The Use of 5S in Healthcare Services: a Literature Review

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Abstract

The aim of this paper is to review the use of 5S in healthcare services. The scholarly literature up to June 2014 was searched through the Proquest, Pubmed and Google Scholar databases. Information about 5S, Lean, ways to implement 5S in healthcare settings, use of 5S in healthcare, combinations of 5S and other tools and suggestions to enhance success of 5S in healthcare services were reviewed. Results showed that 5S can be applied to healthcare services with beneficial effects. Sustain is a key to success.

Keywords: 5S, Lean, healthcare

1. Introduction

The costs of health care are increasing very rapidly, health care providers, clinics, hospitals, are under significant pressure to reduce costs despite more pressure to improve service and patient safety, reduce patient waiting times, and minimize errors and associated litigation. The total time from the beginning to the end of a patient process in hospitals, therapy settings and laboratories, and becomes a key measurement that needs to improve (Ahlstrom, n. d.).

The Toyota manufacturing company has developed system principles to address similar issues in automobile manufacturing (Ikuma and Nahmens, 2014). In the early 1980s Takashi Osada formalized a framework of applying 5S within a business (Ho et. al., 1995). Ho (1999) described 5S as a five-phase technique to establish and maintain a quality environment in an organization. 5S stands for five words translated from Japanese, sort, straighten/set in order, shine/scrub, standardize, and sustain. The outcome of 5S is a well-organized workplace, where employees can easily distinguish common and uncommon conditions to ensure a reduction of defects and costs, and to maintain a safe work environment (Ikuma and Nahmens, 2014). The basic idea is to provide what is needed, at the time it is needed and where it is needed. 5S is one of the tools that within the set of Toyota management system principles termed Lean thinking/philosophy (Womack and Jones, 1996). Lean practitioners recognize that the 5S is the foundation of a Lean facility (Summers, 2007). The original goal of 5S was to improve efficiency and product quality. After decades of development by automotive manufacturers, the implementation of Lean, including 5S, resulted in improved productivity, quality and safety (Ohno, 1988). Different health care institutes have adopted the 5S to improve efficiency and services. The aim of this article is to provide an updated account on the application and effect of 5S in healthcare services by reviewing the literature.

2. Materials and Methods

The scholarly literature up to June 2014 was searched through the Proquest, Pubmed and Google Scholar databases. In the medical database PubMed, using the search string "5S OR Lean OR Toyota Production System"; in the business/management database Proquest, using "5S OR Lean OR Toyota Production System" and a collection of health/medical care terms (e.g, health care, medical care, hospital, clinic); and (3) the interdisciplinary database Google Scholar using "health care OR medical care OR hospital OR clinic AND Lean OR Toyota Production System OR 5S." Finally, the references of retrieved articles were searched for other relevant articles. Books within the disciplines of Management and HealthCare were searched in the Hong Kong Shue Yan University library and the University of Hong Kong library in relation to the topic of 5S, Lean, Toyota Production System. The uses and applications of 5S management applicable to healthcare management were summarized.

3. Description of 5S

5S is a popular housekeeping management tool within the Lean paradigm. 5S is intended for the physical work environment and is the simplest to implement for organizing, standardizing and maintaining the workplace (Kilpatrick, 2003). 5S stands for sort (seiri), straighten/set in order (seiton), shine/scrub (seiso), standardize (seiketsu), and sustain (shitsuke). In Sort: Separate needed items from unneeded items by sorting through items and disposing of rarely used items using red tagging. In Straighten/Set in order: Arrange the remaining items to be most efficient and accessible following the process flow by organizing and labeling item locations. In Shine/Scrub: Maintain the work area for the already sorted and set in order items by cleaning the work area. In Standardize: Ensure consistency across all users by developing procedures to maintain and monitor the first three S's. In Sustain: Maintain and improve the outcome from sort, straighten/set in order, shine/scrub and standardize phase through the use of management audits to stay disciplined (Ikuma and Nahmens, 2014).

