

# The Barriers in Lean Healthcare Implementation

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## Abstract

Lean is about optimization of a process by eliminating waste that exists in a process. Recently, the lean improvement initiative has been adopted in the service sector such as healthcare that provides services towards a public community which is known as lean healthcare. Lean healthcare is the application of “lean” ideas in the healthcare system to minimize waste in every process, procedure, and task through an ongoing system of improvement. This research identified the factors leading to the barriers in implementing lean in healthcare. A better understanding of lean methodology is significant to assure the victory of the lean implementation process in the healthcare sector. The study is conducted at one government service sector located in the southern region of peninsular Malaysia namely Hospital Sultan Ismail Johor Bahru. 28 factors of barrier in lean healthcare implementation discover from the findings of the literature review. However, 136 respondents agreed that there 23 barriers in Lean Healthcare implementation at Hospital Sultan Ismail in Johor Bahru. The finding of this research is significant to deliver the knowledge on what hindering the implementation of lean in healthcare sector. It can be used as a guidance to make sure that the implementation of lean in healthcare sector can be successful.

**Keywords:** Barrier, Lean in Healthcare.

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## 1. Introduction

Lean concept has been initiated in the healthcare area throughout the world for the benefit of patients, employees and healthcare organizations [2]. Healthcare systems are being challenged in this century to be as economical, accessible, safe, intensive, proficient and cost-effective as possible. There is a need to search for new and more proficient methods for healthcare services. Numerous healthcare associations embrace the Toyota Production System often referred to as the Lean Healthcare Management System as the performance improvement strategy. The Lean methodology intends for upgrades inside the system of an association's current procedures. According to (Bonome et al., 2015) the primary factors that motivated lean healthcare implementation in the

hospitals are reducing patient waiting times, costs and making financial improvements in the healthcare sector.

In Malaysia, lean was introduced to the Ministry of Health (MoH) as a part of PSDT initiative (Public Service Delivery Transformation). It was introduced in MoH to have more patient-centered care improving work processes, efficiency, and the patient's flow that eventually can reduce congestion and waiting time.

The lean initiative is not limited to an approach in increasing effectiveness and efficiency in the process, but it is also cover the management strategy that is applicable to all organizations because it has to do with improving processes. [10] stated that the use of Lean in healthcare services appears to require a progressively coordinated methodology as a structure for Lean thinking, with both

services and operational perspectives. All organizations including healthcare organizations are composed of a series of processes, or sets of actions, intended to create value for those who use or depend on them like their stakeholder, customer or patient.

## 2. Literature Review

### Management Roles & Responsibility

Professional knowledge is often linked to organizational power in healthcare, rendering the structure very hierarchical which placing doctors as the dominant decision-makers [14]. Cultural issues based on the hierarchy of health care personnel and the way in which management roles are assigned generally become barriers to Lean's introductory phase [18].

Moreover, different sector exhibit different culture in their organization prior to their nature of organizational and professional. Cultural and language barrier present specific difficulties for comprehensively actualizing lean techniques [12]. [5] stated that typical reason that lead to inadequately performance of lean transition is that they neglect to connect with the workforce in generating a culture of lean improvement.

Next, lack of managerial skills observes as one of barrier in lean healthcare implementation. An optimum approach to make a genuine lean transformation is with a solid managerial skill at the highest point of an organization. This will help to incorporates intellectual reinforce as well as physical commitment in the program [15]. It is prerequisite for top management to comprehend and provide adequate foundation to encourage the lean concept. Lack of responsibility and commitment may prompt considerable obstacle and barrier, including constrained access to many resources, lengthy decision-making processes and lack of communication [13].

As medical professionals are trained to focus on improving patient wellbeing, they often lack of soft skills and knowledge in management [3]. Management in healthcare ought to consult form outside facilitator that expert in lean in order to adopt change, comfort others through team building, resolve problems, be interested in instructing others and be passionate enough to constantly improve their services. Thus, an effective managerial decision is significant in lean transition.

