

MEASURING THE LEVEL OF LEAN HEALTHCARE IMPLEMENTATION OF PRIVATE HOSPITALS TOWARDS ORGANISATIONAL PERFORMANCE

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ABSTRACT

Private healthcare in Malaysia is one of the industries that contributes toward National GDP. However, increasing costs and waste has led to the issue of sustainability. Numerous studies examined the impact of lean healthcare practices on organisational performance. However, there is limited research examining the level of lean healthcare practices among private hospitals. Hence, this study attempted to investigate the level of lean healthcare implementation that lead to enhanced operational performance. The sociotechnical and operational aspects are variables adopted to measure the level of implementation of lean healthcare practices on operational performance. The questionnaire was developed based on previous literature, comprising three aspects, namely operational (24 items), sociotechnical (8 items), and operational performance (10 items). Out of 184 private hospitals in Malaysia, 118 were randomly selected, and 54 questionnaires were returned and used for analysis. Rasch quality control was applied to ensure that the instrument was valid, reliable, and able to measure what it is supposed to measure. It was found that sociotechnical aspect is difficult to implement as compared to operational aspect. Motivation factor dimensions contribute the highest mean value, which is indicative that if an organisation is able to improve this dimension, it is then able to further improve the organisational performance.

Keywords: *Operational aspects, sociotechnical aspects, lean healthcare, Rasch Measurement Model*

INTRODUCTION

The healthcare sector in Malaysia has been progressively developing since the early 1990s and was recognised under the Tenth Malaysia Plan (2011-2015) as one of the National Key Economic Areas, or NKEA (Jamaludin, Habidin, Shazali, Ali, & Khaidir, 2012).

According to the Department of Statistic's Index of Services, private healthcare contributed 5.6 percent to the index for the fourth quarter of 2015 (Department of Statistics Malaysia, 2016). Despite an annual growth with an average of 5.5 percent and a contribution of RM24.1 billion to Malaysia's economy during the whole of the Tenth Malaysia Plan (Economic Planning Unit, 2015b), private healthcare poses a variety of challenges due to increasing private healthcare spending, and thus, affecting the performance and sustainability of the healthcare system. The Ministry of Health Malaysia (2011) also stated that sustainability issues are related to increasing costs that lead to waste, which is a notion supported by Ramlan and Ahmad (2014).

Nerminathan et al. (2014) proposed that in order to minimise expenditure and rising costs related to healthcare, healthcare providers need to consider reducing waste, which would then ensure improved organisational performance. The implementation of lean healthcare will assist organisations to eliminate waste, which is seen as one of the best practices to accelerate productivity (Economic Planning Unit, 2015a). There are numerous studies on lean healthcare; however, the variables and dimensions tested vary among researchers, which inadvertently leads to different outcomes. Most studies focused on operational aspects such as the application of lean tools; however, social aspects have always been overlooked as an intervention tool at the operational level (Joosten et al., 2009). Hence, this study adopted operational and sociotechnical aspects as variables to be measured when gauging the operational performance of private hospitals. These two variables are discussed separately in relation to operational performance. Hence, this study attempted to measure the operational performance of private hospitals by adopting both variables. Most of previous analysis were inferential analysis and qualitative analysis, however this study attempted to measure the level of implementation by measuring the level of item difficulties. The Rasch Measurement Model was adopted as the analysis technique.

The Rasch Measurement Model (RMM), using the Winsteps software, is a tool of analysis used mainly due to its capability to convert an ordinal response or rating into an interval response. The rating is only an order of preference that is continuum in nature and not linear, as well as not having equal intervals, thus, contradicting the nature of numbers in statistical analysis (Azrilah Abdul Aziz et al., 2008; Wright, 1977). RMM moves away from the concept of "best fit line" when predicting linear regressions but it fits the Rasch model. RMM focuses on constructing an accurate measurement instrument rather than fitting the data to suit a measurement model with errors.

LITERATURE REVIEW

Operational Performance in Healthcare Sector

There are numerous studies that measured the operational performance of healthcare sector. According to Li and Benton (1996), the healthcare sector's performance can be characterised into internal and external measures that involve two dimensions, namely cost or financial status, and quality performance. Meanwhile, Elg, Palmberg Broryd, and Kollberg (2013) identified three approaches to measure performance in healthcare organisations, such as management accounting, operational performance, and

strategic control. Conversely, several studies (Nerminathan et al., 2014; Elg et al., 2013; Capkun et al., 2012; Gares 2011) had analysed operational performance using average length of stay (ALOS) or length of stay (LOS), which refers to the number of days patients stay at the hospital.

