

Using Expert Consensus to Evaluate the Readiness Factors of Lean Implementation in Healthcare

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Abstract

Background: The core idea of the Lean philosophy in healthcare is a continuous improvement by minimizing waste and maximizing the value delivered to patients. Although there is growing interest in lean applications in healthcare organizations, the study of readiness factors for implementing Lean in this sector remains one of the reasons for Lean failure.

Objective: This study aims to identify and validate the readiness factors that influence the successful and sustainable implementation of Lean in healthcare organizations.

Methods: A systematic review of the literature was performed to synthesize readiness factors that help healthcare organizations implement lean practices. The Delphi method was used to validate the identified factors from the perspective of the healthcare experts.

Results: This systematic review revealed eleven readiness factors that are important contributors to the success of Lean implementation in healthcare. After three rounds of Delphi, a moderate consensus (Kendall's $W=0.519$; $P<0.001$) was achieved among the experts' panel regarding the nine readiness factors. Seven factors were extracted from the literature review and two were derived from experts' suggestions.

CONCLUSIONS: The investigation of organizational readiness to implement lean may help healthcare organizations be better prepared for their initiation of the Lean journey and enable the sustainability of improvements.

Key Words: Lean, Healthcare, Readiness factors, Delphi

1. Introduction

More and more, healthcare institutions are facing the growing demand from both society and government for affordable, accessible, safe, and efficient care services. Moreover, the trend of the aging population is pushing this demand even further. On the other hand, funding care quality programs remains a major concern for the healthcare sector (Poksinska 2010). The challenge for increased quality of healthcare services, combined with the pressure to achieve more with limited resources, has oriented healthcare organizations toward new and more efficient management strategies for providing care (Al-Balushi et al. 2014, Noori 2015). In response to these challenges, many healthcare organizations are adopting concepts and methods often used by the manufacturing industry (Radnor 2011, Radnor et. al 2012). The literature concerning the implication of such concepts in the public sector shows that 51% of published articles are focused on Lean, with 35% indicating their use in health services (Radnor et. al 2012). The core idea of the Lean philosophy is continuous improvement through eliminating waste and maximizing the value delivered (Womack and Jones, 1997). As Lean thinking is increasingly becoming an international phenomenon, there is a growing interest in Lean applications in healthcare. Since 2008, 56 articles concerning Lean in healthcare have been published, whereas only 22 articles were published from 2000-2010 (Antony et. Al 2019). Although the Lean application in healthcare organizations is expanding, success rates for Lean sustainability is remaining low, resulting in failure rates of 50% to 95% (Thelen 2014). One reason is that the focus of healthcare institutions has been mainly directed on short-term gains by applying Lean

techniques just to solve separate problems, rather than adopting and maintaining a systemic approach for implementing Lean (Radnor 2011, Radnor et. al 2012). Another reason is lacking to address the organizational readiness to embrace Lean (Al-Balushi et al. 2014). The purpose of this research is to explore the readiness factors that influence the successful implementation of Lean in healthcare organizations and to validate these factors through expert consensus.

2. Methods

A systematic review of the literature was conducted to discover and compile a list of candidate readiness factors for Lean implementation in the healthcare industry. This process was conducted based on the following steps: Identification of articles, Review of abstract, Selection of articles, Identification of readiness factors, and Ranking of the readiness factors based on their appearance in selected articles.

The multidisciplinary search engine Google Scholar was used to identify and collect articles published during the period from 2005 to 2020. Only articles from peer-reviewed journals from credible publishing houses such as Emerald, Elsevier, Inderscience, Wiley, Taylor & Francis, and Sage were selected. The initial search returned over 163 references. After reviewing the abstracts, articles that did not provide information on readiness factors and/or the application of Lean in healthcare were excluded. Finally, only 22 articles were selected. After carefully analyzing the content of the selected articles, 11 readiness factors were identified, as the main contributors to the success of Lean implementation in healthcare. These factors were further coded and ranked according to the frequency of their appearance. The identified factors were included in the Delphi survey for further validation by healthcare experts.

