

# Analysis of the Effect of Quality Control Circle on the Central Sterile Supply Department

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**Abstract:** *Objective:* To analyze the effect of quality control circle on the central sterile supply department (CSSD). *Methods:* The control group and the observation group each consisted of 180 instruments received by the sterilization supply center from January to March 2023 and 11 CSSD staff. The control group underwent routine management while quality control circle was implemented in the observation group. The quality of work, disinfection and sterilization qualification rates, disinfection and sterilization of various instruments, cleaning indicators, and management satisfaction of both groups were compared. *Results:* The observation group scored higher in terms of work quality, the qualification rate of disinfection and sterilization in each link, the disinfection and sterilization of instruments, and cleaning indicators compared to the control group. Besides, the management satisfaction of the observation group was higher than that of the control group ( $P < 0.05$ ). *Conclusion:* A quality control circle ensures the quality of work, improves the cleaning, disinfection, and sterilization of instruments of the CSSD, and improves the management satisfaction of the CSSD staff.

**Keywords:** Quality control circle; Central sterile supply department; Nursing quality; Disinfection and sterilization

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## 1. Introduction

The central sterile supply department (CSSD) is responsible for supplying, cleaning, disinfecting, and sterilizing medical equipment in a hospital<sup>[1]</sup>. Incomplete sterilization and unstandardized equipment management can directly affect the quality of care and even increase the risk of infection. Quality control circle is a commonly used quality management method that can improve the quality of nursing services. Furthermore, quality control circles can enhance the sense of responsibility among staff at the CSSD and boost their satisfaction with management. This, in turn, ensures the practicality and sustainability of nursing management<sup>[2]</sup>. Building upon the aforementioned theory, this study analyzed the significance of implementing quality control circle activities using 360 instruments and involving 22 CSSD staff members.

## 2. Materials and methods

### 2.1. General information

The control group and the observation group each consisted of 180 instruments received by the sterilization

supply center from January to March 2023 and 11 CSSD staff. The instruments included in the control group were 61 surgical scissors, 61 surgical forceps, and 58 vascular forceps; the staff in this group consisted of two males and nine females, aged 22 to 41 years old, with an average age of  $35.01 \pm 1.29$  years. The instruments included in the observation group were 62 surgical scissors, 62 surgical forceps, and 56 vascular forceps; the staff in this group consisted of three males and eight females, aged 21 to 42 years old, with an average of  $35.38 \pm 1.77$  years. There were no significant differences in the general information between both groups ( $P > 0.05$ ).

## 2.2. Method

The control group followed standard instrument management procedures, involving rinsing the instrument's surface with purified water, followed by soaking the instrument in an enzyme-containing washing solution. After a 5-minute soak, the instrument was subjected to ultrasonic cleaning, and a visual inspection was conducted to assess the cleanliness of the instrument's surface and teeth. Lastly, the instrument was cleaned with a high-pressure water gun and allowed to dry.

The observation group implemented a quality control circle. (1) Team establishment: The head nurse served as the leader, and the CSSD staff involved in the study became team members. They collectively acquired skills and concepts related to quality control circle management and mastered the activity procedures and precautions. (2) Theme selection: The current status of equipment management in CSSD was studied, management issues were identified, relevant literature and equipment management guidelines were reviewed, and the activity theme was selected through brainstorming. (3) Formulation of an activity plan: The team members reviewed relevant information on the activity theme, distributed questionnaires, and evaluated the opinions and suggestions of medical staff in the hospital on the current equipment management of the CSSD. (4) Activity analysis: The causes of device management problems were identified, which included equipment factors, staff factors, environmental factors, and management factors. Prevention and control measures were proposed for each factor, seminars were organized, and continuous improvement of prevention and control measures was established as the foundational basis. A management plan was initially formulated. (5) Implementation of countermeasures: regular training sessions were conducted with the team leader selecting typical cases, organizing members to analyze potential safety hazards, and demonstrating correct operational methods to improve the skills of the team members. A two-person supervision mechanism was adopted for each link, such as instrument cleaning and disinfection, to ensure standardized operations. The performance of the team members was evaluated based on the passing rate of the instruments, and a reward and punishment mechanism was implemented to improve the members' sense of responsibility. Communication with other departments increased, collecting opinions through visits and discussing problems and rectification suggestions weekly. The cleaning agents were selected according to the type of contaminants and the instrument's material. For example, acidic cleaning agents were used for organic contaminants, while alkaline ones were used for others. These cleaning agents were freshly prepared and used. Besides, the instruments were soaked for over 20 minutes, and the soaking water temperature was maintained at around  $40^{\circ}\text{C}$ . (6) Effect evaluation: Each day before leaving or finishing work, team members were required to provide detailed reports on their daily tasks. The team leader oversaw equipment management and conducted spot-checks on the day's equipment cleaning and recycling activities. (7) Review and improvement: Weekly meetings were organized to review the week's work, identify management issues, and devise improvement strategies.

