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Application of the 5S-KAIZEN Approach in Improving the Productivity and Quality of the Healthcare System: An Operational Research

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ABSTRACT

Introduction: Quality is an important index in various aspects of life. The 5S-KAIZEN method is widely applied for the improvement of work environments. This systematic approach is fundamentally used to enhance the quality of services in all types of organizations. The present study aimed to assess the application of the 5S-KAIZEN approach in improving the quality of care provision in hospitals and evaluate its effects on the job satisfaction of the healthcare providers.

Materials and Methods: This interventional, operational research was conducted at a teaching hospital. In-depth interviews were performed to obtain the viewpoints of the physicians, and group discussions were held for nurses in order to assess their satisfaction with the implementation of the 5S-KAIZEN approach in the work environment.

Results: Patient-hospital cycle time decreased by more than 50% after implementing the 5S-KAIZEN approach. In addition, the healthcare professionals believed that applying the 5S-KAIZEN approach saved time, money, and efforts, while reducing their daily workload and stress.

Conclusion: According to the results, the 5S-KAIZEN approach could improve the standards in the healthcare work environment, support the safe practices leading to high-quality and efficient care services, enhance productivity at a low cost, and increase the satisfaction of the healthcare staff with their professional image and communication with the other personnel.

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Introduction

Quality is an important index in various aspects of life, as well as an essential component of any services and production processes.

Quality is considered to be a strategic tool in all the organizations constantly seeking sustainable quality, increased productivity, and promoted performance (1).

Quality could be defined as the excellence, fitness for use, and meeting the customers' expectations by providing services in accordance with the latest functional specifications. The Nation's Health defines quality in health care as a direct correlation between the level of improved care services and the desired healthcare outcomes in individuals and populations (2, 3). Quality of healthcare services is difficult to measure as these services vary depending on the providers, clients, time and place, and professional experience. Therefore, quality control in the healthcare system is challenging since the clients are not able to judge the quality except after receiving the services (4, 5).

The Quality Improvement Program is a systemic, continuous approach that requires changes in the culture of an organization in order to overcome challenges.

This occurs when the staff members realize their roles and responsibilities in supporting their organization, as well as the ability of the organization to manage changes through leadership and teamwork (6).

The 5S-KAIZEN method is a structured approach, which is used to achieve and enhance a specific work area so as to ensure the safety and efficiency of the operations with minimum waste at the lowest cost.

This systematic approach is fundamentally used to improve productivity, quality, and safety in all types of organizations (7). The five words in 5S are a convenient mnemonic device, which are derived from the equivalent Japanese starting with the letter "S", as follows:

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S1: Sort (Seiri), which means keeping only the items that are essential to the workplace, while all the other items are stored or discarded depending on their value; S2: Set (Seiton), which refers to arranging the tools, equipment, and supplies, so that they would encourage the work flow; S3: Shine (Seiso), which denotes keeping the workplace clean; S4: Standardize (Seiketsu), which means that the work practices should be performed in a standardized manner, and S5: Sustain (Shitsuke), which refers to maintaining and reviewing high standards at the workplace. In this regard, the concept of KAIZEN has been defined as the problem-solving technique, which depends on the plan-do-check-adjust (PDCA) quality cycle and the practices required for constant improvement (8, 9).

The 5S management approach has been recommended as an effective method for improving the quality of healthcare services, particularly in low- and middle-income countries. The governments of Sri Lanka and Tanzania have officially adopted the 5S approach as a national strategy for enhancing the quality of healthcare services (10). Moreover, the method was introduced to the healthcare sector in Egypt as a pilot intervention program of the Japan International Cooperation Agency (JICA) in 2013 at a teaching hospital.

The present study aimed to improve the quality of the healthcare services at a teaching hospital through assessing the effects of the 5S-KAIZEN implementation and on the job satisfaction of the healthcare staff.

Materials and Methods

This interventional, operational research was conducted at a teaching hospital located in one of the governorates in Upper Egypt. This center provides curative health services for the entire population of the region in its outpatient clinics, inpatients wards, operation theaters, intensive care unit (ICU), emergency department, laboratory, and pharmacy. The hospital is composed of three buildings; one section has been designated for the surgical departments, the second building belongs to the departments of internal medicine and pediatrics, and the third building consists of the ophthalmology and ear-nose and throat (ENT) sections. These departments have 365 staff members, including 189 physicians and academic staff members (51.7%) and 176 nurses (48.2%).

