

HOSPITAL SAFETY: INVESTIGATION OF 5S IMPLEMENTATION

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Abstract

Hospital safety is important in any hospitals to increase safety in design, construction, and operation within the hospitals. Many standards are currently implemented in Thailand, especially the Joint Commission International (JCI), the Quality Improvement (QI), and the 5S standard. The 5S standard assists in organizing the hospital, decreasing wastes, and optimizing its quality and productivity. Five key 5S factors, including Sort, Strengthening, Shine, Standardize, and Sustain, are used, together with their 24 associated items, to develop the questionnaire survey to investigate the perception of the standard implementation in different sized hospitals. The exploratory factor analysis confirms the five key factors with the high reliability. Moreover, the analysis of variance proves no difference in the standard implementation in different sizes of the hospitals.

Keywords: ANOVA, Exploratory Factor Analysis, Hospital Safety, 5S Implementation.

1. INTRODUCTION

Hospitals and healthcare services are vital component of any well-ordered and human society, and will indisputably be the recipients of societal resources (Hinchcliff et al. 2012). Quality of hospitals and healthcare services are also great interest. Hospital safety is developed to help increase safety in design, construction, and operation of hospitals. By focusing on hospital safety, hospital planners and administrators can transform the hospital environment into an essential component of the healing process (Hinchcliff et al. 2012).

In Thailand, there are three common international hospital safety standards, which are the Joint Commission International (JCI), the Quality Improvement (QI), and the 5S standards (Bangkok Hospital 2013). The Joint Commission International is a US-based non-profit organization focused on improving the safety of patient care and organization management through the provision of accreditation and certification. The standard focuses on 10 critical areas, including 1) access to healthcare, 2) infection control, 3) health assessment and care process, 4) collaborative integrated management, 5) education and rights of individuals, 6) facility management, 7) management of information and human resources, 8) performance measurement, 9) safety of facility, and 10) education and rights of patients (Bangkok Hospital 2013). The Quality Improvement, on the other hand, is a systemic approach to planning and implementing continuous improvement in performance. It emphasizes on continuous examination of work processes by team members trained in basic statistical techniques and problem solving tools, and empowered to make decision based on their analysis of the data (Bangkok Hospital 2013). The systemic focus of QI complements a growing recognition in the field that the quality of the care delivered by clinicians depends on the performance

capability of the organization systems in which they work. Operationally, QI combines three elements: 1) use of cross-functional teams to identify and solve quality problem, 2) use the scientific methods and statistical tools by these teams to monitor and analyze work processes, and 3) use of process management tools to help team members use collective knowledge effectively. Although QI holds promise for improving quality of care, hospitals often struggle with its implementation, as it requires sustained leadership, extensive training and support, robust measurement and data systems, realigned incentives and human resources practices, and cultural receptivity to change (Bangkok Hospital 2013).

Apart from the above two standards, most hospitals in Thailand also implement the 5S standard. This standard is a system to reduce waste and optimize productivity through maintaining an orderly workplace using visual cues to achieve more consistent operational results (Siliconfareast, 2002). Implementation of this method cleans up and organizes the workplace basically in its existing configuration. The standard considers the implementation of 5S, including Sort, Straightening, Shine, Standardize, and Sustain. However, it is not clear if this standard could be implemented in all hospitals, regardless of the size. This paper, thus, aims at investigating the implementation of the 5S standard in small-, medium-, and large-sized hospitals in Thailand, using the statistical techniques called the exploratory factor analysis and the analysis of variance. It is expected that the study results guide the hospital to effectively plan and implement such a safety standard.

2. FACTOR OF THE 5S STANDARD

According to Siliconfareast (2002), the 5S standard is a structured program to systematically achieve total organization, cleanliness, and standardization in the workplace. It is believed that with 5S implementation, a well-organized workplace results in a safer, more efficient, and more productive operation will occurs. To enhance the standard, each factor of the 5S is examined, as below.

2.1 Sort

Sort refers to the act of throwing away all unwanted, unnecessary, and unrelated materials in the workplace (Improsys 2010). The idea is to ensure that everything left in the workplace is related to work. Based on a number of hospital safety-related literature, this factor consists of three items as follows (Improsys 2010, St. Louis Community College 2013, Fetterman and Friend 2013).

- Eliminate non necessary items from the work area (S1.1).
- Separate work-related and non work-related items (S1.2).
- Sort own and nearby work areas (S1.3).