4. Description of Lean

"Lean" is a term adopted from Toyota manufacturing (therefore also referred to as Toyota Production System) defining a philosophy that reduce waste in any form and seriously strives to eliminate defects. Waste means any action that does not add value to the product. The Lean process evaluates operations step by step to identify waste and inefficiency and then creates new solutions to improve operations, increase efficiency, and reduce expenses. Lean Manufacturing Principles, are applied in the manufacturing environment, especially in the automotive industry. Two basic Lean concepts are: the relentless elimination of waste through standardization of processes and the involvement of all employees in process improvement (Ohno, 1988, Liker, 2004).

Another way of looking at Lean is through the five 'Lean principles' (Womack & Jones, 1996). These are based on an underlying assumption that organisations are made up of processes, and through engaging with these five principles in a step-wise and sequential way organisations can work to add value, reduce waste and continuously improve ("kaizen") in an ever-repeating process (Radnor et. al., 2012).

Lean is not a program, a quick fix, a responsibility that can be delegated, nor a set of quality improvement tools. It is a cultural transformation that changes how an organization works. It is a journey, not a destination. Unlike specific programs, Lean has no finish line. No one stays on the sidelines in the quest to discover how to improve the daily work. It requires new skills, new habits, and often a new attitude throughout the organization from senior management to front-line service providers. Creating a culture of Lean is to create a continuous desire for improvement; there is no turning back (Toussaint and Berry, 2013). Lean consultant Joan Wellman (2011) states, "With Lean, you will keep changing your definition of what 'good' is."

Radner and coworkers (2012) distinguished three aspects of the Lean activities: assessment, improvement, and performance monitoring. Assessment activities which include reviewing the performance of existing organizational processes in terms of their waste, flow or capacity to add value. Improvement activities to support and improve processes, e.g. Rapid Improvement Events ("kaizen blitz" or "kaikaku") which are held over several days and involve staff evaluating, developing and redesigning processes through forms of problem solving or housekeeping tools, such as "5S". Finally, monitoring to measure the processes and any improvements made, which include visual management tools that feature highly visible information on process flows, standard operating procedures and performance data.

In a Lean organization, everyone is responsible and accountable for integrating lean thinking principles, methodologies, and tools into daily work. In the health care perspective, it is simply providing the best value from the patient's perspective, while using the talents of the people in the system and the fewest resources (Fairbanks, 2007). Fairbanks (2007) identified eight wastes in any organization: unused human potential, waiting, inventory, transportation, defects, motion, overproduction, and processing.

This paper will focus on the Lean that included 5S.

5. Ways to Implement 5S in Healthcare Settings

When implementing 5S, staff should not focus on getting organized. Rather, they need to consider how they deal with all the things that come to them and what is within their environment; this will help in creating a 5S workplace (Ahlstrom, n.d.).

For example, doctors do not focus on getting their operating room organized. Instead, they have a defined process for preparing for an operation: they wash their hands in a certain way; the instruments used are predefined and laid out in a specific way. Instruments are checked and counted in a standard way for each surgical case every day. The result of these processes is a 5S workplace (Ahlstrom, n.d.).

5.1 Sort

The first step in the process is called "Sort".

Sort is getting rid of what is not needed. Unnecessary items were removed from the work spaces. All incomplete work was completed or removed from the area. The team created a redtag area to hold items that required a decision, such as whether the items needed repairs and replacement. All work areas, cabinets, and drawers were cleaned, organized, and labeled for contents (Fairbanks, 2007).

Experts described how to perform sorting (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007): it is about categorising items in your work environment. There are two main ways of sorting, first, for each items SORT into 3 groups: 1. always used; 2. sometimes used; 3. rarely used or, second, place into product families (i.e. IV requirements, Respiratory, Elimination, etc.). This allows workers to see how much space to allocate back in the storeroom when the items are returned. The reason behind is to identify the more important items needed to do your work (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007).

5.2 Set in order/Straighten

The next step is called "Set in order" or "Straighten", to put away the things that you wish to keep. However, this time you will put them in a specific location: "A place for everything and everything in its place." (Ahlstrom, n.d.).

Straighten involves placing the items in the order of flow. The team made sure that all work areas, storage areas, and equipment were clearly marked and well organized. Standard information boards were established for data management so that we could measure the success of the changes (Fairbanks, 2007).

