THE EFFECTIVENESS OF LEAN SIX SIGMA IMPLEMENTATION IN HEALTH-CARE FACILITIES

Donn Kevinson Sondakh
Adventist University of the Philippines, Philippines
2053743@aup.edu.ph
donnsondakh@gmail.com

Risty Mandane Laloan
Universitas Klabat, Indonesia
risty@unklab.ac.id

Abstract

This study was conducted to investigate the effectiveness of implementing Lean Six Sigma within the field of health care facilities. Lean Six Sigma is a powerful tool that can increase the organization performance. In this study A systematic review was performed in accordance with current best practices through close adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. This study was found that the implementation of Lean Six Sigma enables the hospital to reduce the consumption of plasminogen by 69%, block utilization was increase by 13%-28%, book appointment increases by 24-276%, time saving were increase by 17% to 21%. And for service quality in blood collection was increased by 55% housewide. Lean Six Sigma is an inexpensive methodology to implement, it can bring many benefits to the organization in the health-care facilities. The successful implementation of Lean Six Sigma was able to reduce waste, reduce defect rate, increasing the quality of service, and reduce process variability that led to patient satisfaction and cost effective.

Keywords: lean six sigma, health-care facility, productivity, efficiency

INTRODUCTION

Business environment is dynamic and constantly change especially for health care facilities during pandemic Covid-19. This push hospital and other health care facilities to discover best practices to improve productivity and service quality. Lean Six Sigma (LSS) are the concept that can help the organization to continuously improve productivity and service quality (Drohomeretski et al., 2014).

Six Sigma promote concept of attributes of the most importance to the customer (critical to quality), failing to deliver what the customer wants (defect), what the process can deliver (process capability), what the customer sees and feels (variation), ensuring consistent, predictable processes to improve what the customer sees and feels (stable operations), designing to meet customer needs and process capability (design for six sigma) (Stern, 2019). Six Sigma has gained important attention in the academic and business field due to its financial impact and levels of customer satisfaction (Stern, 2019; Swink & Jacobs 2012).

Lean Manufacturing is a production practice that concentrates on the elimination of waste. TQM capitalizes on the involvement of management, workforce, suppliers and even customers, to meet or exceed customer expectations. Originally, Lean identified the following as the worst forms of waste: transportation, inventory, movement, waiting, over production, over processing, defects, and skill (Stern, 2019).

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According to the report of Deloitte Indonesia Business and Industry Updates (2020), the biggest challenge for health care industry in Indonesia are the shortage of manpower and health care facilities. In other words, to face this challenge the health care industry should add more manpower, facilities, and improve the operational process to be more effective and efficient, and Lean Six Sigma is a method that can help the organization to achieve that objective.

Lean Six Sigma have been implemented in many organization (Aqlan & Al-fandi, 2018; D'Andreamatteo, et al., 2015; Grima et al., 2013; Kumar, Antony, & Tiwari, 2011). They have been used to effectively improve organizations' performance (Drohomeretski et al., 2014). However, according to Peimbert-Garc´ıa (2019) there are very few studies for Lean and Six Sigma in health care, and the healthcare industry is not well-versed in the long-term advantages of the Lean Six Sigma strategy, particularly in developing countries (Rathi et al., 2021). Hence, the systematic review was conducted to investigate the effectiveness of Lean Six Sigma implementation within the field of health care facilities.

RESEARCH METHOD

A systematic review was performed in accordance with current best practices through close adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Liberati, et al., 2009) as show in figure 1 below.

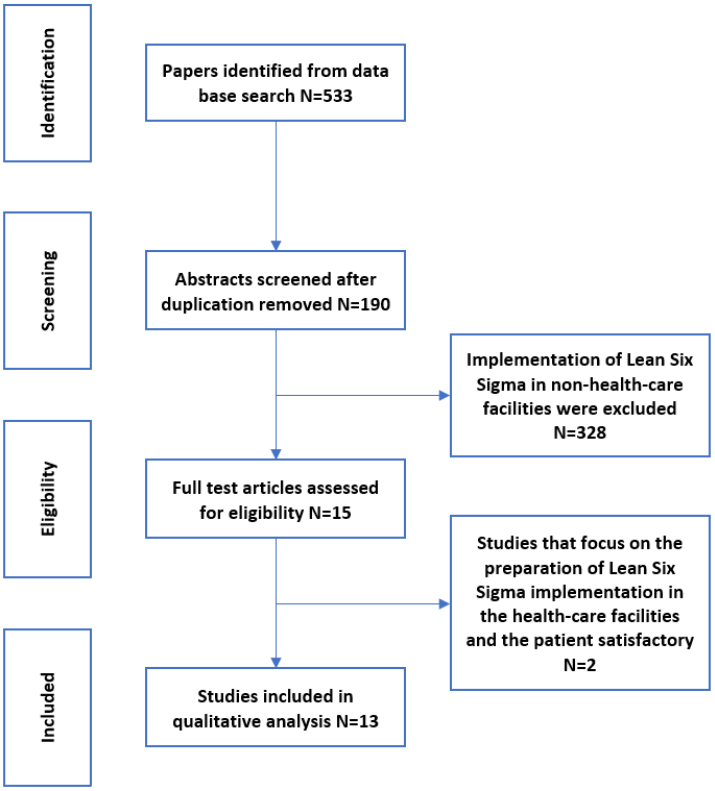

Figure 1
Selection of studies for inclusion in the systematic review.

