Migration Letters

Volume: 20, No: S12 (2023), pp. 1496-1509

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Lean Quality Management In Healthcare

[1]Awdah Mishaal Alelyani, [2]Turki Hamed Al-Harithi, [3]Tirad Hassan Alsharif, [4]Saif Abdullah Alzahrani, [5]Sabah Hamad Aljaed, [6]Youssef Mohammed Althwebi, [7]Fahad Mohammed Althwebi, & [8]Bandar Mohammed Alnefaie

Abstract

This paper aimed to systematically review the literature on lean management in healthcare. Google Scholar was used to identify and select papers. PRISMA flow diagram was used to filter and select the suitable papers for this review. This process yielded 30 papers. The reviewed papers unequivocally demonstrated the usefulness of lean management in healthcare. It increases efficiency, reduces wastage, reduces cost, reduces patient wait times and improves the performance of healthcare organisations despite some barriers and challenges. However, the uptake of lean management by healthcare organisations has been slow. Government support, funding, guidelines, and standards may increase the level of lean management adoption by healthcare organisations. More studies using experimental approaches, especially in developing countries, are required. This research has implications for the management of hospitals.

Keywords: *Lean Quality Management, Healthcare, Performance, Efficiency.*

Introduction

The lean production system was originally used by the Toyota car production line system. The intention was to maximise value for customers through continuous improvement consisting of structured inventory management, waste reduction and quality improvement. It aims to funda[1]mentally change the organisation's thinking and values, which ultimately leads to the transformation of organisational behaviour and culture over time. The Toyota model focuses on how efficiently resources are being used to increase value for customers at every step of the process. The development and implementation of lean management in Toyota has been described by Dekier (2012). Apart from banishing waste and creating wealth for the organisation, lean management involves five principles: determine the product's value from the customer's viewpoint, identify the value stream through the process, provide a rapid and undisturbed value stream, allow customers to elicit value from the producer, and strive for excellence. Human resources management is key to its success. It includes a good working environment, setting objectives, communication, proper motivation, avoiding wastage of human potential, employee development, and leadership.

In healthcare, lean aims to reduce the waste and waits for patients using continuous learning driven by involving healthcare professionals and providers, support staff, patients and their families and other stakeholders. The Virginia Mason Medical Centre first used lean management in healthcare. A few other healthcare systems around the world followed it. Other authors refer to Theda Care (Barnas, 2011) as an example or simply to a lean management system or lean principles/lean philosophy. In Saskatchewan, daily visual

[1, 2, 3, 4, 5, 6, 7, 8] Taif Health Affairs, Ministry of Health, Saudi Arabia

[1]Corresponding Author Email: alwasi0606@gmail.com

management was added to lean management, in which the employees take the time each day to evaluate their progress using the key elements of daily huddles and visibility walls. This was called Hoshin Kanri. Many other variants of lean management have been reported (See: (McDermott, et al., 2013); (Ulhassan, et al., 2013), (Mazzocato, et al., 2012), (Belter, et al., 2012), and (Esain, Williams, & Massey, 2008)).

Based on the above background, this systematic review aims at an evaluation of the research works done on lean management in healthcare. A protocol for a systematic literature review on this topic was proposed by Lawal et al. (2014). However, this protocol requires the involvement of many researchers and stakeholders. Hence, in this paper, a much simpler method will be used for the identification and selection of research papers.

Method

To ensure in-depth discussions of research papers, a limit of 30 papers was set for this review. To achieve this target, the first few pages of Google Scholar were searched, and the selection of papers was stopped when 30 papers were selected. For identification, screening, and selection, the PRISMA flow diagram was used. In the selection process, papers not in English, abstracts, books, book sections, theses, and editorials were excluded. The selected 30 papers are discussed below.

Results

General

Challenges of lean implementation in hospitals were categorised into three moments by Spagnol, Min, and Newbold (2013) as the initial approach, implementation, and lean thinking maintenance. Most hospitals implement lean management only at certain department levels. Thus, a holistic approach is missing. Administration support is only in principle. Negotiating lean with employees is another problem. Variations in attitudes among staff can lead to differences in implementing different aspects of lean management. Showing them how some organisations have successfully implemented it is one way of solving this problem. Quick, visible results can convince employees. Frequent meetings with all employees to update them on lean implementation, discuss the problems, and brainstorm solutions are effective ways to educate them. A new management culture needs to be in place when lean is implemented. Building internal competencies and spending adequate resources are also important.

Trial

Based on semi-structured interviews with ten experts on lean management, Ahn, Rundall, Shortell, Blodgett, and Reponen (2021) evaluated the use of lean management in healthcare organisations to achieve breakthrough improvements in performance. The findings showed that experts defined breakthrough improvement as a significant change in a performance metric, a fundamental redesign in a process or service, or both. The study also highlighted the value of human-centred design thinking as a complement to Lean management in achieving breakthrough improvement. Additionally, the study identified resources, culture change, and leadership commitment as important facilitators for achieving breakthrough improvements in organisational performance.

