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LEAN SUSTAINABILITY FACTORS IN HEALTHCARE: A SCOPING REVIEW

Muniamal Krishnan.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
muniamal.k@moh.gov.my

Lum Kah Yee.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
lkyee@moh.gov.my

Zalina binti Libasin.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
zalina.l@moh.gov.my

Ku Anis Shazura binti Indera Putera.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
kuanis.ip@moh.gov.my

Nur Nadia Renu binti Abdullah.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
nurnadiarenu.a@moh.gov.my

Natasya Nur Binti Mohd Nasir.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
drnatasyanur@moh.gov.my

Intan Syafinaz binti Saman@Saimy.
Institute for Health Management, National Institutes of Health (NIH), Shah Alam, Malaysia.
intan.syafinaz@moh.gov.my

*Corresponding author's email: muniamal.k@moh.gov.my

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ABSTRACT

Lean is a commitment to continuous improvement that may greatly influence an organization's health, wealth, and competitiveness. This research attempted to identify the factors affecting lean sustainability in healthcare. The scoping review was conducted per a pre-established protocol that complies with the Preferred Reporting Items of Systematic Review and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR). Thematic analysis of the included articles revealed eleven themes aimed at enhancing the sustainability of lean implementations in healthcare. These themes included capacity building, value-based lean, leadership, monitoring and evaluation, attitudes and behaviours, project team, project management, dissemination, organizational capacity, incentives, and policy. This review is helpful in providing evidence-based recommendations on factors to support long-term lean sustainability in a health organization.

1.0 Introduction

Increasing the effectiveness, providing higher-quality treatment, and handling spikes in demand are the pressures currently faced by the healthcare industry (Lingaratnam, 2013; Fong, 2016). Inadequate use of resources and poor patient flow are examples of inefficiencies that can lead to overcrowding and delays in treatment which can compromise patient safety, staff and patient satisfaction, and the overall standard of care (Beck, 2016; Sánchez,2018). Hospitals are integrating lean healthcare (LH) into their operations to improve efficiency, reducing waste, and maximizing patient value (Crema, 2015). Lean is a combination of operational principles, leadership and management techniques, and tools (Lawal, 2014; Kimsey, 2010). Lean emphasizes continuous improvement, in which all staff members actively detect and eliminate wasteful operations. Lean also aids in removing obstacles across disjointed departments, enabling various departments to operate more effectively for the benefit of the patients. Lean therefore presents a possible response to the need for productivity and efficiency to raise the quality of health services.

LH categorizes activities as either value-added (VA) or non-value-added (NVA). NVA activities do not satisfy patient requirements and waste time, space, or resources, while VA activities help to fulfil patient demands (Cohen, 2018). LH helps to reveal NVA activity and implement measures to minimise or eliminate it (Zidel, 2006). Specifically, NVA is defined as everything that is not required to bring value to a service in terms of space, equipment, or staff time (Westwood, 2020). LH implementation is not without its challenges. These include modifications in applying the tools and concepts to a new context (Jimmerson, 2005) and methodological limitations during the implementation stage (Vest, 2009).

Although lean is becoming increasingly popular, its adoption is far from trouble-free, and organizations can have trouble maintaining long-term success (Eklund et al., 2014). The organizations must better comprehend the factors that can foster long-term program sustainability if they are to reap the total reward of their significant investment in lean (Scheirer and Dearing, 2011). A standard definition of sustainability is the continued use of program components and activities to constantly achieve desirable program and population outcomes (Scheirer and Dearing, 2011). Sustainability is a dynamic process involving intricate connections between practice environments, interventions, and a wider external effect (Chambers et al. ,2013).

Studies have indicated that it was difficult to maintain momentum when lean efforts were implemented and the initial excitement subsided (Davis and Adams, 2012). Furthermore, lean advancements tend to regress to their initial form over time, indicating that lean sustainability is lacking in health organizations (Bateman and David, 2002; Kaye & Anderson, 1999). According to estimates, between 70 and 90% of organizations are unable to maintain a lean environment (Henrique et al. ,2021). Generally, studies on lean sustainability factors in healthcare is still lacking (De Souza, 2009; D'Andreamatteo et al., 2015), and majority focused on the aspects of lean productivity and efficiency (Pokskinka, 2010). Thus, a scoping review was conducted to identify and summarize all the factors contributing to lean sustainability with a specific focus on healthcare. This review is useful in providing evidence-based recommendations to support long-term lean sustainability in health organizations.