In addition, Elg et al. (2013) and Pillay et al. (2011) had embraced the elements of processes that measure performance, which covers waiting time (examination and surgery) and lengthy waiting time based on various departments. Currently, lengthy waiting time has become a major problem in the healthcare setting and now, the phenomenon has become worldwide, including healthcare in Malaysia (Pillay et al., 2011). Correspondingly, several studies (Davis et al., 2013; Chen, 2013; Elg et al., 2013; Caballer-Tarazona et al., 2010; Gomes et al., 2010) had considered efficiency as part of operational performance in healthcare organisations because operational performance has been viewed as a critical element to quantify efficiency of action (Elg et al., 2013).

On the contrary, Hadid et al. (2016) categorised internal and external customer satisfaction, waste elimination, and reduction in process time as indicators of operational performance in the service sector. Meanwhile, Cho (2014) used operational capabilities that comprised costs, quality, speed, and flexibility to measure business performance in the hospitality industry. Traditionally, these dimensions have been applied for measuring operational performance in the manufacturing industry. Previous studies (Wiengarten & Longoni, 2015; Nawanir et al., 2013; Chavez, Gimenez, Fynes, Wiengarten, & Yu, 2013; Rahman, Laosirihongthong, & Sohal, 2010) suggested that costs, quality, delivery, inventory minimisation, productivity, and flexibility be considered as factors effecting operational performance. Liaropoulos & Goranitis (2015) had highlighted these dimensions as traditional issues affecting quality of care, cost-effectiveness, and patient involvement in the healthcare sector.

Nevertheless, Purbey et al. (2007) argued that performance measurement in the healthcare industry is still an unsettled issue. This is because many scholars are unable to establish a consensus on what are the constructs of operational performance as most constructs overlap with one another. However, according to Yasin and Gomes (2008), it evident that literature on operational performance (efficiency, quality, flexibility, and reliability) in the service sector appears to be the main focus among scholars compared to other categories. Furthermore, they argued that there are fewer empirical studies concerning performance issues.

Therefore, this study was ideally concerned about relevant operational performances linked to lean healthcare practices. Hence, for the purpose of this study, operational performance was defined as an organisation's capability to make improvements on several aspects.

Lean Healthcare Practices

The implementation of lean practices as well as its approaches or tools is still based on the principles of lean thinking introduced by Womack and Jones (1996) and it is exceptionally relevant to other sectors (Burgess & Radnor, 2013). Furthermore, the use of terms such as lean practices, tools, techniques, and others keep on changing among scholars and it is arguable whether these terms are similar or different from one another. Plytiuk et al. (2013) identified lean healthcare practices and analysed the practices based on 19 categories that were frequently cited by scholars and the results revealed that six practices were predominant. Meanwhile, Aoun (2015) postulated that lean practices fall into two dimensions, namely lean strategies and standardisation. Lean strategies include *kaizen*, *kanban*, JIT, *andon*, *jidoka*, *poka yoke*, quick changeover, and *Hoshin Kari*, while standardisation solely focuses on the 5s.

In a similar vein, Machado et al. (2014) used lean tools as an instrument to describe the implementation of lean philosophy that helps to solve the waste problem and affected hospitals to make a decision. They summarised about 11 tools from preceding scholars. Chiarini (2013) showed in her study that the effectiveness of using lean tools in departments, wards, and outpatient clinics in a large Italian public hospital in the form of VSM, spaghetti chart, and activity worksheet, had helped to solve patient transportation issues. Hence, lean tools managed to achieve a reduction in time wastage and cost by shifting the patient from the emergency room to hospitalisation and finally, to being discharged. Likewise, Radnor (2011) claimed that it is adequate to use simple techniques or tools in public hospitals such as 5s, VSM, visual management, process mapping, and *kaizen*. Radnor (2011) also proposed lean implementation programmes in the form of short-term workshops known as Rapid Improvement Events (RIE's) or a *kaizen* event in order to sustain long periods.