Hussain and Malik (2016) presented a comparison of lean implementation as a tool for waste minimisation in public and private hospitals in the UAE. The seven wastes were categorised into three types of sub-criteria. AHP was used for this purpose and to rank waste minimisation strategies. Inventory waste was the focus of private hospitals. The least important waste was defects and motion. Overprocessing had the highest importance for public hospitals. Transportation was next in importance. Cost minimisation should be an important aim for UAE hospitals. In this study, only waste reduction was considered for lean management.

From an EFA and CFA analysis of 238 Malaysian hospitals, Habidin (2017) observed that eight constructs of lean management were acceptable. The eight constructs were leadership, employee involvement, organisational culture, customer focus, technological innovation, process innovation, managerial innovation, and healthcare performance.

Nielsen and Edwards (2011) noted that healthcare organisations implement only a limited number of lean tools. Four hypotheses were tested by the authors. Excepting the first hypothesis, the other three were validated. Thus, lean management in healthcare is not in its infancy. Lack of understanding and absorptive capacity is a major barrier. The nature of work and processes in some areas of healthcare are barriers to lean implementation. Different healthcare professionals have different mindsets and rationalities, which can obstruct lean implementation.

A multivariate analysis of secondary data on lean implementation in US hospitals by Shortell, Blodgett, Rundall, Henke, and Reponen (2021) showed that for better performance, lean should be implemented throughout the organisation. It improves patient satisfaction, reduces the cost per inpatient, lowers the rate of readmission, and improves the use of imaging. USA

In the studies of Demirdöğen, Işık, and Arayici (2020), the addition of information modelling, big data analytics and energy performance simulations to lean management had a synergistic effect on the benefits achieved by lean alone. This result prompted the authors to propose that lean alone is inadequate to improve performance and other methods need to be integrated with it. Two case studies were used to validate the models.

To build consensus about the effectiveness of lean practices, two simulation models for the two costliest departments of a public healthcare facility in Southern Italy (an Elective Surgery Department and the Intensive Care and Resuscitation Unit) were developed by Calogero, Longo, Nicoletti, and Padovano (2017). The simulation models were equipped with built-in functions for implementing different lean policies like the 5S method, visual management, kanban method, and pull system. These models were aimed to support planning and patients' scheduling activities. The results showed managerial advantages like improved resource utilisation levels, savings on overtime costs, and improved customer satisfaction due to reduced patient waiting times and the length of waiting lists. The tables and figures do not show the comparison between simulated and non-simulated results. Thus, without reading the text, these tables and figures are difficult to understand.

Prado-Prado, García-Arca, Fernández-González, and Mosteiro-Añón (2020) discussed the changes in the healthcare sector, focusing on patient-centred management models and the implementation of lean management principles. The authors proposed a new participative methodology (Fig 1) for deploying lean principles in health services and described its practical application in the sleep unit of a Spanish hospital unit as a pilot project. The methodology involved phase 1 of the theoretical basis (Fig 2) and phase 2, the applied phase. Two teams (one to oversee and the other to implement) were formed to implement the processes. The implementation of improvement actions to eliminate waste, create follow-up and control, and continuously improve processes. This approach led to improvements in patient flow management, including quality improvement, cost reduction, and increased productivity. Thus, the participative methodology was validated.