2.0 Methodology

This review was conducted in line with the pre-established protocol created in compliance with the Preferred Reporting Items of Systematic Review and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR). A scoping review was chosen to provide a broad overview of the key concepts of lean sustainability factors (Tricco et al., 2016).

Search strategy

The search engines used were PubMed, Emerald Insight, Ovid MEDLINE, and Google Scholar. The search terms were constructed using the PIO (Population, Intervention, and Outcome) paradigm, as shown in Table 1. The search strategy was tailored to each database. Manual searching was done to find other relevant articles from the bibliographies of the retrieved papers. The search of the literature review for this study conducted from 16/10/2022 till 16/12/2022.

Table 1: Population, Intervention, and Outcome paradigm

Population	Health OR healthcare OR hospital
Intervention	Lean OR "lean Six Sigma" OR kaizen OR "total quality management" OR "value stream mapping"
Outcome	Sustainability OR sustainment OR sustained OR maintenance OR factors

Selection process

Articles eligible for inclusion focused on the discussing and identifying factors related to lean sustainability in healthcare settings. The articles were included if they were published (a) between 2012 and 2022, (b) in the English language, and (c) in any research designs, including qualitative and quantitative studies. Studies conducted in non-health-related fields such as manufacturing, education, and hospitality rather than health settings were excluded. Study protocols, ongoing studies, and journal commentaries were also excluded. The inclusion and exclusion criteria are summarized in Table 2.

Table 2: Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Population	Health-related fields	Non-health related such as manufacturing, education, and hospitality
Time period	2012-2022	Any study outside these years
Language	English	Non-English
Research designs	Any research designs, including qualitative and quantitative studies	Study protocol, ongoing studies, and journal commentaries

The articles were imported to reference management software Endnote Web for title and abstract screening. To reduce the possibility of error, six researchers reviewed all titles and abstracts independently. Any discrepancies were resolved by discussing them with the study team to decide on eligibility.

Data extraction

An online Google form was created to extract data from studies that met the inclusion criteria. Six independent researchers conducted full-text screening, and any discrepancies were resolved in discussion among study members. The extraction Google form included data items on [1] publication details; [2] study context (e.g., hospital/clinic/university hospital); [3] study design (e.g., quantitative, qualitative, mixed methods); [4] data collection methods; and [5] the factors affecting lean sustainability in healthcare.

Data synthesis and analysis

Simple descriptive analyses, such as counts and percentages were calculated to provide a concise overview of the volume and scope of the articles. This included details on the types of study designs, countries, and the factors influencing lean sustainability in healthcare. Due to the dynamic nature of the factors, a thematic analysis was used to analyse the findings. The researchers independently coded the factors extracted from the included articles using Microsoft Word, which were later collated to form themes and sub-themes, as shown in Appendix A. The theming process was conducted inductively through an iterative discussion among the researchers.