The current research aimed to evaluate the effect of implementing the 5S-KAIZEN approach on the job satisfaction of the physicians and nurses with the improvement of the healthcare quality as a step toward achieving comprehensive quality management in this major healthcare organization.

Multistage stratified randomized was performed to select the participants. The first stage was based on the hospital building (internal medicine and surgical departments), and the second stage was based on the occupation of the healthcare staff (physicians and nurses). Sample size was calculated in Epi Info 2000 using a special formula based on the lowest expected percentage of satisfaction, which was estimated at approximately 8.0% (confidence interval: 95%, precision: 2%). We increased the final sample size by 10% in order to overcome problems such as lack of response and missing data.

The Six Sigma method was obtained in the present study, consisting of the five steps of define, measure, analyze, improve, and control (DMAIC) as the roadmap to achieve the objectives of the study (11).

The study was conducted during a January 2012-2017.

During this period, the situation analysis phase was performed for 130 months (January 2012-2013), the implementation phase was carried out for 41 months (February 2013-June 2016), and the evaluation phase was performed for six months (July-December 2016).

The research was conducted in three stages; the first stage encompassed the situation analysis of the selected healthcare system by utilizing a self-administrated, structured questionnaire for the patients, direct observation of the patient-hospital cycle, conducting in-depths interviews with the physicians, and holding group discussions for the nursing staff. The second stage was the implementation phase, which consisted of orientation sessions, training courses, and workshops on the 5S-KAIZEN approach.

The final stage was the evaluation phase, which was performed using the same tools as the analysis phase in order to assess the effect of the 5S-KAIZEN approach on the healthcare system.

Ethical considerations

Study protocol was reviewed and approved by the Ethical Committee of the School of Medical Research.

Objectives of the study were explained to the participants, and they were assured of confidentiality terms. In addition, verbal consent was obtained from all the participants prior to distributing the questionnaires.

Participants were allowed to withdraw from the study at any given time.

Data Entry and Statistical Analysis

Collected data were coded and entered twice, and data analysis was performed in SPSS version 18 for Windows 7. Mean and standard deviation were calculated for the quantitative variables in the form of simple descriptive analysis.

Moreover, categorical data were analyzed by computing the percentages, and the differences were statistically analyzed using Chi-square for the comparison of the study groups in terms of the qualitative and categorical data, as well as student’s t-test for the comparison of the groups in terms of the quantitative data. P-value of less than 0.05 was considered significant in all the statistical analyses, and Avedis Donabedian's assessment model was applied to analyze the narrations of the physicians (12).

Results

1. Situation Analysis Phase

This stage was performed on multiple axes based on the triangle of healthcare services, including the patients, physicians, and nurses, in order to identify the problems that could lead to the dissatisfaction of the healthcare staff and patients and discern the challenges associated with the quality of health services provided by the hospital.

A structured, pretested, self-administrated questionnaire was distributed among the patients, 495 of which were completed (total: 600) with the response rate of more than 82.5%. The questionnaire consisted of 34 items on the six aspects of satisfaction with healthcare services, including administrative services and quality of functional performance (15 items), communication and patients' rights (10 items), time management (4 items), and overall satisfaction (5 items).

Among 495 enrolled patients, 276 (55.8%) expressed dissatisfaction with the long waiting time (more than 30 minutes) for booking an appointment, and 462 patients (93.3%) claimed that the physicians did not spend adequate time on their examination (less than five minutes). In addition, 215 respondents (43.6%) mentioned that it would take 3-5 days to obtain the examination results, while 290 patients (58.6%) claimed that all the facilities and supplies of the hospital were deficient, and 378 patients (76.4%) complained of the insufficient number of the seats in the waiting halls of the hospital.

With regard to the overall satisfaction and healthcare outcomes, 424 patients (85.7%) expressed dissatisfaction with the care services in the selected hospitals, 253 respondents (51.1%) were dissatisfied with the performance of the physicians, and 213 patients (43.0%) were dissatisfied with the communication of the healthcare staff.

Direct observation was conducted by following the patient cycle in the outpatient clinic of the hospital based on the procedures that were required to complete the care services in order to discover the defects and shortcomings in the cycle. Observation was performed in 50 patients on alternative days over 10 days (rate: five patients per day). According to the results, 35 patients (70.0%) spent about 30 minutes on booking appointments, 30 patients (60.0%) waited for five hours for their consultation session, and 30 patients (60.0%) spent 7-10 minutes in the consultation session with the physicians. During consultation, the physicians did not respect the privacy of the patients and failed to fully explain the examination process in the case of 41 patients (82.0 %).

