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A SYSTEMATIC REVIEW OF STUDIES ANALYZING IMPLEMENTATION OF LEAN CONCEPT IN HEALTHCARE

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Abstract

Lean principles and practices are very helpful in healthcare organizations as pure waste is identified and eliminated. Implementation of lean principles into the healthcare system helps to get the most value and good feedback from the patients. This paper presents a review of lean implementations and practices in the healthcare organizations by highlighting the barriers, errors, wastes or pain areas in them. Nowadays healthcare organizations are focusing on quality improvement processes to improve the patient's satisfaction. Lean helps to improve the quality of healthcare services. It identifies the conflict between traditional environment and a conventional environment in healthcare organizations.

Keywords: Lean, lean principles, healthcare organizations, 5S in an organization, waste elimination, pain areas in healthcare

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1. Introduction

The term Lean was coined by Taiichi Ohno in late 90's. A lean environment provides authority to the employees and concentrates on the customer or end product. In other words, we can say that lean provides tools and techniques that are used to eliminate waste and improve the quality. It helps to meet high demand with fewer inventories (using Kanban System) (Rahman, Sharif et al. 2013).). It enables to predict unprecedented market changes or values in the organization by improving their manufacturing process. It basically refers to the processes like an absence of waste, i.e. identifying and removing waste to enhance the end product for the customer or patient. Waste is anything which decreases the end product value and decreases the amount of profit and it may be time, money, material, power as they are vital for the organization.(Naufal, Jaffar et al. 2012)

Lean was first discovered by automotive and manufacturing organizations and after that expanded into the hospitals and healthcare sector. Lean starts with identifying and removing waste to improve the end quality of product or service for the patients. Removing wastes from the organization and implementation of lean principles helps to focus on the customer. It helps to learn and operate in a fundamentally different way for safe and reliable service delivery and improve the quality care with improved staff experience and provide services at the lowest possible cost. Lean is about increasing value or quality and on other hand removing waste so the end customer gets the most value. Lean also makes things better for employees and the organization. According to Shah and Ward (2007), Lean is defined as "An integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability."

Lean is about the process, not the people. It is a continuous improvement cycle to approach better quality every time. It is not repeating mistakes and removes the error occurrence probability for the future. A lean system is represented as two pillars: the first is 'jidoka' and the second is 'just-in-time'. The main goal of a lean manufacturing system is to produce products of higher quality at the lowest possible cost and in the least time by eliminating wastes.

1.1. Pain areas in Organizations

A waste is defined as anything that does not add value to the product. Lean tool techniques when combined with SWOT (strength, weakness, opportunity, threats) analysis help in eliminating wastes within the organization. (Upadhye, Deshmukh, & Garg, 2010).

1. Transportation Waste
2. Inventory Excess
3. Ambulatory Waste
4. Non-Utilized Talent/ Talent Waste
5. Waiting time/ Time Waste
6. Over-processing Waste
7. Over-production Waste
8. Defects /Rework Waste

Transportation Waste: Transport which is not required and leads to delay delivery of health care services is known as transportation waste. Causes of transportation waste may be unorganized building structure, unplanned shifting of the patient, lack of coordination between departments or employees, unavailability of transport mean.

Inventory Excess: Waste created by storing inutile inventory. Causes of inventory excess waste may be overproduction (low demand and high supply), scale error if it is situational based.

Ambulatory Waste: All employee motion or activities which are included in decreasing end value are motion waste. Causes of motion waste are searching for equipment or material, lack of knowledge about system and patient among healthcare employees.

Non-Utilized Talent: It represents the waste of talent because the right employee is assigned to wrong services or at wrong place that may cause unused creativity.

Time Waste: Waste that leads to delay to provide appropriate health care services to the patient. it may be caused by unnecessary employee activities, unscheduled or unplanned strategies.

Over-processing Waste: The activities which are repeated more than one with zero output and activities which are not useful are called as over-processing waste. This type of waste can be generated due to recording data at multiple places by multiple healthcare activists.