Lastly, healthcare organization had to deal with massive pressure from various sides to enhance their operation effectiveness and efficiency. Even though patients are the primary clients, there are several other stakeholders that need to be considered like varied department, clinicians and local community [14]. Healthcare organizations' intricacy implies that a substantial number of stakeholders.

### Leadership Empowerment

Lack of communication and leadership discover as one of major barrier in lean implementation within the service [9]. Leaders are essential as a role models to illustrate the desired behaviors to incorporate [2]. If lean project become the primary focus for the management in healthcare sector, it must be supported with the set of guidelines such as a vision, objective and strategy, goals and a direction to ensure lean is inclines towards the absolute track. In fact, poor leadership has been recognized as the causes of poor manageability and sustainability of lean change [9]. Particularly, leadership is significant at all level of management. Leadership will incorporate and reconciles personal objectives with organizational objectives.

Furthermore, one of the most frequently cited factors is the lack of commitment and support from top management and has been classified as a massive inhibitor in lean implementation [15]. Most argued that top managers ought to be engaged in implementing Lean and spend time in the working environment as part of their support supervising the processes and provided adequate resources for lean workplace implementation and deploy it at all level [2]. This barrier obviously relates directly to the first barriers noted. Alteration process in service sector that will affect organizational operations ought to be centrally coordinated and led from the top management with such a definite strategic framework to assure the process can be done deliberately across an organization [9].

### People Management

One of the major barriers in lean implementation is inadequate awareness and training about the lean concepts among professionals in healthcare [12]. Training helps to promote credibility among those involved and to integrate workers' conception and thinking [14]. Absence of educated human resources particularly staff in healthcare is one of the significant risk factors in lean application. This barrier exists referred to the inexperienced of lean principles and methods among the employee. Lean's successful implementation demands that employees to be an effective problem solvers and learners [2]. However, training in healthcare poses a major challenge, as only a few instructors have a well-founded knowledge and experience of lean in healthcare, facilitator must be hired from manufacturing sector and typically lack relevant service sector can be used as a guideline [14]. This barrier pertains to lack of experience in lean principles and methods. If there is an alteration in the work environment like lean application, members must be provided with the prerequisite formal and informal training [4]. Training in lean preparing an encouragement to the professionals to get familiar with the fundamental knowledge and expertise for improvement at the early stage

### Employee Empowerment & Involvement

According to (Poksinska 2010) employees are the one whose experts in their work and their full involvement entitle them to deploy their professional knowledge, skills and expertise for the improvement of an organization. Thus, due to personnel empowerment of practice and specific knowledge about each department process flow, essential participants during a value stream map construction along the lean implementation phase and the involvement of professionals at each department is extremely important to assure effective lean implementation. Thereby, all employee needs to be educated on the strategy of the organization, comprehend its role and personal goals, with specific dates to be achieved [19].

Next, engagement of management skills in terms of engagement with all departments also contribute to barrier in lean healthcare implementation. Top managers' difficulty then is to delegate, boost operators' decision-making applicability, respond to them and establish an alternate relationship are the one difficulty in lean application [6]. A solid collaboration and mutual trust between the staff and the management is prerequisites to generate encouraging surrounding for lean implementation. Lack of engagement and mutual trust among the management and staff will cause distraction for victorious lean implementation in any sector [12]. According to Grove et al (2013) poor communications prompt to failure of lean project implementation. All the professionals or staff in healthcare organization should be appropriately informed about the improvements made [10]. Lean objective like cost reduction and lead time decrease were not being conveyed effectively to varied level of the association. This may lead to lack of awareness of the accomplishment of the project which resulting to little reinforcement from them.

### Resources Management

Few organizations have difficulties in implementing lean due to lack of time in training or money and resources to invest in lean project. Cost and time engaged with lean implementation is one reason that limiting the momentum of lean implementation. Resource constraints with reference to volume were considered as a barrier in lean implementation [12]. On the contrary, lack of resources incorporate of financial, human and technical is a typical obstruction for lean implementation [5]. Improvement programs significantly require resources, the lack of resources, such as technical, human or financial resources, may hinder lean transition programme. According to [2] resources are not only linked to the program's financial allocations, those more technical aspects need to be perceived, such as access to facilities and financial assistance, assigning committees to facilitate the program and budgeting for reward systems.