In-depth interviews were conducted with 100 physicians in order to obtain their viewpoints regarding the implementation of the 5S-KAIZEN approach. Interview scripts were prepared and assessed for five physicians prior to each interview (10-20 minutes each). As for the nursing staff, four focused group discussions were held for 60 nurses with variable work experience. In the discussions, the nurses were enquired about their working hours, work environment and infrastructures, attendance in training courses, and the main challenges at work. Each discussion was held for 15 nurses with an average length of 30-60 minutes.

According to the results of the in-depth interviews and focused group discussions, the majority of the healthcare providers expressed their dissatisfaction with the inadequate number of the staff members (both physicians and nurses), long working hours (six hours daily only in the outpatient clinics in addition to the inpatient and emergency sections), narrow spacing in the clinics, and overcrowding of the patients, which affected the time of communication with the patients.

Some of the other problems were the disorganized patient entries and flows in the clinics, lack of supplies and electronic recording systems, and patient referral policies. Furthermore, the nurses mentioned that they had to spend 2-3 hours per day to search for the necessary medications, supplies, and patient files. All the interviewed physicians and nurses complained of the lack of on-job training or educational courses on the quality of care services during the employment period in the hospital.

Problem Statement

As is evident from the results of the situation analysis phase, the main problem in the selected healthcare organization was the length of the patient flow cycle from booking appointments to consultation session and obtaining the examination results, which lead to the slow productivity of the hospital in providing effective healthcare services.

2. Intervention Phase

A: Planning and Preparation Stage

- Revision of the hospital records with regard to the number of the patients attending the center for medical advice, as well as the number of the physicians and nurses in the hospital;
- Developing various investigation tools (e.g., questionnaires, scripts of in-depth interviews, focused group discussions, and direct observation forms) to follow the patient flow cycle in the hospital;
- Developing training programs on the 5S-KAIZEN approach, consisting of presentations for the trainers, handouts for the trainees, trainer's evaluation forms, and pretest and posttest for the training programs;
- Developing orientation posters about the 5S-KAIZEN approach and quality of care services to be distributed in all the hospital departments;
- Developing checklists and sheets for the monitoring and supervision of the implementation phase

B: Implementation Stage

Four orientation sessions were held for the nursing staff, physicians, and house officers, and two sessions

were held in each hospital building in the form of two-hour lectures about the concept of the 5S, as well as the aim, importance, and benefits of improving the work environment. Additionally, a two-hour presentation was held to compare the current situation of the selected hospital with the various other healthcare organizations in Japan, Sri Lanka, and Tanzania.

Six training courses were conducted for the nursing staff twice per year, each of which encompassed four hours of training per week for three months, focusing on the 5S-KAIZEN approach, improvement of the work environment, quality improvement, staff productivity, and leadership and communication skills.

Work improvement teams (WITs) were established and assigned to the implementation of the 5S approach in all the hospital departments. Moreover, 22 workshops were held for the WITs focusing on the 5S tools in order to initially implement the method in five pilot areas inside the hospital under meticulous observation and the constant monitoring and guidance of well-trained teams, who had received national and international training, so as to assess the progress of the implementation phase. Following that, 17 other workshops targeted other WITs in order to disseminate the 5S-KAIZEN approach to all the hospital departments.

Finally, seven training sessions about KAIZEN were held for the nursing supervisors to train their staff on organizational problem-solving.

3. Evaluation Phase

Direct observation of 50 patients in was performed to evaluate the effect of the 5S-KAIZEN implementation on their hospital cycle. According to the results, 40 patients (80.0%) spent less than 10 minutes on booking an appointment, 35 patients (70.0%) waited for two hours for their consultation session, and 30 patients (60.0%) spent 12-15 minutes in the consultation session.

During consultation, 35 physicians (70.0%) respected the privacy of the patients and explained the examination process to 30 patients (60.0%). In addition, the time spent on booking an appointment reduced by 20 minutes (66.7%), while waiting for consultation decreased by approximately three hours (60.0%), and length of consultation and examination increased by five minutes (30.0%). Moreover, the percentage of the physicians who respected the privacy of the patients increased by 52.0%.