Expert described how to perform Set in order (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007): the principle is to arrange work items in a sequence of process that relates to the work involved. Decide what high, medium and low use items are. When placing items back in the storeroom group items together according to their product family (IV equipment, Respiratory etc). Place high use items in the place with the easiest access and low use items further away. Also think about heights of shelves, high use items may be better at shoulder level, lower use at feet level. Heavy items shouldn't be placed up high or down low if possible. Critique the amount of stock held, for example, do you really need to hold 1000 envelopes in the stationary drawers? Or are you always running out of IV sets? Adjust levels to what feels right. The reasons behind are items should be easier and faster to find, saving time and frustration (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007).

5.3 Shine/Scrub

With everything sorted and set in order, it is time to clean. When you are cleaning, you observe things that need to be fixed, this step is called "Shine/Scrub."

Scrub is the cleaning portion of the checklist. All areas of the department were cleaned. This was a huge undertaking because the 'backstage' portions of a hospital are often ignored in this regard. All garbage and recyclables were removed and discarded or recycled. We had the work environment checked for good air quality; appropriate temperature, humidity, and lighting; and the presence of dust or fumes. Any problems revealed during this process were handled promptly (Fairbanks, 2007).

Experts described how to perform shine (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007): The principle is inspecting and cleaning the work environment. Remove old notices and posters, broken equipment, sticky tape etc and clean the area. The reasons behind are hazardous or broken equipment, potentially posing safety risk, is easily and quickly identified (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007).

5.4 Standardize

Now you can stand back and look at your accomplishment. You will need to repeat this exercise again regularly by creating the guidelines for Sort, Set in order, and Shine and this is called "Standardize".

Standardization. The rapid improvement team identified the roles of the staff and defined the standard tasks with regard to keeping the area clean and orderly. The team posted visual management tools to keep track of whether tasks were completed. These improvements were accomplished without any additional paperwork (Fairbanks, 2007).

Experts described how to perform standardization (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007): The principle is standardizing is about making different work areas with same function look the same. Use visual techniques to store these items in product families (labels, colours, signs, min/max levels). Place products back on the shelves in product families in the following colour boxes: For example: IV: Yellow; Wound Care products: Red; Elimination: Green; Respiratory: Blue; Personal care: Blue; PPE (Personal Protective Equipment): Red; Miscellaneous: Red. The reasons behind are to ensure the work areas stay looking the same and any unwanted changes are easily identified. It can help staff find equipment easily and quickly. This allows rotating and new staff to be able to find what they need, without asking for help (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007).

5.5 Sustain

It is necessary to actually follow those rules in standardization. Sustain is having the discipline and keeping the 5S processes going.

Sustain. The last and the most difficult of the five S's is sustain. The sterile processing team now follows posted standard work guidelines and standard cleaning and work procedures. They also use standard information boards that contain current and relevant information. The sterile processing supervisor keeps documents and instructions current. In addition, the entire area is neat, clean, and orderly and no unsafe conditions have been observed (Fairbanks, 2007).

Experts described how to perform sustain (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007): The principle is long term maintenance the new work environment. Develop standard work to ensure the process can be sustained and establish a person responsible to maintain this. Documented standard operating procedures outlining roles and responsibilities. Develop metrics to monitor this. Changing workplace culture to say 'this is the new way of working.' The reasons behind are to ensure that the 5S process is not just a big spring clean & the effort and benefit of 5S is long term.

After all, develop Address book for location of items in the area that you have 5S'd. Create Visual management signs for grouped items i.e.: IV equipment, Elimination, etc. Ensure all stakeholders are informed of changes made. Take photos of finished product. (Southern Adelaide Local Health Network, 2012; Graban, 2009; Liker and Meier, 2007).