Furthermore, Gowen III et al. (2014) found that lean tools used in lean management implementation (LMI) consisting of JIT, process and VSM, *kaizen*, and 5s had extraordinarily improved patients' safety due to lean management tools being easily implemented and the ability to provide prompt results. However, it is argued that the implementation of lean tools does not reach the level of competitiveness because the deployment of lean is quite limited. Elshennawy et al. (2012) found that approximately 80 percent of hospital managers reported adopting lean activities and tools comprising waste elimination, continuous improvement, five whys, VSM, types of wastes, and 5s. Jorma et al. (2016) found that the PDCA cycle, *kaizen*, VSM, and root cause analysis were the most adopted lean tools in the Finnish public healthcare service, whereas, 5s, visual control, and *kanban* were reported to be the least adopted lean tools.

Typically, the interpretation of lean practices, tools or approach remain the same; however, the above arguments emphasised more on technical or operational aspects, but unfortunately not in the context of human or social aspects. Joosten et al. (2009) firmly remarked that sociotechnical aspects were generally overlooked when making interventions at the operational level since most of the research mainly focused on operational aspects. Waterson, Gray, and Clegg (2002) said that a work system based on sociotechnical principles (STS) should be classified into two provisions that include technical (human and machine) and social (human and human) aspects. However, previous studies had shown that "respect-for-human-system" or also known

the sociotechnical aspects, have drawn much attention from academicians and practitioners in efforts to make lean implementation successful (Joosten, Bongers, & Janssen, 2009).

Operational Aspects of Operational Performance

Some studies on manufacturing organisations indicated positive results regarding the relationship between lean practices and operational performance (Chavez et al., 2013; Nawanir et al., 2013; Rahman et al., 2010). Meanwhile, Jr. (2006) claimed that JIT was the backbone of lean manufacturing and also encompasses the TPS Model house, which has a positive impact on organisational performance. Furthermore, his study found a strong relationship between the integration of technology with lean manufacturing and organisational performance, such as quality, cost, morale, ergonomics and safety, human resource, inventory control, attendance, and response time. These results were consistent with those of other studies concerning the service sector as well as technical lean service consisting of process factors, error prevention factors, and customer value that have a positive relationship with operational performance (Hadid et al., 2016).

There are limited studies concerning the relationship between lean healthcare practices and operational performance in a healthcare setting. Al-Hyari, Abu Hammour, Abu Zaid, and Haffar (2016) had empirically substantiated that lean bundles comprising JIT, HTM, and TQM intensely improve hospital performance of private hospitals in Jordan. However, there have been proposals to examine the relationship between lean management and improvement in hospital services, such as cost, quality, safety, and delivery (Roszell, 2013). Operational failures such as scheduled medication not delivered on time and adjourning patient care causing patient harm have been identified as major errors or disruptions to system functionality. In addition, Miller and Chalapati (2015) had shown that lean tools such as root cause analysis and VSM are able to dramatically reduce waste and improve productivity at Indian hospitals.

Consequently, it has been revealed that less cost is incurred if average length of stay (ALOS) is shorter, while lower costs are associated with higher mortality rates (Stock & McDermott, 2011). Hence, this analysis verified that operational performance has a positive correlation with overall hospital costs. Meanwhile, Gares (2011) discovered that LOS is significantly associated with overall patient satisfaction. The study was conducted in an acute inpatient medical/surgical nursing unit, which was restricted to patients who were 18 years old and above and discharged from the hospital in seven days or less.

The results showed improvements in operational performance, which is evident in the reduction of staff that had led to patients' reduced length of stay as well as reduced hospital costs because principally, lean goals based on the Toyota House attempts to reduce costs, lead times, provides best quality, safety, and high morale (Suryadevara, 2015).

In summary, past studies indicated that operational performance is strongly associated with lean practices. However, various scholars debated that lean management refers to a set of complementary operating practices that intend to eliminate unnecessary activities throughout the organisation (Hajmohammad, Vachon, Klassen, & Gavronski, 2013). Therefore, this study examined whether operational aspects influence operational performance in Malaysian private hospitals.

