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2026 Volume 11, Issue 1
Advances in Precision Medicine
ISSN: 2424-9106 (Online)
ISSN: 2424-8592 (Print)

The Application Effect of Process Quality Control Nursing Model in Nursing of Physical Examination Center

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Abstract: *Objective:* To explore the application effect of process quality control nursing model in the nursing work of a physical examination center, and to evaluate its impact on improving nursing quality, work efficiency, and customer satisfaction. *Methods:* Two hundred examinees who received services at the physical examination center of our hospital from June 2022 to May 2023 were selected as the research subjects and randomly divided into a control group and an experimental group, with 100 cases in each group. The physical examination efficiency, nursing defect rate, and report issuance time were compared between the two groups. Questionnaires and scales were used to assess customer satisfaction and nursing quality, and 20 nurses were also evaluated. *Results:* The total physical examination time and nursing defect rate in the experimental group were significantly lower than those in the control group, the report issuance time was shorter, the customer satisfaction and nursing quality scores were significantly higher, and the nurses' comprehensive assessment scores were significantly improved. All differences were statistically significant. *Conclusion:* The application of process quality control nursing model in the nursing work of a physical examination center can improve the workflow, reduce nursing defects, reduce the waiting time and report issuance time for examinees, significantly improve the quality and efficiency of nursing work, enhance examinee satisfaction, and improve the comprehensive professional level of nurses. It has positive promotion and application value.

Keywords: Process quality control; Nursing model; Health checkup center; Nursing quality; Customer satisfaction

Online publication: January 26, 2026

1. Introduction

With increasing awareness of health management, health checkups have become a means for people to prevent and detect diseases early. Health checkup centers are the places where people undergo health examinations, and the service quality and efficiency of these centers are directly related to the public's sense of well-being and experience. Traditional health checkup procedures often focus on the order of various items, lacking detailed control over the connections and quality at each stage before, during, and after the examination. This can easily lead to unclear instructions, long waiting times,

missed steps, poor communication, and delayed reports, reducing the overall health checkup experience and the center's operational efficiency.

Process-oriented quality control (POC) is a quality control approach that focuses on process control. By setting standards, controlling, and improving each stage of the service or production process, it ensures stable and high-quality final output. Applying this concept to the nursing management of a health checkup center aims to break through the mechanical nature of traditional processes and create a customer-centric, dynamically adjustable, and interconnected quality assurance system. This article applies the POC nursing model to the practice of a health checkup center and compares it with the conventional nursing model, systematically evaluating the effectiveness of the POC nursing model. It hopes to provide empirical evidence and management strategy references for improving nursing services in health checkup centers [1].

2. Materials and methods

2.1. General information

Two hundred individuals who underwent physical examinations at our hospital's health checkup center between June 2022 and May 2023 were selected. Inclusion criteria: age 18 to 70 years; conscious and able to communicate normally; voluntary participation in this study and signing of informed consent. Exclusion criteria: those with acute illnesses or serious physical conditions requiring emergency treatment; those with mental disorders or cognitive impairments; those who withdrew from the health checkup midway. Participants were randomly divided into an experimental group and a control group, with 100 participants in each group. The experimental group consisted of 52 males and 48 females, with a mean age of (45.3 ± 10.8) years; the control group consisted of 49 males and 51 females, with a mean age of (46.1 ± 11.2) years. There were no statistically significant differences between the two groups in terms of gender, age, and type of health checkup package, making them comparable. Furthermore, 20 registered nurses who regularly worked at the health checkup center were also included in this study as subjects for evaluating nursing quality; their professional titles, years of service, and other basic information were consistent [2].

2.2. Methods

2.2.1. Control group

Routine nursing procedures were followed. After the examinees arrived at their scheduled time, the front desk nurse verified their information and issued examination guidance slips. The examinees then proceeded to their respective examination departments according to the guidance slips. Nurses in each department completed the examination items and provided nursing care as per their department's routine procedures. After the examinations, the nurses collected and compiled the reports and issued them uniformly.

2.2.2. Experimental group

Using the process quality control nursing model. The specific implementation is as follows:

(1) Constructing a process quality control system

Establish a process quality control team with the head nurse as the leader. The entire physical examination process is broken down into six main parts: appointment registration, guidance and diversion, specialist examination, specimen management, report summary and distribution, and follow-up consultation. Detailed standardized operating procedures, quality evaluation standards and key control points are formulated for each process.

(2) Pre-examination process quality control

Optimize the appointment system, implement precise appointments in different time periods, and control the flow of people per unit time. Use SMS, APP push and other methods to inform patients of the precautions, process and required documents for the physical examination in advance, and push personalized pre-examination knowledge.