Next, improvement programs require everyone involved to devote some of their time however, insufficient time allocated is frequently mentioned as obstruction to lean's implementation [2]. Even though outcomes seemingly surpass the required resources, the fire-fighting mentality of healthcare professionals rather than solving the root cause acts as a feasible barrier in lean healthcare implementation [15].

### Strategy & Planning

A definite, well-communicated strategy is one of attribute that lead towards lean accomplishments. Frequent changes in a strategy for improvement inhibit the progression of potentially successful lean implementation programmed [2]. Lack of integration of both the lean strategy with the overall strategy of hospitals and other organizational programs perceived as considerable barrier. A compelling vision and a clear and well-planned strategy should come with the appropriate facilitators approach to advice in lean implementation. Besides the objectives and aims of the programed must be clearly explain towards everyone that involved even the top management should possess a well comprehension and enthusiasm on what they want to accomplish prior to lean implementation and, well define strategy on how to accomplish it and what aspects should be taken into account.

Besides resistance to change is a significant problem in any organization's improvement program, thus this obstacle deserves special attention when attempting to implement Lean, since the involvement of healthcare professionals is crucial [15]. Employee empowerment is vital where involvement of healthcare professional that eventually allow the management team to forge a supportive environment through which the employee can learn, improve and enforce goals effectively.

In addition, poorly deliberation of target is kind of barrier exist in any organization even in health services. Target set a measurable goal that will reorienting the organization to the desired goal. A regularly occurring event like an emergency case occurs in healthcare services, prompts several processes to happen. More forecasted that any sector would be the same, however they were apparently different. This lack of standardization rendered the challenge in mapping processes and consenting the task to assign to whom [9].

For the sake of effective improvements transition, performance measurement need to be established [9]. Although a substantial amount of data is available in the healthcare sector, but majority is not prepared for analysis. As an outcome, poor analytical results require extensive time, effort and expense, as well as those primarily needed to turn such data into information [8]. Moreover, diverse cross-functional department in healthcare sector led to barrier in lean implementation [5]. Development of a CFT is fundamental to lean implementation. The CFT includes representatives from different department, in healthcare

from top to lower levels. However, in lean environment, CFT's are completely critical [17]. Each colleague must aware about group structure, his job and obligations and participate and engage in lean project to fortify an effective lean implementation. However, poor communication leads to destructive conflict for cross departmental, which lead to obstruction in lean implementation.

Meanwhile, Health services authority has been controlled under government, including federal, state and local regulators, the one that responsible in challenge them to raise standards of care, adapt to periodic regulatory changes, and face long processes of authorization to introduce changes. The current health care reform trend is for the prevalence of evidence-based guidelines and audit regimes that emphasize the standardization, bureaucratization, and re-regulation of clinical practice. Therefore, adoption of Lean practice will be influenced by system regulations and legal incentives in the healthcare sector [10].

### Information & Knowledge about lean

Manufacturing myths and lack of understanding of lean principles among health care professionals is seen as a barrier [15]. According to Grove et al., (2013) lean implementation needs a comprehensive understanding of the underlying principles instead of just selecting and implementing lean tools evolved elsewhere. Lean philosophy encompasses of understanding both lean thinking and lean tools. Lean thinking is an English name describing the system within the company that created it, now known as the Toyota Way [12]. The origin of this name was Respect for Humanity System, which emphasized a Toyota culture of mentoring people in thinking through and fixing the underlying causes of the problems, supporting society and empowering work. By concentrating on the "soft" side of lean and Six Sigma initiatives, only then any organization may adopt change in its process by obtaining extensive, robust and sustainable benefits.

