Determinants of effectiveness of lean healthcare performance in Malaysian public hospitals

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Abstract

Purpose – This study aims to explore the lean leadership factors influencing the effectiveness of lean healthcare performance at hospitals.

Design/methodology/approach – A total of 217 healthcare professionals' responses were included for data analysis. The data were analyzed using the partial least square technique.

Findings – The findings revealed that improvement culture, gemba (hands-on approach), hoshin kanri (goal-oriented) and qualification are the crucial lean leadership factors that positively influence the effectiveness of lean healthcare performance at hospitals. The results indicated that the self-development of lean leaders has no significant impact on the effectiveness of lead healthcare performance.

Originality/value – The findings of this study could contribute to the healthcare institutions in Malaysia perceive the benefits of lean healthcare and show a positive intention of using lean leadership principles.

Keywords Effectiveness, Lean healthcare, Performance, Hospital, Malaysia

Paper type Research paper

1. Introduction

The concept of Lean was taken from the production system of Toyota. It was adopted to identify the kind of management in business, define the look and operations of the Japanese automotive industry, and make that the products and services delivered are of high quality by means of using as few resources as possible along with improving the performance of the organization and making sure that the needs of the customers are met (Alnadi and McLaughlin, 2021). As such, the "Lean" concept has been adopted and used for the past 40 years in order to enhance the process efficiency, and ensure the competitiveness of an organization while minimizing operational wastes (Gento *et al.*, 2021). The lean concept has continuously improved partnerships in business and established long-term relationships (Migita *et al.*, 2011). Lean management and traditional management greatly differ from each

other. The focus of traditional management is on the results, whereas lean management focuses on both the process and results (Alnadi and McLaughlin, 2021; Bouranta *et al.*, 2021).

Organizational management is encouraged to use lean management because of its efficiency. However, as stated by Chambers *et al.* (2013), employees need to perceive that having a new change in the dynamics of a system can create a successful implementation of any plans of improvements in the long run. External and internal lean management can be adjusted accordingly to the size and nature of an organization. Internal lean management is connected to competing priorities such as quality, cost, flexibility and delivery of the products and services (Chanegrih and Creusier, 2016; Chavez *et al.*, 2020), while external lean management is associated with the customer preferences, and suppliers' resources (Chanegrih and Creusier, 2016; Al Rusheidi and Supian, 2022). External lean management refers to the financial performance of the healthcare organization, which can be improved by reducing cost and organizational processes, and increasing labor and productivity. Many misconstrue that lean management is exclusive to the manufacturing industry. This is often the perception upon introducing lean management. Love *et al.* (2021) and Vlachos *et al.* (2021) stated that lean management in manufacturing has proven its efficiency in reaping benefits and its ability to be adopted in the business world. It should be noted though that lean can be adopted by any industry, and this includes the healthcare industry (Chalice, 2007; Rahman *et al.*, 2021a) to minimize waste, improve efficiency and quality service, and create a harmonious working environment within the healthcare setting (Mahmoud, 2020; Rahman *et al.*, 2021b).

Given the many problems in the healthcare industry, Malaysia is consistently seeking long-term healthcare solutions because there is always provision for improving the healthcare service delivered. The healthcare service provider plays a vital role in the delivery of such service (Rahman, 2019). Because almost every Malaysian has had considerable experience of being a patient and having visited a hospital, also perceives the problems being faced by the public healthcare system (Rahman *et al.*, 2018). Customer satisfaction is deemed the most important factor; thus, a well-organized healthcare system should include processes and be able to look for ways to improve the given system.

At present, the public healthcare system in Malaysia is facing many challenges. Around 80% of the patients in Malaysia need to be attended to. This includes expensive healthcare expenses, performance problems of healthcare institutions and limited resources. The public healthcare system offers in-patient and out-patient services to the greater number of the Malaysian population; the number of admissions increases consistently. There are a total of 20–30 patients being admitted each week to hospitals. A great number of it is classified as "walk-in." These are patients who have not made any prior appointments, and returnees who have regular check-up appointments. The common problems cited by Malaysians who avail the services of public healthcare systems include the quality of healthcare service delivered, given medical services, period of waiting time, customer service and shortage in drug prescriptions (Chan, 2016; Rahman *et al.*, 2021b; San, 2022). Thus, this study has explored the lean leadership factors influencing the effectiveness of lean healthcare performance in Malaysian public hospitals.