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SEARCH STRATEGY

The Papers was searched in the following databased: ScienceDirect and Scopus between March 30, 2020, to April 3, 2020. Both databases provide compatible metadata such as abstracts of articles, references, citation indexes, authors, institutions, among others. The search included article were published since 2015 to 2020.

The search terms used were:

[[Lean Six Sigma* OR Lean* OR Six Sigma*] and [Health care facility* OR health care* OR hospital* OR Clinic*]]

Inclusion/exclusion criteria

Research articles, review and conference paper examining the implementation of Lean Six Sigma in the health-care facility, were sought. Studies should have one outcome measure relating to cost effective, service quality, optimization or time saved by health professionals or patients. Studies that focus on the preparation of Lean Six Sigma implementation in the health-care facilities, the patient satisfactory, and papers that contain studies for Lean Six Sigma in other industries was excluded.

RESULT

Paper that included in the table are those that have at least have one outcome measure relating to cost effective, service quality, optimization or time save by health professionals or patients. However, there were two studies that related to implementation of Lean Six Sigma in health-care facilities was excluded because the focus was preparation of implementation and the other paper was measure the patient satisfactory.

The following table shows that Lean Six Sigma has given many benefits both for the organization and the patient. This study was found that Lean Six Sigma is effective to be implemented in the health-care facility, it significantly contributes to the performance in many health-care facilities, for cost-effective with the implementation of lean six sigma hospital were able to reduce the consumption of plasminogen by 69%. For the optimization in audiology, block utilization was an increase by 13%-28%, book appointments increase by 24-276%. Time saving was increased by 17% to 21%. Service quality in the blood collection process was increased by 55%. For patient, the implementation of Lean Six Sigma was giving a positive impact, the discharge process become faster compare to processing time before the implementation. Time discharge in the morning schedule was increased by 21.3 points and for the noon time increased by 7.5 points.

There is evidence from a study shows that the implementation of Lean Six Sigma in the hospital was helped the organization being mature. The other evidence also shows that there is significant improvement in turn-time, physician downtime, on-time patient arrival, on-time physician arrival, on-time start as well as sheath-pulls inside the Cath Lab. The implementation of Lean Six Sigma in the Children Operating Room over a 6-month period was help the health professional to demonstrate that a coordinated multidisciplinary process improvement redesign that can significantly improve efficiency in an academic Children's Hospital without preselecting specific services and removing surgical residents or incorporating new personnel or technology.

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DISCUSSION

Lean Six Sigma is a good methodology to implement in many organizations, however the preparation should be done prior to the establishment of the methodology. According to Fong et al., (2016) approaches to improving intraoperative efficiency can occur on many levels based, however, the level of resources and institutional support are required. Implementation of Lean Six Sigma principles to enhance performance in a health-care environment requires a pre-assessment of the organization's competences (Al Khamisi et al., 2018). Resistance to change can be exist in all level of organization when improvement is implemented (Stern, 2019). Hence, involving all stakeholders in value stream mapping is essential (Huddle et al., 2016). In addition, Fong, et al (2016) says data transparency and communication are critical to improvements.

Lean Six Sigma is an inexpensive methodology to implement but significantly increase the productivity and efficiency in the heath-care facilities. The successful implementation was able to reduce waste, increasing the quality of service, and reduce process variability that led to patient satisfaction and cost efficiency. If the health care facilities are implementing Lean Six Sigma, the process will be efficient and effective, which can help the organization to run the operation with a limited manpower and enable the organization to use the facilities more effective and efficient. Effective and efficient operation or process in the health care facilities will result to the higher number of patients that can be serve during this pandemic Covid-19.