Overproduction Waste: Production that is in excess as compared to it's needs. For Examples: Repeating sampling or diagnostic tests.

Rework Waste: When healthcare activists are not able to provide right service at right time to the right patient at first attempt that leads to second attempt or repetition of work.

1.2 Lean in Healthcare

The lean concept was evolved in Japan in the automotive sector and it came into healthcare sector as a quality improvement tool. But acceptance of lean initially caused tension in healthcare organizations because health care activists need proof before implementing it on (Andersen, Røvik et al. 2014). But later on, lean implementation became a major element of health care services. Lean strategies create and establish an easy understanding among employees for providing higher quality care, more experience, patient-centered and significant time, inventory, cost savings for healthcare organizations by removing error occurrence probability for future. It helps the employees to provide right services to the right client at the right time that is more important in the health sector. Lean empowers frontline employees to identify and remove waste so that it becomes easy to understand the causes of medical errors

1.3 Lean Principles

It is important to follow lean principles step by step. It helps to guide "how to eliminate wastes thoroughly in healthcare ". Brief description of lean principles is given below:

1. The value in the eye of Customer

The value may be different for different people connected with organizations that may be an employee, stakeholder, owner, customer, consumer, etc. But more importance is given to the result because whatever may be the efforts but in the end, result or conclusion matters. So the result or end value is decided by the end user (end user is a consumer who is consuming a product or service and responsible for the feedback). It is important to identify the "value" and create a way to get it. Organization members are more concerned about getting more and more value from the customers and retain them. Teams are putting all their efforts (time, energy, experience) to achieve the value. The firm or organization's reputation depends on their consumer's feedback or we can say that the good or bad reputation of the firm is in the hands of consumers. Lean says give importance to end user and gets more value from them. Identifying

the need for consumers and providing the same is a good idea to get the most value from them. All value is the result of a process (which we often call a "value stream").

2. Identify waste and elimination

Identify Value added actions which are helpful to add value to customers and eliminate pure waste (which do not add value to customers.) Waste is the activity which is unusable and unwanted due to which expenses rise; value decreases and most errors occur. So, it is necessary to identify "pure waste" and eliminate them.

3. Removing hurdles and create a smooth flow

A partial or temporary solution which deals with situational problems is not ideal or longer helpful to maintain quality. Make an ideal strategy for removing wastes and ensure that the flow of process should be error free and helpful to achieve the best value. Bennett (1998) observed that identifying waste and hurdles at an early stage helps to prevent losses by creating protecting shield at right time. So, the planned strategy is the key to smooth flow process which helps to take right decisions at right time.

4. Increase pull value by creating up streaming activity for customers

After mapping the value stream process apply pull strategy to enable the delivery of product/service to the customer

5. Begin the process again with perfection

Implementing lean principles/strategies into the health care system, this should lead to a redefinition of the value-added process without any hurdles with improvements every time. It should be one directional process with a stability of workload which leads to continuous process and achieves good quality services.

1.4 5S in organisation

Solve the problem: According to lean, problem-solving process is a continuous procedure. It is important to stride (follow) steps of the problem-solving process. It doesn't just tackle the issue yet in addition, enhances the quality at end of each cycle.

Stipulate in order: Stipulate in order means arranged in a standardized way. For example, naming, color coding, signs, pictures and assigned a unique code to each patient.

Sheen: Sheen highlights the hypothetical errors that may affect the quality of the hospital. It helps to acknowledge the gaps and helps to fill the gaps.

Standardize: It helps to create universal standards for all employees among the organization and helps to observe the initial three S's - solve the problem, stipulate in order, sheen.

Sustain: It helps to create an efficient environment in the organization and proceeding to center around the four past "S's."