2. Literature review
2.1 Underpinning theory
This study uses the concept of lean leadership practices (Ljungblom, 2012), which can reflect the effectiveness of lean healthcare performance in hospitals. Ljungblom (2012) explains that lean leadership is perceived as a crucial aspect in organizing a process and improving quality. Bianco *et al.* (2021) and Al-Najem *et al.* (2013, 2019) concluded that lean will only be successful in an institution if it is adopted together with lean culture, adept and experienced employees, a

commitment of the top management coupled with strong leadership. There are many principles of lead leadership, however, in this study, we have used five major crucial factors of lean leadership such as improvement culture, self-development, qualification, gemba and hoshin kanri that may lead to influence the effectiveness of lean healthcare performance at a hospital. Connor and Cormican (2021) explain that the most basic prerequisite of lean is leadership. Leaders need to be supportive of improvement culture and its implementation should be the utmost priority and responsibility of management. Leyer *et al.* (2021) stated that continuous improvements to empower employees must be done in order to ensure positive changes. Everyday interactions between management and employees can help improve the lean production systems. Lean leadership may be a novice methodical system, but it emphasizes the customer and continuous development of both the employees and leaders.

2.2 Improvement culture

Executives need to develop themselves in the next years to arrive at lean leadership (Taha *et al.*, 2021; Ljungblom, 2012; Emiliani, 2021). Rosefsky and Opfer (2015) mentioned that by doing so, lean leaders will understand more the structure of a company. They will gain a more complex understanding and see the bigger picture. Moreover, they will have the talent to perceive a clearer vision for the organization to iron out the dynamics. Lean leaders must develop employees and perceive the needs of every individual (Bianco *et al.*, 2021). Lean leaders play a very important role in problem-solving strategies, coaching, accompanying and being able to draw out the problem-solving talents of employees (Prakash *et al.*, 2021; Puram and Gurumurthy, 2021). The key to lean leadership is not to find solutions for the problems but to promote problem-solving methods by empowering employees to perceive proposed solutions (Ljungblom, 2012). Denham *et al.* (2013) explained that giving feedback is difficult for managers to affirm employees who have committed mistakes. Lean leaders can identify the root causes to avoid a zero-defect production process. Defects in production refer to noticeable defects in products and services that can be seen by customers. Hence, the improvement culture can indeed increase productivity. Lean leaders know how to admit their fault but never punish the employee for no reason at all. They become more suitable to improve the healthcare value itself. In conclusion, a positive belief in the cultural improvement of lean leaders creates a positive influence on lean healthcare performance (Denham *et al.*, 2013; Mamun *et al.*, 2021). Thus, we postulated that:

H1. The improvement culture of lean leaders has a significant impact on the effectiveness of lean healthcare performance.

2.3 Self-development

Lean leaders need to see the potential of every individual under care, steer each one to develop and help attain personal goals in life. Leaders need not feel affirmed just because their objectives seem far-fetched given their present talents and behavior (Connor and Cormican, 2021; Panayiotou and Stergiou, 2020). Communication plays a vital role in lean leadership. It encourages the consistent flow of information. Lean leaders need to communicate and coach their subordinates because it promotes better understanding. It also builds commitment to any undertaking and assures implementation because of involvement. Leaders should be given promotion once mastery of the processes has been achieved, ideally from the very bottom operational level (Seidel *et al.*, 2019; Reynders *et al.*, 2020). By doing so, leaders will be able to coach the next batch of successors given the knowledge and experience gained. Complex processing of knowledge is paramount in lean leadership because leaders will have to coach juniors later on (Ljungblom, 2012; Davidson *et al.*, 2020). Lean leaders are knowledgeable when it comes to getting feedback from customers. Such a skill is helpful in

designing reasonable objectives for single processes, and employees, which may reflect the performance of the organization. In this study, self-development is about the practices and academic disciplines that help improve the various qualities of a person. Lean leaders can explain objectives and can facilitate an effective training session (Salentijn *et al.*, 2021). They are able to identify and design a plan in order to achieve given objectives. Lean consultants are usually hired to train new employees while focusing on refining individual performance. Thus, we believed that,

H2. Self-development of lean leaders positively influences the effectiveness of lean healthcare performance.