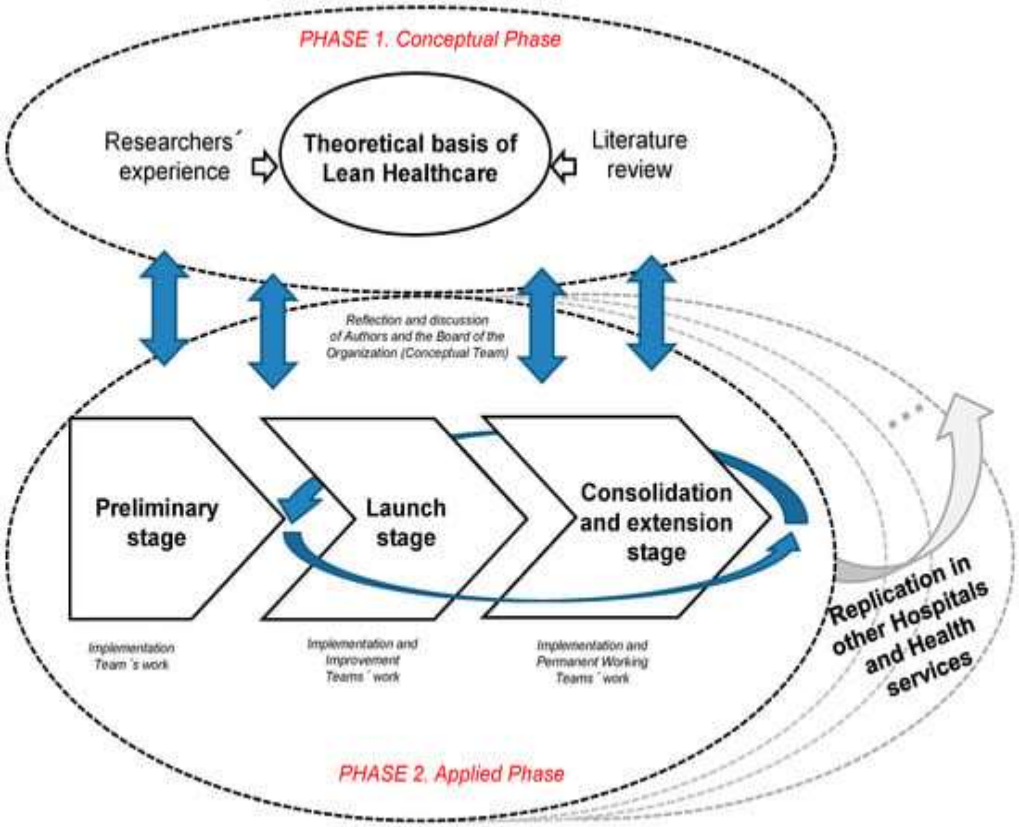


Figure 1 The proposed participative approach for lean management (Prado-Prado, García-Arca, Fernández-González, & Mosteiro-Añón, 2020).

The data on wastes with direct and indirect impacts on patients, improvement actions, and tabulated data on improvements achieved are presented. Although the number of diagnostic tests increased from 14 to 20 per week, other productivity variables did not show any significant improvement. Patient wait time for preferential treatment decreased from 67 to 62. For diagnostic tests to review, it decreased from 49 to 15. Although the current normal and urgent data are given, whether they improved is not clear. There is no data on costs to support the claim of cost reduction. Based on these limitations, the proposed methodology cannot be regarded as successful. The problem may be in the selection of the evaluation variables. More operational and economic variables should have been included in the evaluation.

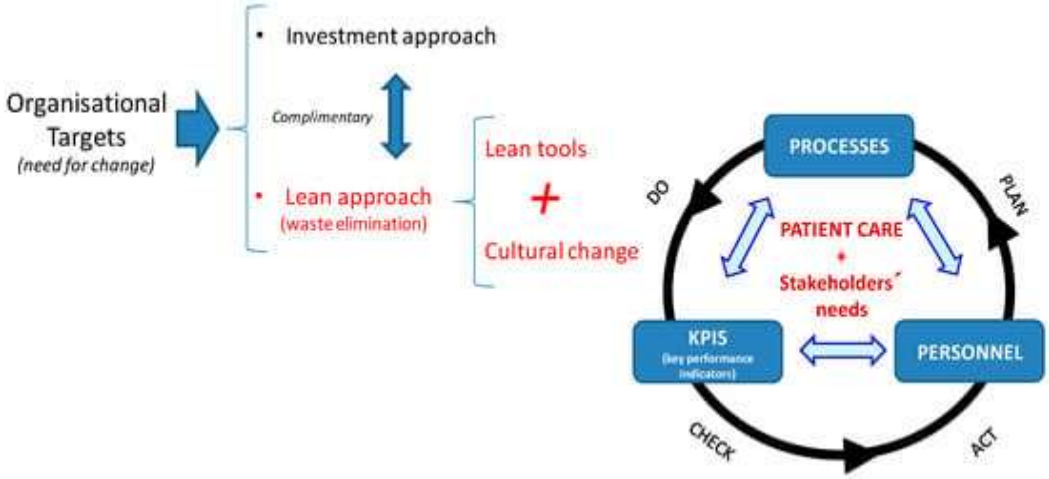


Figure 2 Phase 2: Theoretical phase (Prado-Prado, García-Arca, Fernández-González, & Mosteiro-Añón, 2020).

Lean has proven to be effective in improving results in the manufacturing industry by reducing operational costs and cycle time and increasing customer satisfaction. However, its success in the service sector is variable. While some industries, such as healthcare, have reported success, others have not. In order to get a more comprehensive understanding of the success of Lean in the service sector, Abdallah (2020) conducted a literature search and surveyed 18 top Jordanian hospitals. The results of the survey revealed that organisational leadership was the most influential factor in implementing lean, followed by employee knowledge, training, customer satisfaction, and involving physicians in improvement efforts. Based on this information, the author created a framework for implementing lean (Fig 3), which was successfully applied with the use of various engineering tools such as 5S, visual management, and waste reduction strategies. These tools helped reduce cycle time by 60% and operational costs by 80%, along with other qualitative benefits in the hospital setting.