Sociotechnical Aspects and Operational Performance

Several studies on lean healthcare practices have focused on sociotechnical and operational performance aspects in healthcare organisations. However, some studies have shown positive results, such as studies conducted in the service sector by Hadid et al. (2016), which revealed that social bundles have a positive effect on operational and financial performances. Unfortunately, the social bundles that have a positive effect were only motivational factors, and not human factors. Human factors were found to have an insignificant relationship with operational performance. Operational performance was measured based on internal and external customer satisfaction, waste elimination, and human errors. Meanwhile, with regard to the healthcare setting, Ulhassan et al. (2014) emphasised on teamwork from a sociotechnical aspect and found that more than 80 percent of patients were discharged in a short period of within four hours. Moreover, strong leadership among the leaders and staff has made lean implementation more efficient. Besides that, effective communication between doctors, nurses and staff together as well as the harmonisation among patients have an exceptionally successful team. Indeed, Abdallah (2014) has judgmentally identified leadership as one of the most important factors that drives the challenge to implement quality initiatives in the hospital. Hence, leadership can either lead to success or failure. Nonetheless, Mark, John, and Tony (2013) reviewed several articles pertinent to the relationship between lean healthcare and the Productive Ward: RTC (releasing time to care) programme, in which they discovered that leadership plays a significant role in developing an organisation's socio-cultural aspects. Indeed, implementing quality improvement would form a socio-cultural environment for lean. However, findings had revealed that studies on sociotechnical aspects and operational performances were limited. Therefore, to bridge the gap, there is a necessity to examine the roles of sociotechnical aspects in the Malaysian context.

RESEARCH METHODOLOGY

Sample

This study was conducted at private hospitals in Malaysia as the unit of analysis. A total of 187 private hospitals were in the population frame and 118 samples were randomly selected based on Krejcie and Morgan (1970), however only 54 (45%) participated in the survey, and useable in this study. These respondents comprised the management team from these hospitals, such as general managers, quality managers, and other managers who have knowledge and experience about lean healthcare.

Instruments

The questionnaire used in this study was developed based on an exhaustive literature review regarding lean healthcare practices and operational performance in the context of private hospitals. The questionnaire was designed to evaluate an organisation's willingness to implement lean healthcare practices. The questionnaire consisted of 42 questions separated into three variables, which were the operational aspect (24 items), sociotechnical aspect (8 items) and organisational operational performance (10 items) aspect. Details of these items can be found in Table 1 below. Responses to the questionnaire were evaluated using a Likert scale ranging from "1" (strongly disagree) to "6" (strongly agree) (Sekaran, 2003). All the items were adapted from numerous authors such as Hadid, Mansouri, and Galler (2016), Woehl (2011), Gupta and Jain (2015), Malmbrandt and Åhlström (2013), and Aoun (2015).

Table 1
Measurement items

No	Items	Statements	Sources
Operational Aspects			
1	OA_KAI1	The hospital practices continuous improvement.	Woehl (2011)
2	OA_KAI2	Specialized teams gather and assess data to track work improvements.	
3	OA_KAI3	Implementation of improvement plans enable employees to become more efficient.	
4	OA_KAI4	Continuous improvement focuses on waste reduction and efficiency improvement.	Gupta and Jain (2015)
5	OA_FS1	The hospital provides clear written standards to dispose unused things.	
6	OA_FS2	There is no unused machine or equipment present.	
7	OA_FS3	Shelves are labeled with signboards for identification.	
8	OA_FS4	Storage areas are marked with indicator.	
9	OA_FS6	The floor is free of wastewater and oil.	
10	OA_FS7	The air in the hospital is odorless and fresh.	
11	OA_FS8	All staff prevents dirtiness in the hospital compound.	
12	OA_FS9	The hospital is equipped with adequate lighting.	
13	OA_FS10	Activity boards up are up to date and regularly reviewed.	
14	OA_VSM1	Visual stream mapping (VSM) is able to identify waste within the hospital.	Malmbrandt and Åhlström (2013);
15	OA_VSM2	VSM helps the flow of hospital operations to work smoothly and continuously.	
16	OA_VSM3	Process maps of each department are updated more often than once per year.	Aoun (2015)
17	OA_WE1	The hospital trains the employees on methods to identify waste.	
18	OA_WE2	Employees are capable of using tools like Ishikawa (fish bone) diagrams, to identify sources of waste.	
19	OA_VM2	Visual sign (e.g. colors) are used to distinguish similar items at the workplace.	
20	OA_KA1	Signboard system is used to control in-process inventories.	
21	OA_KA2	Materials, tools and equipment are stored in standard size containers	
Sociotechnical Aspect			
22	SA_M1	The hospital has shown a good management support.	Hadid et al. (2016)
23	SA_M2	The hospital has provided a good reward system.	
24	SA_M4	The hospital always provided training to the employees and top management.	
25	SA_HF1	The hospital has shown a good leadership practice.	
26	SA_HF2	The employees have shown a good involvement towards the hospital.	
27	SA_HF3	The employees have shown a good commitment towards the hospital.	
28	SA_HF4	The hospital permits the employees to make a decision.	
Operational Performa			
29	OP1	The hospital managed to reduce operational cost.	Hadid et al. (2016)
30	OP3	The hospital has shown a better operational efficiency.	
31	OP4	The hospital managed to reduce human errors.	
32	OP6	The hospital consistently provides high-quality service.	
33	OP7	The hospital concerned about the customer satisfaction.	
34	OP8	The hospital concerned about the employee satisfaction.	
35	OP9	The hospital concerned about the employee performance.	