3.0 Result and Discussion

Search and selection of scoping reviews

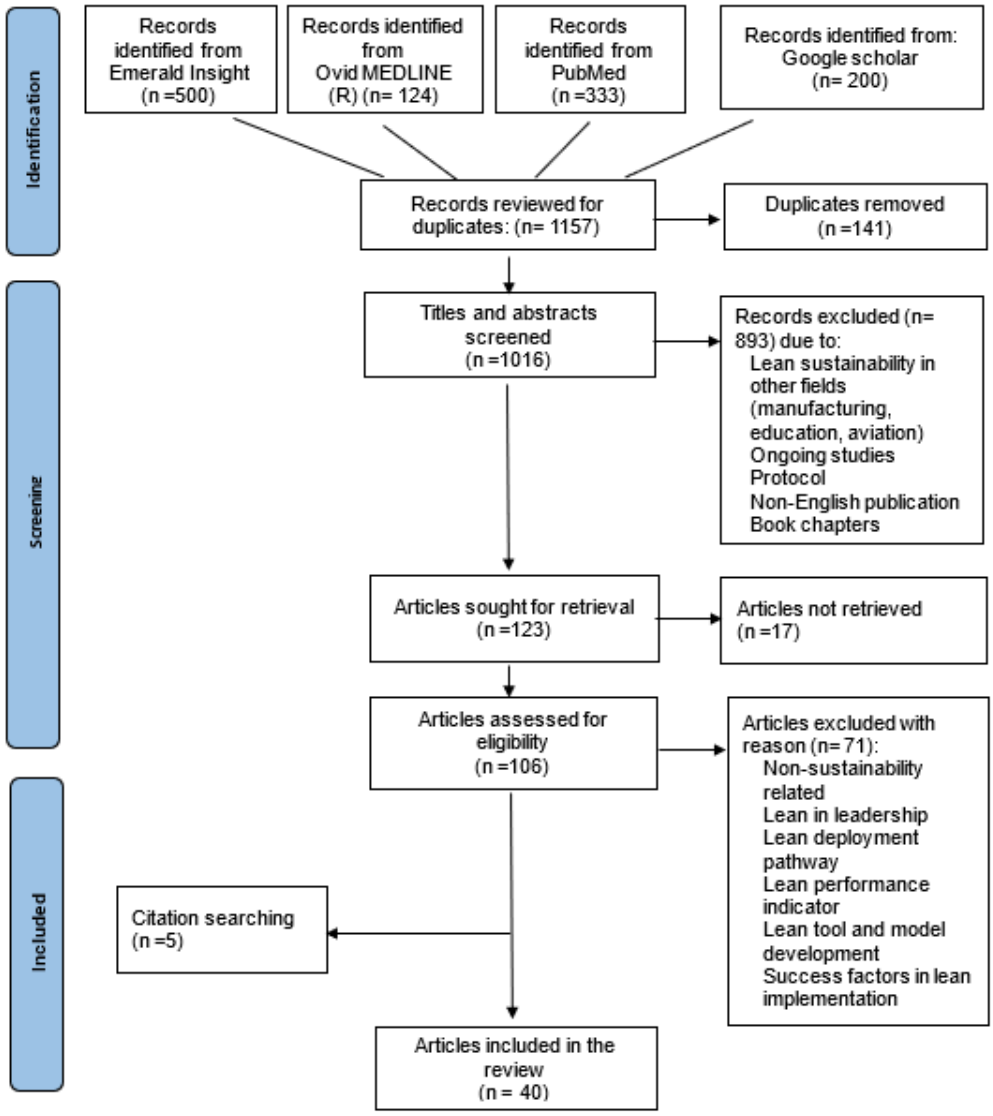

Figure 1 : Article selection process

The search yielded 1016 articles after duplicates were removed. Title and abstract screening led to the exclusion of 893 articles. Full-text screening was performed on 123 articles, of which 17 articles were not able to be retrieved. Seventy-one were subsequently excluded as unrelated to sustainability or related to lean in manufacturing. A total of 40 articles were considered relevant as assessed by the inclusion and exclusion criteria. Figure 1 represents the selection process.

Summary characteristics of included articles

Eligible articles published between 2013 and 2023 originated from the United States (n=14), the United Kingdom (n=6), Canada (n=5), Sweden (n=3), Brazil (n=2), Portugal (n=2), Egypt (n=1), Ireland (n=1), Belgium (n=1), Italy (n=1), Jordan (n=1), Netherlands (n=1), New

Zealand (n=1) and Norway (n=1). Figure 2 shows the distribution of included articles by country of origin. On the other hand, the majority of the articles employed a qualitative approach (n=25) followed by quantitative (n=6), literature review (n=3), systematic review (n=3), mixed methods (n=1), scoping review (n=1) and realist review (n=1).

