Journal of Multidisciplinary Healthcare

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Application of Lean Visual and "6S" Management Concept in Clinical Nursing

Xia Wang, Yanhua Liu

Department of Nursing, Tianjin Beichen Traditional Chinese Medicine Hospital, Tianjin, 300400, People's Republic of China

Correspondence: Yanhua Liu, Email Liuyh1017@126.com

Background: Although the "6S" management was shown to improve the work efficiency and quality of enterprises, the significance of lean "6S" combined with visual management in clinical nursing settings has not yet been reported.

Objective: This study aimed to explore the effect of lean "6S" combined with visual management mode on clinical nursing quality.

Methods: From June 2019, the "6S" combined with visual management mode was implemented in Tianjin Beichen Traditional Chinese Medicine Hospital. The satisfaction of nurses in the ward, hand-over items and warehouse inventory time, ICU rescue efficiency, and the incidence of nursing adverse events before and after the implementation of the mode were compared.

Results: Implementation of the visual and "6S" management mode led to significantly higher satisfaction of nurses in the ward compared to pre-implementation. Further, a significant decrease was observed in hand-over items and warehouse inventory time, ICU rescue efficiency, and the incidence of adverse nursing events ($P<0.05$).

Conclusion: The visual and "6S" management mode in the ward could significantly improve the quality of clinical nursing management and the satisfaction of medical staffs. This study is a single-centre prospective study, so some selection bias is inevitable. Future multicentre, long-term randomized clinical trials are needed to provide more evidence that this method can benefit nursing practice.

Keywords: "6S" management, visual management, nursing, intensive care unit, rescue, safety, inventory time, satisfaction

Introduction

The "6S" management method originated from the enterprise operation management mode of the 5S concept proposed by the Japanese scholar Hiroyuki Hirano.[1] The core of the 5S management method includes five items: Sort (Seiri; Distinguishing between what is needed and not needed, and remove the latter), Set in order (Seiton; Neatly arranging the needed items for easy use and implementing visual controls), Shine or Sweep (Seitetsu; Cleaning up the work environment and looking for ways to continue keeping it clean), standardize (Standardize; To practice seiri, seiton and seiso at frequent intervals and set standards to make 5S a way of life), and Sustain (Shitsuke; Maintaining continued compliance to the 5Ss). Based on these concepts, the 6S methodology helps create a safer working environment, which is considered equally important as other benchmarks for improving staff's productivity, use and performance of equipment, work efficiencies, and reduced product scrap.

In practice, the "5S" has been reported to significantly improve the work efficiency and quality of enterprises.[2] On this basis, the "6S" management method represents an improvement over the 5S concept by adding the "Safety" item,[3] which aims at improving efficiency, reducing waste and ensuring the safety of the on-site environment. Thus, as a mode of on-site management, the "6S" management method seems more promising for effectively solving management issues and improving hospital nursing services without additional investment.[4] In addition to the 6S concept, Visual management is characterized by the visibility of the requirements and intentions of managers as well as executors' work content in the management process. Moreover, the clear division of responsibilities and rapid expression of purposes can improve management and self-control and achieve efficient and intuitive management.[5]

Visual and "6S" management methods have become the two basic pillars of on-site management for improving nursing levels and bringing huge benefits to the hospital.[6] As a type of lean thinking mode, the "6S" management is

Received: 5 September 2023
Accepted: 22 November 2023
Published: 7 December 2023

complementary to visual management. In addition, the effective application of visual management with the "6S" management can double the results with half of the efforts. Currently, the visual and "6S" managements are widely used in enterprises, laboratories and other fields and have yielded promising results.[7]

There are a little of reports on the application of Visual and "6S" management methods in nursing care, so it is not clear whether it can improve nursing work. Therefore, this study aims to explore whether these methods can improve the efficiency of nursing work, in order to provide strong support for its application in nursing work.

Methods and Study Design

General Information

The Tianjin Beichen Traditional Chinese Medicine Hospital is a grade A tertiary comprehensive Traditional Chinese Medicine (TCM) hospital established in 1989 and mainly focuses on the combination of TCM and western medicine. The hospital has 550 open beds and more than 800 employees. Among these employees, there are 668 health professionals.