2.4 Qualification

Qualification refers to the education attained through examination, certification, experience and knowledge on how to make an objective clearer, reframe issues and assess a situation. Multitasking is an indicator that a leader has become successful in stabilizing processes and developing the problem-solving skills of an employee. Having this trait, a leader can now do other tasks while grooming a possible successor (Tortorella *et al.*, 2020). It is a complex undertaking for any organization to promote a multi-skilled work structure that the lean organization heavily relies on in order to promote flexibility and responsiveness. Young and Brewer (2008) comments that industries have now understood the need of hiring leaders who can do multitasking activities to promote future development. Employees are highly encouraged to be a part of the continuous improvement process (McAdam *et al.*, 2021). The coaching done in lean leadership can help create top performers and the long-term development of employees (Van Kemenade, 2022; Ljungblom, 2012). Lean leaders must encourage employees to enhance their knowledge and skills, promote their motivational level and enhance their self-confidence to take on any problem. Lean leaders must also be able to promote short problem-solving cycles of the organization by giving immediate feedback and quick succession in learning. Lean leaders give employees the independence to function while coaching and monitoring the performance of each employee. Qualified lean leaders foster motivation, and empower individuals in the decision-making process (Ljungblom, 2012). Therefore, we proposed that,

H3. Qualification of lean leader has a significant influence on the effectiveness of lean healthcare performance.

2.5 Gemba

Gemba (hands-on approach) in Japanese means lean leaders who work in a real workplace scenario or platform of action and learning. These are leaders who are able to create value. They do a hands-on approach and direct interaction with customers. Such a lean leader would pay a visit to patients on the different floors regularly, is aware of the processes involved, consults employees and uses practical knowledge and experience as a direct result of problem-solving (Ljungblom, 2012; Sales and De Castro, 2021). In this study, gemba refers to the shop floor management of the hospital for patient safety and satisfaction. Lean leaders should make decisions based on given facts where the actual work is done, which is on the operation floor of patients. By observing employees and knowing where and how work is done, leaders will gain a better understanding of the root causes of a problem. Therefore, the office of a leader must be placed as close to the operation floor to offer support for continuous improvement (Ljungblom, 2012; Migita *et al.*, 2011). Lean leaders should be able to go down to check on how the staff is doing their given designations, interact with each one of them and evaluate the organization system. They are expected to give more than just an order to be delivered. Seidel *et al.* (2019) stated that being at the ground level helps leaders get feedback

from customers and get acquainted with them. This is done in order to ascertain those processes are done with minimum costs, minimum errors and maximum productivity, and assures the satisfaction of customers. Lean leaders who can go down and walk around will be able to get first-hand information on how things get done. Lean leaders can also help motivate their employees to work harder. Thus, we proposed that,

H4. Lean leader following gemba principles positively influences the effectiveness of lean healthcare performance.

2.6 Hoshin kanri

Hoshin kanri (goal-oriented) is a means of getting and sealing strategic goals and having an insight about the future to build up people. Failure to set healthcare goals leads an organization to terrible performance outcomes and may also lower the productivity and motivation of staff (Ljungblom, 2012; Ai *et al.*, 2022; Al Mamun *et al.*, 2022). Mahmoud *et al.* (2021) reported that although lean management practices are used in the healthcare sector, however, their impacts on staff have not been synthesized. Mahmoud *et al.* (2021) highlighted the gaps in lean-on frontline professionals and the findings identified the positive, negative and mixed effects of healthcare services. Hoshin kanri refers to the target management and planning goals in the organization. Lean leaders foresee the planning of long-term and short-term goals (Rother, 2009; Barclay *et al.*, 2021). The objectives may include everyday activities, checking on the current condition to meet the objectives of the day, continuous review of objectives and discussion of problems encountered in everyday work. Barnabè and Giorgino (2017) postulated that planning serves the purpose of quality improvement and seeing safety at all levels of an organization. Organizations that have been made for communication and visual control make goals clearer and provide immediate feedback. Using charts, and coloring markers for whiteboards can instantly create instant and stimulating information because the objective is to provide employees with a high degree of ownership through teamwork by means of having information that is readily available and easy to comprehend. Ljungblom (2012) explained that lean leaders should opt to be fair in order to motivate and promote a work environment that is conducive to doing tasks. Moreover, leaders must be able to exercise an equal perception of their subordinates and work toward achieving objectives (Akmal *et al.*, 2020). Goals have to be created in such a way that it promotes the development of both processes and the employees. Therefore, we postulated that,

H5. Lean leaders implementing hoshin kanri principles positively influence the effectiveness of lean healthcare performance.