In-depth interviews were conducted with 100 physicians, who represented 52.9% of the physicians employed in the selected hospital, so as to obtain their viewpoints and assess their satisfaction with the implementation of the 5S-KAIZEN approach. According to the findings, the majority of the physicians (n=80; 80.0%) noted that the 5S-KAIZEN approach saved effort, money, and time by using minimal resources at the workplace. Furthermore, the method helped them to identify and differentiate necessary and unnecessary items to determine the deficiency and their needs, while the recycling of the valued items was reported to become easier as well. On the other hand, 20 physicians (20.0%) considered the application of the 5S-KAIZEN approach to cause excess workload and consume more time to be implemented.

Some of the viewpoints of the interviewed physicians are as follows: "Implementation of the 5S-KAIZEN approach saves my time and enables me to offer patients better care." [Ph 1]

"The 5SKAIZEN approach directed us to better exploit our limited resources in the optimum way." [Ph. 2]

With respect to the challenges associated with the implementation of the 5S-KAIZEN approach, the participants emphasized on the role of poorly motivated part-time staff members who fail to follow the instructions properly. About 76 of the interviewed physicians (76%) mentioned that the poor communication between the nursing staff and their supervisors is the main obstacle against the implementation of the 5S-KAIZEN approach. One of the viewpoints in this regard are as follows:

"The 5S-KAIZEN approach causes many obstacles, the most obvious of which is the poor communication between the nursing staff and their supervisors." [Ph. 3]

With regard to the satisfaction of the healthcare staff with the implementation of the 5S-KAIZEN approach, seven participants (7.0%) stated that they were strongly satisfied, 67 cases (67.0%) were satisfied, 16 participants (16.0%) were not satisfied, and 10 participants (10.0%) were strongly dissatisfied.

When enquired about achieving sustainability, 30 physicians (30.0%) emphasized on the importance of incentives, and 66 participants (66.0%) claimed that moral appreciation and respect played a key role in achieving sustainability in the 5S-KAIZEN approach. However, four physicians (4.0%) believed that punishment could also be effective in maintaining sustainability. One of the remarks in this regard is as follows:

"Sustainability is a very critical step toward the implementation of the 5S-KAIZEN approach. Appreciation and incentives could also contribute to maintaining sustainability." [Ph. 4]

Another participant stated:

"The 5S-KAIZEN approach is very beneficial that I have started implementing it at home. It saves time and effort." [Ph. 5]

In the present study, four focused group discussions were held for 60 nurses, who represented 34.1% of all the nursing staff in the selected hospital. The aim of the discussions was to assess the impression and satisfaction of nurses toward the implementation of the 5S-KAIZEN approach. About 54 nurses (90.0%) agreed on the clarity of the objectives of the 5S-KAIZEN approach and confirmed its positive effects

on improving their work environment. One of the statements in this regard is as follows:

"The 5S-KAIZEN approach makes me feel relieved at work." [Nu. 1]

Furthermore, 40 nurses (66.7%) agreed on the feasibility and sustainability of the 5S-KAIZEN approach, and the method became part of the staff's attitudes and behaviors. Another comment in this regard is as follows:

"The 5S-KAIZEN approach makes me think in a systemic way." [Nu. 2]

Another nurse stated:

"The 5S-KAIZEN approach is easy to implement and facilitates the work flow." [Nu. 3]

On the same note, 50 nurses (83.3%) claimed that the 5S-KAIZEN approach made them more organized, and therefore, they started to disseminate the 5S-KAIZEN concepts among their family, friends, and colleagues.

Table 1: Satisfaction, knowledge, attitude, and challenge scores among different age, sex, and work experience in study group

Variables	Satisfaction score	Knowledge score	Attitude score	Challenge score
	Mean± SD	Mean± SD	Mean± SD	Mean± SD
Age groups				
21-34 years	65.3±9.5	52.4±6.9	22.2±3.4	33.7±3.7
35-44 years	73±10.7	58.3±4.4	27±1.9	39.5±0.93
45-54 years	88±0	63±0	25±0	40±0
P-value	0.002*	0.012*	0.001*	0.000*
Sex				
Male	64.9±12.2	52.9±7.6	22.3±3.9	34.8±3.7
Female	69.9±7	54.4±6.2	23.7±3	34.6±4.5
P-value	0.06	0.43	0.14	0.88
Experience duration				
< 5 years	65.7±10.1	52.9±6.2	22.6±2.7	34.4±3.4
5-10 years	69±12.8	50.3±10	20.3±6.2	32.5±5.9
>10 years	71.2±10.2	59.2±4.4	26.4±1.7	37.8±3.7
P-value	0.29	0.011*	0.000*	0.013*

*statistically significant difference p-value <0.05

Discussion

Analysis of the interviews conducted among the hospital staff in the current research was indicative of the positive perceptions and satisfaction of the healthcare staff members toward the implementation of the 5S-KAIZEN approach.

