

LEAN SIX SIGMA APPROACH FOR WAIT TIME ANALYSIS IN RADIOLOGY SERVICES AT KRAKATAU MEDIKA HOSPITAL

Alifah Nur Fadhilah, Dian Ayubi

^{1,2} Fakultas Kesehatan Masyarakat, Universitas Indonesia
Email: alifahnf7@gmail.com, dian.ayubi@gmail.com

ABSTRACT

KEYWORDS

Lean Six Sigma,
Hospital, Radiology
Services

Krakatau Medika Hospital (RSKM), an integral part of Indonesia Healthcare Corporation (IHC), grapples with challenges in radiology services and wait time standards. Amidst the surge in healthcare facilities, IHC, overseen by PT Pertamina Bina Medika, strategically plans Lean Six Sigma implementation to enhance radiology quality, efficiency, and customer satisfaction. Non-Communicable Diseases (NCDs) complexities. The research methodology adopts a qualitative approach, incorporating process flow observations, document reviews, and in-depth interviews at the Radiology Installation of Krakatau Medika Hospital. Data collection involves direct observations, in-depth interviews, and research instruments with various stakeholders. The study, encompassing January to July 2023, reveals RSKM's radiology indicators falling short, with excessive wait times jeopardizing service effectiveness. The Lean Six Sigma approach, utilizing the DMAIC methodology, aims to eliminate waste, improve processes, and enhance organizational performance. Findings emphasize the urgency for improvements, with Lean Six Sigma anticipated to play a pivotal role in reducing wait times and overall performance enhancement. Ethical considerations guide the research, ensuring informed consent and confidentiality. Collaborative efforts with RSKM management are vital for sustained positive outcomes. The study underscores Lean Six Sigma's potential benefits, emphasizing ethical healthcare research principles.

INTRODUCTION

Krakatau Medika Hospital (RSKM), part of the Indonesia Healthcare Corporation (IHC), faces a number of challenges in providing radiology services and meeting waiting time standards. The rapid increase of state-owned and private hospitals in Indonesia, in line with increasing competition, encourages IHC's strategy in the form of the Indonesia Healthcare Corporation (IHC) run by PT Pertamina Bina Medika. The challenges faced by RSKM include low quality of services, investment costs, human resource management, and effective financing. The increasing prevalence of Non-Communicable Diseases (NCDs) such as cardiovascular diseases and diabetes in Indonesia adds complexity, prompting the need for specialized health programs (Pertamina Bina Medika IHC, 2023; Saifudin, 2018).

Radiology has an important role in the diagnosis of NCDs, but faces difficulties in maintaining the quality of service. RSKM plans to use the Lean Six Sigma approach to improve quality, efficiency, and customer satisfaction in radiology services (CGI, 2014; Gittell, 2009; Hamka, 2018). Lean Six Sigma, involving Define, Measure, Analyze, Improve, and Control (DMAIC) measures, aims to eliminate waste, improve process effectiveness, and improve organizational performance (Mboi et al., 2018). This methodology has been successfully applied in addressing schedules, waiting times, and errors in radiology services in hospitals. Although the demand for healthcare services continues to increase, challenges remain in managing NCDs and ensuring timely radiology services (Borgermans et al., 2017a, 2017b;

Keaver et al., 2018; Lopreite & Mauro, 2017). This text highlights the potential benefits of Lean Six Sigma in addressing these challenges and improving overall hospital performance.