A panel of ten healthcare experts was selected based on the following criteria:

1. Being directly involved in the healthcare field dealing with performance of the delivery of knowledge, services, or production in healthcare institutions such as pharmaceutical industries, hospitals, medical universities, and government institutions that finance healthcare services.
 2. Holding a high position in healthcare institutions and a work experience in the same role for at least five years. This included academics, supervisors, managers, and directors of public and private care institutions.
- After all selected participants were contacted separately and agreed to be part of this research, the Delphi instrument was distributed to them via email providing clear instructions about the completion and submission of responses.

The first Delphi round was divided into three sections. In the first section, participants were asked to provide information about their professional experience and area of expertise. In the second section, participants were presented with the list of readiness factors derived from the literature and were asked to rate each of the factors according to their importance using a scale from 1 to 5 with 1 indicating the lowest level of significance and 5 indicating the highest level of importance. In the third section, the respondents were encouraged to give their own opinion regarding other factors (not mentioned in the list) they considered important for facilitating the implementation of new initiatives such as Lean healthcare. The internal consistency, or validity of survey questions, was assessed using Cronbach's alpha (values from 0.70 to 0.95 were considered acceptable) (Tavakol and Dennick 2011).

Responses of Round 1 were analyzed by calculating the mean score of experts' ratings on each factor along with the standard deviation. Only the factors with an average mean rated above 4 were included in the next round. Subsequent rounds of the Delphi survey were designed as a closed form without space for giving opinions. If no consensus was reached, the experts were provided in subsequent rounds with the results of collective opinion resulting from the analysis of the previous round items and were required to rate again each factor, using the same scale. The consensus level was measured through Kendall's Coefficient of Concordance W. Kendall's W ranges from 0 to 1 ($W > 0.7$ indicating a strong consensus, $W = 0.5$ indicating moderate consensus, and $W < 0.3$ indicating poor consensus) (Kobus and Westner 2016). An appropriate level of consensus was reached after three rounds of Delphi. All statistical analyses were performed using IBM SPSS Statistics 21.0. The methodology framework is presented in Fig. 1.