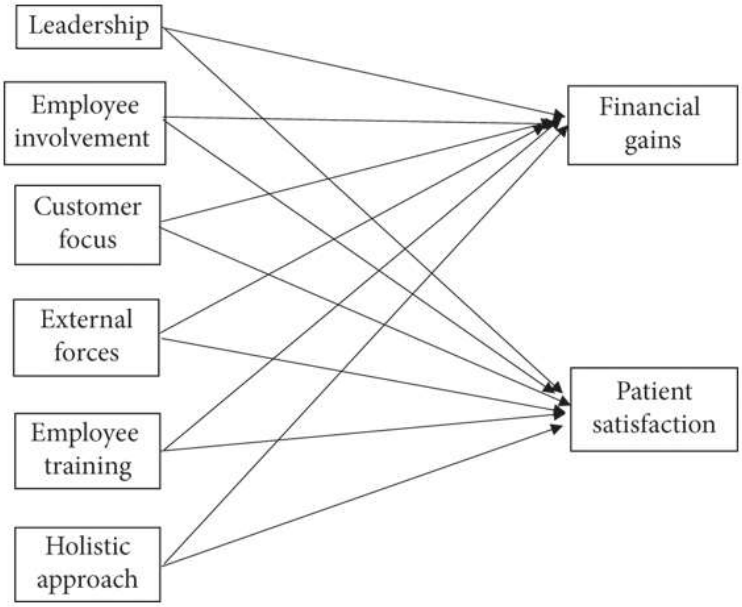


Figure 3 Lean management implementation framework (Abdallah, 2020).

Reviews

A review of the impact of lean management on healthcare professionals was done by Mahmoud, Angelé-Halgand, Churruca, Ellis, and Braithwaite (2021). The identified impacts were morale, motivation, job satisfaction, work intensification, job strain, anxiety, stress and dehumanisation, teamwork, communication and coordination, learning organisational skills, and personal development. Overall, the articles reported positive, negative, and mixed impacts of Lean on frontline healthcare professionals. A majority of papers reported positive impacts. This conclusion was based on just 17 papers. Hence, its validity may be low.

Kunnen, Roemeling, and Smailhodzic (2023) conducted a thematic analysis on 24 papers to qualitatively review the topic. Their analysis revealed four main themes, including mobilising employees, guiding change efforts, methods, and local context. Among the various facilitators of LM, the following were deemed particularly significant: promoting a culture of improvement and learning, offering professional development opportunities, delegating more decision-making responsibilities to employees, and appointing change agents as local leaders for LM. On the other hand, certain barriers to sustaining LM were also identified, such as overburdening employees with tasks, not involving staff in LM implementation, lacking patient engagement, insufficient resources for LM, lack of

commitment and follow-up from leadership, and a lack of knowledge about LM among leaders.

In a review of 28 reviews, Marsilio and Pisarra (2021) observed an increasing interest in lean management in healthcare. About 6% of the reviews proposed a system-wide approach, but this was rarely practised. Its implementation was limited to adoption in isolated standard departments or the use of single techniques and tools. Most commonly, organisational structure, techniques and tools, organisational culture, and strategic management were studied, and significant impacts were observed. However, there is inadequate evidence for sustainable results.

According to Crema and Verbano (2017), there is a link between the concept of Choosing Wisely (avoiding unnecessary care) and Lean management in healthcare. Lean management is standardised to reduce unnecessary care through the processes of prioritisation, evaluation, and control, leading to the most effective healthcare. This was a review paper.

A review of 243 papers on lean management in healthcare by D'Andreamatteo, Ianni, Lega, and Sargiacomo (2015) showed that lean was mostly understood as a way to increase productivity. Most studies were done in hospital settings and were restricted to emergency and surgery departments. Most applications were tested in the USA. The theoretical works were confined to barriers, challenges, and success factors. The least amount of work was done on sustainability and the framework. Critical evaluations of the system-wide approach were still rare.

Based on the content analysis of 50 papers, Vinodhini, Seethalakshmi, and Sowdamini (2018) concluded that the implementation of lean management had a positive impact on reducing waiting time, increasing job satisfaction of professionals, and improving service quality.

A review of 48 papers by Mousavi Isfahani, Tourani, and Seyedin (2019) showed that most studies were done in developed coun mobilising studies in the general hospital and emergency departments. Lean and Lean Six Sigma were commonly discussed as lean management. The five-phase Six Sigma was the most commonly employed lean management. Timing of processes and length of stay were most frequently measured. Only less than half of the indicators were improved by lean management.

An integrative review of 33 papers by de Barros, et al. (2021) showed that the most used lean tools were define, measure, analyse, improve and control (DMAIC); value stream map (VSM); suppliers, inputs, process, outputs, customers analysis (SIPOC), Ishikawa Diagram and 5S. Waste analysis led to a reduction in the times of process, waiting, cycle and total costs, workload and an increase in calls.

Case study

Edwards and Nielsen (2011) tested four hypotheses on lean management. Four case studies of Danish hospitals proved that the first hypothesis, lean management is in its infancy, was rejected. The remaining organisations were accepted. Thus, there is a lack of organisational and absorptive capacity for the lean concept. Some work processes in healthcare act as barriers to lean management. Different mindsets and different rationalities between different types of healthcare professionals act as major barriers to lean management in healthcare.