Based on the review of the literature we have proposed the conceptual model (Figure 1).
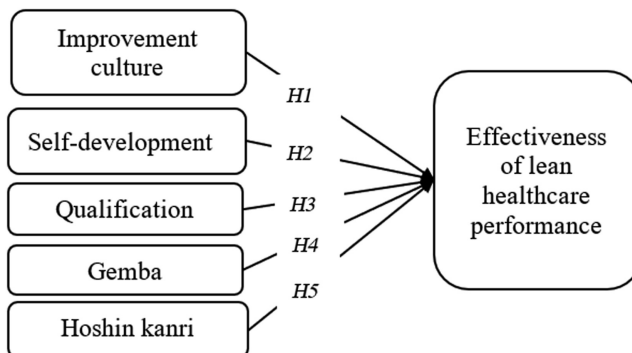

Figure 1.
Conceptual model

3. Methodology

3.1 Measurement instrument

The operationalization of the constructs and measurement items were modified from the review of the literature. Nine measurement items were modified from Ljungblom (2012) to evaluate the improvement of culture and self-development. To evaluate the qualification of lean leaders, four items were adopted from Migita *et al.* (2011) whereas five items were modified from Ljungblom (2012) to measure the lean leader following gemba principles. Ten measurement items were adapted from Rother (2009) to evaluate the lean leaders implementing hoshin kanri principles, and the effectiveness of lean healthcare performance. A five-point Likert scale ranging from strongly disagree (1) to strongly agree (5) has been for this study.

3.2 Data collection procedure and sample

The pilot test was done in order to make check the time to complete the survey and to assess the reliability and validity of the context presented to check also if certain revisions have to be made. The researcher kept strict confidentiality on the identity of the respondents. The pretest was given to three business and accountancy faculty members, two licensed doctors from Hospital Alor Star, and three nurses from Hospital Pulau Pinang who were tasked to go over and evaluate the instrument. The pretest also serves as feedback about the delivery of the survey and how the delivery may be improved for the administration of the whole set of surveys. The respondents in the pretest spend an average of 14 min completing the entire survey.

It can be safely assumed that the two chosen healthcare institutions for this study, University Malaya Medical Center (UMMC) and Hospital Kuala Lumpur (HKL), are adequate representations of healthcare facilities (Azlan *et al.*, 2020; Qasem *et al.*, 2022). *UMMC* strives to achieve the *highest* quality of standards not only in *Malaysia* but throughout the world (UMMC, 2022). UMMC is a leading teaching hospital with an international reputation and it provides services that are of the highest quality, safe and fulfill patients' needs. The researcher employed the non-probability sampling method since the healthcare professionals who have been included in the study are the nearest in proximity and available in Klang Valley public hospitals. The research code of ethics takes into consideration the individual rights to dignity, privacy, confidentiality and protection from harm. Each respondent has been given respect and politely influence to participate in this study.

In this study, a total of 250 questionnaires were distributed. The questionnaire was written in English and translated into Bahasa Malay due in order to ensure that the respondents have adequate knowledge and would have the ability to accomplish completely the questionnaires. The head of the medical centers permitted the researcher to conduct a meeting session with the 250 healthcare practitioners employed at the University Malaya Medical Center (UMMC) and Hospital Kuala Lumpur (HKL) to maximize the number of respondents. The respondents agreed to participate by means of an internal announcement made by the Head of the Department. A follow-up was made through e-mails in order to remind the staff who did not respond right away in the five-day period. The e-mail was also sent to encourage participants to respond and ask questions and clarifications if there are such. Incomplete and useless questionnaires were deleted as missing responses. All missing responses were deleted and resulting in 217 valid respondents with a response rate of 86.8%.