Management Methods

Implementation of 6S Nursing Management Method

Flat organization modes were adopted in project management, via the following three stages: project initiation stage, project execution and system application stage, effect evaluation and achievement summary stage.

Project Organization

The two group leaders were responsible for promoting the decision-making and resource coordination of the projects. The five members were responsible for supervising and coordinating the Visual and "6S" management methods-related work at their corresponding departments in charge.

The Selection Criteria for the Study Participants

To guarantee the successful implementation of the Visual and 6S management methods and reduce bias in the study process. Before the study was carried out, project supervisors, implementers and participants in various departments were trained in the theory of the Visual and 6S management methods, and they were tested to see if they had mastered these methods. Only those who passed the exam were allowed to participate in the study.

Establishing and Maintaining the Visual and "6S" Management Methods

Five hospital-level supervisors were responsible for the correct application of the Visual and "6S" management methods project.

The departments and personnel participating in this project were the hospital administrative office, medical nurses, general affairs bureau, outpatient department, pharmaceutical department, information department, publicity department, equipment department, material department, and more. In addition, all clinical departments of the hospital also participated in this project.

Based on the actual situation of the corresponding departments, various mechanisms were established to promote the implementation of "6S", guide and support the correct use of "6S" in the participating departments, and organize and evaluate the effects of the "6S" via rewards and sanctions incentives.

Main Content of the Project

The implementation of this project was divided into the following five steps: (1) project initiation; (2) "6S" sort and set in order; (2) "6S" shine and safety; (3) "6S" standardize and sustain; (5) summary. This project was performed following the principles of systematic design, unified promotion, and process control.

Project Promotion Evaluation and Incentive Methods

The overall promotion plan and objective of the projects were performed in layered phases by the hospital's promotion office. Each department was requested to formulate and report a monthly plan for implementing the "6S" concept to the

promotion office, which was responsible for process tracking, control, and evaluation via weekly inspections and monthly appraisals. The mobile red flag and bottom supervision mechanisms were also set up to evaluate the effect of rectification and implementation in each department. Exchange activities were also organized in all departments to allow experience sharing, outcome summary and commendation, etc. Personnel who excelled in establishing and promoting the "6S" concept were rewarded to enhance participation and promote the implementation of the concept.

Requirements for Project Promotion

The main significance of the "6S" promotion was implementing on-site management reforms. The head of departments, head nurses and supervisors were instructed to maintain a high degree of consistency with the overall "6S" concept objective of the hospital. Thus, to some extent, the old mindset of office management and behavioral habits were improved to increase work and management efficiencies of routine activities. Also, the leaders were required to participate in the promotion activities as a form of exemplary practitioners of "6S".

On basis of the division of responsibilities, each department was requested to actively participate by systematically assessing management issues in their respective department, put forward relevant improvement suggestions based on the 6S concept and promote the implementation of these suggestions.

All departments were requested to strengthen, train and organize various activities to reward the good and punish the bad for encouragement and guidance, and then to create a good promotion atmosphere of "comparing, learning, catching up, and helping".

Each department was required to check the progress of the "6S" management work under the jurisdiction of the corresponding department every week, such as the offices, wards, operation rooms, warehouses, locker rooms, toilets, etc. For the problems found, it was necessary to determine the specific completion time of rectification from the responsible person of the team. Besides, closed-loop management was realized by simultaneous implementation of checking, rectifying and improving. At the end of each month, the main work of "6S" management was summarized and reported to the hospital promotion office, which then reported the situation of the whole hospital to the "6S" management leading group on a quarterly basis.