2.2 Straightening

Straightening or orderliness is all about efficiency (Improsys 2010). This step consists of putting everything in an assigned place so that it can be accessed or retrieved quickly, as well as returned in that same place quickly. If everyone has quick access to an item or materials, work flow becomes efficient, and the worker becomes productive. Based on a number of hospital safety-related literature, this factor consists of six items as follows (Improsys 2010, Ministry of International Trade and Industry Malaysia 2012, St. Louis Community College 2013, Fetterman and Friend 2013).

- Organize all the documents and work-related items (S2.1).

- Assign items in appropriate places, and provide signs indicating the designated areas (S2.2).
- Place items in the designated areas (S2.3).
- Provide the designated area for fire hydrants (S2.4).
- Utilize colors to symbolize work operations (S2.5).
- Provide enough space for storage (S2.6).

2.3 Shine

Shine consists of cleaning up the workplace and giving it a 'shine' (Improsys 2010). Cleaning must be done by everyone in the organization, from operators to managers. It would be a good idea to have every area of the workplace assigned to a person or group of persons for cleaning. Based on a number of hospital safety related literature, this factor consists of five items as follows (Improsys 2010, Ministry of International Trade and Industry Malaysia 2012, St. Louis Community College 2013, Fetterman and Friend 2013).

- Eliminate all impurities from the work space (S3.1).
- Provide signs indicating types of trash cans (S3.2).
- Clean all the equipments (S3.3).
- Publicly present responsibility chart and cleaning schedule (S3.4).
- Provide hand sanitizers (S3.5).

2.4 Standardization

Standardization consists of defining the standards by which personnel must measure and maintain cleanliness (Improsys 2010). It encompasses both personal and environmental cleanliness. Based on a number of hospital safety related literature, this factor consists of six items as follows (Improsys 2010, Ministry of International Trade and Industry Malaysia 2012, St. Louis Community College 2013, Fetterman and Friend 2013).

- Repair damaged area (S4.1).
- Repair damaged equipment (S4.2).
- Provide signs that clearly indicate men and women toilets (S4.3).
- Clean toilets regularly (S4.4).
- Keep electrical cords in safe places (S4.5).
- Provide adequate lighting and ventilating in work areas (S4.6).

2.5 Sustain

Sustain means discipline. It denotes commitment to maintain orderliness and to practice the first 4S as a way of life. It emphasizes on eliminating bad habits and practicing the good ones (Improsys 2010). Based on a number of hospital safety related literature, this factor consists of four items as follows (Improsys 2010, Ministry of International Trade and Industry Malaysia 2012, St. Louis Community College 2013, Fetterman and Friend 2013).

- Assign individual responsibility to maintain the 5S implementation (S5.1).
- Motivate individual to expedite the practice of 5S (S5.2).
- Provide a well-defined plan for practicing the 5S (S5.3).
- Set up the meeting to continually improve 5S implementation (S5.4).

A total of 24 items are then used in questionnaire survey development. Details are explained next.

3. DATA COLLECTION AND PRELIMINARY ANALYSIS

Target respondents are those working in small-, medium-, and large-sized hospitals. The respondents are familiar with the 5S implementation, and have direct responsibilities related to the 5S standard.

In this study, 150 surveys are launched, with 57 returns; representing 38% of the total surveys. Three of them are, however, incomplete, and thus are deleted from the data file. This leads to a total of 54 data for the analyses. The 54 data are then tested with the preliminary analyses, including the normality and outlier tests. Based on Tabachnick and Fidell (2007), the skewness and kurtosis value should not exceed zero and seven, respectively. The results show normal distribution for all data. Moreover, the z-scores of all data do not exceed 3.29, which are considered acceptable. The 5% trimmed means also show that there is no outlier in all data (Tabachnick and Fidell 2007). The screened data are then used to perform the exploratory factor analysis to confirm the key 5S standard factors into groups.

4. EXPLORATORY FACTOR ANALYSIS

The exploratory factor analysis (EFA) is used to identify complex interrelationships among items and group items that are part of unified concept. In this study, the principal axis factoring (PAF) method is used in the analysis, as the 5S factors are considered correlated with each other, and have a KMO value over 0.6 (Coakes and Steed 2003).

The varimax rotations, the factor loading of more than 0.3, and the eigenvalue over one, are used, together with the PAF method, to extract a number of key 5S standard factors. The first run extracts three 5S factors, with 70.54% total variance (as shown in Table 1). Factor 1 consists of eight items, explaining mainly on the Sort and Straightening factors. Factor 2, on the other hand, is associated with eight items, explaining the Shine and Sustain factors. Lastly, Factor 3 consists of eight items associated with the Standardize factor.