Out of the 217 respondents, the females were 57% whereas males were 42.9%. Indeed, more women in the service industry in comparison to men. The age range of the majority of the respondents is between 21 and 40 years old or 83%. A great number of the respondents hold a certificate or diploma (51.4%) and a bachelor's degree qualification 30.6%. Healthcare performance is deemed critical; therefore, it requires a higher education level in order to avoid

risks. The healthcare practitioners that have participated in the study have been classified according to each of their career profiles. The classification includes the educational level and seniority in service in UMMC and HKL. An average of 76% of the participants from healthcare organizations included in the study have served an average period of three to ten years. Table 1 shows the details of the profile of the respondents.

4. Analysis and results
4.1 Measurement model analysis
The SmartPLS 3.3.3 software was used through structural equation modeling to test the measurement model. The partial least square (PLS) technique was used for this study because it has the capability to do a single, systematic and comprehensive analysis by means of modeling the relationships among the independent and dependent variables (Anderson and Gerbing, 1992). Many academicians are using the SmartPLS in their research work because PLS is a component-based method compared to another method (e.g. SPSS), and it provides an inner model test, measurement model test, and weight relationship for the latent variables (Chin, 1998). The findings revealed that items with loading of less than 0.60 were omitted from the present study. Hair *et al.* (2017) suggests that an item with a factor loading of 0.60 is acceptable. Composite reliability (CR) is preferred compared to Cronbach's alpha in order to measure the internal consistency of the research constructs (Hair *et al.*, 2017). Table 2 presents the CR values of all the constructs being higher than 0.70. The findings revealed that CR values ranged between 0.186–0.897, while AVE values ranged between 0.526–0.638. The range of factor loading values is from 0.617 to 0.880. This coincides with the explanation given by Hair *et al.* (2017). The Average Variance Extracted (AVE) was also employed to evaluate the convergent validity. The AVE values of all the constructs used in the study are

Profile	Percentage	Profile	Percentage
Gender		*Age*	
Male	42.9	20 or below	1.2
Female	57.0	21 to 30	39.0
Race		31 to 40	42.3
Malay	72.3	41 to 50	15.8
Chinese	11.2	51 and above	1.7
Indian	9.7	*Academic*	
Others	6.8	Secondary education or below	12.4
Working department		Certificate/diploma	51.4
Triage Area	19.8	Bachelor degree	30.6
Registration area	13.0	Post graduate	5.6
Consultation hall	24.9	*Position*	
Blood taking area	14.7	Head of department	1.1
Radiology area	7.3	Medical interns	4.5
Pharmacy area	5.6	Registered nurse	19.8
Pathology area	7.9	PPK personnel	4.0
Others	6.8	Pharmacist	3.4
Years of employed		Physician	13.0
Two years or below	11.9	Medical assistant	18.0
3–5 years	18.0	Radiology technician	11.3
6–8 years	30.0	Pharmacy technician	4.5
9–10 years	26.0	Clerk	6.2
11 years and above	14.1	Administrative staff	8.6
		Doctor	5.6