6. Use of 5S in Healthcare

Despite its origin in manufacturing, 5S projects have been documented in a variety of settings in healthcare through a project administered by the National Health Service (UK) including wards of acute patient facilities, finance, information technology, laboratories, and community offices (Esain et. al., 2008). The Institute for Innovation and Improvement's 'Productive Series' is the most prominent example of Lean within the NHS. This initiative presents a systematic way of making improvements in various hospital settings, including wards, theatres and community services, mainly through the application of the 5S approach (NHSIII, 2007). The application of Lean principles in healthcare, particularly hospitals, should remove duplicate processes and unnecessary procedures such as: recording patient details in multiple places; excessive waiting for staff; and uncoordinated, variable discharge processes resulting in a longer length of stay (NHSIII, 2007).

There are specific examples of successful 5S transformations in a variety of healthcare areas. For instance, an endoscopy unit in a community hospital was able to convert one storage room to a staff room, save $7,000 on linens and inventory, save $1,000 on suture supplies, decrease on-hand inventory by two-thirds, eliminate 0.8 full time equivalent, and reduce cycle time by 17 minutes (Laing and Baumgartner, 2005).

At the University of Michigan Health Systems, peripherally inserted central catheter (PICC) services was able to find an additional hour of time per nurse per shift for value-added activities and could easily identify safety and quality issues with supplies carts due to their 5S results (Kim et. al., 2009). Another report showed that a core laboratory department was able to remove unnecessary equipment and supplies, which allowed all employees to see the work area optimally. This 5S event was considered a necessary component to an overall Lean transformation (Rutledge and Simpson 2010). These examples show that 5S applied to healthcare settings can improve processes and work environments and in some instances improve safety through standardization (Ikuma and Nahmens, 2014).

The setting for the case studies is Ochsner Health System in southeastern Louisiana, USA, which has been a proponent of Lean and has conducted 45 5S events between 2008 and 2010. These events have resulted in over $4 million created in revenue capacity, $509,000 savings, and 215.8 m^2 space created (Nahmens et. al. 2011). The specific departments that implemented 5S ranged from direct patient care units such as medical-surgical inpatient units and intensive care units, to patient treatment and diagnostics in radiology, operating rooms, and endoscopy, to peripheral laboratory work in histology, and finally to support services such as central supply (warehouse) (Nahmens et. al. 2011).

7. Combinations of 5S and Other Tools on Various Healthcare Systems

7.1 The Effect of Lean Utilizing 5S in Healthcare

Healthcare organizations are increasingly employing Lean tools in an effort to reduce waste while providing high quality healthcare, and 5S is one of the more popular tools in use to achieve Lean healthcare (Esain et. al., 2008). The following studies show the effect of Lean using 5S in healthcare.

Mazzocato et al. (2010) provides four mechanisms to summarize how Lean actually works in healthcare through a review of 33 papers published from approximately 1998 to 2008 spanning 15 fields within healthcare. While this research looked at Lean from a broad perspective, these mechanisms may provide guidance for how 5S can address safety.

Radner et.al. (2012) showed some other examples of the implementation of Lean in health, indicating various approaches and tools that have been used. It also illustrates some typical tangible and intangible benefits of the Lean implementation. In Scotland Cancer Treatment using Lean, resulted customer waiting times for first appointment from an average 23 to 12 days and improvement of customer flow time for patients of 48%. In Royal Bolton Hospital, using Bolton Improving Care, Systems (Lean), resulted direct savings of £3.1m. Death rate for patients fell by a third. The time taken to process important categories of blood fell from 2 days to 2 hours. Average turnaround time in pathology from over 24 h to 2-3 h. In Nebraska Medical Centre, using Lean principles to redesign the work area in the sterile processing centre and in the clinical laboratories, resulted in reduced staff walking by 167 miles a year. Reduce lab space by 825 sq ft and specimen processing turnaround time by 20%. Reduced manpower by 11 full time equivalents, who were redirected to other critical work. Average length of stay decreased from 6.29 days to 5.72 days. In the Pittsburgh General Hospital, using Lean techniques, resulted in change to the procedure for intravenous line insertion giving a 90% drop in the number of infections after just 90 days. Saving almost $500,000 a year in intensive-care-unit costs. In Flinders Medical Centre, using Lean thinking, resulted 20% more work, fewer safety incidents, same budget, same infrastructure, staff, and technology (Guthrie, 2006; Radnor, Walley, Stephens, & Bucci, 2006); (Fillingham, 2008; Young & McClean, 2008).