Table 1: Three factors extracted from the EFA.

Item	Factor		
	1	2	3
S2.3	0.84		
S2.2	0.82		
S1.2	0.75		
S2.1	0.70		
S2.4	0.65		
S2.5	0.59		
S1.1	0.53		
S1.3	0.46		
S5.3		0.86	
S5.2		0.78	
S5.4		0.75	
S5.1		0.66	
S3.1		0.64	
S3.4		0.59	
S3.5		0.56	
S3.3		0.50	
S4.3			0.74
S4.2			0.72
S4.4			0.71
S4.6			0.70
S2.6			0.66
S4.5			0.63
S3.2			0.59
S4.1			0.52

To further investigate the key 5S factors, and plan for 5S implementation, Factor 1 is reanalyzed with the exploratory factor analysis. The factor extraction is, however, set as two. The analysis results extract the eight items into two key factors; including the Sort (with two items) and Straightening (with six items) factors (see Table 2).

Table 2: Two factors extracted from Factor 1.

Item	Factor	
	Straightening	Sort
S2.2	0.79	
S2.3	0.74	
S2.1	0.73	
S2.4	0.71	
S1.3	0.63	
S2.5	0.52	
S1.1		0.82
S1.2		0.77

Factor 2 is also reanalyzed to separate the Shine and Sustain factors. The results contain the Shine factor with four items and the Sustain factor with four items (see Table 3). The reanalysis of the Standardize factor, however, cannot separate this factor into smaller groups, thus, confirming the Standardize factor with eight items.

Table 3: Two factors extracted from Factor 2.

Item	Factor	
	Shine	Sustain
S3.1	0.78	
S3.3	0.73	
S3.4	0.71	
S3.5	0.69	
S5.1		0.71
S5.2		0.86
S5.3		0.84
S5.4		0.72

In summary, the 24 items are grouped into five key factors, as shown in Table 4. To further confirm the extraction of the five factors, the reliability test is performed. The Cronbach's alpha of over 0.7 is considered acceptable (Pallant 2005). Table 5 confirms that all five factors are reliable.

Table 4: Summary of five key 5S factors extracted from the EFA.

Item	Factor				
	Sort	Straightening	Shine	Standardize	Sustain
S1.1	0.82				
S1.2	0.77				
S2.2		0.79			
S2.3		0.74			
S2.1		0.73			
S2.4		0.71			
S1.3		0.63			
S2.5		0.52			
S3.1			0.78		
S3.3			0.73		
S3.4			0.71		
S3.5			0.69		
S4.1				0.52	
S4.2				0.72	
S4.3				0.74	
S4.4				0.71	
S4.5				0.63	
S4.6				0.7	
S2.6				0.66	
S3.2				0.59	
S5.1					0.71
S5.2					0.86
S5.3					0.84
S5.4					0.72

Table 5: Reliability test results.

Factor	Cronbach's Alpha
1. Sort (2 items: S1.1 and S1.2)	0.86
2. Straightening (6 items: S2.1, S2.2, S2.3, S2.4, S2.5, and S1.3)	0.91
3. Shine (4 items: S3.1, S3.3, S3.4, and S3.5)	0.90
4. Standardize (8 items: S4.1, S4.2, S4.3, S4.4, S4.5, S4.6, S2.6, and S3.2)	0.94
5. Sustain (4 items: S5.1, S5.2, S5.3, and S5.4)	0.94

To further investigate the implementation of 5S standard in different sizes of hospitals in Thailand, the analysis of variance is performed.

5. ANALYSIS OF VARIANCE

According to Brandvold and McLemore (1998), the significant value of each factor should be over 0.5 to reject null hypothesis. In this study, the null hypothesis is assumed that sizes of hospitals affect the 5S implementation. The ANOVA results, as shown in Table 6, show the significant values of the five factors of over 0.5, thus, reject the null hypothesis. This could be concluded that the sizes of hospitals do not affect on the 5S implementation.

Table 6: The ANOVA test results.

Factor	Significant Value
Sort	0.70
Straightening	0.25
Shine	0.84
Standardize	0.35
Sustain	0.61

6. CONCLUSION

The 5S standard is considered one of the important safety standards implemented in the hospitals in Thailand. The five key factors, including Sort, Straightening, Shine, Standardize, and Sustain, are confirmed with the exploratory factor analysis with a total of 24 associated items to explain their constructs. The analysis of variance also confirms that there is no difference in the 5S implementation in the small-, medium-, and large-sized hospitals.

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