The hospital staff believed that the implementation of the 5S-KAIZEN approach saved time, money, and effort, reduced routine work-related stress, and resource waste.

These findings are consistent with a study performed in India, which concluded that the utilization of the 5S principles saved time and reduced resource waste, thereby contributing to the productivity of the healthcare staff and improving the quality of care services (13).

Satisfaction of the participants gave them the confidence to apply and disseminate the 5S-KAIZEN approach in all the hospital departments. Moreover, they felt more committed to their work and more organized, which resulted in the improvement of staff communication, efficiency, productivity, and problem-solving capability.

This finding is in line with a study conducted at Columbia University Medical Center in New York, USA, which reported that the implementation of the 5S-KAIZEN approach reduced the time for the residents to locate an item, while increasing the efficiency of finding supplies (14).

In the current research, the hospital staff had a clear knowledge of the significance, objectives, and positive effects of the 5S-KAIZEN approach on their work environment. In low- and middle-income counties, the budget is mostly allocated to physical resources and focusing on the costs of services.

Therefore, the 5S-KAIZEN approach could achieve the difficult balance between low costs and high productivity, while it also addresses the safety, comfort, and satisfaction of the healthcare staff, which is indirectly reflected in the quality of care services and patient satisfaction.

Findings of the present study are in congruence with a research conducted in Senegal, which documented the effects of implementing the 5S-KAIZEN approach on facilitating the job and setting up a safe environment. In addition, the method was observed to exert a statistically significant effect on the satisfaction of the employees (15). Our findings are also in line with the results obtained in Benin, indicating that the implementation of the 5S strategy was considered satisfactory by organizational employees (16).

According to the results of the present study, implementation of the 5S-KAIZEN approach improved the safety of the healthcare providers, which is consistent with a research conducted in India, confirming that the 5S strategy could be a mechanism for enhancing safety. It is also noteworthy that safety was affected positively in each step of the 5S approach (17).

In a study performed in India, the Lean methodology was reported to improve quality at a lower cost, while it also offered opportunities for substantial waste reduction, simplification, and quality improvement (18).

In this regard, case reports in India have indicated that improving the quality of healthcare services could be achieved by the introduction of the 5S management rather than the combination of infection control guidelines and continuous quality improvement-total quality management (CQI-TQM) (19).

In Northern Tanzania, the 5S approach has been strongly contributing the success of organizations through radically reorganizing the system depending on problem-solving, and therefore, the 5S approach has been considered suitable for the initiation of CQI

approaches on an organizational scale (20). A review article in this regard concluded that the 5S-KAIZEN approach could be implemented and activated in healthcare facilities regardless of their location.

Furthermore, this method was considered to be a strategic option for policymakers, leading to the improvement of quality through reinforcing safety, efficiency, and productivity (21, 22).

Limitations of the Study

The interviews with the physicians were difficult to perform as they were overloaded by the tasks in the hospital. In addition, the qualitative part of the study was a challenging process in terms of the collection and analysis of data, which might have affected many confounders. Another limitation of the study was the poor motivation of some of the participants to express or share their viewpoints toward the subject matter. On the other hand, some nurses and physicians were quite reluctant toward the implementation of the new approach in the work environment.

Finally, it was difficult to differentiate the system improvements due to the implementation of the intervention and effects of other factors, such as the interest of the management in the problem and developing and enhancing the monitoring system.

Conclusion

According to the results, the hospital staff reported that the application of the 5S-KAIZEN approach in the teaching hospital saved time and effort, decreased work-related stress, reduced supply waste, improved staff and patient safety, and enhanced communication, efficiency, productivity, and problem-solving capability.

Implications for Research

Regular supervision and evaluation are recommended to assess the progression of the program.

Moreover, it is suggested that refreshment training courses and workshops be organized in order to increase the motivation and interest of the healthcare staff to implement the 5S-KAIZEN approach.

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