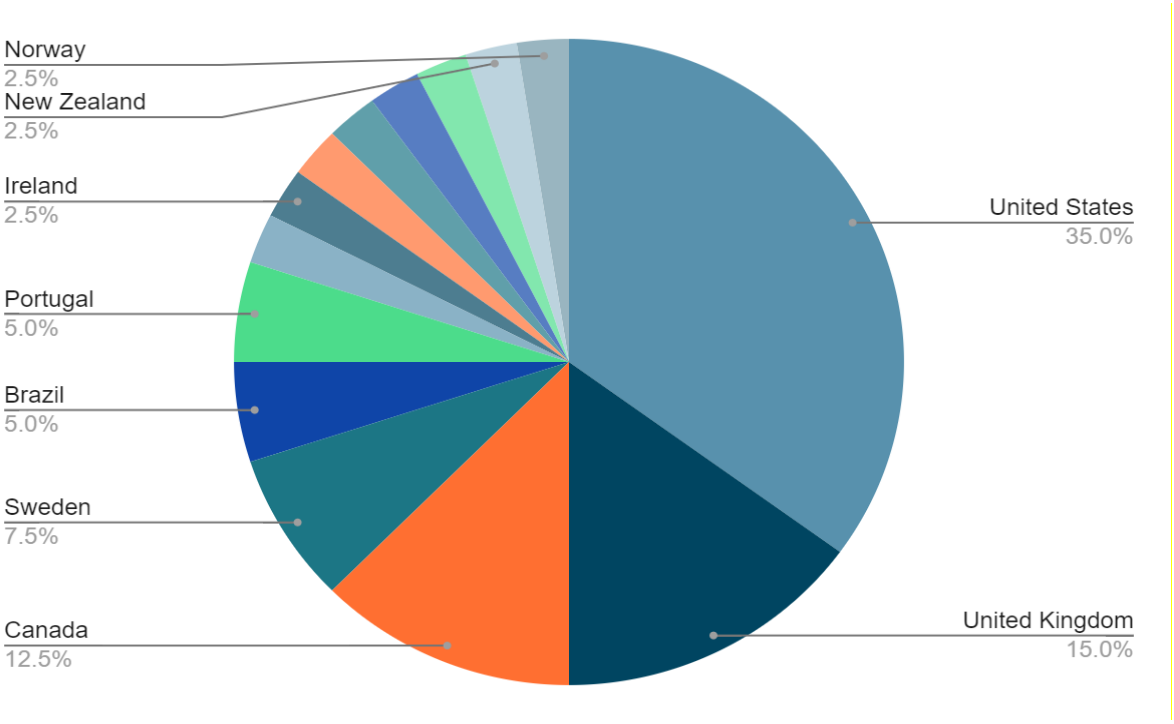

Figure 2: Included articles according to the country of origin

Themes related to the sustainability of lean implementation in healthcare

Upon conducting a thematic analysis of the included articles, eleven overarching themes and 52 sub-themes were identified as the factors related to the sustainability of lean implementation in healthcare, as shown in Table 3. The themes were (1) capacity building, (2) project team, (3) project management, (4) monitoring and evaluation, (5) attitudes and behaviours, (6) dissemination, (7) policy, (8) incentives, (9) leadership, (10) organizational capacity and (11) value-based lean.

Table 3 : Themes and sub-themes of factors related to the sustainability of lean implementation in healthcare from scoping review

Themes	Sub-themes
(1) Capacity building	Competency Lean champion Expertise Soft skills development

Themes	Sub-themes
(2) Project team	Team establishment Engaging lean expert Defined role for staff Stakeholder engagement
(3) Project Management	Lean Tool Comprehensive approach Planning of new workflow Communication Voice of customer Staff engagement Continuous improvement Visual management
(4) Monitoring & Evaluation	Auditing and feedback Data management Documentation Key performance indicator Lean outcome measurement
(5) Attitudes & Behaviours	Active participation Adaptability Commitment Support to staffs Accountability Respect for people Staff empowerment
(6) Dissemination	Project expansion Knowledge sharing Success stories
(7) Policy	Strategic management Standard operating procedures
(8) Incentives	Accreditation Appreciation to staff Reward system
(9) Leadership	Internal lean leader Coach and support staff Site visit Qualification Problem-solving skills Role model Dedication Setting direction Opportunity for leadership
(10) Organizational capacity	Knowledge Time allocation Human resource Financial resources Technology
(11) Value-Based Lean	Value compatibility Sense-making

The themes were further mapped according to the factors in the included articles, as shown in Table 4, and elaborated on in the following subsections.