The working groups of each department were requested to regularly sum up their experience and potential areas that could be improved. Specifically, each group was often briefed on departments that were excelling in implementing th "6S" and used them as study examples to gradually improve their own protocols and make their "6S" management work more effective. The promotion office frequently visited each department to give them necessary guidance and supervision, correct the deficiencies in the "6S" management work, and promote correct practices in a timely manner. Any defects were required to be solved in time; and if necessary, a "6S" management problem diagnosis sheet was issued. Besides, the rectification dates were limited based on the severity degree of the diagnosed problem. Through various forms (monthly report analysis, meeting comments, public rewards, exchange of experience, etc.), the "6S" management work was promoted in a balanced manner. Lastly, following these regular assessments of issues identified and implementation of rectifying strategies, the "6S" management scheme was gradually realized for the long-term in all hospital departments.

Evaluation Indicators

The main indicators of this study were nurses' satisfaction, inventory time of hand-over materials, warehouse inventory time, ICU and emergency rescue efficiency before (June 2019 to May 2020) and after (June 2020 to May 2021) the implementation of "6S" combined with visual management, via stratified sampling and electronic questionnaires which were distributed to nurses in all departments of the hospital.

Ethical Considerations

The following ethical considerations exist in this study: (1) Subjects' right to informed consent: in order to ensure the rights and interests of the subjects, we have fully understood the employees' attitudes towards the visual and "6S" management method through public opinion surveys before conducting this study, and to ensure that all subjects participated in this study voluntarily. (2) Subjects' right to privacy: in order to ensure that subjects fill in the questionnaire truthfully, we use anonymous questionnaires, and no personal information of subjects will be shown; (3) Principle of fairness: in order to promote the efficient implementation of the Visual and "6S" Management Method in

each part, we set up a reward and punishment mechanism such as the one mentioned above. The results of supervision will be made public in a timely manner, and subjects can contact the supervision department at any time if they have any questions; (4) Patients' rights and interests: The implementation of any new policy in the hospital may affect the medical safety of patients. We took this into full consideration, so before the visual and "6S" management method, we conducted theoretical training and examination of participants and supervisors in each section to minimise the impact on patients' medical safety. We also closely monitored the efficiency of patient care during the implementation of the method. If the method is found to compromise medical safety, we stop it immediately.

Statistical Methods

Continuous variables were expressed as mean ± standard deviation. The *t*-test was used to compare between groups when the distribution was normal, and the Mann–Whitney *U*-test was used if the distribution was not normal. Categorical variables were expressed as frequencies (rates), and comparisons between groups were analysed using the chi-squared test or Fisher exact probability test. The SPSS26.0 statistical software was used for the statistical analysis of the data. $P < 0.05$ was considered statistically significant.

Results

Increased Satisfaction of Nurses After Implementing the Visual and "6S" Management

A total of 174 electronic questionnaires on nurse satisfaction were distributed and retrieved in this study, and the rank sum test was performed on the statistical data. As shown in Figure 1, after the implementation of the Visual and "6S" Management, the working environment becomes clean and tidy, and the items are placed in order. Most of the nurses (150 (86.06%)) were very satisfied with the working environment. In addition, the dissatisfaction rate was significantly lower than that before it was implemented (0.14% vs 4.31%). The results of this study revealed significantly higher nurses' satisfaction with on-site work environment after the Visual and "6S" Management compared with before implementation ($P < 0.01$) (Table 1).

Figure 1 The difference of the working environment before and after the implementation of the Visual and "6S" Management. (**A** and **B**) shown the environment before the method was implemented, (**C** and **D**) shown the environment after the method was implemented.

Table 1 Comparison of Nurses' Satisfaction with the Work Environment Before and After the Visual and "6S" Management

Time	Before"6S" (n[%])	After"6S" (n[%])	*P*
n	174	174	<0.01
Very Satisfied	106 (60.78%)	150 (86.06%)	
Quite Satisfied	34 (19.68%)	22 (12.36%)	
General	26 (15.23%)	1 (1.44%)	
Unsatisfied	8 (4.31%)	1 (0.14%)	

Note: the terms "before '6S'" and "after '6S'" refer to the short form of before and after implementing the Visual and "6S" Management.