A rapid improvement team at Lehigh Valley Health Network, Allentown, Pennsylvania, implemented a plan, do, check, act cycle to determine problems in the central sterile processing department, test solutions, and document improved processes. By using A3 thinking, a consensus building process that graphically depicts the current state, the target state, and the gaps between the two, the team worked to improve efficiency and safety, and to decrease costs. Use of this methodology has increased teamwork, created user-friendly work areas and processes, changed management styles and expectations, increased staff empowerment and involvement, and streamlined the supply chain within the perioperative area (Kimsey, 2010).

Pediatric surgeons at Seattle Children's vie to perform surgery at their new Bellevue Clinic and Surgery Center because of the efficient flow for patients, families, and the care team.

Non-operative time, defined as the time when dressings are placed on patient A to incision time for patient B, is 50% less than for similar operations performed at the main campus surgery center. Operations start when scheduled 99% of the time. More than 90% of patients and families give the Bellevue Surgery Center a 9 or 10 rating for overall care (Toussaint and Berry, 2013). ThedaCare, a Wisconsin-based integrated health system, reduced inpatient total cost of care by 25% while improving patient satisfaction to nearly 100% of patients rating their care 5 of 5. For 5 years running, no medication reconciliation errors occurred for patients in hospital units served by care teams that include a pharmacist (Bielaszka-DuVernay, 2011; Toussaint and Berry, 2013). The staff of the otolaryngology department of the Christie Clinic in Champaign, Illinois, begins each day with a huddle to identify problems and discuss potential solutions. The daily rhythm of the huddles, which include physicians, has improved internal communications and teamwork. In less than 1 year after starting the huddles, waiting time for appointments decreased by 28%, departmental capacity improved by 10% with no increase in head count, and patient satisfaction increased from 4.3 to 4.7 on a 5- point scale. Leadership of the huddles rotates weekly among the department's staff (Toussaint and Berry, 2013). These 3 health systems named and numerous others have clearly demonstrated that the Lean approach is just as applicable and useful in complex knowledge work as in assembly-line manufacturing (Toussaint and Gerard 2010; Toussaint and Berry, 2013).

Holden (2011) critically reviewed 18 articles describing the implementation of Lean in 15 Emergency departments (EDs) in the United States, Australia, and Canada. The review revealed numerous ED process changes, often involving separate patient streams, accompanied by structural changes such as new technologies, communication systems, staffing changes, and the reorganization of physical space. Patient care usually improved after implementation of Lean, with many EDs reporting decreases in length of stay, waiting times, and proportion of patients leaving the ED without being seen. Few null or negative patient care effects were reported, and studies typically did not report patient quality or safety outcomes beyond patient satisfaction. The effects of Lean on employees were rarely discussed or measured systematically, but there were some indications of positive effects on employees and organizational culture. Success factors included employee involvement, management support, and preparedness for change. Despite some methodological, practical, and theoretic concerns, Lean appears to offer significant improvement opportunities. However, many questions remain about Lean's effects on patient health and employees and how Lean can be best implemented in health care (Holden, 2011).

The most prominent example of Lean in the NHS is the Institute for Innovation and Improvement's Productive Series (NHS Confederation, 2006). The Productive Theatre programme comprised a series of modular activities for enhancing the smooth, efficient and safe running of operating theatres. These included training guides that enhance the capacity of leaders to inspire and introduce change; resources to assist service leaders to 'know how we are doing' through auditing and measuring theatre usage and waste; models and tasks to improve the organization and scheduling of theatres; and a series of toolkits to improve theatre preparation, safety checks, equipment planning and handover. For example, it promoted the use of improvement techniques such as 5S. This approach has found popular appeal in healthcare, often in relation to the problems of hospital-acquired infections. With this 'bundle' of activities they aimed to redesign clinical practices and resources around streamlined, efficient and value-adding care pathways (NHS Confederation, 2006).