In theory, the study at this stage was only counting the prioritised responses from organisations. The rating intended to determine the order of preference, which is continuum in nature and not linear as well as not having equal intervals, which contradicts the nature of numbers in statistical analysis (Azrilah Abd Aziz, Mohamed, Arshad, Zakaria, Zaharin, Ghulman, & Masodi, 2008; Wright, 1997b). In the traditional test, the scatter plot is applied to establish the best regression. However, prediction based on ordinal responses is almost impossible due to absence of interval scales. Hence, Rasch Measurement Model (RMM) by using Winsteps converts ordinal data into interval values called *logit*.

RESULTS

Data collected from 54 respondents representing private healthcare institutions were analysed in accordance with the RMM using Winsteps software Version 3.68.2. The reliability, unidimensional, and fit analysis are discussed below.

Reliability Analysis

Table 2 below shows the results indicating item and person reliability. The Cronbach alpha value obtained was 0.97, which indicates a high internal consistency between the set of items used in this instrument. Further analysis on the internal consistency is discussed in the unidimensional analysis section. As stated by Bond and Fox (2015), a reliability index of >0.5 and a separation index of > 2 is regarded as adequate in the RMM. Measurement of 35 items showed that item reliability was at 0.89 and item separation was at 2.84, which is satisfactory (Fisher, 2008; Linacre, 2004). Meanwhile, person reliability was at 0.96 with separation at 4.90, which is considered to be at an excellent level (Fisher, 2008).

Table 2
Reliability analysis

Parameters	Index
ITEM	
Reliability	0.89
Separation	2.84
PERSON	
Reliability	0.96
Separation	4.90
Cronbach alpha	0.97

Unidimensionality Analysis

This refers to one underlying measurement construct or dimension that accounts for variations in examinee responses. Violating this assumption could severely bias the item and the ability for parameter estimation (Yu, Popp, Digangi, & Jannasch-

Pennell, 2007). Table 3 shows the standardised residual variance in Eigenvalue units. The raw variance is explained by measures that was 40.7 or 53.7%, which is considered a strong measurement dimension, while unexplained variance for the first construct was 5.8 or 7.6%, which indicated that the first factor of residual support unidimensionality (Conrad, Conrad, Dennis, Riley, & Funk, 2011).

Table 3
Dimensionality indices

Variance	Eigenvalue	Percentage%
Raw variance explained by measure	40.70	53.70
Raw variance explained by person	23.90	31.60
Raw variance explained by items	16.80	22.20
Unexplained variance by 1 st contrast	5.8	7.6

Item fit analysis

The validity of the items in the RMM framework is detected by Mean Square (MNSQ), Standard Deviation (ZSTD) and Point Measure Correlation (Pt MeaCorr) indices. According to Bond and Fox (2015), the yardstick for item fit is a Pt MeaCorr of between 0.4 and 0.8, an outfit MNSQ that lies between 0.5 and 1.5, with a ZSTD that is within ± 2 . The 35 items representing three dimensions, were fit to the model. Figure 1 below shows the model fit within 95% confidence interval.