1.5 Aims of lean Management

- ✓ Reduce Costs
- ✓ Improve efficiency
- ✓ Improve Productivity
- ✓ Improve Quality
- ✓ Improve customer satisfaction
- ✓ Improve employee satisfaction and morale

2 Evolution of Lean

In 1900's, Toyota faced many technical issues in their production system like material shortages thereby disturbing the entire production. After that Toyota's director Sakichi Toyoda came up with Jidoka concept which helped in manufacturing quality products with production procedures that separated manual work from machine works. Later on, in 1924, he developed an automatic loom that enabled an individual to work on different machines. The rights to make the automatic loom outside Japan were at the end sold to the Platt Brothers Ltd. in England. In 1936 Toyota began first "Kaizen" concept that changed the future of the group. 'Lean Thinking' concept began in Japan by Taiichi Ohno with Toyota generation framework in 1960. Womack and Jones in their book "The Machine that Change The World" introduced the lean concept. Since 1970 lean has been successfully implemented in various sectors like manufacturing, operations, automobile, and healthcare.

3 Literature on Lean implementation in Healthcare

Some important studies regarding lean implementation in healthcare is presented in Table 1.

Table 1: Literature on Lean implementation in Healthcare

S.No	Journal/Book	Author/Year/Title
1	J Healthc Leadersh	Aij, K. H. Rapsaniotis, S., 2017,Leadership requirements for Lean versus servant leadership in healthcare : a systematic review of the literature
2	Int J Qual Healthcare	Dunsford, J. Reimer, L. E. ,2017, Relationship-centered healthcare as a Lean intervention
3	Med Intensiva	Sirvent, J. M. Gil, M. Alvarez, T. Martin, S. Vila, N. Colomer, M. March, E. Loma-Osorio, P. Metje, T. , 2016, Lean techniques to improve the flow of critically ill patients in a health region with its epicenter in the intensive care unit of a reference hospital
4	Health policy	Antonio D'Andreamatteo, Luca Ianni , Federico Lega , Massimo Sargiacomo, 2015, Lean in healthcare: A comprehensive review
5	J Behav Health Serv Res	Steinfeld, B. Scott, J. Vilander, G. Marx, L. Quirk, M. Lindberg, J. Koerner, K., 2015 , The Role of Lean Process Improvement in Implementation of Evidence-Based Practices in Behavioral Healthcare
6	Science Direct, Elsevier Publications	R.Sundara , A.N.Balajib, R.M.SatheeshKumar , 2014, A Review on Lean Manufacturing Implementation Techniques
7	BMJ	Hege Andersen, Kjell Arne Røvik, Tor Ingebrigtsen,2014 , Lean thinking in hospitals: is there a cure for the absence of evidence? A systematic review of reviews
8	Presented at 5 th International & 26th All India Manufacturing Technology, Design	A. P. Chaple, B. E. Narkhede , M. M. Akarte, 2014, Status of implementation of Lean manufacturing principles in the context of Indian industry: A Literature Review

	and Research Conference (AIMTDR 2014) December 12th–14th, 2014, IIT Guwahati, Assam, India	
9	Science Direct, Elsevier Publications	Nor Azian Abdul Rahmana, Sariwati Mohd Sharifb , Mashitah Mohamed Esac, 2013, Lean Manufacturing Case Study with Kanban System Implementation
10	Mayo Clinic	John S. Toussaint, MD, and Leonard L. Berry, PhD,2013,The promise of lean in Healthcare
11	Taylor & Francis publications	Shaman Gupta and Sanjiv Kumar Jain , 2013, A literature review of lean manufacturing
12	SciVerse Science direct , Elsevier Publications	Joachim Metternich, Sven Bechtloff, Stefan Seifermann , 2013, Efficiency and Economic Evaluation of Cellular Manufacturing to enable Lean Machining
13	Business Process Management Journal	Karim, Azharul, Arif-Uz-Zaman, Kazi, 2013, A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations
14	BMC health services research	Siri Wiig, Marianne Storm, Karina Aase, Martha Therese Gjestsen, Marit Solheim, Stig Harthug, Glenn Robert, Naomi Fulop and QUASER team,2013, Investigating the use of patient involvement and patient experience in quality improvement in Norway: rhetoric or reality?
15	SciVerse Science direct, Elsevier Publications	Ahmad Naufal, Ahmed Jaffar, Noriah Yusoff, Nurul Hayati, 2012, Development of Kanban System at Local Manufacturing Company in Malaysia – Case Study
16	SciVerse Science direct , Elsevier	Rahani AR , Muhammad al-Ashraf , 2012, Production Flow Analysis through Value Stream Mapping: A Lean