The need to implement lean to the entire process flow regularly was demonstrated by Matt, Arcidiacono, and Ra in an optimisation case study. The case study showed that patient flows can be optimised using a lean approach. An inclusive study is required to understand the complexity of healthcare delivery systems from various points of view. This is why the case-study approach is the most suitable research method, and a large number of researchers use it. The authors used a 12-step optimisation method in the emergency departments of

four Italian hospitals. The research involved teams consisting of doctors, nurses, technicians, and employees of administration departments. The systematic, holistic approach leads to a better working environment and employees' satisfaction. The project is still being continued.

Drotz and Poksinska (2014) used three case studies to conclude that lean in healthcare settings had influenced the roles, responsibilities, and job characteristics of the employees. The focus shifted from clinical autonomy and professional skills of healthcare professionals to process improvement and teamwork. Different job characteristics made it difficult to implement certain lean practices in healthcare. Teamwork and decentralisation of authority could be considered countercultural due to the strong professional culture and uneven power distribution, with doctors as the dominant decision-makers.

ThedaCare was an integrated healthcare delivery system introduced in Wisconsin in 2003. It adopted lean management (Toyota Production System) in its five hospitals and 27 physician clinics in 2003. Lean management changed the analysis of quality management from a crisis-reactive to a proactive system. Quality issues and crises were solved by proactive methods. This change was a product of a culture change, visual management, and the inclusion of frontline workers in daily continuous improvement (Mannon, 2014).

Using thematic interviews with seven nurse managers and seven medical managers, Hihnala, Kettunen, Suhonen, and Tiirinki (2018) found that the use of the lean manager development model to improve personal management skills consisted of a common set of values, development of activities and management challenges.

A simulated case study on the Thai Medical Centre undertaken by Salam and Khan (2016) showed that by adopting a lean process system, the TMC could become more efficient and provide a better, faster, and safer healthcare system, contributing to patient satisfaction. These findings can be benchmarked elsewhere to improve healthcare system-wide efficiency.

The main focus of lean management in healthcare has been the optimisation of all types of waste and losses in all tasks and processes. This led to the effective use of time, materials, resources, and medical procedures. With the achievement of these results, healthcare organisations could focus on their core function and dedicate more time and effort to patients with organisational costs for them or the healthcare system. However, many healthcare organisations failed to realise these benefits by implementing lean management. Kovacevic, Jovicic, Djapan, and Zivanovic-Macuzic (2016) reviewed four successful examples. The four hospitals could reduce patient wait times, improve patient flow, reduce the time taken to process important categories of blood, reduce the average turnaround time in pathology, reduce staff walking distance, reduce lab space and specimen processing turnaround time, reduce human power and their redeployment in other critical areas, decrease average patient stay, reduce ICU cost, and reduce in-hospital infections from injection. Some other successful examples, like Virginia Mason Medical Cendecentralisationen, are described.

The results of four case studies by Radnor, Holweg, and Waring (2012) showed that lean generally involves the application of specific Lean tools like kaizen blitz and rapid improvement events. These tend to produce small-scale and localised productivity gains. Thus, lean might not currently deliver the efficiency improvements desired in policy. In moving to a more system-wide approach, organisational and managerial differences exist between the manufacturing and healthcare sectors. First, the customer and commissioner in the private sector are one and the same. This is essential in determining the ‘customer value’ that drives process improvement activities. Second, healthcare is primarily designed to be capacity-led. Hence, there is limited ability to influence demand or use freed-up resources.

Bharsakade, Acharya, Ganapathy, and Tiwari (2021) categorised wastes into seven types: transportation, inventory, motion, waiting, overproduction, overprocessing and defects. The leanness priority framework for multicriteria decision-making using a case study is given in Fig 4. The higher the value for the subcategory, the higher the priority.