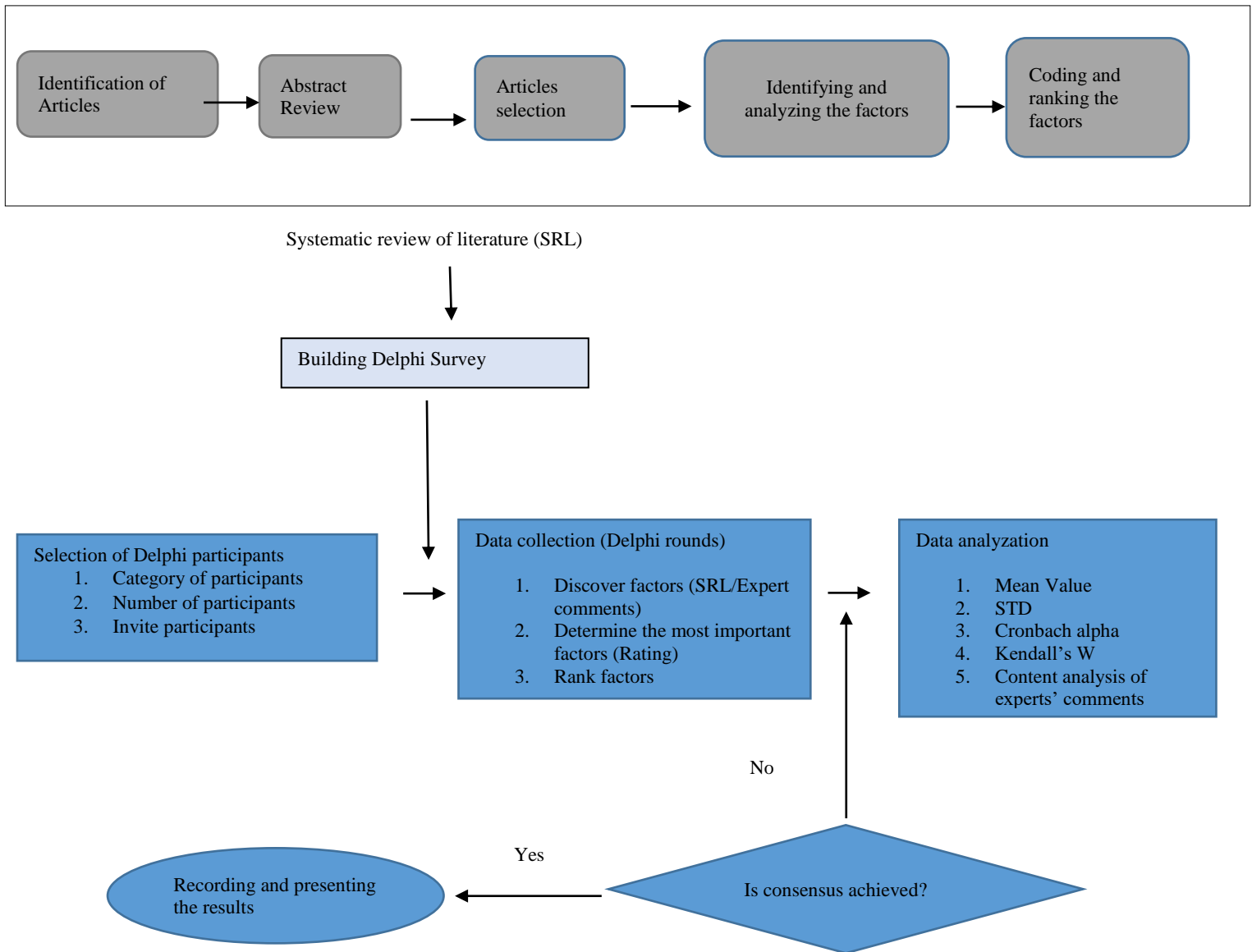


Figure 1. Methodology framework

3. RESULTS

3.1 Systematic Review of the Literature

Of the 22 selected articles, 14 base their results on findings from a case study approach, concerning the readiness factors of Lean in healthcare organizations, while 8 articles present a review of the Lean adoption process. For instance, the study by Habidin's team (2014) explored Lean in the Malaysian healthcare context and indicated four organizational factors to have a positive relationship with performance outcomes: leadership, employee involvement, organizational culture, and customer focus. Additionally, the presence of a measurement and reward system, integrating Lean into the strategic agenda of a healthcare setting, performing end-to-end processes, and balancing the demand with the capacity of care are as well attributed to readiness factors throughout the general change management (Al-Balushi et al. 2014). For a healthcare organization to successfully embrace Lean, it is essential to have support, engagement, and commitment from both management and healthcare staff. For this, managers should set realistic goals, and empower employees to achieve them, by emphasizing that everyone can contribute to the change process, once taking responsibility (Eller 2009, Tortorella et al. 2019, Alnajem et al. 2019). To take responsibility and involve actively in Lean practices, healthcare staff must be ready. For this, managers should schedule relevant training (Abdallah and Alkhalidi 2019). This is a useful way of encouraging staff to engage in Lean projects

as well as reduce the fear of "unpreparedness" in them. Another efficient way of encouraging healthcare staff to embrace change initiatives is through promotion, recognition, and reward, based on staff effort and progress within the healthcare setting (Al-Balushi et al. 2014, Noori 2015).

The importance of leadership as a success factor for implementing change initiatives such as Lean in the healthcare sector is demonstrated through several case studies (Jimmerson et al. 2005, Dickson et al. 2009, Rees 2014). Leadership has the potential to allow staff involvement; hence, encouraging a bottom-up approach, effective communication, and shared information (Jimmerson et al. 2005, Dickson et al. 2009, Rees 2014, Van Rossum et al. 2016).

Another important factor mentioned in literature as a contributor to the success of Lean implementation is organizational culture. The results of Rees (2014), emphasize the positive outcomes of a supportive organizational culture, and multi-skilled staff. Healthcare staff should be clear about Lean objectives on freeing resources and directing them to the important areas; contrary to the erroneous belief that the Lean approach brings staff reduction (De Souza and Pidd 2011). In this relation, Lean should be communicated to staff as a long-term vision aligned to the mission and the strategy of the healthcare setting, for facilitating resistance to change (Al-Balushi et al. 2014, Waring and Bishop 2010). Continuous improvement to deliver the maximum value to customers must be at the core of the healthcare strategy. In this regard, Lean tools such as structured problem solving, visual management, and implementation of standardized activities will facilitate the establishment of a culture of continuous improvement (Jimmerson et al. 2005, Papadopoulos et al. 2011). The summarized information regarding the readiness factors extracted from the literature along with the codification and the frequency of their appearance is presented in Table 1.