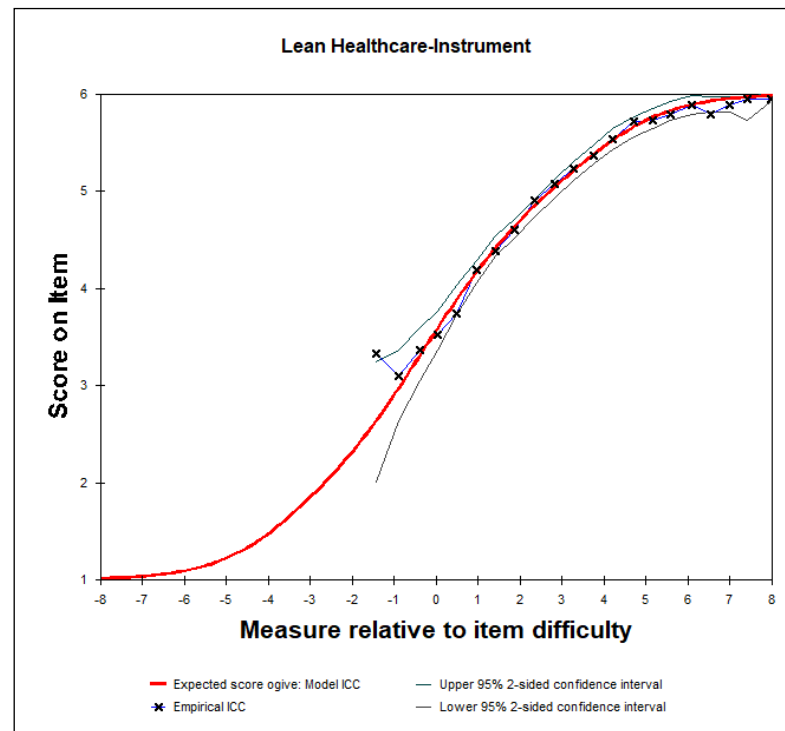


Figure 1
Model Fit

DISCUSSION

The questionnaire was developed to measure the level of implementation of lean healthcare factors among private hospital. The two variables were operational aspect and social technical aspect. Person-item distribution map in Figure 2 below places the ability of respondents on the left hand side and item difficulties are distributed on the right hand side of the map. The 35 items were divided into three 3 columns.

The mean item for all 35 items was 0.00 logit and mean for person was reported at 2.59 logit. It was noted that about 38 or 70% of the respondents had ability to perform all the items. They had no difficulties and were able to implement all related items with regard to lean healthcare. A total of 16 respondents or 30% of respondents had potential to improve their lean healthcare practices and will lead to enhance organisational performance.