To improve patient care in cardiac surgery using Lean, a new cardiac surgery program was developed in a community hospital setting using the operational excellence (OE) method, which is based on the Lean principles. The initial results of the first 409 heart operations, performed over the 28 months between March 1, 2008, and June 30, 2010, were studied. Operational excellence methodology was taught to the cardiac surgery team. Coaching started 2 months before the opening of the program and continued for 24 months. As problems occurred, the tools of TPS such as visual management, Kanban, standardization, one-by one-processing, and 5S were introduced and implemented to achieve the solution. The results showed of the 409 cases presented, the risk-adjusted operative mortality rate was 61% lower than the regional rate. Likewise, the risk-adjusted rate of major complications was 57% lower than The Society of Thoracic Surgeons regional rate. Daily solution to determine cause was attempted on 923 distinct perioperative problems by all team members. Using the cost of complications as described by Speir and coworkers, avoiding predicted complications resulted in a savings of at least $884,900 as compared with the regional average. To conclude, by the systematic use of a real time, highly formatted problem-solving methodology, processes of care improved daily. Using carefully disciplined teamwork, reliable implementation of evidence based protocols was realized by empowering the front line to make improvements.

Low rates of complications were observed, and a cost savings of $3,497 per each case of isolated coronary artery bypass graft was realized (Culig et. al. 2011).

Dart (2010) in the Editorial of Annals of Emergency Medicine, raised the issue 'Can Lean Thinking Transform American Health Care?' The Editor commented 'The process of Lean is demanding but remarkably rewarding for employees at all levels of the organization. For example, a rapid improvement event was a week-long interaction of frontline staff, midlevel managers, and executive staff. The experience and insights of employees actually doing the work was combined with the executive power to authorize change promptly and ensure that change was focused on creating value for the patient. Dart (2010) commented Lean thinking could transform American health care. Lean thinking was a bottom-up revolution of health care that created value for the patient while increasing efficiency, improving quality, and reducing cost. The process united frontline staff, middle management, and executive leadership. Lean was a tough and resilient concept that has been tested thousands of times in a variety of manufacturing and service industries. Health care services would not prove an exception.'

In the Surgery Clinic, Seattle Children's Hospital, USA., a large teaching institution, two Rapid Process Improvement Workshops (RPIWs) were conducted to apply lean methods. During the first workshop, 5S techniques were applied to standardize the exam rooms and office work space. A second workshop focused on the clinic process. Semi quantitative data was collected using the 5S methodology that measures the degree of work-space organization. Similar data were collected at 30 days, 60 days, and 1 year. Satisfaction surveys were followed at 6 months and 1 year. Results showed Median pre-RPIW room time was 49 minutes. Post-RPIW times were 33 minutes at 30 days, 41 minutes at 60 days, and 42 minutes at 1 year. Face to face provider-patient time increased 30% to 61% at 30 days, 58% at 60 days, and 59% at 1 year. The median number of patients in a 4-hour clinic increased from 10 to 12. Satisfaction survey Problem Scores improved and were sustained. The one-year sustained results indicate that the system could be replicated among different providers and ones newly introduced to the system (Waldhausen et. al., 2010).

7.2 Making Safety an Integral Part of 5S in Healthcare

Safety is always a top priority in healthcare, but healthcare organizations often struggle in implementing programs that make meaningful, sustainable improvements in safety. Meanwhile, healthcare has turned to Lean, one specific Lean tool, 5S, can potentially improve safety through improved housekeeping practices (Ikumaa and Nahmens, 2014).

5S encourages streamlined inventories, clutterfree workspaces, and processes to maintain housekeeping standards. This tool is being used in healthcare to reduce inventory, create space, and reduce travel and search times. However, little attention has been given to the effects of 5S on safety. Several have suggested that safety is an important aspect of 5S (Graban, 2009). In one specific 5S example, Kim et al. (2009) noted that by using 5S on supply carts, nurses could more easily identify safety or quality problems because the layout and content of each cart was identical, orderly, and clean. In another example, Ballé and Régnier (2007) showed improvements in a hospital ward that directly impact safety by clearing items from hallways, redesigning storerooms with visual management cues to easily identify out-of-date products, and establishing routine checklists to maintain order (Ikumaa and Nahmens, 2014).