## 2.3. Observation indicators

The work quality of the staff was evaluated by the head nurse using a self-made evaluation scale, which

covered aspects like cleaning process standardization, equipment quality control, supply timeliness, recycling work quality, delivery work quality, and service attitude, with a maximum score of 100 points. The instrument disinfection and sterilization passing rates were assessed, encompassing various aspects like classification, cleaning, recycling, disinfection, packaging, and sterilization, with a possible score of 10 points for each. A score above 7 points was considered a pass. Additionally, the disinfection and sterilization pass rate for surgical scissors, surgical forceps, and vascular forceps was evaluated, taking into account factors such as cleaning time, bacterial count in biofilm 2 hours post-cleaning, cleaning costs, and other cleaning effectiveness indicators. A self-designed satisfaction survey questionnaire was administered, which covered aspects of the management process, strategies, and work efficiency, with a total score of 100 points. Scores exceeding 75 points was labeled as “very satisfied”, scores between 40 and 75 points were labeled as “satisfied,” and scores lower than 40 points were labeled as “dissatisfied.”

## 2.4. Statistical analysis

The data were analyzed using SPSS 28.0. Measurement values were compared and tested using *t*-tests, while count values were compared and tested using chi-square ( $\chi^2$ ) tests. Statistical significance was determined at  $P < 0.05$ .

## 3. Results

### 3.1. Quality of work

The quality of work the observation group was higher than those of the control group ( $P < 0.05$ ), as shown in **Table 1**.

**Table 1.** Comparison of nursing quality scores between the two groups (mean  $\pm$  standard deviation/min)

Group	Number of staff	Standardization of the cleaning process	Instrument quality control	Timeliness of supply	Recycling	Delivery	Service attitude
Observation group	11	92.35 $\pm$ 2.65	93.48 $\pm$ 2.71	93.58 $\pm$ 2.56	93.18 $\pm$ 2.44	94.15 $\pm$ 2.81	94.76 $\pm$ 2.77
Control group	11	88.14 $\pm$ 2.61	89.75 $\pm$ 2.64	90.01 $\pm$ 2.46	90.13 $\pm$ 2.41	91.02 $\pm$ 2.76	91.03 $\pm$ 2.76
<i>t</i>	-	3.754	3.270	3.335	2.950	2.636	3.164
<i>P</i>	-	0.001	0.004	0.003	0.008	0.016	0.005

### 3.2. Disinfection and sterilization passing rates

The disinfection and sterilization passing rate in the observation group was higher than in the control group ( $P < 0.05$ ) as shown in **Table 2**.

**Table 2.** Comparison of disinfection and sterilization passing rates between the two groups (*n* [%])

Group	Quantity	Classification	Clean	Recycle	Disinfect	Package	Sterilize
Observation group	180	177 (98.33)	178 (98.89)	177 (98.33)	179 (99.44)	178 (98.89)	179 (99.44)
Control group	180	170 (94.44)	171 (95.00)	169 (93.89)	173 (96.11)	171 (95.00)	173 (96.11)
$\chi^2$	-	3.910	4.595	4.756	4.602	4.595	4.602
<i>P</i>	-	0.048	0.032	0.029	0.032	0.032	0.032

### 3.3. Passing rates of various types of devices

The passing rates of various types of devices in the observation group were higher than those in the control group ( $P < 0.05$ ), as shown in **Table 3**.

**Table 3.** Comparison of passing rates of various types of devices between the two groups ( $n$  [%])

Group	Surgical scissors		Surgical forceps		Vascular forceps	
	Number of examples	Passing rate	Number of examples	Passing rate	Number of examples	Passing rate
Observation group	62	98.39 (61/62)	62	100.00 (62/62)	56	98.21 (55/56)
Control group	61	88.52 (54/61)	61	93.44 (57/61)	58	87.93 (51/58)
$\chi^2$	-	4.918	-	4.202	-	4.617
$P$	-	0.027	-	0.040	-	0.032

### 3.4. Cleaning effects

The cleaning effect indicators of the observation group were better than those of the control group ( $P < 0.05$ ), as shown in **Table 4**.

