T. S. (2021). Analisis *Lean Healthcare* Guna Meminimasi Waste Pada Poliklinik Penyakit Anak (*Lean Healthcare Analysis to Minimize Waste in Children's Disease Polyclinics*), *JISI: JURNAL INTEGRASI SISTEM INDUSTRI*, 8(1), 23–33. <https://doi.org/10.20396/jihm.v1i1.9305>
8. Febianti, E., Muharni, Y., & Mustikawati, E. A. (2018). Pendekatan *Lean Healthcare* dan Simulasi Untuk Meminimasi Waktu Pelayanan Rawat Jalan di RSUD X (*Lean Healthcare Approach and Simulation to Minimize Outpatient Service Time at RSUD X*), *Journal Industrial Servicess*, 4(1), 38–46. <https://doi.org/10.36055/jiss.v4i1.4087>
9. Ferdias, I., Budiawan, W., & Susanto, N. (2017). Implementasi *Lean Healthcare* dan *Root Cause Analysis* Dalam Mereduksi Waktu Pelayanan Unit Rawat Jalan di RSKB Diponegoro Dua Satu Klaten (*Implementation of Lean Healthcare and Root Cause Analysis in Reducing Outpatient Service Time at RSKB Diponegoro Dua Satu Klaten*). *Industrial Engineering Online Journal*, 6(3), 1-12
10. Fogliatto, F. S., Anzanello, M. J., Tonetto, L. M., Schneider, D. S., & Muller Magalhães, A. M. (2020). *Lean-Healthcare Approach to Reduce Costs in a Sterilization Plant Based on Surgical Tray Rationalization*. *Production Planning & Control*, 31(6), 483-495.
11. Gabrielle, K. (2021). Application of Lean Management Principles in the Identification of Wastes and Improving Waiting Time at A Hospital Pharmacy. *International Journal of Public Health and Clinical Sciences*, 8(4), 41-52.
12. Julipriohadi, A. (2018). Analisis Pelayanan Kemoterapi Peserta Badan Penyelenggara Jaminan Sosial di Rawat Singkat Anyelir Rumah Sakit Kanker "Dharmais" dengan Metode *Lean* Tahun 2015 (*Analysis of Chemotherapy Services for Participants in the Social Security Administering Body in Carnation Short Care at the "Dharmais" Cancer Hospital with the Lean Method in 2015*), *Jurnal Administrasi Rumah Sakit Indonesia*, 2(2), 84-97
13. Kartika, N., Melati, I. P., & Hanum, F. (2021). Analisis Penggunaan *Lean Healthcare* untuk Identifikasi Waste pada Poli Spesialis Kandungan di Rumah Sakit X (*Analysis of the Use of Lean Healthcare for Waste Identification in Gynecology Specialist Poly at X . Hospital*), *Jurnal Ilmiah MEA (Manajemen, Ekonomi, & Akuntansi)*, 5(3), 2149-2165.
14. Kharismawati, A., & Herliansyah, M. K. (2016). Implementasi *Lean Healthcare* pada Pasien BPJS Rawat Jalan di Rumah Sakit Bethesda Yogyakarta (*Implementation of Lean Healthcare for Outpatient BPJS*

*Patients at Bethesda Hospital Yogyakarta), In Seminar Nasional Teknik Industri Universitas Gajah Mada, 408-417, Teknik Industri UGM, Yogyakarta*