### 3. Methodology

This research used quantitative approach using survey questionnaire distribution. A total of 196 respondents needed to quantify this research. Population sample was calculated referred to the Krejcie Morgan table where there is 400 number of population, thus referring to Krejcie Morgan table, a total of 196 respondent required to distributed to the targeted respondent from 10 different departments which is orthopedics, ophthalmology, medical ward, pediatrics, radiotherapy & oncology, emergency department, surgical department, psychiatrists, pathology, and dentistry.

Table 1: Response Rate

| Indicator                   | No. Of Respondent |
|-----------------------------|-------------------|
| Total Sample Required       | 196               |
| Total Respondents Collected | 136               |
| Response Rate (%)           | 69.4 %            |

The data collected in this survey is 136 respondents where the actual population sample decided from the previous Krejcie Morgan table is 196. Baruch & Holtom (2008) stated that a minimum 55.6% response rate required for a survey. Thus, it can be concluded that the response rate obtained for this survey is adequate and further analysis can be carried out.

There are several data analysis method were used to analyze the data obtained from the questionnaire such as interdependence method multivariate analysis with Exploratory Factor Analysis (EFA), KMO & Bartlett's Test of Sphericity and Friedman test (mean ranking analysis).

### 4. Result

#### Barriers in Lean Healthcare Implementation

Total of 28 barriers in lean healthcare implementation had been found in the journals. The factors found were regrouping to its same construct. Seven construct of factors leading to barrier in lean healthcare implementation had been develop.

Table 2: Barriers in Lean Healthcare Implementation

| Construct                                                         | Item | Barriers                                                            |
|-------------------------------------------------------------------|------|---------------------------------------------------------------------|
| <b>Construct 1:</b><br><b>Management Roles and Responsibility</b> | A1   | Hierarchy and management resistance                                 |
|                                                                   | A2   | Variation of organizational culture and style                       |
|                                                                   | A3   | Organizational silos                                                |
|                                                                   | A4   | Lack of managerial skills                                           |
|                                                                   | A5   | Lack of clear focus on customer stakeholder value                   |
| <b>Construct 2:</b><br><b>Leadership Empowerment</b>              | B1   | Lack of leadership team involvement                                 |
|                                                                   | B2   | Lack of commitment and support from top managers                    |
|                                                                   | B3   | Lack of qualified people in healthcare to guide the lean transition |
| <b>Construct 3:</b><br><b>People Management</b>                   | C1   | Inadequate training and education                                   |
|                                                                   | C2   | Attribute of professional skills in healthcare                      |
|                                                                   | C3   | Lack of facilitator who are expert in lean                          |
| <b>Construct 4:</b><br><b>Employee</b>                            | D1   | Lack of involvement (commitment & participation of the staff)       |

|                                               |    |                                                                    |
|-----------------------------------------------|----|--------------------------------------------------------------------|
| <b>Empowerment &amp; Involvement</b>          | D2 | Lack of engagement                                                 |
|                                               | D3 | Poor communication                                                 |
| <b>Construct 5:</b>                           | E1 | Lack of human and technical resources                              |
| <b>Resources Management</b>                   | E2 | Financial resources constraints                                    |
|                                               | E3 | Absence of specific time allocate for this lean transition project |
| <b>Construct 6:</b>                           | F1 | Strategy and Purposes                                              |
| <b>Strategy &amp; Planning</b>                | F2 | Resistance to change                                               |
|                                               | F3 | Unclear vision                                                     |
|                                               | F4 | Numerous targets                                                   |
|                                               | F5 | High process variability                                           |
|                                               | F6 | Lack of data collection and performance management                 |
|                                               | F7 | Cross departmental                                                 |
|                                               | F8 | Regulation in healthcare                                           |
| <b>Construct 7:</b>                           | G1 | Perception (Lack of lean philosophy)                               |
| <b>Information &amp; Knowledge about Lean</b> | G2 | Terminology                                                        |
|                                               | G3 | Variation in defining waste                                        |

Based on the findings above, the interdependence method multivariate analysis with Exploratory Factor Analysis (EFA) was used to develop the model of barriers lean healthcare implementation at Hospital Sultan Ismail in Johor Bahru.