Table 4 : Mapping of themes according to factors identified in the articles

Authors (Year)	Themes										
	Capacity building	**Project team**	**Project Management**	**Monitoring & Evaluation**	**Attitudes & Behaviours**	**Dissemination**	**Policy**	**Incentives**	**Leadership**	**Organizational capacity**	**Value-Based Lean**
Agarwal et al. (2015)		√		√	√						
Al-Balushi et al. (2014)	√		√			√	√		√		
Allaudeen et al. (2017)		√					√				
Antierens et al. (2019)	√	√			√		√				
Beck et al. (2015)				√					√		
Bell et al. (2016)									√		
Brown et al. (2019)		√	√				√				
Costa et al. (2017)	√		√	√	√						
Eamranond et al. (2020)					√						
Flynn et al. (2018)	√	√	√		√				√	√	√
Gao et al. (2020)		√	√		√				√		

Authors (Year)	Themes										
	Capacity building	Project team	Project Management	Monitoring & Evaluation	Attitudes & Behaviours	Dissemination	Policy	Incentives	Leadership	Organizational capacity	Value-Based Lean
Hallam and Contreras (2018)		√									
Hefner et al. (2016)	√	√									
Hung et al. (2019)	√	√	√	√	√					√	√
Ishijima et al.(2020)				√							
Kaltenbrunner et al. (2019)	√		√		√					√	
Machado et al (2013)	√			√	√	√					
Mutwiri et al.(2016)									√		
Radcliffe et al. (2020)			√								
Taylor et al. (2020)					√						√
Timmons et al. (2014)		√	√		√						
Udod et al. (2020)	√								√	√	
Van Rossum et al. (2016)		√	√		√				√		
Mansour et al. (2018)							√	√			

Authors (Year)	Themes										
	Capacity building	**Project team**	**Project Management**	**Monitoring & Evaluation**	**Attitudes & Behaviours**	**Dissemination**	**Policy**	**Incentives**	**Leadership**	**Organizational capacity**	**Value-Based Lean**
Régis et al. (2018)			√	√	√		√				
Ronge (2015)		√	√	√							√
Vandersteur (2022)		√	√			√			√		
Rees (2014)	√		√			√					
Guimarães (2013)		√	√	√		√					
Lindskog et al. (2016)		√									
Andersen (2015)		√				√					
Flynn and Scott (2020)	√			√	√				√		√
Flynn et al. (2019)			√								
Trakulsunti et al. (2020)	√		√	√	√	√	√	√	√	√	
Lindsay et al. (2020)	√								√		
Crema and Verbano (2015)		√	√	√		√	√		√		
Machado et al. (2014)				√			√				
Kaplan et al. (2014)			√		√		√	√			

Authors (Year)	Themes										
	Capacity building	**Project team**	**Project Management**	**Monitoring & Evaluation**	**Attitudes & Behaviours**	**Dissemination**	**Policy**	**Incentives**	**Leadership**	**Organizational capacity**	**Value-Based Lean**
Leite et al. (2016)	√		√				√				
Naik et al. (2012)	√	√	√							√	
Total	**15**	**18**	**21**	**13**	**16**	**8**	**11**	**3**	**13**	**6**	**5**

Capacity building

The synthesis of findings from this review reveals that capacity building, encompassing sub-themes such as competency, soft skills, expertise, and lean champion, influences the sustainability of lean implementations. Fifteen articles suggested that capacity building is an essential theme for Lean sustainability. Developing professional skills and deepening knowledge of lean principles is imperative for enhancing competency among healthcare providers (HCPs) (Al-Balushi et al., 2014; Antierens et al., 2019; Costa et al., 2017; Hung et al., 2019; Trakulsunti et al., 2020; Radcliffe et al., 2020). Continuous development through retraining and re-education should be enhanced (Al-Balushi et al., 2014; Hallam et al., 2018; Machado et al., 2013) to progressively increase the level of lean competency among individuals to the point where middle managers should become certified lean practitioners (Trakulsunti et al., 2020). Most importantly, the expertise of these lean practitioners in terms of methodologies and concepts of lean must be suited to their applicability in healthcare (Costa et al., 2017; Crema et al., 2015; Flynn and Scott, 2020; Leite et al., 2016; Rees, 2014; Trakulsunti et al., 2020; Udod et al., 2020).

Project team

In this review, eighteen articles supported the idea that the sustainability of lean practices within an organization would not be possible without a proper project team. The sub-themes of the project team consist of team establishment, defined roles for staff, engaging lean experts, and stakeholder engagement. Prior to implementing lean, establishing a project team is essential. Ideally, these teams should be multi-disciplinary (Flynn et al., 2018; Lindsay et al., 2020) to ensure active involvement from all levels of staff (Timmons et al., 2014). It is imperative that all staff within a unit to be systematically involved in lean initiatives (Ronge, 2015) and work collaboratively towards the same goals (Andersen, 2015; Van Rossum et al., 2016). Early involvement, support, and active participation from relevant stakeholders serve to convince the staff at all levels to practice lean as part of their daily work processes (Brown et al., 2019; Lindskog et al., 2016).