Based on the quality report of the radiology installation of Krakatau Medika hospital in 2023, the achievement of radiology indicators until July 2023 has not met the standards set by the hospital and PT Pertamina Bina Medika IHC as the holding (Fitrian 2018). The waiting time for radiological examinations in January-April 2023 reached an average of 4,597 minutes from the maximum target of 60 minutes, while the waiting time for conventional radiological examinations cito <60 minutes in May-July 2023 only reached an average of 28.96% of the target of 100% (Kementerian Kesehatan RI, 2018; WHO, 2018). Failure to achieve these quality standards has the potential to hamper the effectiveness of services and the enforcement of patient diagnosis, threatening the quality of service at Krakatau Medika hospital. To overcome the gap in the achievement of quality indicators, the study will analyze the delivery of radiology services as a whole using the Lean Six Sigma approach (Ravikanth, 2017). The main research question is how the Lean Six Sigma approach can reduce the waiting time for radiology services at the hospital (Rezazade Mehrizi et al., 2021; Vella et al., 2022). The purpose of the study in general is to reduce the waiting time for radiology services, with specific objectives involving the identification of process flows, measurement of time needed, determination of bottlenecks, analysis of activity variants, and causes of obstacles and waste in the waiting time process for radiology services at Krakatau Medika hospital (Amaratunga & Dobranowski, 2016; Benmamoun et al., 2023; Dowell et al., 2017; Karstoft & Tarp, 2011; Rawson et al., 2016).

RESEARCH METHOD

This study used a qualitative approach with process flow observation techniques, document review, and in-depth interviews at the Radiology Installation of Krakatau Medika Hospital (RSKM). The research location is RSKM, and the research time is from November to December 2023. The data collection method involves direct observation, in-depth interviews, and research instruments involving administrative officers, radiographers, radiologists, and radiology chiefs.

Observations were made on the radiology flow at RSKM during the service period, assisted by two observers in two shifts. In-depth interviews were conducted with selected informants using the snowball sampling method (Bungin, 2012). Research instruments include observation guidelines, interview guidelines, and document review guidelines. Data were analyzed using triangulation methods, and data validation was performed by reviewing secondary data.

Data analysis was conducted through a Lean Six Sigma (DMAIC) approach. The analysis step involves creating Current State Value Stream Mapping, Value Stream Mapping (VA, NVA, waste) analysis, lead time calculation, cycle time, bottleneck, time variation analysis, root cause analysis of problems with 5 Whys diagrams, and improvement and creation of Future State Map.

This research follows the principles of research ethics, including obtaining informed consent, maintaining anonymity, and confidentiality of information. This also involves an ethical clearance process in the Ethics Review Team of the Faculty of Public Health, University of Indonesia before data collection. Research has limitations until the improvement stage, and the control stage requires teamwork and RSKM management. Research ethics also includes maintaining the confidentiality of informants and organizing processes by taking into account ethical aspects.

RESULTS AND DISCUSSION

The research focused on implementing a Lean Six Sigma approach to address the challenges faced by Krakatau Medika Hospital (RSKM) in providing radiology services and meeting wait time standards. The hospital, part of Indonesia Healthcare Corporation (IHC), aimed to improve the quality, efficiency, and customer satisfaction of its radiology services. The study used the Define, Measure, Analyze, Improve, and Control (DMAIC) methodology to identify and eliminate waste, enhance process effectiveness, and improve overall organizational performance.

The quality indicators of the radiology installation at RSKM up to July 2023 did not meet the standards set by the hospital and PT Pertamina Bina Medika IHC as the holding company. The wait time for radiology examinations from January to April 2023 averaged 4,597 minutes, far exceeding the maximum target of 60 minutes. Additionally, the wait time for emergency radiology examinations (<60 minutes) from May to July 2023 only reached an average of 28.96%, significantly below the 100% target.

Discussion

Challenges and Need for Improvement

Facing challenges encompassing low service quality, investment costs, human resource management, and effective financing, RSKM grapples with obstacles hindering its operational efficiency. The escalating prevalence of Non-Communicable Diseases (NCDs), notably cardiovascular diseases and diabetes, adds a layer of complexity to healthcare demands, necessitating the development of specialized health programs to address the growing health issues.

Implementation of Lean Six Sigma

In response to these challenges, RSKM strategically plans to implement Lean Six Sigma as a transformative solution to bolster the quality, efficiency, and overall customer satisfaction in its radiology services. The DMAIC methodology serves as the chosen guide for this strategic transformation, involving comprehensive steps that include defining the problem, measuring current performance, analyzing data, implementing targeted improvements, and controlling the enhanced processes to ensure sustained positive outcomes.