Prior to EFA, the KMO & Bartlett's Test was conducted to measure the sample is adequacy. Based on table 4.2, the value of for Kaiser-Mayer-Olkin is more than 0.5. Thus show the sample is adequate. Besides, it is measure of sampling adequacy indicates that the proportion of variances in variables is caused by underlying factors, thus it allows for the application of factor analysis. This can be supported by the Bartlett's test of sphericity value which is 0.00 that is less than 0.05. It proves that the analysis is significant.

Table 3: KMO & Bartlett's Test of Sphericity

**KMO and Bartlett's Test**

|                                                  |                    |          |
|--------------------------------------------------|--------------------|----------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .723     |
| Bartlett's Test of Sphericity                    | Approx. Chi-Square | 1256.026 |
|                                                  | df                 | 378      |
|                                                  | Sig.               | .000     |

Rotated factor Varimax with Kaiser Normalization as shown in Table 4.3 was used to analyses the factor of the barriers in Lean Healthcare implementation at Hospital Sultan Ismail in Johor Bahru.

Table 4: Rotated factor Varimax with Kaiser Normalization

**Rotated Component Matrix<sup>a</sup>**

|    | Component |      |      |      |      |      |      |      |
|----|-----------|------|------|------|------|------|------|------|
|    | 1         | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
| A1 |           | .627 |      |      |      |      |      |      |
| A2 |           | .647 |      |      |      |      |      |      |
| A3 |           |      |      |      |      |      | .723 |      |
| A4 | .581      |      |      |      |      |      |      |      |
| A5 |           |      |      |      |      |      |      | .721 |
| B1 |           |      |      |      |      |      |      |      |
| B2 |           |      |      |      |      |      |      |      |
| B3 |           | .563 |      |      |      |      |      |      |
| C1 |           |      |      |      |      | .613 |      |      |
| C2 | .621      |      |      |      |      |      |      |      |
| C3 |           | .759 |      |      |      |      |      |      |
| D1 |           |      |      |      |      | .731 |      |      |
| D2 |           |      |      |      |      |      |      |      |
| D3 |           |      |      |      |      |      |      |      |
| E1 | .727      |      |      |      |      |      |      |      |
| E2 | .765      |      |      |      |      |      |      |      |
| E3 |           |      |      |      |      |      | .793 |      |
| F1 |           |      | .726 |      |      |      |      |      |
| F2 |           |      | .538 |      |      |      |      |      |
| F3 |           |      | .660 |      |      |      |      |      |
| F4 |           |      |      |      | .658 |      |      |      |
| F5 |           |      |      |      | .644 |      |      |      |
| F6 |           |      |      |      |      |      |      |      |
| F7 |           |      | .504 |      |      |      |      |      |
| F8 | .748      |      |      |      |      |      |      |      |
| G1 |           |      |      | .726 |      |      |      |      |
| G2 |           |      |      | .693 |      |      |      |      |
| G3 |           |      |      | .712 |      |      |      |      |

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

**Rotation converged in 8 iterations**

The result indicated that the 23 items from the original 28 items are loaded into 8 main constructs or components. Comparing with original items and constructs from the

questionnaire, there is one additional constructs generated and five items were excluded. Thus, the barriers in Lean Healthcare implementation at Hospital Sultan Ismail in Johor Bahru can be concluded in a simple diagram or model as shown in Figure 4.1.

First construct can be classified as people & management and revolves around the following five items: lack of managerial skills, attributes of professional skills in healthcare, lack of human and technical resources, financial resources constraint and regulation in healthcare.

Second construct can be classified as organization management and system and consists of the following four items: hierarchy and management resistance, the variation of organizational culture and style, lack of qualified people in healthcare to guide the lean transition and lack of facilitator who is expert in lean.

Whereas, the third construct can be categorized as a process, strategic planning & operations and comprises the following four items: strategy and purposes, resistance

to change, unclear vision and variation of cross-departmental in HealthCare. Moreover, the fourth construct can be classified as information & knowledge about lean that consist of three items which are perception (lack of lean philosophy), terminology and variation in defining waste.