15. Kurniasih, D., Nuryakin, N., & Pribadi, F. (2021). Implementasi *Lean Hospital* dalam Meningkatkan Pelayanan Rawat Jalan Poliklinik Penyakit Dalam (*Implementation of Lean Hospital in Improving Outpatient Services of Internal Medicine Polyclinic*), *Performance: Jurnal Personalia, Financial, Operasional, Marketing dan Sistem Informasi*, 28(01), 01-14.
16. Muthia, A., Riandhini, R. A., & Sudirja, A. (2020). Optimalisasi Upaya Penerapan *Lean Hospital* Di Unit Rawat Jalan Rumah Sakit Tugu Ibu Depok (*Optimizing the Implementation of Lean Hospital in the Outpatient Unit of Tugu Ibu Hospital, Depok*), *Jurnal Manajemen Kesehatan Yayasan RS. Dr. Soetomo*, 6(1), 108-127.
17. Nancy, Marchaban, & Wardani, P. E. (2013). Pendekatan *Lean Hospital* Untuk Perbaikan Berkelanjutan Proses Pelayanan Instalasi Farmasi Rumah Sakit (*Lean Hospital Approach for Continuous Improvement of Hospital Pharmacy Installation Service Process*), *Jurnal Manajemen Dan Pelayanan Farmasi*, 91–98.
18. Novianti Fatli Azizah, Wakhid Slamet Ciptono, S. (2017). Analisis Proses Pengelolaan Obat RSUD Di Jawa Timur Dengan Pendekatan *Lean Hospital* (*Analysis of the Drug Management Process for Hospitals in East Java Using a Lean Hospital Approach*), *Jurnal Manajemen Dan Pelayanan Farmasi*, 7(1), 49–56.
19. Nugroho, T., Fitriasari, N., Ekasari, P. A., Prasanti, I., Rumah, M., Fakultas, S., Universitas, K., Timur, J., & Kualitas, B. (2019). Pengaruh Waste dengan Pendekatan *Lean Hospital* Terhadap Pengendalian Biaya Kualitas dan Produksi *Effect of Waste With Lean Hospital Approach Toward Quality and Production Cost Control (Effect of Waste With Lean Hospital Approach on Quality and Production Cost Control Effect of Waste With Lean Hospital Approach Toward Quality and Production Cost Control)*, *Jurnal Manajemen Kesehatan Yayasan RS. Dr. Soetomo*, 5(1), 38–45.
20. Nuraini, N., & Wijayanti, R. A. (2017). Efisiensi Waktu Tunggu Pelayanan Poli Rawat Jalan dengan Metode *Lean Healthcare* di Klinik Pratama dr. M. Suherman Jember (*Waiting Time Efficiency of Outpatient Poly Service with Lean Healthcare Method at dr. M. Suherman Jember*), Prosiding Seminar Nasional Hasil Penelitian 2017, 251-252, Politeknik Negeri Jember, Jember
21. Nurlita Putri Apriliani, Sutopo Patria Jati, E. Y. F. (2017). Analisis Waste Pada Alur Rujukan Pasien Pelayanan Poned Puskesmas Halmahera Kota Semarang Dengan Pendekatan *Lean Healthcare* (*Waste Analysis on Patient Referral Flows for Poned Services at Halmahera Health Center Semarang City with a Lean Healthcare Approach*), *Jurnal Kesehatan Masyarakat (e-Journal)*, 5(4), 102–111.
22. Rakhmawati, Y. S., Damayanti, R. W., & Iftadi, I. (2017). Identifikasi Waste pada Alur Proses Pemulangan Pasien dengan Pendekatan *Lean Hospital* di RSUD Kabupaten Karanganyar (*Identification of Waste in Patient Discharge Process Flow with Lean Hospital Approach at Karanganyar District Hospital*). In *Seminar Nasional Teknik Industri Universitas Gadjah Mada 2017*, 101-109, Teknik Industri UGM, Yogyakarta.
23. Roselina Dwi Nuraina, Nuzulia Khoiriyah, N. (2021). Pendekatan *Lean Healthcare* Untuk Meminimasi Waktu Tunggu Pelayanan Rawat Jalan di Fasilitas Kesehatan (*Lean Healthcare Approach To Minimize Waiting Time For Outpatient Services in Health Facilities*). *JAPTI: Jurnal Aplikasi Ilmu Teknik Industri*, 2(1), 10–21.
24. Sayyida, G., Fahma, F., & Iftadi, I. (2018, March). Process Improvement in Outpatient Installation RSUD dr. Soediran Mangun Sumarso Using *Lean Hospital* Approach. In *IOP Conference Series: Materials Science and Engineering* (Vol. 319, No. 1, p. 012077). IOP Publishing.
25. Suryana, D. (2018). Upaya Menurunkan Waktu Tunggu Obat Pasien Rawat Jalan dengan Analisis *Lean Hospital* di Instalasi Farmasi Rawat Jalan RS Atma Jaya (*Efforts to Reduce Waiting Time for Outpatient Drugs with Lean Hospital Analysis at the Outpatient Pharmacy Installation of Atma Jaya Hospital*). *Jurnal Administrasi Rumah Sakit Indonesia*, 4(2), 110-121
26. Susanto, S. (2017). *Lean Hospital Approach to Identify Critical Waste in the Outpatient Pharmacy Installation of RSI PKU Muhammadiyah Pekajangan*. *Jurnal Medicoeticolegal dan Manajemen Rumah Sakit*, 6(2), 163-173.
27. Tarigan, U., Ishak, A., Hutaikur, Y. O., Siregar, K., Sari, R. M., & Tarigan, U. P. P. (2020, December). Implementation of Lean Services and Facility Layout to Improve Health Clinical Service Processes. In *IOP Conference Series: Materials Science and Engineering* (Vol. 1003, No. 1, p. 012031). IOP Publishing.

28. Trisnawati, N., Bahauddin, A., & Ekawati, R. (2013). Rancangan Perbaikan Pelayanan Puskesmas dengan Pendekatan Lean Healthcare dan Simulasi (*Health Center Service Improvement Design with Lean Healthcare Approach and Simulation*). *Jurnal Teknik Industri*, 1(1), 71–76
29. Widiatama, Y. (2018). Simulasi Perbaikan Alur Pelayanan Pasien Rawat Jalan Dengan Pendekatan Lean Hospital Pada Rumah Sakit Umum (RSU) Kabupaten Tangerang (*Simulation of Improvement of Outpatient Service Flow with Lean Hospital Approach at Tangerang District General Hospital*). *JITMI (Jurnal Ilmiah Teknik dan Manajemen Industri)*, 1(1), 37-49.
30. Yunganingsih, T., Widodo, G. P., & Saptarini, O. (2021). Pendekatan Lean Hospital untuk Meminimalkan Waste di Instalasi Farmasi Rawat Jalan di Rumah Sakit Umum Daerah Pandan Arang Boyolali (*Lean Hospital Approach to Minimize Waste in the Outpatient Pharmacy Installation at Pandan Arang Regional General Hospital Boyolali*). *Jurnal Penelitian Kesehatan" SUARA FORIKES"(Journal of Health Research" Forikes Voice")*, 12.

**INFO**

**Corresponding Author:** Bambang Suhardi, Department of Industrial Engineering, Faculty of Engineering, Universitas Sebelas Maret, Surakarta, Indonesia.

**How to cite this article:** Bambang Suhardi, Hanin Tsimar Andriyani, Iksan Widiantoro, Niken UtamiTyastuti, Literature Review: The Application of Lean Healthcare to Waste in Healthcare Sectors, Asian. Jour. Social. Scie. Mgmt. Tech.2022; 4(1): 228-236.