Implementation of the Visual and "6S" Management Shortens Inventory Time of Warehouse in Each Ward and Materials in Treatment Room

Statistical analysis of the inventory time of warehouses and materials in the treatment room showed that the inventory time of the warehouse in each ward and materials in the treatment room during shift hand-over was significantly shorter after the Visual and "6S" management compared with that before the management ($P < 0.05$). Among them, the warehouse inventory time of Gynecology (24.75 ± 3.14 vs 9.9±0.83) and Brain Surgery (20.93 ± 2.31 vs 10.03 ± 0.20) was shortened most significantly. In part of material inventory time, Brain Surgery (31.93 ± 2.13 vs 9.01 ± 0.84) and Encephalopathy 3(16.80 ± 1.88 vs 5.37 ± 0.24) had the most shortened shift hand-over. (Tables 2 and 3).

Comparison of the Incidence of Nursing Adverse Events and Rescue Efficiency Before and Implementation of the Visual and "6S" Management

Here, we investigated the incidence of adverse events in nursing before and after implementing the Visual and "6S" management. Compared with before the management, a remarkable decrease was observed in the incidence of nursing adverse events after implementing the Visual and "6S" management (3% vs 1%, $P < 0.05$) (Table 4).

Further, we also investigated the effects of the Visual and "6S" management on the rescue time in the ICU and emergency departments. The results showed that the Visual and "6S" management demonstrated a significantly shorter time in the airway opening time (150.70 ± 30.56 vs 368.73 ± 65.62) during ICU rescue, material preparation time for severe cardiovascular collapse (CVC) insertion (139.6 ± 25.23 vs 421.99 ± 70.83), and the preparation time of the

Table 2 Comparison of Warehouse Inventory Time in Each Ward Before and After Implementing the Visual and "6S" Management

Department	Before"6S" Min (Mean±SD)	After"6S" Min (Mean±SD)	t	*P*
Intensive care unit	21.0±1.87	15.0±1.58	4.9	0.003
Urology	16.93±2.80	13.25±2.42	1.98	0.095
Ward Eight	12.03±0.54	11.23±0.46	1.11	0.329
Cardiology	11.15±0.74	10.18±0.22	2.52	0.045
Orthopedics	30.5±0.24	23.7±0.31	16.83	<0.001
Gynecology	24.75±3.14	9.9±0.83	4.56	0.004
Hemodialysis Room	10.38±0.15	8.3±0.14	20.13	<0.001
Operating Room	11.23±0.20	10.2±0.14	4.11	0.006
Brain Surgery	20.93±2.31	10.03±0.20	8.13	0.001
Encephalopathy 1	13.85±0.59	8.58±0.63	12.11	<0.001
Encephalopathy 3	13.68±0.49	8.25±0.23	19.84	<0.001
Emergency	11.00±0.81	8.25±0.95	4.37	0.005
Surgery	17.23±0.81	14.98±0.93	3.63	<0.001

Note: the terms "before '6S'" and "after '6S'" refer to the short form of before and after implementing the Visual and "6S" Management.

Table 3 Comparison of Material Inventory Time in Each Ward During Shift Hand-Over Before and After Implementing the Visual and "6S" Management

Department	Inventory Time (Min)		t	*P*
	Before "6S" (Mean±SD)	After "6S" (Mean±SD)		
ICU	8.18±2.47	6.38±0.47	1.3	0.241
Urology	4.55±0.16	2.98±0.24	10.67	<0.001
Ward Eight	13.67±1.65	10.72±0.34	3.48	0.013
Cardiology	24.13±4.70	10.89±1.03	5.49	0.002
Orthopedics	20.76±1.84	17.8±0.49	3.1	0.021
Gynecology	5.12±0.49	3.82±0.94	2.44	0.05
Hemodialysis Room	3.65±0.49	2.29±0.09	3.83	0.062
Operating Room	26.18±5.20	10.26±0.26	6.11	<0.001
Brain Surgery	31.93±2.13	9.01±0.84	17.32	<0.001
Encephalopathy 1	24.27±4.27	19.28±5.82	1.38	0.216
Encephalopathy 3	16.80±1.88	5.37±0.24	12.01	<0.001
Emergency	14.00±1.41	9.94±0.57	5.32	0.002
Surgery	9.03±4.65	7.04±0.54	0.85	<0.001

Note: the terms "before '6S'" and "after '6S'" refer to the short form of before and after implementing the Visual and "6S" Management.