Table 1: Readiness factors of Lean implementation in Healthcare extracted from literature review

No.	Readiness Factors	Author(s)/Year of publication	CODE	Frequency of appearance in the selected articles
1.	Leadership Support and Commitment	Jimmerson et al. (2005), Fillingham (2007), Dickson et al. (2009), Waring and Bishop, (2010), de Souza and Pidd (2011), Dahlgard et al. (2011), Papadopoulos et al. (2011), Radnor et al. (2012), Al-Balushi et al. (2014), Rees (2014), Habidin et al. (2014), Noori (2015), van Rossum et al. (2016), Narayanamurthy et al. (2018), Alnajem et al. (2019), Tortorella et al. (2019), Almutairi et al. (2019), Abdallah & Alkhalidi (2019)	LSC	18
2.	Organizational culture	Jimmerson et al. (2005), Kollberg et al. (2007), Dickson et al. (2009), Eller (2009), Waring and Bishop (2010), de Souza and Pidd (2011), Dahlgard et al. (2011), Radnor et al. (2012), Spangol et al. (2013), Rees (2014), Al-Balushi et al. (2014), Noori (2015), van Rossum et al. (2016), Narayanamurthy et al. (2018), Alnajem et al. (2019), Almutairi et al. (2019), Abdallah & Alkhalidi (2019)	OC	17
3.	Staff training and involvement	Jimmerson et al. (2005), Fillingham (2007), Eller (2009), de Souza (2009), Dickson et al. (2009), Radnor et al. (2012), Spangol et al. (2013), Habidin et al. (2014), Al-Balushi et al. (2014), Noori (2015), van Rossum et al. (2016), Narayanamurthy et al. (2018), Alnajem et al. (2019), Tortorella et al. (2019), Almutairi et al. (2019), Abdallah & Alkhalidi (2019)	STI	16
4.	Identifying customer groups and what they value	Kollberg et al. (2007), Fillingham (2007), Eller (2009), Papadopoulos et al. (2011), Dahlgard et al. (2011), Radnor et al. (2012), Spangol et al. (2013), Al-Balushi et al. (2014), Habidin et al. (2014), Noori (2015), Narayanamurthy et al. (2018), Alnajem et al. (2019), Almutairi et al. (2019)	ICV	13
5.	Communication	Jimmerson et al. (2005), Eller (2009), Papadopoulos et al. (2011), Al-Balushi et al. (2014), Noori (2015), van Rossum et al. (2016), Narayanamurthy et al. (2018), Alnajem et al. (2019), Almutairi et al. (2019), Abdallah & Alkhalidi (2019)	C	10
6.	Multi-skilled teams	Jimmerson et al. (2005), Kollberg et al. (2007), Dickson et al. (2009), de Souza and Pidd (2011), van Rossum et al. (2016), Narayanamurthy et al. (2018), Alnajem et al. (2019), Tortorella et al. (2019), Almutairi et al. (2019)	MST	9
7.	Integration of Lean into the organization's strategy	Kollberg et al. (2007), Fillingham (2007), Rees (2014), Waring and Bishop, (2010), Radnor et al. (2012), Al-Balushi et al. (2014), Habidin et al. (2014), Noori (2015), Almutairi et al. (2019)	ILS	9
8.	Measurement and	Jimmerson et al. (2005), Kollberg et al. (2007), Fillingham (2007), de	MRS	8

	Reward System	Souza and Pidd (2011), Al-Balushi (2014), Noori (2015), Narayanamurthy et al. (2018), Abdallah & Alkhaldi (2019)		
9.	Relationship with suppliers	Dahlgard et al. (2011), Habidin et al. (2014), Noori (2015), Narayanamurthy et al. (2018), Alnajem et al. (2019), Almutairi et al. (2019), Abdallah & Alkhaldi (2019)	RS	7
10.	Balancing demand with the capacity	Kollberg et al. (2007), Fillingham (2007), Dickson et al. (2009), Radnor et al. (2012), Al-Balushi et al. (2014), Narayanamurthy et al. (2018)	BDC	6
11.	Reducing waste through an end-to-end process	Fillingham (2007), de Souza (2009), Papadopoulos et al. (2011), Radnor et al. (2012), Al-Balushi et al. (2014)	RW	5