Project Management

Project management is another theme under factors influencing lean sustainability, encompassing sub-themes such as communication, a comprehensive approach, continuous improvement, lean tools, planning, staff engagement, visual management, and the voice of the customer. This theme is the most frequently mentioned, with 21 articles covering it.

Utilizing a comprehensive approach in project management is important for maintaining lean principles within the organisation. Additionally, by adopting a bottom-up strategy, the organisation empowers its staff to contribute actively (Al-Balushi et al., 2014). Using proper lean tools in problem-solving plays an instrumental role in sustaining lean practices (Trakulsunti et al., 2020; Vandersteur, 2022). As highlighted by Hung et al. (2019), tools helped to build support and relationships among HCPs and were recognized as a factor for sustainability. In contrast, Leite et al. (2016) cautioned against relying solely on lean tools as it will lead to the trend known as ‘toolism’.

Several studies have suggested the inclusion of patients as the voice of customers in healthcare organizations during lean implementation as they are the integral users of the whole process (Flynn et al., 2018; Kaplan et al., 2014). Recognizing the values that are important to patients can aid in the sustainment of lean practices (Brown et al., 2019; Kaltenbrunner et al., 2019).

Monitoring and Evaluation

Monitoring and evaluation (M&E) are crucial components of lean sustainability, which encompasses the subthemes of data management, auditing and feedback, documentation, key performance indicators (KPIs), and outcome measurement. The sustainability of lean efforts has been linked to monitoring and evaluation, according to 13 articles.

Evaluation in this context refers to assessing the effectiveness of lean initiatives using KPIs and outcome measurement criteria in achieving sustainability. Setting clear, predefined KPIs are essential to provide specific goals for the organisation (Machado et al., 2013; Agarwal et al., 2016; Trakulsunti et al., 2020). It can provide an opportunity to measure progress and assess whether established standards are being met (Allaudeen et al., 2017).

Attitudes and Behaviours

There are 16 articles that covered this theme showing the significance of staff attitudes and staff behaviours in lean sustainability. The subthemes that emerged include active participation, adaptability, commitment, support to staff, accountability, respect for people, and staff empowerment. As the lean methodology is people-centred, staff's active participation in decision-making is crucial in sustaining lean practices within the organization (Hung et al., 2019; Machado et al., 2013). Staff members are expected to play an active role in organizational changes and the planning process redesigns of their work environment (Hung et al., 2019). Moreover, staff involved in lean are expected to continuously adapt to the evolving trends of lean (Agarwal et al., 2016) and to be open to any modifications of current policies and processes, encouraging seamless adaptation to work process changes (Trakulsunti et al., 2020).

Dissemination

Compared to the rest of the themes identified in this review, dissemination was only mapped in five articles. Dissemination is vital in the sustainability of lean initiatives (Al-Balushi et al., 2014). Project expansion, a subtheme that emerged, is an effective dissemination method where these projects are demonstrated to individuals beyond the department or organisation where the projects are expanding into (Machado et al., 2013). Dissemination has more relevance when the knowledge regarding the lean process and implementation is captured and shared internally or externally (Crema et al., 2015). Promoting the success of lean implementation by highlighting the positive results or improvements done will inspire others to begin adopting lean in their units (Andersen, 2015; Guimarães et al., 2013; Rees, 2014; Vandersteur, 2022).

Policy

The policy has emerged as one of the themes affecting lean sustainability. The sub-themes under policy encompassed strategic management and standard operating procedures. In this review refers to the integration of lean within the organization's strategic planning. A strategic plan can act as the organisation's compass (Kaplan et al., 2015), guiding the long-term plan for the sustainability of improvements (Mansour et al., 2018; Rees, 2014). At the same time, lean initiatives should be aligned with the organisation's goals, operating plans, and budget (Machado et al., 2013; Regis et al., 2018) to ensure lean sustainability.