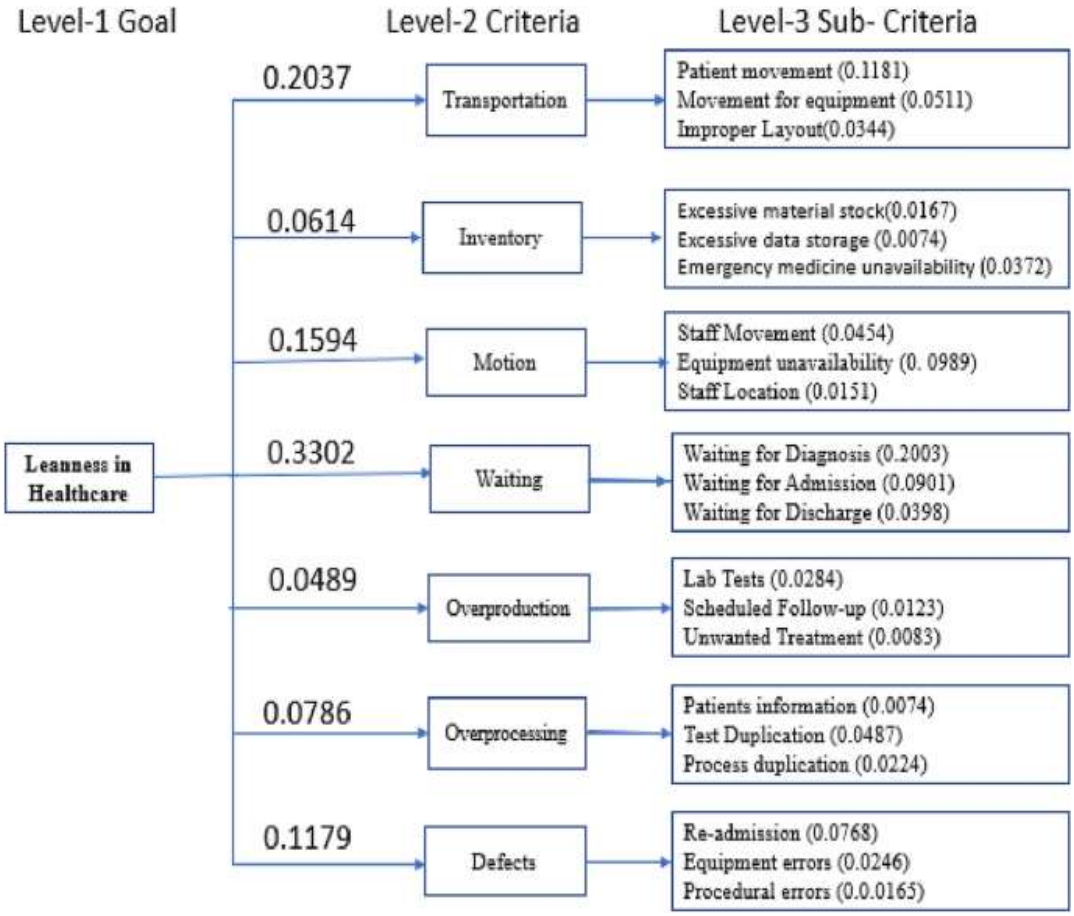


Figure 4 Leanness priority framework (Bharsakade, Acharya, Ganapathy, & Tiwari, 2021).

To prioritise, the total value of subcategories under each category or value for each subcategory can be considered. The authors have given both tables.

The authors Dahlgaard, Pettersen, and Dahlgaard-Park (2011) proposed a streamlined method for evaluating and improving healthcare organisations. It consisted of three main components: a framework for assessment, data collection and analysis methodology, and an index called ILL (innovativeness, learning and lean) for measuring the level of excellence and potential for improvement. This model was based on the 4P excellence model, which considers both intangible systemic factors such as leadership and tangible factors like processes and product/service results. The system was put to the test at a Danish hospital, where a questionnaire survey was administered to employees. The results showed that the model was successful, with the hospital achieving an excellent rating of 0.81 on a scale of 0 to 1.

Using a case study, Dammand, Hørlyck, Jacobsen, Lueg, and Röck (2014) investigated lean implementation at Odense University Hospital (Denmark). Both qualitative and quantitative data were used for analysis. Redorganisationsient waiting time, increase in process cycle efficiency and elimination of on-value-adding activities were obtained. Financial pressure from the government, with increased organisational openness to forward practice from the private sector, full employee involvement, adequate resources, and a

better definition of the hospital's business model, contributed to the success of lean management.

Other

Teich and Faddoul (2013) provided an example of using lean management in a dental college to improve the operation of handpieces. Replacement of control boxes was the solution that sustained the satisfaction of students, and eventually, the reduced time for preparation satisfied the patients also.

Discussion

Some quantitative trends are discussed below.

Year of publication

The frequency of the 30 reviewed papers according to the year of publication is given in Fig 5. As the years progressed, there was a tendency for an increase in papers. This trend may indicate the growing interest in lean management in healthcare, as several authors have shown. This trend is expected to continue localised.