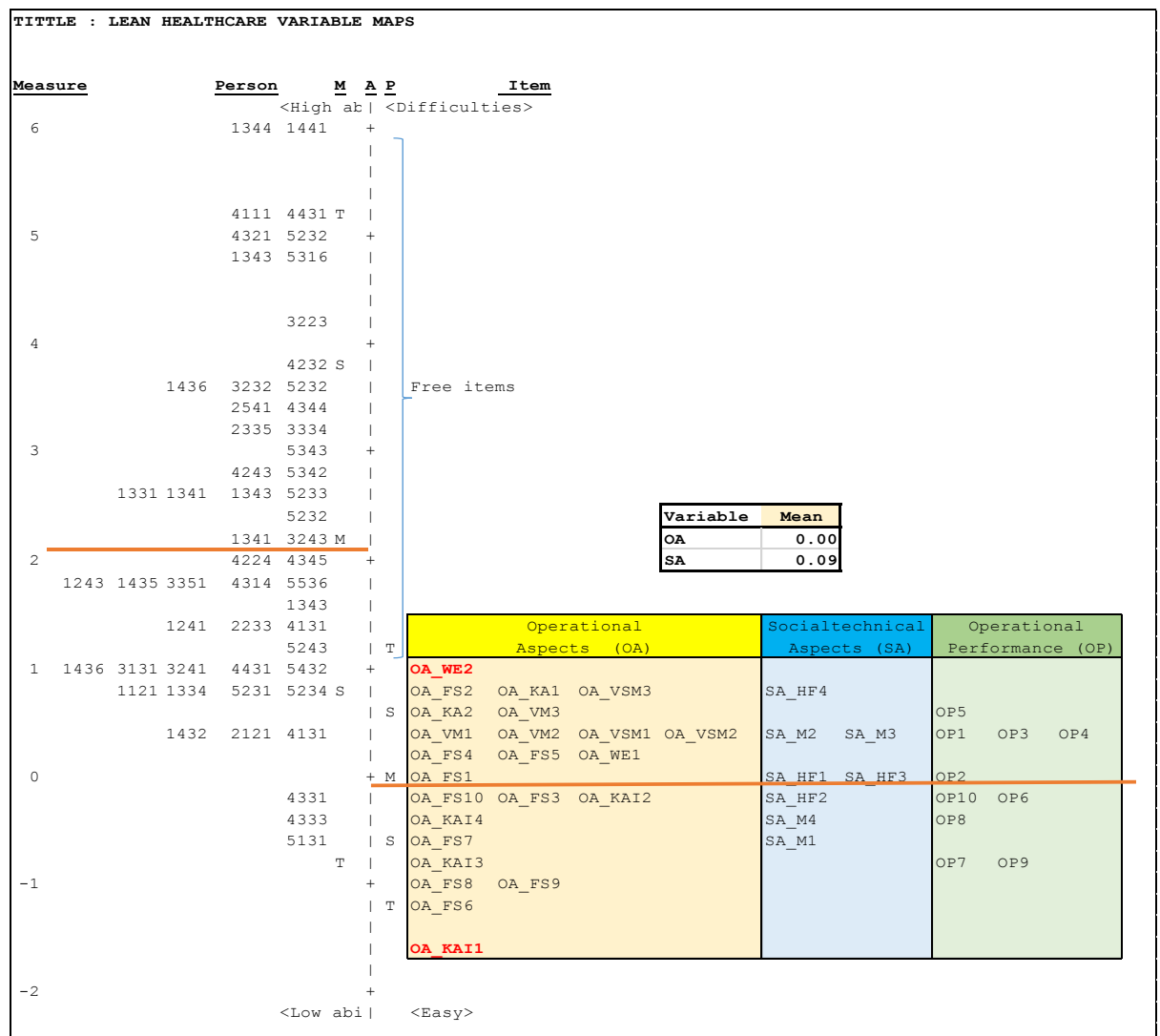


Figure 2
Person-item distribution Map

Figure 2 above also indicated that the easiest item to perform is OA_KAI1 which is related to the statement “the hospital practices continuous improvement” and the most difficult item to perform is OA_WE2, which is related to the statement “employees are capable of using tools like Ishikawa (fish bone) diagrams to identify sources of waste”. This indicated that all the responses organisation did practice the continuous improvement, however 13 out of 54 responded, which stood at 24%, were not familiar with quality tools such as Ishikawa diagram.

Among the three variables examined (operational aspects, sociotechnical aspects, and operational performance) the highest mean was reported by sociotechnical aspects at 0.09 logit as compared to operational aspects at 0.00 logit. This indicated that sociotechnical aspect variable is perceived by respondents to be difficult to implement at their organisation. There two dimensions representing the sociotechnical aspect variable, are the motivation factors (SA_HF1 - SA_HF4) and human factors (SA_M1-SA_MA4). The results showed that the mean_{item} for motivation factors is higher than human factors, namely 0.25 logit and -0.12 logits respectively. This indicated that the motivation factors play an important role in ensuring the performance of the organisations. This finding is consistent with Hadid et al. (2016) where the result showed the significant relationship between motivation factors and operational performance. Nevertheless the most difficult item to implement was SA_HF4 which represents “the hospital provides continuous training to the employees and top management”. No doubt due to time constraint, it is difficult to get people to attend training. On the other hand, SA_M1 was reported the easiest among sociotechnical aspect items, which is related to “the hospital has shown a good leadership practice”. Therefore, the private hospital may further enhance their organisational performance by not only focusing on lean technical aspects, but also giving more emphasis on social aspects.

CONCLUSION

This study had set out to examine the level of lean healthcare implementation among private hospitals in Malaysia. Two main variables employed were operational and sociotechnical aspects. Operational performance was the impact of the implementation. Rasch Measurement Model as adopted as analysis technique where it emphasises on the easy and difficult items. All the items were developed from the past literature. The results showed that the dominant factor among these two variables was the sociotechnical aspect. Upon further investigation, it was revealed that motivation factors have greater influence on the success of the lean healthcare implementation. Hence for the organisations that practice lean healthcare, they have to focus more on sharing information with employees, arrange more training, and also encourage lifelong learning. Besides this, good reward systems and good management support will boost employee performance, hence this would increase organisational performance.

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