3.2 Delphi Results

The first section of Round 1 of Delphi revealed that 60% of experts had a working experience of 11-20 years and 40% between 6-10 years. In terms of working profile, our experts held the following positions within the care institution they worked for: 30% Academics, 30% Directors, 20% Supervisors, and 20% Managers. The first round of Delphi generated a response rate of 100%. After collecting the responses, the value of Cronbach's Alpha resulted at 0.803 which means acceptable for our research. Regarding the second section of Round 1, only nine factors scored an average above 4.00 out of 5.00, while two factors were excluded, expressly: "Relationship with suppliers" with an average mean of 4.00 and "Balancing the demand with capacity" scoring 3.90 (P=0.001). After careful content analysis of additional factors mentioned by respondents in the third section, six new factors not mentioned in the literature were identified, coded, and added for evaluation in the next round. The information about the new factors is presented in Table 2. Kendall's Coefficient of Concordance, W after the first Round indicated poor compatibility of .255.

Table 2: Readiness Factors of Lean implementation in Healthcare suggested by experts

Factors	CODE
Technological recognition	TR
Having a Planning Strategy for implementing Lean	LPS
Having a Strategy of Continuous Evaluation of the change implemented	SCE
Having a Strategy for Maintaining the Change already implemented	SMC
Having a system of recall and reject	RRS
Having support from state institutions through legislative measurements	LMS

Round 2 of Delphi resulted in a total of 15 factors (9 original factors, 6 new factors). In this Round, participants were presented with the mean score for each factor and were again asked to rate each of the factors using the same Likert scale. Round 2 generated a response rate of 100%. Based on the exclusion criteria, only nine factors scored above 4 out of 5.00 in the mean average, while 6 factors were excluded from further analysis. Kendall's Coefficient of Concordance, W for the second Round resulted in compatibility of .486 (P<0.001).

In the third round of Delphi, all respondents were provided with feedback from the collective opinions of the second round and were once again asked to rate each of the 9 remaining factors using the same Likert scale. In round 3, only 8 from 10 experts returned their responses resulting in a response rate of 80.00 %. Kendall's Coefficient of Concordance W in Round 3 resulted being .519 (P<001). The comparison of readiness factors in 3 Delphi Rounds is illustrated in Table 3.

Table 3: Comparison of readiness factors in 3 Delphi Rounds.

Readiness factors (CODE)	Round 1			Round 2			Round 3			Literature Rank
	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	
LSC	5.00	.000	1	5.00	.000	1	4.88	.354	1	1
OC	4.50	.707	3	4.80	.632	3	4.88	.354	1	2
STI	4.30	.675	5	4.20	.422	6	4.13	.354	4	3
ICV	4.10	.568	8	4.10	.316	7	3.88	.354	6	4
C	4.70	.675	2	4.90	.422	2	4.88	.354	1	5
MST	4.40	.699	4	4.20	.422	6	4.13	.354	4	6
ILS	4.10	.316	7	3.90	.000	10	Excluded			7
RS	4.00	.816	9	Excluded			Excluded			8
MRS	4.20	.919	6	4.00	.816	9	Excluded			9
BDC	3.90	.738	10	Excluded			Excluded			10
RW	4.40	.699	4	4.60	.966	4	4.50	.756	3	11
RRS	Added			4.00	.471	8	Excluded			
LPS	Added			4.80	.632	3	4.63	.518	2	
SMC	Added			4.50	.850	5	4.00	.535	5	
SCE	Added			3.40	.843	13	Excluded			
LMS	Added			3.90	.738	11	Excluded			
TR	Added			3.50	1.080	12	Excluded			

Abbreviations: LSC= Leadership Support and Commitment; OC=Organizational Culture; STI= Staff Training and Involvement; ICV= Identifying Customer groups and what they Value; C=Communication; MST= Multi-Skilled Teams; ILS= Integration of Lean to the organization’s Strategy; RS=Relationship with Suppliers; MRS= Measurement and Reward System; BDC= Balancing Demand with the Capacity, RW= Reducing Waste through an end-to-end process; RRS= Recall and Reject System; LPS=Lean Planning Strategy, SMC= Strategy of Maintaining the Change; SCE=Strategy of Continuous Evaluation; LMS=Legislative Measurements Support; T= Technological Recognition
 † Factors scoring 4.00 or below were excluded from the next round.