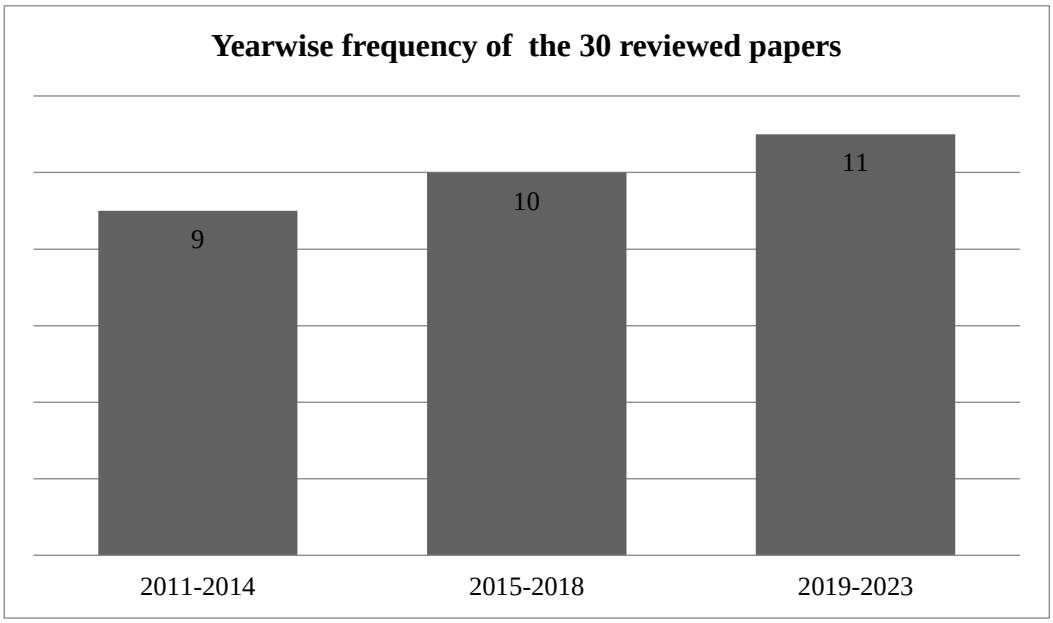


Figure 5 Frequency of the 30 reviewed papers according to their years of publication.

Types of papers

The frequency of the 30 reviewed papers according to organisational types of study is presented in Fig 6.

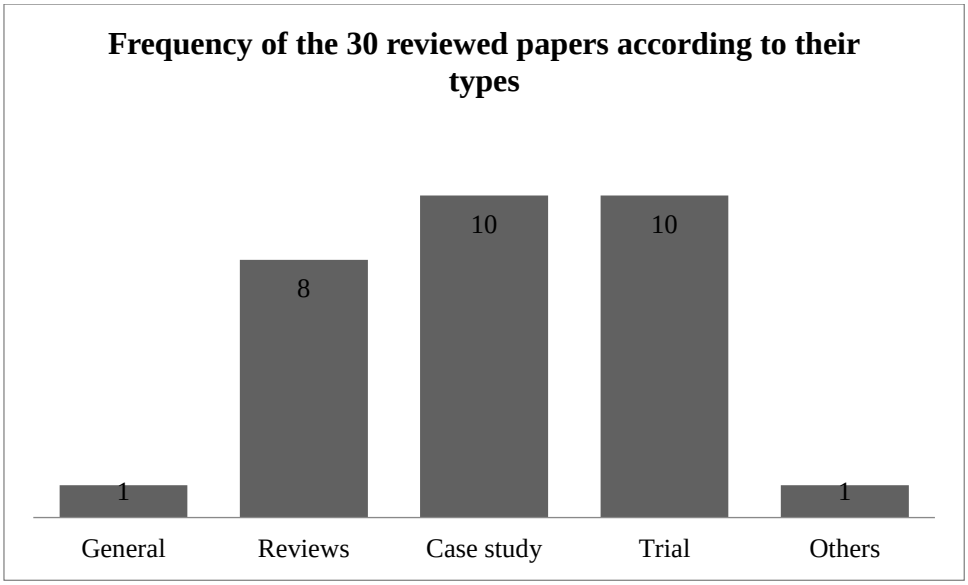
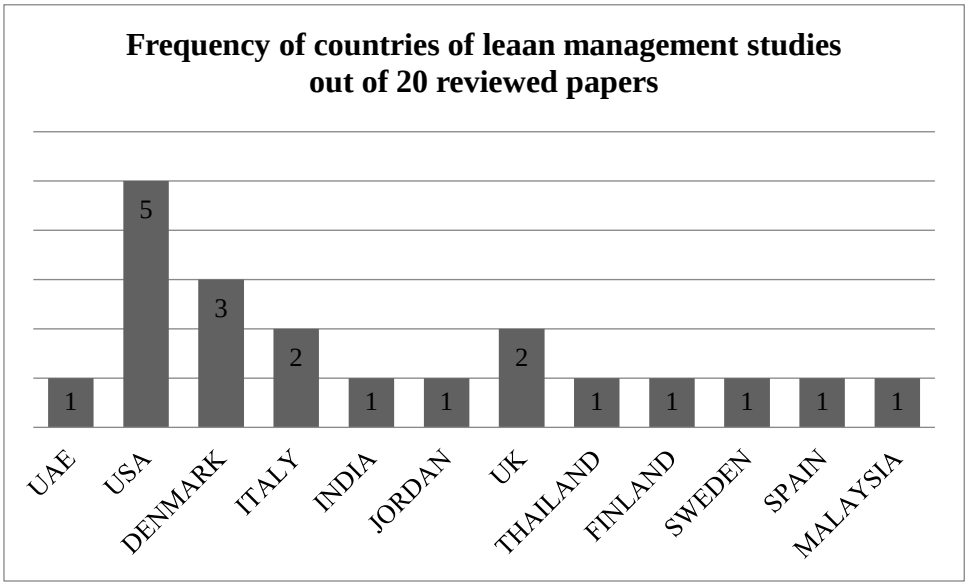


Figure 6 Frequency of the 30 reviewed papers according to their types of study.