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Appendix

Table 1
Lean Six Sigma Implementation in Health-care Facilities

Author(s)	Purpose and Design	Sample	Findings
Huddle, Tirabassi, Turner, Ries & Lin, (2015).	To apply Lean Sigma—a quality improvement strategy to eliminate waste and reduce variation and defects—to improve audiology scheduling and utilization in a large tertiary care referral center. Prospective quality improvement study.	2995 preintervention and 3714 postintervention booked appointments	• Block utilization increased from 77% to 90%, • Utilization of joint-with-provider visits increased from 39% to 67%, • Booked appointments increased 24%, • Joint-with provider booked appointments increasing 276%, • Appointment lead time averaged 24 days postintervention, compared with 29 days,
Migita, Yoshida, Rutman & Woodward, (2018)	To improve health care processes over time. Interview.	39 members	• The counterintuitive finding of this exercise is that the lead time decreases significantly, • More planes are completed despite the fact that everyone feels that their work is easier.
Steere, Rousseau & Durland, (2018).	To identifying opportunities for improvement that influence efficiency while saving money. literature review	26-month study. October 2014 to December 2016.	• Over the course of the 26-month study, • Hospital experienced a 69% total reduction in tissue plasminogen activator use representing a total 26-month savings of $107,315.
Fong, Smith & Langerman, (2016).	To improve efficiency in the operating room. Review.	39 Studies	• Approaches to improving intraoperative efficiency can occur on many levels based on the required level of resources and institutional support.
Tagge, Thirumoorthi, Lenart & Mitchell, (2017).	To improve performance by systematically identifying root causes of problems. Interview.	Six hundred twelve cases were included in the seven Children's Hospital operating rooms (OR) over a 6-month period.	• These results demonstrate that a coordinated multidisciplinary process improvement redesign can significantly improve efficiency in an academic Children's Hospital without preselecting specific services, • Removing surgical residents or incorporating new personnel or technology.
Molla, Warren, Stewart, Stocking, Johl & Sinigayan, (2018).	To Improve the timeliness of patient discharge. ANOVA.	627-bed.	• Time saving in morning patient discharge increased by 21.3 points, • Patients discharged by noon increased by 7.5 points.
Damato & Rickard, (2015).	To improve preanalytical workflow and blood collection processes—both negatively affected by hemolyzed specimens. Interview.	819-bed. The ECC is a medium-sized facility of 60 beds with a mean of 90,000 patient visits each year. Approximately 80% of ECC patients require one or more laboratory tests.	• Service quality in blood collection increase 55% (Housewide hemolysis decreased by 59%—from 3.4% (2,046 hemolyzed/ 60,307 collected) to 1.39% (619 hemolyzed/44,528 collected).

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Hynes, Murray, Murray, Eustace, Gilchrist, Dolan & Lawler, (2019).	To assess the use of Lean Six Sigma methodology to improve the turnaround time (TAT) for inpatient peripherally inserted central catheter (PICC) placement. GraphPad Prism Version 7.	The TAT for PICC line placement was recorded for the 6 months prior to implementation of changes, and subsequently, at the 6-month and 2-year follow-up points.	• 3.743.28 days (95% confidence interval [CI]¼3.3e4.17). Six months after implementation, the mean TAT was 1.891.82 days (95% CI¼1.72e2.06, p<0.0001). • The reduction was sustained such that at 2 years post-implementation the mean TAT was 1.881.87 days (95% CI¼1.78 e1.99, p<0.0001).
De Freitas, Costa & Ferraz, (2017).	To verify how Lean Six Sigma (LSS) could influence the organizational sustainability through their projects. Qualitative.	520 LSS certified experts and invited to participate.	• Reduce waste, defect rate, increasing the quality of service, and reduce process variability.
Mancosu, Nicolini, Goretti, De Rose, Franceschini, Ferrari, Scorsetti, (2018).	To provide nearperfect services to large processes, by reducing improbable occurrence. Statistical analysis and data correlation.	14,931 consecutive shifts from 1342 patients were analyzed.	• Only 0.8% of patients presented median shifts >1 cm. The major observed discrepancy was the monthly percentage of fractions with almost zero shifts (AZS = 13.2% ± 6.1%). : LSSM was implemented in a RT department, allowing to redesign the breast repositioning matching procedure.
Agarwal, Gallo, Parashar, Agarwal, Ellis, Khot, Kapadia, (2016).	To improve the operational efficiency of our catheterization laboratory (Cath Lab). Cleveland Clinic Institutional Review Board.	All elective and urgent cardiac catheterization procedures including diagnostic coronary angiography, percutaneous coronary interventions, structural interventions, and peripheral interventions performed between June 2009 and December 2012	• A significant improvement in turn-time, physician downtime, • on-time patient arrival, • on-time physician arrival, • on-time start as well as sheath-pulls inside the Cath Lab.
Shortell, Blodgett, Rundall & Kralovec, (2018).	Improvement Systems in Hospitals in the United States. Survey.	1,222 hospitals.	• Sixty-nine percent (69.3%) reported use Lean or related Lean plus Six Sigma or Robust Process Improvement approaches. • 12.6% (n = 102) of hospitals reported being at a mature hospital wide stage of implementation.
Ramos, Bonfá, Goulart, Medeiros, Cruz, Puech-Leão & Feiner, (2016).	To analyze the impact of a process improvement project in a large public tertiary academic hospital with the goal of reducing OR FCT. Stata version 11 (STATA Corp., Texas, USA).	13,316 electives first-case surgeries	• Time saving by 12% • Late decrease in OR room from 62% by 50%

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