	Publications	Manufacturing Process Case Study
17	Public Money And Measurement	de Souza, Luciano Brandão Pidd, Michael,2011,Exploring the barriers to lean healthcare implementation
18	BMC health services research	Glenn B Robert, Janet E Anderson, Susan J Burnett, Karina Aase, Boel Andersson-Gare, Roland Bal, Johan Calltorp, Francisco Nunes, Anne-Marie Weggelaar, Charles A Vincent, Naomi J Fulop and QUASER team, 2011, A longitudinal, multi-level comparative study of quality and safety in European hospitals: the QUASER study protocol
19	International Journal of Management Science and Engineering Management	Upadhye, Nitin, Deshmukh, Suresh Garg, 2010, Lean manufacturing system for medium size manufacturing enterprises: an Indian case
20	Applying lean in healthcare: A collection of international case studies	Aherne, Joe Whelton, John ,2010
21	Quality Management in Healthcare	Poksinka, Bozena, 2010,The Current State of lean implementation in healthcare : Literarture Review
22	Quality Management in Healthcare	DelliFraine, Jami L, Langabeer, James R, Nembhard, Ingrid M, 2010, Assessing the evidence of Six Sigma and Lean in the health care industry
23	Healthcare Quarterly	Benjamin A. Fine, Brian Golden, Rosemary Hannam and Dante Morra ,2009,Leading Lean: A Canadian Healthcare leader's guide
24	Leadership in health services	Brandao de Souza, Luciano, 2009, Trends and approaches in lean healthcare
25	International Journal	Tom Joosten, Inge Bongers, Richard Janssen 2009, Application

	for Quality in Healthcare	of lean thinking to healthcare : issues and observations.
26	Implementation science	Damschroder, Laura J Aron, David C Keith, Rosalind E Kirsh, Susan R Alexander, Jeffery A Lowery, Julie C, 2009, Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science
27	Quality and Safety in Healthcare	TP Young, SI Mc Clean ,2008, A Critical look at Lean Thinking In healthcare
28	Elsevier Publications	B.J Hicks, 2007, Lean information management: Understanding and eliminating waste
29	Emerald Group Publishing Limited	Beata Kollberg, Jens J. Dahlgaard, Per Olaf Brehmer, 2006, Measuring lean initiatives in healthcare services: issues and findings
30	Quality and Safety in Healthcare	Healthcare redesign: meaning, origins and application
31	British Medical Journal	Smith, Jane ,2001,Redesigning healthcare
32	Elesvier	Joanna Macrae, Anthony B.Zwi, LucyGilson, 1996, A triple burden for health sector reform: 'Post'-conflict rehabilitation in Uganda
33	MCB UP Ltd	Daniel T. Jones, Peter Hines, Nick Rich, 1997, Lean logistics
34	The machine that changed the world	James P.Womack, Daniel T.Jones, Daniel Roos and Donna sammons carpenter, 1990
35	Toyota production system Lean Concept	TaiichiOhno,1988

4 Why is lean management significant for healthcare

Lean implementation is a vital part among healthcare organizations as it not only helps to improve the quality but also helps to identify the type of medical error and gives an ideal cycle to solve the problem and remove waste to increase the value. Change is the need for developing countries. Acceptance of change helps to improve the delivery process of value. Continuous changes and continued acceptance of changing tradition with new technologies is not an easy step in health sector because healthcare practitioners need proof before acceptance and implementation on real peoples. Lean is an old idea but it is new to the health sector.