The fifth construct is organizational process variability which consists of numerous targets and high process variability. The sixth construct is skills and expertise which are inadequate training & education and lack of involvement (commitment & participation of the staff). The seventh construct also consists of two factors and can be classified as organizational planning. Those two factors are organizational silos and the absence of specific time allocated for this lean transition project.

The final construct which is construct number eight is classified as human perception which is a lack of clear focus on customer and stakeholder value.

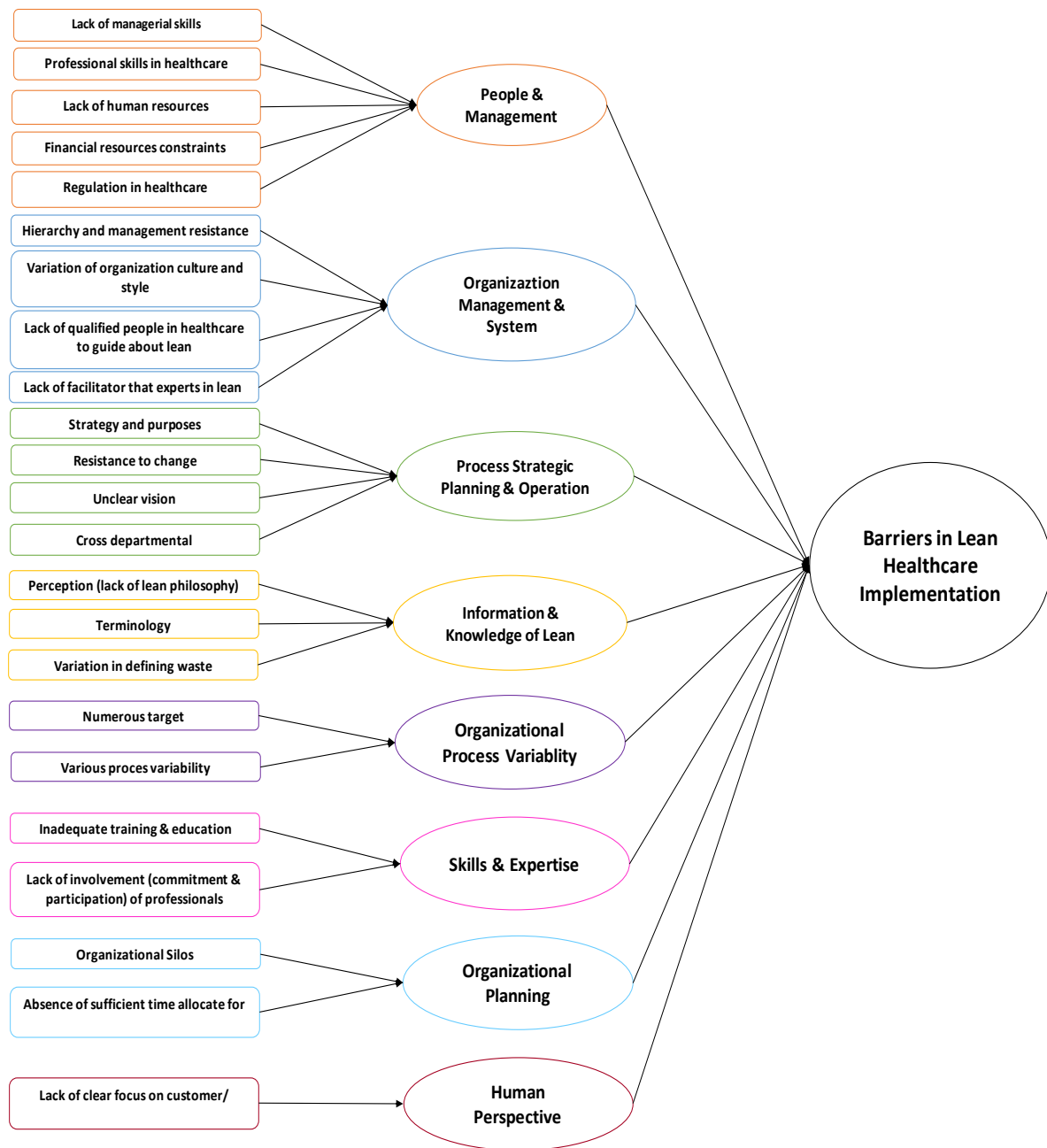


Figure 1: Barriers in Lean Healthcare implementation at Hospital Sultan Ismail in Johor Bahru