Table 4 Comparison of the Incidence of Nursing Adverse Events Before and After "6S" Combined with Visual Management

Variables	Hospitalized Patients	Medication Errors	Incidence (%)	χ^2	*p*
Before"6S"	28,164	10	3	0.001	<0.001
After"6S"	23,547	2	1		

Note: the terms "before '6S'" and "after '6S'" refer to the short form of before and after implementing the Visual and "6S" Management;

ventilator items (114.72 ± 13.87 vs 278.07 ± 50.78 Table 5). In addition, compared with before the management implementation, the time for the first electrocardiograph (93.18±12.25 vs 266.81±16.42), establishment of intravenous access (105.21 ± 7.98 vs 214.81 ± 24.09), and first drug administration (111.18 ± 13.62 vs 125.25 ± 7.41) in the emergency department was significantly shortened after implementing the Visual and "6S" management (Table 6). The above results indicated that the Visual and "6S" management could be applied to improve the rescue efficiency of ICU and emergency departments.

Table 5 Comparison of ICU Rescue Efficiency and Time Before and After "6S" Combined with Visual Management

Variables	n	Time Taken to the Following Procedures (Seconds)		
		Airway Opening(s)	CVC Item Preparation(s)	Ventilator Items(s)
Before "6S"	83	368.73±65.62	421.99±70.83	278.07±50.78
After "6S"	88	150.70±30.56	139.6±25.23	114.72±13.87
t		28.11	35.12	29.05
P		<0.001	<0.001	<0.001

Note: the terms "before '6S'" and "after '6S'" refer to the short form of before and after implementing the Visual and "6S" Management; s, second;

Table 6 Comparison of Rescue Efficiency and Time in the Emergency Department Before and After "6S" Combined with Visual Management

Variables	n	Time Taken to the Following Procedures (Seconds)		
		Time to First Electrocardiograph	Time to Establish Venous Access	Time of First Dose
Before"6S"	32	266.81±16.42	214.81±24.09	125.25±7.41
After"6S"	34	93.18±12.25	105.21±7.98	111.18±13.62
t		48.88	25.15	5.17
P		<0.001	<0.001	<0.001

Note: the terms "before '6S'" and "after '6S'" refer to the short form of before and after implementing the Visual and "6S" Management.

Discussion

Nursing quality is the core of nursing management. Its quality level depends on the effectiveness of nursing quality management methods, the quality awareness of nursing groups, and participation in quality monitoring.[4] The results of this study indicated that the implementation of the "6S" combined with visual management reduced the occurrence of nursing adverse events, which was in line with the study by Alzahrani et al.[8] The possible reason could be related to the following two aspects. First, visual management allows the placement of drugs and medical devices at a clear glance through quantitative, fixed and partitioned placement strategies. This enables fewer confusions, reduces ineffective hand-overs, and improves medical security. Second, the "6S" management method can help to prevent events leading to unused drugs over their expiration date, backlog, waste and loss, reduction in medication errors,[9] and relieves the situation of receiving and refunding materials by various departments.

Our results also showed that the Visual and "6S" management could significantly shorten the inventory time of the warehouse and the material inventory time in the treatment room during shift hand-over, which was concordant with a previous report.[10] Additionally, the establishment of a guiding identification system and nearby placement of medical equipment and instruments not only promote the independent medical treatment of patients but also reduce the workload of medical staff and improve patients' treatment experience.[11] Based on the economic principles in action, systematic optimization of medical activities like material sorting and medicine dispensing of medical staff from the operation level can improve and increase the efficiency of operation methods. Besides implementing visual management of offices, nurse stations and other places, Visual and "6S" management can enhance individual behavior and promote the professionalism of employees. All in all, we believe these were the contributors leading to increased nurses' satisfaction as they could observe improvements in their working environment and experience increased working efficiencies.