Implementation of lean helps to get benefits in three area's (Kilpatrick 2003):-

a) Operational Area
b) Administrative Area
c) Strategic Area

Administrative Area: Administrative improvements help to improve customer service function, reduction of errors and prevent an occurrence of medical errors, reduce the workload of rework from employees or reduce duplicity of work, divides the work among employees with responsibility.

Operational Area: Well established Operations reflect the coordination or balance between the use of medical resources and efficiency of the health care system in developing healthcare organizations. Some effects of good operational activities are processing time decreased, service delivery increases and enhancement of quality.

Strategic Area: Organisations who execute lean implementations are taking advantages of the improvement. Lean implementation helps the health sector to get benefits. Assembling lean standards and promoting towards to support efforts of employees.

4. Cycle for Lean Implementation

It is a cyclical process. Various steps of lean implementation is given below:

- Observe: The procedure of seeing with the help of an instrument, record data or outcome of any process and identifying the cause of problem by observing.
- Frame strategies for solution: Setting up a standard arrangement for eliminating waste and set up a plan to solve the observed problem.
- Fix the directions: Give the clear cut directions to the employees for achieving an aim.
- Evaluation of plan: Hypothetical test is necessary to prevent the occurrence of an error.
- Implementation: Apply the Strategies into the practical field.
- Analysis: Testing the implementation results and recording them for further evaluation so that it will help to take decisions for future.
- Feedback: Get the feedback from patients and record data for observation it may help to take further actions.

Cycle for lean implementation is depicted in Figure 1.

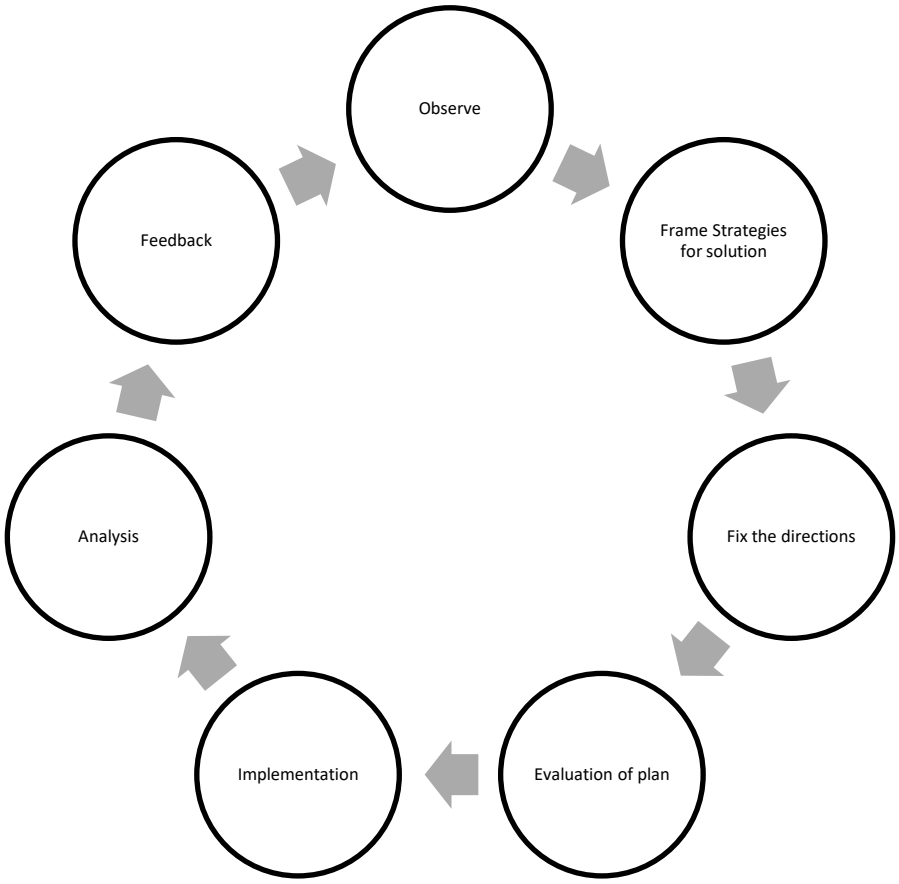

Figure 1: Cycle for lean Implementation

Source: Herman Miller, Lean in Healthcare (Healthcare 2008)