### The Most Significant Barriers

Friedman test (mean ranking analysis) was used to identify the most significant barriers in Lean Healthcare implementation at Hospital Sultan Ismail in Johor Bahru.

|             |      |
|-------------|------|
| df          | 22   |
| Asymp. Sig. | .000 |

a. Friedman Test

Table 5: Friedman Test Statistic by item

### Test Statistics<sup>a</sup>

|            |         |
|------------|---------|
| N          | 119     |
| Chi-Square | 616.742 |

Table 6: Mean Rank of Friedman Test by item

| Ranks |           |
|-------|-----------|
|       | Mean Rank |
| A1    | 9.92      |

|    |       |
|----|-------|
| A2 | 11.64 |
| A3 | 13.10 |
| A4 | 10.74 |
| A5 | 14.95 |
| B3 | 15.73 |
| C1 | 13.13 |
| C2 | 7.98  |
| C3 | 15.33 |
| D1 | 15.06 |
| E1 | 8.84  |
| E2 | 9.26  |
| E3 | 15.09 |
| F1 | 10.66 |
| F2 | 9.72  |
| F3 | 11.59 |
| F4 | 12.10 |
| F5 | 11.87 |
| F7 | 8.88  |
| F8 | 7.39  |
| G1 | 15.19 |
| G2 | 13.88 |
| G3 | 13.94 |

Table 7: Friedman Test Statistic by Construct

**Test Statistics<sup>a</sup>**

|             |         |
|-------------|---------|
| N           | 120     |
| Chi-Square  | 276.235 |
| df          | 6       |
| Asymp. Sig. | .000    |

**a. Friedman Test**

Table 8: Mean Rank of Friedman Test by Construct

| Ranks |           |
|-------|-----------|
|       | Mean Rank |
| AA    | 3.50      |
| BA    | 5.60      |
| CA    | 3.46      |
| DA    | 5.28      |

|    |      |
|----|------|
| EA | 3.07 |
| FA | 2.34 |
| GA | 4.76 |

Friedman test is conducted to rank a list in order of preference or significance level in from highest to the lowest factor. The significant value for Friedman test is below than 0.05 ( $p\text{-value} < 0.05$ ) indicates that there are differences in the distributions across the conditions. Thus, it can be concluded that both Friedman test by item and by construct is significant.

Based on the table above the highest rank is item B3 which is lack of qualified people in healthcare service to teach or guide about lean transition. This significantly shows that absence of this factor leads towards major difficulties in lean healthcare implementation. Next item is C3 which is lack of outside facilitator who is expert in lean to guide the lean transition in healthcare service. The third item is G1 which is perception (lack of philosophy and knowledge in lean in healthcare). Thus, from the result, it can be concluded that absence of these three crucial factors will significantly lead towards failure along lean initial project implementation in healthcare.

Whereas the highest rank for construct is construct B which is leadership empowerment. Absence of leadership empowerment in healthcare environment will hinder lean healthcare transition. The second highest is construct D which is employee empowerment and involvement whereas the third construct is the last construct before factor analysis was formed which is information and knowledge about lean. Thus, absence of these three significant factors will extremely affect initial lean transition.

## 5. Conclusion

Performing factor analysis will omit any insignificant or repeated factor. In this study, the factor loading below than 0.5 will be omitted. Thus 5 barriers from originally 28 barriers have been omitted in this study which is barriers B1, B2, D2, D3 and F6. Other 23 barriers remain with rotation convergence in 8 construct. Thus, the barriers in lean healthcare implementation at Hospital Sultan Ismail Johor Bahru are consisting of 23 barriers that loading into 8 main factors.