Performance Indicators

Notably, the hospital's radiology performance indicators have fallen short of the established standards, raising concerns about potential threats to patient diagnoses and the overall quality of services provided. In light of this, the research aims to undertake a thorough analysis of the entire radiology service delivery, leveraging Lean Six Sigma principles. The primary emphasis is on strategically reducing wait times, a pivotal aspect in enhancing overall service delivery.

Data Collection and Analysis

Employing a qualitative approach, the research employed various methodologies, including direct observation, document review, and in-depth interviews conducted at RSKM's Radiology Installation. The subsequent data analysis adhered to the Lean Six Sigma DMAIC approach, incorporating elements such as Current State Value Stream Mapping, waste analysis, lead time calculation, bottleneck identification, variation analysis, root cause analysis using the 5 Whys, and the formulation of a Future State Map.

Ethical Considerations

The study prioritized ethical research principles, ensuring the acquisition of informed consent, safeguarding anonymity, and maintaining the confidentiality of information. Ethical clearance was diligently secured from the Faculty of Public Health at the University of Indonesia before the commencement of data collection, reflecting a commitment to conducting the research with the utmost integrity and consideration for all stakeholders involved.

CONCLUSION

The initial findings highlight the urgent need for improvement in the radiology services at RSKM. The Lean Six Sigma approach, with its structured DMAIC methodology, is expected to play a crucial role in identifying and addressing inefficiencies, reducing wait times, and ultimately enhancing the overall performance of the hospital. Further collaboration with the hospital management and the implementation of the improvement plan are essential for sustained positive outcomes. The study also underscores the importance of ethical considerations in healthcare research to ensure the well-being and confidentiality of all stakeholders involved.

REFERENCES

- Amaratunga, T., & Dobranowski, J. (2016). Systematic Review of the Application of Lean and Six Sigma Quality Improvement Methodologies in Radiology. *Journal of the American College of Radiology*, 13(9), 1088-1095.e7. <https://doi.org/10.1016/j.jacr.2016.02.033>
- Benmamoun, Z., Fethallah, W., Bouazza, S., Abdo, A. A., Serrou, D., & Benchekroun, H. (2023). A Framework for Sustainability Evaluation and Improvement of Radiology Service. *Journal of Cleaner Production*, 401. <https://doi.org/10.1016/j.jclepro.2023.136796>
- Borgermans, L., Marchal, Y., Busetto, L., Kalseth, J., Kasteng, F., Suija, K., Oona, M., Tigova, O., Rösenmuller, M., & Devroey, D. (2017a). How To Improve Integrated Care for People with Chronic Conditions: Key Findings from EU FP-7 Project INTEGRATE and Beyond. *International Journal of Integrated Care*, 17(4). <https://doi.org/10.5334/ijic.3096>
- Borgermans, L., Marchal, Y., Busetto, L., Kalseth, J., Kasteng, F., Suija, K., Oona, M., Tigova, O., Rösenmuller, M., & Devroey, D. (2017b). How to improve integrated care for people with chronic conditions: Key findings from EU FP-7 Project INTEGRATE and beyond. *International Journal of Integrated Care*, 17(4). <https://doi.org/10.5334/ijic.3096>
- Bungin, B. (2012). *Analisa Data Penelitian Kualitatif*. Rajawali Pers.
- CGI. (2014). *Healthcare Challenges and Trends: The Patient at the Heart of Care*. <https://www.cgi.com/sites/default/files/white-papers/cgi-health-challenges-white-paper.pdf>
- Dowell, J. D., Makary, M. S., Brocone, M., Sarbinoff, J. G., Vargas, I. G., & Gadkari, M. (2017). Lean Six Sigma Approach to Improving Interventional Radiology Scheduling. *Journal of the American College of Radiology*, 14(10), 1316–1321. <https://doi.org/10.1016/j.jacr.2017.02.017>
- Fitrian, N. (2018). *Analisis Lama Waktu Tunggu dan Kejadian Kegagalan Pelayanan Rontgen Di Unit Radiologi RS Bhakti Yudha 2018*. Universitas Indonesia.
- Gittell, J. H. (2009). *High Performance Healthcare: Using the Power of Relationships to Achieve Quality Efficiency and Resilience*. Mc Graw Hill.
- Hamka. (2018). Effect of Service Quality and Customer Satisfaction Patients in General Hospitals of Makassar City Region. *2nd International Conference on Statistics, Mathematics, Teaching, and Research*, 1028(1). <https://doi.org/10.1088/1742-6596/1028/1/012107>
- Karstoft, J., & Tarp, L. (2011). Is Lean Management Implementable in A Department of Radiology? *Insights into Imaging*, 2(3), 267–273. <https://doi.org/10.1007/s13244-010-0044-5>