5. Comparison of a conventional environment with the lean environment(Healthcare 2008)

Conventional Environment	**Lean Environment**
Mentality silos It is an authoritative attitude which is seen in the conventional environment.. Autocratic decisions can raise conflicts among employees which can cause misconceptions among employees due to lack of knowledge about the reasons behind the decision and blunders are more likelihood which may impact quality of healthcare services.	**Team work** Team work is defined itself by word but in a lean environment, decisions are taken after group discussion due to which there is smooth coordination between administration and employees. Every Health team member acknowledges about the topic due to which good interpersonal relationships build up (conflict between administration and employees will low) and blunder events diminish which expand the quality of healthcare services.
Condemnate Others It is misguidance which drives the decisions into the wrong direction. One wrong decision in healthcare sector can take one or more lives in return.	**Integration of problem Cause** Only solving the problem or taking the right decision at right time is not preferable. Analysis of causative reason of the problem and evacuating it as a waste is preferable rather over faulting others.

Individual credit When all the team members are helping to achieve the common goal and giving credit to an individual.	**Team credit** When all team members are helping to accomplish common goal and giving credit to all team members.
Protect Information Hospitals having traditional culture keep information isolated from their employees, When an employee or Team shares common task but determines their energy or status. They less inclined to impart data to other colleagues or department which may lead for confound thinking in the group, diverts members from shared objective , increase the chances for rework or defects and in the last patient need to endure.	**Share Information** In a conventional environment, information is shared with all employees. Coordinated efforts by team members to achieve the common goal. Sharing information with all team members helps to improve the patient care. Constant communication improves the understanding among employees. It prevents medical errors.
Internal Concentrate At the point when consideration is given to improve the picture of association and workers, partners all people are occupied in making enhancements by utilizing diverse apparatuses instead of concentrating on quality of service delivered to the patients.	**Patient Concentrate** At a point when consecrations is given to the end value, decisions are taken to accomplish same and methodologies are spin around to enhance the end value (quality of service provided to the patients). In this, feedback of patient matters.

6. Discussion and Conclusion

Lean strategies enhance the quality of healthcare services. But in the meantime, there are methodological and useful contemplations (practical considerations) that should be considered. Otherwise implementation of lean will be shallow and fall flat, adding to existing waste/pain area and making it harder to enhance the quality of services in the long haul. Lean helps to guide how implementation should be planned, organized, and scheduled for better impact on quality of health services. Lean implementation cycle helps to identify local barriers to implementation. It analyzes hypothetically as how to identify the errors and how implementation activities will facilitate a desired change. Comparison of conventional and lean environment helps to identify traditional myths, wrong practices among healthcare practitioners, identify waste and factors affecting quality of health services. Once acknowledged about barriers, lean guides to remove them and increase the quality of healthcare services. During implementation, it is necessary to evaluate progress for an occurrence of error which can influence the lean implementation process to achieve the goal. Lean concept uncovers the effects of lean implementations into the healthcare organizations. The systematic implementation of lean concept lessens the length of time and errors, helps to manage the conditions/situations. In embarking to accomplish its goals, lean gives clear-cut aims, objectives and standard process, identify and eliminate waste, improve the quality and all these are interconnected at a strategic level. By applying the standards of lean concept, organization has to take patient-centered decisions. These strategies and standards provide coherence and steadiness, for both patient and healthcare organization. Lean concept supports the organization and change the specific part of their organization while uplifting quality of healthcare services. Working together along with lean concept will bring fruitful end result.

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