Another important subtheme under this factor is standard operating procedures. The included evidence has emphasized the need to formalize the standardization of activities into guidelines (Machado et al., 2013; Trakulsunti et al., 2020). The guidelines are necessary to guide the actions needed to achieve the objectives of lean initiatives (Al-Balushi et al., 2014; Crema et al., 2015). Additionally, it is recommended that front-line staff be involved in developing

standard operating procedures (Allaudeen et al., 2017). Integrating lean with ISO standards can also ensure that lean becomes a uniform improvement method within the organization, with transparent and predictable routines, leading to sustained lean practices across all units (Kaplan et al., 2014).

Incentives

Three articles included in this review considered incentives as a significant theme for lean sustainability. Within this theme, three sub-themes emerged, accreditation, appreciation of staff, and a reward system. Several studies acknowledged the importance of providing motivational support to staff at work as a sign of appreciation (Crema et al., 2015; Lindskog et al., 2016). This approach appreciates their hard work but also reinforces the organisation's commitment to fostering a workplace that values and rewards exceptional contributions.

Leadership

As mentioned in 13 articles, leadership plays an important role in influencing the sustainability of lean in a healthcare organization. Within this theme, several leadership-related subthemes emerged such as role models, site visits, internal lean leader, coaching and support of others, commitment, qualifications, problem-solving, and leadership opportunities.

Leaders are anticipated to attend daily meetings, remove obstacles, and uphold accountability. In addition, leaders who cultivate the practice of conducting site visits or 'Gemba walk' to understand the challenges encountered by their staff also appear to be one of the contributing factors in sustaining lean (Vandersteur, 2022). The existence of internal lean leaders ensures that there is dedicated expertise tailored to the organization's specific needs. Besides, lean initiatives appeared to be sustained in health organisations where leaders coach and support others. This motivated and empowered the staff members to sustain lean practices while also facilitating the presence of a talent pool of lean leaders.

Organisational capacity

The organisational capacity is related to the organisation's capabilities in delivering services that continuously satisfy internal and external customers. However, this possibility may require the essentiality to address various aspects of organisational management and capability, such as listed under sub-themes of knowledge, time allocation, human resources, financial resources, and technology, as supported in six articles.

Allocating protected time for staff to engage in improvement works enhances the likelihood of sustaining lean initiatives in the organisation (Hung et al., 2019; Kaltenbrunner et al., 2019). Additionally, the availability of adequate human resources was determined to be an influencing factor (Naik et al., 2012; Udod et al., 2020), as well as an organization with stable financial support and management. Although lean is aimed at identifying and eliminating existing wastes in the processes and system, sufficient financial support is still a crucial element to enhance the success of lean projects and the good-impact kaizens (Trakulsunti et al, 2020). Furthermore, leveraging technology to optimize work processes presents an opportunity for lean organisations to maximize sustainability (Trakulsunti et al., 2020).

Value-based lean

The final theme on factors influencing lean sustainability is related to having a value-based approach in lean. Value-based lean hinges upon the alignment of organizational and personal value compatibilities (Flynn and Scott, 2020; Hung et al., 2019), a synergy achieved by

positioning lean as one of the organisation's important strategies (Hung et al., 2019). This will propagate a holistic lean mindset in the organisation (Guimarães et al., 2013).

Another factor is sense-making, which is defined as the action of people assigning meanings to the experience that they went through (Flynn et al., 2018). In sense-making, staff's emotional experience is fundamental, as is their readiness to take part in a lean journey (Hung et al, 2019; Taylor et al., 2020). The ability of staff to recognize the tangible effects of implementing lean, such as improvement in work satisfaction, higher levels of teamwork, and motivation, is helpful in the embedment of lean in the organisation (Hung et al., 2018).

4.0 Discussion

Sustaining lean in healthcare is a complex and multifactorial process. This scoping review revealed 11 themes related to the factors affecting lean sustainability in healthcare. The themes are capacity building, project team, project management, monitoring and evaluation, attitudes and behaviours, dissemination, policy, incentives, leadership, organisational capacity, and value-based lean. Due to the abundance of evidence, a detailed explanation of findings on each theme is restricted. Nonetheless, our review compiled the fragmented evidence concerning lean healthcare sustainability in the literature and summarised it in the discussion.