The appointment nurse and patients with special needs are contacted by telephone to confirm.

(3) In-examination process quality control

Set up a special guidance nurse and dynamically divert and guide people according to the real-time flow monitoring system and the waiting situation of each department to avoid congestion. Set up quality control posts at each examination node, and nurses check the information of examinees and examination items, without omissions or errors, and perform nursing operations in a standardized manner. Establish a process handover and verification system, and adopt electronic signature method of information handheld terminal to ensure information connection. Set up a health education post in the waiting area and conduct health knowledge micro-lectures during the waiting time.

(4) Post-examination process quality control

Standardize the specimen collection, labeling, transportation and handover process to ensure timeliness and accuracy. Establish a report double-checking and review system to ensure report quality. Optimize the report preparation procedure and specify a clear deadline for issuance. Establish a warning and notification level system for abnormal results, and inform and provide preliminary explanations by telephone by experienced nurses or health managers, and give further diagnosis or health management suggestions.

(5) Continuous quality improvement

The quality control team inspects each process every day, holds a quality analysis meeting every week, and uses information collected by the information system such as the time spent in each process and real-time customer feedback to analyze existing problems, formulate and implement improvement measures. Train and assess nurses on process quality control every month [3,4].

2.3. Observation indicators

(1) Efficiency indicators

The time taken for both groups of examinees to complete all examination items from entering the center, the average waiting time for each major examination item, and the time for issuing the examination report.

(2) Quality and safety indicators

The incidence of nursing defect events in both groups was statistically analyzed, including incorrect guidance, missed examination items, incorrect specimen information, and incorrect or missing report information.

(3) Customer satisfaction

A self-made satisfaction survey questionnaire was used after the examination. The questionnaire included 6 aspects: service attitude, process guidance, waiting time, environment and facilities, health guidance, and overall evaluation, with a total of 20 items. The Likert 5-point rating method was used, with a total score of 100 points. ≥ 90 points was very satisfied, 80–89 points were satisfied, 70–79 points were average, and < 70 points was dissatisfied. Total satisfaction = (number of very satisfied cases + number of satisfied cases) / total number of cases × 100%. The Cronbach's α coefficient of the questionnaire was 0.87.

(4) Nursing quality assessment

The nursing quality assessment scale for the physical examination center formulated by the nursing department of our hospital was used to score the nurses in terms of basic nursing care, specialized operation, communication and collaboration, safety management and health education. The total score was 100 points.

(5) Comprehensive quality assessment of nurses

The 20 nurses participating in this study were assessed before and after the implementation. The assessment content included theoretical examination, communication skills scenario simulation, emergency response case exercise and health guidance ability assessment [5].

2.4. Statistical analysis

Data analysis was performed using SPSS 25.0 statistical software. Quantitative data were expressed as mean ± standard deviation, and independent samples *t*-tests were used for comparisons between groups. Categorical data were expressed as number of cases or percentages, and chi-square tests were used for comparisons between groups. A $p < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of efficiency indicators between the two groups of examinees

The total time spent on physical examinations, the average waiting time for each item, and the time for issuing physical examination reports were all significantly shorter in the experimental group than in the control group, and the differences were statistically significant. See **Table 1**.

Table 1. Comparison of efficiency indicators between the two groups of examinees

Index	Total time spent on physical examination (min)	Ultrasound examination waiting time (min)	Blood draw waiting time (min)	Report issuance time (h)
Experimental group (n = 100)	98.5 ± 15.2	18.3 ± 5.1	8.5 ± 2.8	24.5 ± 3.2
Control group (n = 100)	136.8 ± 20.4	35.6 ± 8.9	15.2 ± 4.7	48.6 ± 6.8
t-value	15.237	18.049	12.673	35.142
p-value	< 0.001	< 0.001	< 0.001	< 0.001

3.2. Comparison of the incidence of nursing defect events between the two groups

During the experiment, 3 nursing defect events occurred in the experimental group, accounting for 3.0% of the total cases. These events included: 1 case of minor delay in instructions, 1 case of typo in the report, and 1 case of incomplete health guidance. In the control group, there were 12 nursing defect events (12.0%): 2 cases of missed detection, 3 cases of incorrect instructions, 2 cases of unclear specimen labeling information, 4 cases of incorrect or missing information in the report, and 1 case of a complaint due to inappropriate communication. The incidence of nursing defect events in the experimental group was significantly lower than that in the control group, and the difference was statistically significant ($\chi^2 = 5.741$, $p = 0.017$).

3.3. Comparison of customer satisfaction between the two groups

Significantly higher overall customer satisfaction scores and overall satisfaction than the control group. See **Table 2**.