Table 1.
Profile of respondents

Characteristics	FL	CR	AVE
Improvement culture			
(IC_1) Leaders in this organization have deep knowledge, able to capture overall status within	0.809	0.816	0.529
(IC_2) Leaders in this organization are able to create a clear vision for the organization	0.657		
(IC_4) Leaders in this organization provide the employees with empowerment and encourage creativity during the problem-solving process	0.617		
(IC_5) Leaders in this organization handle employees' errors and mistakes in a professional way	0.805		
Self-development			
(SD_1) Leaders in this organization are role models	0.854	0.897	0.638
(SD_2) Leaders in this organization build the employee's potential for future development	0.769		
(SD_3) Leaders in this organization are able to coach others who are junior and fresh with their knowledge and experiences	0.880		
(SD_4) Leaders in this organization know how to delegate tasks	0.788		
Qualification			
(QF_1) Leaders in this organization demonstrate the best ways in completing the tasks	0.817	0.846	0.526
(QF_2) Leaders in this organization develop their employees' problem-solving abilities	0.651		
(QF_3) Leaders in this organization ensure the employees are involved in the continuous improvement process	0.760		
(QF_4) Leaders in this organization promote employees' motivation	0.830		
Gemba			
(GB_1) Leaders in this organization move their office located closer to the operation floor, able to understand the problems and root causes	0.642	0.849	0.586
(GB_2) Leaders in this organization spend time on the operation floor and are actively engaged in process improvement, at the same time developing the employees	0.760		
(GB_3) Leaders in this organization are able to identify the problems and understand the root causes	0.830		
(GB_5) Leaders in this organization pay attention to every single employee	0.817		
Hoshin kanri			
(HK_1) Leaders in this organization have short-term goals and long-term goals	0.817	0.824	0.542
(HK_2) Leaders in this organization work hard to archive short-term goals for continuous improvement	0.641		
(HK_4) Leaders in this organization develop the employees and improve healthcare processes equally	0.760		
(HK_5) Leaders in this organization set individual target goals with precise requirements to develop employees and improve healthcare processes	0.830		
Lean healthcare performance			
(HCP_3) Lean leadership initiatives will motivate healthcare professionals to provide efficient service	0.641	0.838	0.633
(HCP_4) Lean leadership initiatives will reduce healthcare mistakes	0.760		
(HCP_5) Lean leadership implementation will have an impact on the overall lean healthcare performance	0.830		

Table 2.
Convergent validity

above 0.50. This signifies a satisfactory degree of convergent validity as explained by Fornell and Larcker (1981).

Two approaches were used to evaluate the discriminant validity. The cross-loadings of indicators were examined as displayed in Table 3. Hair *et al.* (2017) explain that no indicator load should be higher than an opposing construct. Furthermore, Fornell and Larcker (1981) in

	CL	SD	QF	GB	HK	HCP
CI_1	0.809	0.463	0.404	0.484	0.437	0.230
CI_2	0.657	0.313	0.156	0.193	0.234	0.163
CI_4	0.617	0.485	0.495	0.542	0.469	0.157
CI_5	0.805	0.577	0.479	0.610	0.526	0.228
SD_1	0.550	0.854	0.440	0.455	0.461	0.282
SD_2	0.506	0.769	0.624	0.531	0.427	0.169
SD_3	0.561	0.880	0.444	0.446	0.562	0.332
SD_4	0.506	0.788	0.482	0.548	0.475	0.173
QF_1	0.386	0.449	0.656	0.424	0.380	0.248
QF_2	0.463	0.509	0.846	0.601	0.515	0.348
QF_3	0.379	0.528	0.705	0.470	0.474	0.172
QF_4	0.344	0.325	0.643	0.331	0.274	0.183
GB_1	0.317	0.340	0.437	0.641	0.237	0.056
GB_2	0.402	0.442	0.460	0.760	0.284	0.270
GB_3	0.631	0.548	0.539	0.830	0.452	0.238
GB_5	0.533	0.443	0.473	0.817	0.582	0.391
HK_1	0.377	0.447	0.305	0.410	0.607	0.305
HK_2	0.456	0.514	0.523	0.391	0.764	0.332
HK_4	0.400	0.338	0.343	0.396	0.709	0.351
HK_5	0.471	0.431	0.416	0.458	0.844	0.473
HCP_3	0.238	0.353	0.400	0.319	0.358	0.775
HCP_4	0.134	0.166	0.251	0.201	0.382	0.782
HCP_5	0.268	0.200	0.256	0.367	0.461	0.829

Table 3.
Cross loading

suggesting that the square root of AVE of each construct should be higher than the inter-correlations of the construct vis-à-vis other constructs as shown in Table 4. Both analyses have confirmed the discriminant validity of all the constructs.

4.2 Assessment of structural model

Before the structural model was tested, the model fit was initially evaluated. Hair *et al.* (2017) suggests the three criteria for evaluating a model fit. This includes the coefficient of determination (R^2), predictive relevance (Q^2) and effect size (f^2). The coefficient of determination (R^2 value) determines the degree to which an independent construct could explain or predict a dependent construct. The R^2 value for the healthcare performance of 0.287 indicates that improvement culture, self-development, qualification, gemba and hoshin kanri can be accounted for 28.7% of the variance in healthcare performance.