**Table 4.** Comparison of cleaning effects between two groups (mean  $\pm$  standard deviation)

Group	Number of instruments	Cleaning time (min)	Number of bacteria in the biofilm 2 hours after cleaning (CFU/cm <sup>2</sup> )	Cleaning cost (yuan)
Observation group	180	62.11 $\pm$ 4.26	7.21 $\pm$ 1.36	18.66 $\pm$ 1.62
Control group	180	87.65 $\pm$ 4.92	8.54 $\pm$ 1.40	24.43 $\pm$ 1.95
$t$	-	13.016	2.260	7.549
$P$	-	0.000	0.035	0.000

### 3.5. Management satisfaction

The management satisfaction of the observation group was higher than that of the control group ( $P < 0.05$ ), as shown in **Table 5**.

**Table 5.** Comparison of management satisfaction between the two groups ( $n$  [%])

Group	Number of people	Highly satisfied	Satisfied	Not satisfied	Satisfaction
Observation group	11	7 (63.64)	4 (36.36)	0	100.00 (11/11)
Control group	11	5 (45.45)	2 (18.18)	4 (36.36)	63.64 (7/11)
$\chi^2$	-	-	-	-	4.889
$P$	-	-	-	-	0.027

## 4. Discussion

The CSSD is an important department that ensures the quality of disinfection and sterilization of medical equipment. However, many problems were found in equipment management, such as aging or improper maintenance of disinfection equipment, improper equipment selection, failure, or instability. It is also important that the staff understand the disinfection standard operating procedures and take care of their personal hygiene [3]. In addition, insufficient resource allocation, lack of supervision and quality control, and lack of improvement

measures are common problems in equipment management. In order to ensure the quality of care in the disinfection supply center, professional equipment management methods are often adopted.

Quality control circle activities are a highly applied quality control method, aiming to continuously improve work processes and service quality through a high degree of participation and collaboration among staff <sup>[4]</sup>. Its basic principles are as follows. (1) Employee participation: Quality control circle activities encourage employees to actively participate in the quality improvement process, allowing them to discover management problems and propose solutions. (2) Teamwork: Quality control circle activities were carried out in groups, requiring the team members to cooperate with the leader. (3) Periodic meetings: Regular meetings were held to discuss current quality issues and put forward suggestions for improvement <sup>[5]</sup>. (4) Data analysis: Data analysis was performed to understand the root causes of problems and evaluate the effectiveness of improvement measures. (5) Continuous improvement: The goal of a quality control circle is to attain continuous improvement, constantly identify and resolve new management issues, establish management objectives, and consistently iterate the improvement process <sup>[6]</sup>.

The results showed that the observation group had higher nursing quality scores, higher passing rates of disinfection and sterilization of various equipment processes and types of equipment, better equipment cleaning indicators, and higher staff satisfaction compared to the control group ( $P < 0.05$ ). This is because a quality control circle encourages the participation of staff members in identifying and solving common problems in equipment management. By screening management problems and brainstorming ideas, circle members can deeply understand the nature of the problem and propose targeted solutions, thereby improving the work quality of the CSSD <sup>[7]</sup>. A quality control circle encourages staff to collaboratively develop and enhance standard operating procedures to ensure consistency across multiple processes, such as disinfection, cleaning, and sterilization. This reduction in operational variability leads to an improvement in instrument disinfection and sterilization qualification rates and cleaning effectiveness. The circle activities also involve regular training and knowledge sharing. Training helps staff enhance their operational skills and knowledge levels, gain a deeper understanding of the CSSD's workflow and operational requirements, reduce errors, and enhance equipment management effectiveness <sup>[8]</sup>. Furthermore, incorporating a supervision mechanism within quality control circle activities, like the mutual supervision by assigning two responsible individuals in the instrument cleaning process, can mitigate work errors and oversights. Associating the failure rate of device management with staff performance and applying a system of rewards and penalties can bolster staff accountability, ensuring optimal management efficiency.

Most importantly, quality control circle activities foster a culture of improvement and facilitate the involvement of every employee in continuous enhancement <sup>[9]</sup>. Through regular discussions, staff can identify key issues in their work and develop strategies for improvement. This culture of ongoing improvement contributes to enhancing the quality of care and elevating equipment management standards. It places staff at the forefront, emphasizing their active participation in management and fostering a high level of collaboration. Actively integrating their improvement ideas and suggestions can enhance their satisfaction, ignite their work motivation, and elevate overall work quality <sup>[10]</sup>.

## 5. Conclusion

In summary, quality control circle activities can improve the quality of care in the sterilization supply center, ensure the passing rate of cleaning, disinfection, and sterilization of instruments, and improve staff satisfaction with the management process, which has high management value.

## Disclosure statement

The authors declare no conflict of interest.

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