‡ Factors are ranked based on the mean value (the factors resulting with the same mean and standard deviation are ranked equally).

§ The last column shows the ranking of factors based on the frequency of their appearance in the literature review.

The summary of the Delphi results is presented in Fig. 2.

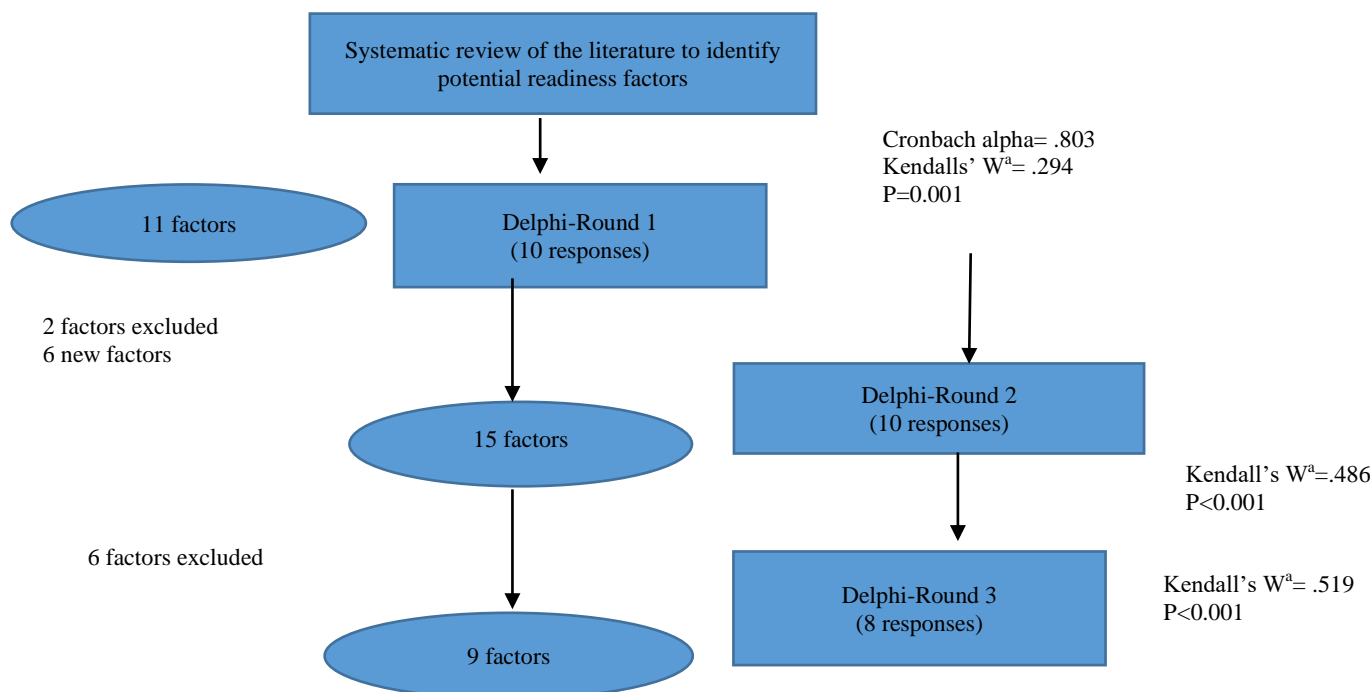


Figure 2: Delphi Results

4. Discussion

After careful examination of the literature, factors such as support and commitment from leadership, organizational culture, staff training and involvement, identifying customer groups and what they value, communication, multi-skilled teams, integration of Lean to the organization's strategy, measurement and reward system, relationship with suppliers, balancing the demand for care with the capacity and reducing waste through an end-to-end process resulted to influence positively the implementation of Lean in healthcare organizations. The examination of Delphi resulted in a moderate consensus of 0.519 after three rounds. However, losing 20% of responses, indicated sample fatigue and made us stop proceeding with another round of the Delphi survey. A moderate agreement of the panel was reached over 9 readiness factors, from which seven were extracted from the literature review, while two were derived from participants' suggestions. The findings confirmed the significance of factors such as support and commitment of leadership, organizational culture, and effective communication for successfully implementing Lean and achieving a better organizational performance. The role of organizational culture confirmed the findings of previous studies (Dahlgaard et al. 2011, Spagnol et al. 2013, Van Rossum et al. 2016) that highlighted the importance of shifting from a hierarchical culture with rigid rules to a culture of continuous improvement, where employees think freely, express their opinions, and have a proactive attitude towards suggesting and implementing improvements. In this regard, leaders can play a significant role in smoothing the hierarchical culture and providing the necessary time and support for being prepared to embrace Lean (Radnor et al. 2012). Some new factors derived from Delphi experts were strategic: "Having a careful planning and strategy for implementation of new initiatives" and "Having a strategy that maintains the already implemented changes". Both these factors confirmed the significance of a strategic orientation while implementing Lean and are supported by previous studies from Habidin et al. (2014) and Noori (2015) stating that strategic orientation determines the goals and strategic adjustment of organizational improvement.

The complex and delicate nature of healthcare processes in treating patients requires a clear view of all the steps involved from the beginning to the end (Al-Balushi et al. 2014). In this regard, the importance of an end-to-end approach is supported by both literature and healthcare experts as a means of uncovering waste and the value attached to healthcare activities.