This review indicates that project management is the most frequently addressed theme, and it reflects its critical role in ensuring lean sustainability. Having a comprehensive approach to lean implementation is an influencing factor in sustaining lean through the creation of a multi-disciplinary lean team, which by default brings together different stakeholders associated with the process (Hallam and Conteras, 2018). The multi-disciplinary nature should be used to enable the generation of planning new workflow (Ruiz and Ortiz, 2016). A continuous improvement approach is a factor for sustaining lean, where continuous means that lean is a long-term philosophy (Wagner et al., 2022). Communication has a compelling impact on the sustainability of lean. Visual management is also a great tool for communication (Wagner et al., 2022). The majority of lean healthcare implementations use value stream mapping because it improves patient flow and enhances process redesign (Hallam and Conteras, 2018). Staff engagement in the early stage is a crucial sustainability factor for staff accepting change (Nwobodo-Anyadiegwu, 2023). Due to the complex nature of the health setting, the voice of the customer is vital in lean sustainability because patients themselves are usually aware of every process involved in their treatment.

Project team and attitudes and behaviours are also prominent themes, addressed by 18 and 16 articles, respectively. The focus on these themes underscores the importance of people factors and teamwork, suggesting that the lean sustainability relies heavily on effective team dynamics and positive behavioural attributes. Similar to this review, some studies have reported that active staff participation is required to achieve and the sustainability of lean improvements (Ruiz et al., 2016). Some studies pointed out that accountability, commitment, support, staff empowerment, ownership of their job, and a sense of belonging were confirmed as crucial sustainability factors (Nwobodo-Anyadiegwu 2023; Prasad and Vasugi, 2023; Wagner et.al, 2022). Respect for people is a basic pillar of Lean and has been identified as a contributor to the sustainability of Lean in hospitals (Wagner et.al, 2022).

In contrast, dissemination is the least explored theme, with only three articles covering it. Disseminating lean findings through the exchanging knowledge and sharing of success stories are reported to influence maintenance of lean in healthcare. Sharing success stories is pivotal

to ensure that the tangible benefits of lean, such as improved patient care and staff satisfaction, can be showcased to a wider audience within and beyond the organisation. Equally important is the role of knowledge sharing, where challenges and strategies encountered during lean implementations were openly exchanged between individuals and health facilities (Madsen DØ et al., 2019). It facilitates a practical demonstration of the practicality and adaptability of lean across diverse departments that can encourage buy-ins from staff. All of these can contribute towards the expansion of lean projects beyond their initial scope, leading to an organizational-wide adoption of lean principles. The minimal focus on dissemination indicates a need for more evidence on how lean outcomes are shared and utilized across different contexts.

5.0 Strengths and limitations

The strength of this review lies in the use of thematic analysis to draw a comprehensive map of evidence on the factors influencing lean sustainability. The results of this review can guide policymakers and lean practitioners regarding the key areas of lean sustainability.

On the other hand, quality appraisal was not conducted due to the nature of the scoping review which was considered one of the limitations. Moreover, the article selection was limited to English publications, which might have caused the loss of evidence published in other languages. Also, the search in Emerald Insight was only limited to 500 articles. However, this review included multiple databases and a forward-backward search to compensate for these limitations.

6.0 Suggestions for further research

During the conduct of this review, the authors noticed the lack of literature published in non-western countries regarding the factors affecting lean sustainability. Most of the articles were predominantly from Western countries such as the United States and the United Kingdom which are recognized pioneers in lean implementation. This underscores a critical need to broaden this scope of research in non-western countries, as health systems across the world differ markedly in terms of their governance structures, resource allocation, and operational challenges. By studying more countries, insights can be gained into maintaining lean practices within healthcare.

7.0 Conclusion

In conclusion, the journey towards sustaining lean practices in healthcare is intricate and multifaceted, as highlighted by this scoping review, and requires a concerted effort and commitment across all levels of the organization and from multiple dimensions. This review provides a comprehensive analysis of the eleven themes involved in lean sustainability, where project management, project team and attitudes and behaviours are the most frequently addressed themes. Conversely, dissemination was less explored, indicating potential areas for future study. By addressing the themes identified in this review comprehensively, healthcare organizations can embed lean culture to foster continuous improvement for sustaining lean practices over the long term to deliver better outcomes for healthcare services.

8.0 Declaration of conflicting interests

None declared.

9.0 Acknowledgment

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10.0 Ethical Clearance

We obtained approval from the Medical Research and Ethics Committee (MREC) and the Ministry of Health Malaysia (MOH), which are registered under NMRR.

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