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## References

- [1] Adler, P. S., Riley, P., Kwon, S.-W., Signer, J., Lee, B., & Satrasala, R. (2012). Performance Improvement Capability: Keys to Accelerating Performance Improvement in Hospitals. *California Management Review*, 45(2), 12–33. <https://doi.org/10.2307/41166163>
- [2] Aij, K. H., Simons, F. E., & Widdershoven, G. A. M. (2013). Experiences of leaders in the implementation of Lean in a teaching hospital — barriers and facilitators in clinical practices: a qualitative study, 1–8. <https://doi.org/10.1136/bmjopen-2013-003605>
- [3] Alwan, F. (2012). Lean implementation problems in the healthcare system.
- [4] Anand, G. (2010). Development of a framework for implementation of lean manufacturing systems Rambabu Kodali \*, 4(1).
- [5] Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human relations*, 61(8), 1139–1160.
- [6] Bonome, L., Costa, M., & Filho, M. G. (2016). Lean healthcare: review, classification and analysis of literature, 7287(February). <https://doi.org/10.1080/09537287.2016.1143131>
- [7] Bonome, L., Costa, M., Filho, M. G., Rentes, A. F., Bertani, T. M., & Mardegan, R. (2015). Lean healthcare in developing countries: evidence from Brazilian hospitals.
- [8] Dahlgaard, J. J., Pettersen, J., & Dahlgaard-Park, S. M. (2011). Quality and lean health care: A system for assessing and improving the health of healthcare organisations. *Total Quality Management and Business Excellence*, 22(6), 673–689. <https://doi.org/10.1080/14783363.2011.580651>
- [9] Escuder, M., Tanco, M., Santoro, A., Escuder, M., & Tanco, M. (2018). Exploring major barriers in Lean health care. <https://doi.org/10.1108/IJLSS-06-2017-0062>
- [10] Grove, A. L., Meredith, J. O., Macintyre, M., Angelis, J., & Neailey, K. (2013). UK health visiting: challenges faced during lean implementation. <https://doi.org/10.1108/17511871011061037>
- [11] Halling, B. (2013). Experienced Barriers to Lean in Swedish Manufacturing and Health Care, 4(2).
- [12] Hurley, A. E., Scandura, T. A., Schriesheim, C. A., Brannick, M. T., Seers, A., Vandenberg, R. J., & Williams, L. J. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of organizational behavior*, 667–683.
- [13] Jadhav, J. R. S. S. M. S. B. R. (2014). Article information: Exploring barriers in lean implementation.
- [14] Po, J., & Bueno, B. (2017). 2017 Annotated Bibliography on Lean in Healthcare Organizations. Center for Lean Engagement & Research in Healthcare (CLEAR), (March).
- [15] Poksinska, B. (2010a). The Current State of Lean Implementation in, 19(4), 319–329.
- [16] Poksinska, B. (2010b). The current state of Lean implementation in health care: literature review, (19), 319–329.
- [17] Repository, I. (2012). Institutional Repository SimLean: utilising simulation in the implementation of lean in healthcare This item was submitted to Loughborough 's Institutional Repository ( <https://dspace.lboro.ac.uk/>) by the author and is made available under the.
- [18] Rossum, L. Van, Harald, K., Frederique, A., Simons, E., Eng, N. Van Der, & Dirk, W. (2016). Article information: Lean healthcare from a change management perspective.
- [19] Souza, L. B. De, Pidd, M., Souza, L. B. De, & Pidd, M. (2011). implementation Exploring the barriers to lean health care implementation, (December 2014), 37–41. <https://doi.org/10.1080/09540962.2011.545548>
- [20] Spagnol, G. S., Li, L., & Newbold, D. (2013). Lean principles in Healthcare: an overview of challenges and improvements. *IFAC Proceedings Volumes (Vol. 46)*. IFAC. <https://doi.org/10.3182/20130911-3-BR-3021.00035>

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