Each stage of a 5S project has an impact on safety, from sort where broken or expired items are removed, to sustain where ongoing cleaning, maintenance, and quality checks are routinely conducted. In the first step, sort, removing expired, broken, or recalled items from the work areas can increase safety by decreasing the chance of using improper items for patient care. In the set in order step, frequently used items will be easily accessible, thus improving ergonomics. Walkways will be clear, which reduces the risk of trips and falls. Finally, being able to access items quickly can be critical in healthcare when patients need to be treated quickly. The third step, shine, ensures that all items, areas, and equipment are clean and properly maintained, which prevents contamination and equipment being out of service. Standardize, the fourth step, improves safety by allowing all providers to quickly assess when items are unfit for use, not in their proper place, or not properly cleaned or maintained. Standardization also allows providers to find items quickly. The last step, sustain, creates mechanisms for maintaining the first four S's over time. Checklists are often incorporated and can include safety measures such as making sure all equipment is properly stored and charged and all trash removed (Ikuma and Nahmens, 2014).

7.3 Lean and Six Sigma Methodology

Operating rooms are resource-intense and costly hospital units. Lean and Six Sigma methodologies were developed in the manufacturing industry to increase efficiency by eliminating non value-added steps. Six Sigma is a different method to reduce process variation through the rigorous application of process metrics collection and statistical analysis (Bendell, 2006). The successful application of Lean and Six Sigma (LSS) and other similar management tools is not limited to manufacturing, but has been applied in the customer and financial service industries and the government (Wang, 2010). Increasingly, Lean and Six Sigma are being used in the health care industry. Similar to other industries, the use of these tools can be applied to several aspects of health care, including finance, inventory management, information processing, outpatient clinics, and inpatient setting (Stuenkel, 2009; Niemeijer 2010).

The Mayo Clinic, Rochester, USA, a tertiary-care academic medical centre, applied Lean and Six Sigma methodologies across an entire surgical suite to improve efficiency (Cima et. al., 2011). Results showed across 3 surgical specialties, process redesign resulted in substantial improvements in on-time starts and reduction in number of cases past 5 PM. Substantial gains were achieved in nonoperative time, staff overtime, and operating rooms saved. These changes resulted in substantial increases in margin/ operating rooms/day. To conclude, use of Lean and Six Sigma methodologies increased operating room efficiency and financial performance across an entire operating suite. Process mapping, leadership support, staff engagement, and sharing performance metrics are keys to enhancing operating room efficiency. The performance gains were substantial, sustainable, positive financially, and transferrable to other specialties (Cima et. al., 2011).

8. Suggestions to Enhance Success of 5S in Healthcare Services

Successful 5S events are characterized by a changed culture of work that promotes continuous improvement through team problem solving (Mazzocato et al. 2010). Some methods for maintaining a clean and clutter-free environment such as taping areas for designated equipment storage are easy to continue, especially when the team developed and agreed on these positive changes. Other changes, such as completing daily checklists, require active commitment from each employee and management support (Ikuma and Nahmens 2014).

The fifth S sustain is the most challenging part of a 5S initiative. Maintaining the first four S's once the excitement of the initial 5S event has concluded requires conscious effort on the part of all employees, not just the ones directly involved in the initial event (Ikuma and Nahmens 2014). In fact, one unintended consequence of using 5S may be the increased time needed by management to properly sustain 5S events (Rutledge and Simpson, 2010). This extra time is considered essential in maintaining progress (Rutledge and Simpson, 2010).

Rather than being isolated to a single department, 5S events must be integrated into the organization through shared objectives and communication (Ikuma and Nahmens 2014). In the National Health Services evaluation of 56 5S projects, 70% of those surveyed said outside departments had an important role in the success of the 5S project, and 40% said that changes in their own 5S had to be negotiated with other departments before implementation (Esain et. al., 2008). The study emphasized that 5S activities must align with the organization's objectives and be supported by management in order to be successful (Esain et. al., 2008).

9. Conclusion

5S can be applied to healthcare services with beneficial effects such as cleaner, organized, efficient workplaces for enhanced safety and increased productivity; reduction of inventory and supply costs and recapturing of valuable spaces and minimizing overhead costs. Sustain is a key to success.

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