Table 2. Comparison of customer satisfaction between the two groups

Group	Number of examples	Total satisfaction survey score (points)	Overall satisfaction [n (%)]
Experimental group	100	95.2 ± 3.8	98 (98.0%)
Control group	100	86.4 ± 6.5	85 (85.0%)
t/χ^2 value		12.069	10.698
p-value		< 0.001	0.001

3.4. Comparison of nursing quality assessment scores

After implementing the process quality control model, the average score of nursing quality assessment in the experimental group during the nursing period was (96.5 ± 2.1) points, which was significantly higher than that in the control group (88.3

± 4.7) points, and the difference was statistically significant ($t = 17.324$, $p < 0.001$).

3.5. Comparison of nurses' comprehensive competency assessment results

After implementing the process quality control model, the 20 nurses showed significant improvement in their assessment scores in four areas: theoretical examination, communication skills, emergency response, and health guidance, compared to before the implementation. See **Table 3**.

Table 3. Comparison of comprehensive competence assessment scores of nurses before and after implementing the quality control model

Assessment items	Theoretical examination (points)	Communication skills (points)	Emergency response (points)	Health guidance (points)
Before implementation (n = 20)	82.5 ± 5.6	80.8 ± 6.1	78.4 ± 7.3	76.9 ± 8.2
After implementation (n = 20)	94.8 ± 3.2	92.5 ± 4.5	91.2 ± 4.8	93.7 ± 3.9
t-value	8.912	7.154	6.583	8.429
p-value	< 0.001	< 0.001	< 0.001	< 0.001

4. Discussion

The results of this study show that using a process quality control model in health checkup center nursing produces many positive effects. This model effectively solves the bottleneck problems of traditional health checkup nursing by using systematic process reengineering and refined process management.

The improvement in service efficiency is significant. The combination of time-slot appointments and dynamic information-based guidance and triage has fundamentally balanced patient flow, resulting in a marked reduction in the total time spent on physical examinations in the experimental group, as well as waiting times for bottleneck items such as ultrasound and blood tests. The shortened report issuance time is a result of the synergistic improvement in the operational efficiency of the physical examination center achieved through standardized post-examination procedures, a double-checking system, and clear time-limit management, which also meets modern people's demand for efficient services.

From the perspective of ensuring nursing quality and safety, the process-based quality control model has its advantages. It constructs a comprehensive quality monitoring network by clearly defining standards for each step, setting key control points, and implementing handover and verification systems. In this study, the incidence of nursing defect events in the experimental group was significantly lower than that in the control group, indicating that this model is effective in preventing errors and plugging loopholes. Standardized operations reduce variability caused by individual differences in habits, while quality monitoring and improvement mechanisms can promptly identify and correct problems, forming a closed loop in quality management [6].

The significant improvement in customer satisfaction is a core indicator of the successful application of the process quality control model. Increased efficiency directly improves the customer's time experience. Humanized methods such as dedicated guides, dynamic triage, and waiting area education transform the physical examination process from chaotic and crowded to orderly and guided, reducing customer anxiety and confusion. More importantly, it emphasizes a "customer-centric" approach, incorporating value-added services such as health guidance, notification of abnormal results, and consultation into the scope of quality control. This transforms nursing services from mere "operational assistance" to "health companionship," increasing customer trust and sense of fulfillment. The experimental group in this study showed significant improvements in service attitude and health guidance scores [7].

Furthermore, it also has a certain impact on the development of the nursing team. Systematic training, specific

quality standards, and regular quality control analysis meetings provide nurses with clear work directions and learning pathways. Nurses are no longer passive executors but become responsible for the quality of each step, participating in process improvement, and their sense of responsibility, critical thinking skills, and comprehensive abilities are trained and improved. As can be seen from the data in **Table 3**, nurses' assessment scores in all aspects have improved, and the process quality control model can promote the professional growth of nursing staff.

In conclusion, the application of the process-based quality control nursing model in health checkup centers represents a shift from extensive to intensive management. By optimizing processes, monitoring stages, and continuously improving, it significantly enhances the efficiency and intrinsic quality of health checkup services, reduces safety risks, and, while injecting more humanistic care and service content, greatly improves customer satisfaction and loyalty, and promotes the professional development of the nursing team. This model is scientific, practical, and highly operable, enhancing the core competitiveness and brand image of health checkup centers, and is worthy of widespread adoption and promotion in the field of health management. In the future, this model can be integrated with smart technologies such as artificial intelligence and the Internet of Things to achieve intelligent prediction and control of the quality of health checkup nursing processes, thereby promoting the upgrading of health checkup nursing services [8].

Disclosure statement

The author declares no conflict of interest.

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