- Keaver, L., O'Meara, C., Mukhtar, M., & McHugh, C. (2018). Providing Nutrition Care to Patients with Chronic Disease: An Irish Teaching Hospital Healthcare Professional Study. *Journal of Biomedical Education*, 2018, 1–7. <https://doi.org/10.1155/2018/1657624>
- Kementerian Kesehatan RI. (2018). *Riset Kesehatan Dasar 2018*.
- Lopreite, M., & Mauro, M. (2017). The Effects of Population Ageing On Health Care Expenditure: A Bayesian VAR Analysis Using Data From Italy. In *Health Policy* (Vol. 121, Issue 6, pp. 663–674). Elsevier Ireland Ltd. <https://doi.org/10.1016/j.healthpol.2017.03.015>
- Mboi, N., Murty Surbakti, I., Trihandini, I., Elyazar, I., Houston Smith, K., Bahjuri Ali, P., Kosen, S., Flemons, K., Ray, S. E., Cao, J., Glenn, S. D., Miller-Petrie, M. K., Mooney, M. D., Ried, J. L., Nur Anggraini Ningrum, D., Idris, F., Siregar, K. N., Harimurti, P., Bernstein, R. S., ... Hay, S. I. (2018). On the road to universal health care in Indonesia, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, 392(10147), 581–591. [https://doi.org/10.1016/S0140-6736\(18\)30595-6](https://doi.org/10.1016/S0140-6736(18)30595-6)
- Pertamina Bina Medika IHC. (2023). *Corporate Bylaws : Indonesia Healthcare Corporation*.
- Ravikanth, R. (2017). Effective Radiological Imaging for The Good of Patients: Weighing Benefits and Risks. *World Journal of Nuclear Medicine*, 16(02), 85–87. https://doi.org/10.4103/wjnm.wjnm_105_16
- Rawson, J. V., Kannan, A., & Furman, M. (2016). Use of Process Improvement Tools in Radiology. In *Current Problems in Diagnostic Radiology* (Vol. 45, Issue 2, pp. 94–100). Mosby Inc. <https://doi.org/10.1067/j.cpradiol.2015.09.004>
- Rezazade Mehrizi, M. H., van Ooijen, P., & Homan, M. (2021). Applications of Artificial Intelligence (AI) In Diagnostic Radiology: A Technography Study. *European Radiology*, 31(4), 1805–1811. <https://doi.org/10.1007/s00330-020-07230-9>
- Saifudin, A. (2018). Pembentukan Holding Rumah Sakit Badan Usaha Milik Negara (BUMN) Studi Kasus PT. Pertamina Bina Medika-Indonesia Healthcare Corporation. In *Jurnal JDM* (Vol. 02).
- Vella, K., Caruana, C. J., Vella, N., Schembri, K., Camilleri, M. L., Busuttil, M., & Pace, E. (2022). Strategic Planning: Case Study For A Diagnostic Radiology Constancy Testing Programme In A Major Hospital In Malta. *Medical Physics International Journal*, vol.10, No.1.
- WHO. (2018). *Noncommunicable Diseases : Country Profiles 2018*.

Copyright holders:

Alifah Nur Fadhilah, Dian Ayubi (2023)

First publication right:

Devotion - Journal of Research and Community Service



This article is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-sa/4.0/)