Case studies and trials dominated with ten papers each. There were eight reviews. The trials were not randomised replicated types. They were like in-depth single cases. In case studies, one or more cases were analysed in depth. There was a tendency to derive too many points from the reviews of a few papers, which affected the conclusions. "Others" means those which do not fall into any particular category.

Countries of study

Excluding one general, one other and eight reviews, which did not relate to any country, the remaining 20 papers were categorised for their countries of study. The results are presented in Fig 7.



The USA dominated with five papers, followed by Denmark. One paper each was published in developing countries. Developing countries have yet to recognise the problems of wastage and low efficiency in their hospitals and the advantages of implementing lean management. This slow uptake of organisations to lean management may be the reason for such low output of papers from these countries.

Some qualitative trends

Most papers used a common pattern of first describing and organisation management. A justification for the use of lean management in health prioritising is provided. Elaborate descriptions of these and a review of the literature followed. The real study and its details and results occupied only the organisation of the paper. In most papers, the very complicated structure of sentences made it difficult to understand what the authors wanted to say. In some papers, legends were missing from tables and figures, making it difficult to know what the result was unless the text was read many times. It will be more useful if authors refer to some good papers for the description of lean management and briefly review the literature, citing only what is relevant to the study. The methodology and results should be presented in clear, simple language for all to understand.

Conclusion

The reviewed papers unequivocally demonstrate the usefulness of lean management in healthcare. It increases efficiency, reduces wastage, reduces cost, reduces patient wait times and improves the performance of healthcare organisations despite some barriers and challenges. However, the uptake of lean management by healthcare organisations has been slow. Government support, funding, guidelines, and standards may increase the level of lean management adoption by healthcare organisations. More studies using experimental approaches, especially in developing countries, are required.

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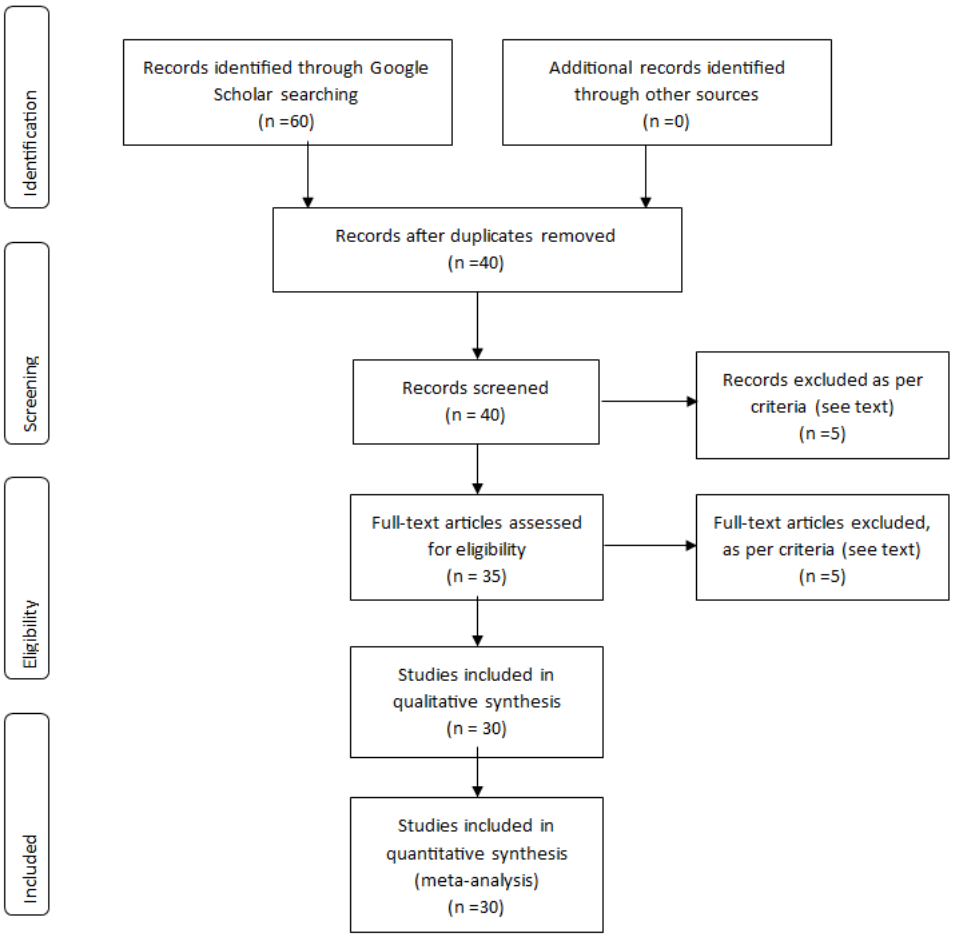
APPENDIX - PRISMA Flowchart



Analysing