Stone (1974) and Geisser (1975) have developed predictive relevance (Q^2 value) in order to assess the model fit. This technique determines the ability of a model to predict the

	IC	SD	QF	GB	HK	HCP
IC	*0.727*					
SD	0.637	*0.799*				
QF	0.532	0.586	*0.725*			
GB	0.640	0.583	0.609	*0.766*		
HK	0.579	0.579	0.537	0.561	*0.736*	
HCP	0.272	0.299	0.377	0.377	0.506	*0.796*

Note(s): IC (Improvement culture), SD (Self-development), QF (Qualification), GB (Gemba), HK (Hoshin kanri) and HCP (Healthcare performance)

Table 4.
Discriminant validity

manifestation of the indicators for each latent construct. For this study, the Stone-Geisser Q^2 (cross-validated redundancy) was computed in order to look into the predictive relevance using the blindfolding procedure in PLS. Chin (1998) explains that a Q^2 value that is greater than zero indicates that the model has a predictive relevance. This study has revealed that the Q^2 values of healthcare performance are greater than zero. This implies that the model has a predictive relevance. The effect size (f^2) could look into the strength of the effect of a specific independent construct on the dependent construct of the model (Hair et al., 2017). Effect size assesses the changes in R^2 value if a specific predictor variable had been included in the model. Cohen (1983) explains that $f^2 = 0.12$ gives a small effect, $f^2 = 0.15$ yields a medium effect and $f^2 = 0.35$ exerts a large effect. The results reveal that hoshin kanri greatly affects lean healthcare performance ($f^2 = 0.153$). This is followed by gemba ($f^2 = 0.025$) then qualification ($f^2 = 0.021$).

PLS is a non-parametric technique that does not assume that a given set of data is normally distributed. As such, non-parametric bootstrapping was employed to test the research hypotheses; bootstrapping is specifically applied to the 217 cases and 2000 subsamples (Henseler et al., 2009). The findings revealed that gemba ($\beta = 0.303$; $p < 0.01$), and hoshin kanri ($\beta = 0.449$; $p < 0.01$) have a highly significant and positive effect on lean healthcare performance, thus, hypotheses H4 and H5 are accepted. The improvement culture ($\beta = 0.127$; $p < 0.05$) and qualification ($\beta = 0.241$; $p < 0.01$) have a significant positive effect on lean healthcare performance, therefore, hypotheses H1, and H3 are accepted. However, self-development ($\beta = -0.049$; $p > 0.05$) has no significant impact on lean healthcare performance, thus, H2 is not supported (Table 5).

5. Discussion

The results indicated that improvement culture, qualification, gemba, hoshin kanri and healthcare performance have a significant impact on the effectiveness of lean healthcare performance. It implies that healthcare organizations prioritize qualifications, improvement culture, gemba and hoshin kanri of lean leaders. These findings are consistent with the findings of previous studies by Ljungblom (2012) and Migita et al. (2011). Nordin et al. (2010) explains that implementation of lean is not an easy undertaking. For an organization to succeed, hindrances must be identified and comprehended.

The findings revealed that self-development has no significant impact on lean healthcare performance. Portioli-Staudacher (2010) supports the reason for the rejection of hypothesis (H2) that it is because leaders who do not involve themselves with the frontline employees. This kind of non-involvement poses a setback in the implementation of lean healthcare organizations. Further reiterated by Anner (2015) and Karimi and Walter (2015), top management who suggests and instructs only through controlling the dynamics of a workplace do not encourage and sustain lean transformation. Lean leaders need to give opportunities for the staff to develop and motivate them as well in order for them to be involved in the implementation of lean. Along with this is the delivery of empowerment to

Hypothesis	Relationships	Path coefficients	Decision
H1	IC → HCP	0.127*	Supported
H2	SD → HCP	−0.049	Not Supported
H3	QF → HCP	0.241*	Supported
H4	GB → HCP	0.303**	Supported
H5	HK → HCP	0.449**	Supported

Note(s): Significant level at *$p < 0.05$, **$p < 0.01$

Table 5.
Hypothesis test

deliver decisions without having to follow the path of the usual decision-making process. Eswaramoorthi *et al.* (2011) explain that various types of lean training are required for healthcare and non-healthcare staff to undertake. The absence of understanding of lean training may be considered a hindrance to lean healthcare improvement; consequently, the absence of awareness and training about lean healthcare concepts also constitutes low participation. The results reveal that a lean leader who undertakes hoshin kanri (target management) creates the greatest influence on the overall performance of lean healthcare. The improvement culture, gemba (shop floor management) and qualification of lean leaders have a significant influence on the effectiveness of lead healthcare performance.