Patients in the emergency department and ICU suffer from complex and critical conditions, and treatment efficiency is directly related to their outcomes; thus, timely and effective rescue is vital in such settings. Some of the important ways that could shorten rescue time and increase the success rate of rescue operations are: (1) correct placement of rescue equipment and instruments at a fixed location, (2) increased awareness of rescues on their responsibilities and roles during rescuing procedures, and (3) proper coordination and collaborations between medical staffs.[12]

After implementing 6S management in the emergency department, our hospital has adopted effective methods in six areas: urging the members of the department to do a good job in daily cleaning and maintenance, standardising the placement of equipment, strengthening equipment training and quality control of equipment, and raising the safety awareness of nursing staff in the use of equipment. In this study, based on the patient-centered principle, the space layout of the rescue room in the emergency department was optimized, and rescue equipment and supplies were positioned and quantified. As a result, the time for picking up items, equipment and medicines was shortened, reducing the time for getting needed items. In addition, the efficiency of nursing work was improved, and the emergency rescue rate was increased. After experiencing significant improvements with the Visual and "6S" management, the ICU department could more effectively apply the ABC positioning rescue method.[13] Under this management mode, the supplementary application of the rescue kit ensures that the department members can get the required rescue tools at a fixed location at any time. Moreover, reasonable, standardized and visual placement of rescue medical equipment can shorten the tool

acquisition time of nurses, thereby ensuring tool integrity and improving the rescue efficiency. The positioning rescue mode makes the rescue operations more orderly and shortens the implementation time of the rescue measures. It might also significantly shorten the injury evaluation and preoperative preparation time, especially for patients with multiple injuries.[14] In recent years, this positioning rescue mode has attracted more and more attention in clinics because of its advantages of providing quick and convenient first aid care and improving the success rate of rescue operations. Combined with the results of previous studies and our study, we consider that the implementation of the 6S management method in the emergency department and intensive care unit is urgently needed.

Since the implementation of the "6S" management in our hospital, significant improvements have been achieved in management systems. In regard to patient care, it helped improve the nurses' productivity, increased overall treatment efficiencies and yields in the ICU department, and improved the use of equipments and timely use of drugs. Thus, this management mode not only effectively realized the transition of nursing staff from "passive work" to "active work"[15] but also improved the quality of nursing and medical efficiency. In the future, we plan to implement the Visual and "6S" management based on the needs of patients and existing problems and deficiencies at our institutions. In addition, our hospital will also try implementing the Visual and "6S" management to further improve the service management mode and increase TCM service levels and comprehensive treatment capabilities.

There is no denying that the management method faces some challenges in its implementation. If there is a lack of effective incentives to maintain the mechanism, the enthusiasm of staff will diminish over time, which will not ensure the continuous progress of 6S management. Therefore, in addition to the workload, work attitude, etc. in the hospital level evaluation, but also to excellent departments to perform, the progress of backward departments to provide incentives. In the "6S" management implementation process, there is also a build the effect of uneven problems, although the same evaluation and assessment standards, but due to the enthusiasm of the staff of each department and human resources allocation issues, will lead to the final build between departments of the effect is uneven, in this case, in the face of the effect of poorer departments, In response to this situation, in the face of the less effective departments, supervisors should continue to help the departments to improve their management and make continuous improvement through the management method of "guidance, assistance and motivation" in terms of direction, resources and mobilisation of motivation.

However, our study has several limitations. Firstly, we measured whether the Visual and "6S" management method benefited nursing work by comparing the various indicators before and after the implementation it. There was no control group during the implementation of this approach. It is an unavoidable bias in this study. Secondly, the study was a single-centre study with some selective bias, and it is uncertain whether this approach would give the same results in other hospitals. More multicentre randomised controlled trials are needed in the future. Thirdly, this study was conducted over a short period of time. It is unclear whether its adherence can be maintained by participants and supervisors when this approach is implemented over a longer period of time. More long-term studies are needed to determine the effectiveness of this method. Finally, this study was conducted in a grade A tertiary comprehensive TCM hospital. It is not clear whether the method is equally applicable to primary and community clinics. In the future, it needs to be applied to different levels and types of medical institutions to determine its general applicability.