Training and involvement of healthcare staff in the Lean principles, tools, and techniques, as well as the presence of multi-skilled teams, seems to be linked to the sustainability of Lean improvements within healthcare organizations. These factors revealed the same average mean regarding the importance given by healthcare experts confirming in this way findings from Narayanamurthy et al. (2018) indicating that to perform different tasks and to be able to solve problems staff need to be trained in different sections within the company. Furthermore, the study by Poksinska (2010), supported the idea of focusing on developing people before developing the organization.

Identifying different customer groups that exist in the healthcare sector and defining the value from their perspective, is another readiness factor derived and supported by the studies of Kollberg et al. (2007), Fillingham (2007) and Almutairi et al. (2019) and validated by our care experts. According to Kollberg et al. (2007), one of the challenges that healthcare organizations face as they initiate Lean implementation consists of identifying end-users of Lean and understanding their requirements. Even though many customer groups exist in healthcare, the findings from Radnor et al. (2012) showed that the term "customer" is still unclear to healthcare staff, and the most common factor identified was the patient. From the professional and ethical perspective, the main "customer" in healthcare is the patient, however from the economical point of view, they usually do not directly pay for the service. Other actors, such as the patient's family, government, and insurance companies are all examples that need to be considered because they also seek the maximum quality of healthcare services (Kollberg et al. 2007). In addition, Almutairi et al. (2019) concluded that close relationships with patients as primary customers of healthcare organizations can be achieved through linking their needs with the hospital's strategic goals. All these results shed some light on healthcare services intended to adopt the Lean philosophy in implementing Lean practice for enhancing performance outcomes. We, therefore, recommend adopting this model and the developed measures to investigate the level of readiness in different healthcare organizations for Lean implementation.

5. Conclusions

Overall, a moderate agreement of 0.519 was reached among Delphi experts over 9 readiness factors. Support and commitment from leadership, organizational culture, staff training, and involvement, identifying customer groups and what they value, clear and effective communication, multi-skilled teams, reducing waste through an end-to-end process, and strategic orientation while implementing Lean were the agreed factors. Addressing them would be of utmost importance for assessing the readiness of healthcare institutions before initiating Lean projects. While their relevance is supported by both literature and healthcare experts, a further understanding is needed of whether readiness factors should be set before adopting Lean tools, or tools and whether readiness factors should be implemented synchronously. Furthermore, it would be interesting to discover the relationship between readiness factors and understand if an organization needs to be more focused on some or all factors. To ensure consensus remains consistent with medical literature, periodic update of readiness factors is warranted.

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