The results indicated that self-development is a negative indicator for lean leadership behaviors in influencing lean healthcare in Malaysia. Such indicators can be perceived as controllable behaviors which are possible to the greater population of lean leaders. Hiring a qualified healthcare professional is deemed much more plausible than having to select leaders without an improvement culture. The lack of self-development is perceived as the most difficult hindrance to implementing lean in healthcare institutions (Nordin *et al.*, 2010; Portioli-Staudacher, 2010).

6. Theoretical and managerial implication

Theoretically, the research has gained a better and wider scope of comprehension of the factors such as improvement culture, self-development, qualification, gemba and hoshin kanri, which contribute to lean leadership among healthcare practitioners in the public healthcare sector and the nature of lean healthcare in the context of Malaysia. The findings have also contributed to the existing literature about lean healthcare services. It is with the hope that this study will be able to contribute to the future development of lean leaders both in the private and public healthcare systems including further improvement of lean healthcare performance. This study concludes that lean healthcare performance in Malaysia is influenced by three main leadership behaviors, such as qualification, gemba (hands-on approach) and hoshin kanri (goal-oriented). The research was done under the assumption that lean leadership is practiced in the healthcare industry in Malaysia through training and development. Leaders who can inspire and motivate their subordinates would be able to achieve the objectives of lean leadership. It has also been observed and understood that those healthcare practitioners included in the study conducted at University Malaya Medical Centre and Hospital Kuala Lumpur have been practicing similar styles of lean leadership in the same organization.

This study offers managerial contributions for policymakers to improve hospitals' operations through the implementation of lean healthcare-related factors such as improvement culture, self-development, qualification, gemba and hoshin kanri. The antecedents of lean healthcare performance should be considered by managers in hospitals to be competitive policies and strategies that lead to improved effective lean healthcare performance in Malaysian public hospitals. To gain the full potential of lean healthcare performance, the improvement culture, qualification, gemba and hoshin kanri are required to adopt and implemented in the healthcare industry. According to the findings, it is assumed that gamba and hoshin kanri, improvement culture and qualification are the most crucial factors that contributed to the effectiveness of lean healthcare performance in the hospitals. They also represent the key to facilitating successful implementation for the effectiveness of lean healthcare performance in the public hospitals in Malaysia. The hospital managers can remove barriers to achieving the goals of lean healthcare performance, and provide the necessary resources, particularly training for employees to improve and sustain the quality performance of the hospitals. The quality and accessibility performance may improve lean healthcare performance in private hospitals.

7. Limitations and future study

The respondents in the survey are all Malaysians who are deemed to be literate in English and Bahasa Malaysia. The questionnaire was written in bilingual form to ensure the full participation of the in-house nurses and the language mastery of the respondents. This was also done to ensure that respondents would feel comfortable and convenient in answering the questionnaire in their mother tongue. The research is limited only to public healthcare institutions; thus, the results do not include private healthcare institutions. Perhaps, this may weaken the analysis and justification of the analysis on lean leadership.

Doctors and nurses who were included in this study may have perceived that their participation in the survey would influence their overall assessment and annual performance review. They may have also perceived that non-participation would be held against the appraisal of their job performance. This study is limited only to the assessment of lean leadership behaviors that influence the healthcare industry from the organizational perspective only. Future studies can be undertaken to assess the perception of patients.

Future studies may be done on the organizational culture of how leadership influences the creation of lean healthcare in a strategic setting. Included in this is a study on the problems of lean leadership and how to improve lean strategies in the public and private healthcare systems in Malaysia. The lean healthcare performance revealed that the public hospitals in Malaysia are wary of the technical resources, time and improvement of quality over saving costs. Including business values like medication technology resources, and reduction of transaction time could lead to influence on cost-saving strategies.

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