Conclusion

This study showed that the Visual and "6S" management effectively increased the quality of clinical nursing management, improved rescue operations efficiency and increased nurses' satisfaction. It also played an important role in improving the overall hospital service management. It should be noted that this was a single-centre prospective study, so some selection bias is inevitable. In addition, our study period was short. In the future, multicentre, long-term randomised clinical trials are needed to provide more evidence that this approach can benefit nursing practice.

Data Sharing Statement

The data used to support the findings of this study are available from the corresponding author upon request.

Ethics Statement

This study was approved by the ethics committee of Tianjin Beichen Traditional Chinese Medicine Hospital. All methods were carried out in accordance with Declaration of Helsinki. Informed consent was obtained from all subjects.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This study was supported by Tianjin Beichen District Science and Technology Commission Project (SHGY2020055).

Disclosure

The authors declare that they have no conflicts of interest.

References

1. Hiroyuki H. *5S for Operators: 5 Pillars of the Visual Workplace*. United States: Taylor & Francis Inc; 2005.
2. Wei W, Wang S, Wang H, Quan H. The application of 6S and PDCA management strategies in the nursing of COVID-19 patients. *Crit Care*. 2020;24(1):443. doi:10.1186/s13054-020-03124-w
3. Wang D, Kuang HM, Wan Q, Sun M, Wu DQ. Application of "6S" integrated visual management mode in neurology ICU ward management. *J Qilu Nurs*. 2017;23(13):118–120.
4. Tian YY, Li HY. Influence of 6S management mode on improving the quality of clinical nursing management. *J Qiqihar Univ Med*. 2019;40(5):638–639.
5. Huang MG, Zeng Q, Lin Y, Luo YM, Liu L. Application of visual management in safety and quality control management of pediatric nursing. *Med Diet Health*. 2020;18(20):197–199.
6. Zhao HW, Gao Z, gS Z. Application of 6S management model in ward management. *Nurs Pract Res*. 2017;14(14):124–126.
7. Guo X, He Y, Liu J, Duan J. [Management pattern of undergraduate teaching laboratory with a focus on creating the educational environment]. *Sheng Wu Gong Cheng Xue Bao*. 2020;36(7):1459–1464. Chinese. doi:10.13345/j.cjb.190593
8. Alzahrani Z. Lean thinking: using 6S and visual management for efficient adverse event closure. *BMJ Open Qual*. 2021;10(1). doi:10.1136/bmjoq-2020-001197
9. Huang DF, Li JB, Liu DJ, Song AM. Application of 6S management in quality control of clinical care. *J Nurs Sci*. 2015;30(13):20–21, 35.
10. Wang LL, Yang L, Wang CH, Ren Y, Ding JL, Li P. Implementation of 6S methodology combining with visual management in COVID-19 wards of Hubei province. *J Nurs Sci*. 2020;35(9):18–20.
11. Zheng G, Xia P, Zhai LX. Literature analysis of application of visual management in medical service management abroad. *West China Med J*. 2020;35(12):1451–1455.
12. Zhao ZF, Wang YY, Chen X, Li SS, Ji SS, Yi XH. The application of rescue positioning in emergency rescue. *J Clin Med Lit*. 2020;7(23):50.
13. Meng NL, Liu YH, Liu HW, Liu ZK. Applied effect and analysis of 6S management for ICU nursing safety management. *J Nurses Train*. 2012;27(24):2224–2227.
14. Teng Y, Wu XL, Wang XH, Wu LL. Observation on the effect of positioning rescue mode training for emergency nursing team. *Nurs Rehabilitat J*. 2017;16(3):277–279.
15. Zhang M, Ning JL, Zhao N, Cui N, Yang JS. Research on the influence of "6S" management mode on adverse events of nursing quality. *Shanxi Med J*. 2020;49(18):2520–2523.