

Research Article

Correlation of ICU Nurses' Cognitive Level with Their Attitude and Behavior toward the Prevention of Ventilator-Associated Pneumonia

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Objective. To analyze the correlation of ICU nurses' cognitive level with their attitude and behavior toward the prevention of ventilator-associated pneumonia (VAP). **Methods.** A total of 90 ICU nurses working in the adult internal medicine ICU, adult surgery ICU, subacute respiratory care ward, etc. from January 2018 to June 2019 were chosen as the subjects to carry out questionnaire survey with the cognition scale, and the correlation analysis on their cognitive level, attitude, and behavior toward the prevention of VAP was conducted. **Results.** The linear fitting analysis finding showed that the cognitive level presented a positive correlation with the attitude score and behavior score ($R^2 = 0.668, 0.734$). **Conclusion.** Improving ICU nurses' cognitive level, attitude, and behavior toward preventing VAP is conducive to the upgrade of their quality of nursing services. In addition, the ICU nurses' cognitive level is positively correlated with their attitude and behavior.

1. Introduction

Ventilator-associated pneumonia (VAP), as the most common type of nosocomial infection, occurs mainly in mechanically ventilated patients who underwent incision of the trachea or tracheal intubation [1]. VAP refers to pneumonia that develops from 48 h after mechanical ventilation (MV) to 48 h after extubation, and advanced age, presence of chronic lung disease, and prolonged bed rest all trigger VAP. Relevant literature has pointed out that VAP has an incidence of 42.8% and a case fatality rate of 50.9%, which will not only increase the financial burden on the patients' family but also prolong the patients' hospital stay and be detrimental to their prognosis [2]. In addition, endotracheal intubation and ventilators are widely applied in ICU wards, but long-term use of ventilators can cause damage to the body's natural defense barrier, trigger respiratory infections, and then increase the risk of occurring VAP [3, 4]. Kallet et al. [5] stated that approximately 28~40% of patients who used respirators were infected with VAP, a

common healthcare-associated infection in critical care units, causing the increase of average per patient healthcare expenditure by more than US \$11,000–57,000 and the rise of mortality rate to 20~70%, so it is a nosocomial infection that cannot be overstated. Ochoa-Hein et al. [6] stated that according to the 2012 data, approximately 4.75 million people die of VAP annually in the United States, with an incidence rate up to 18.1 cases per 1,000 patients undergoing ventilation, while in China, it is 28.5 cases per 1,000 patients undergoing ventilation, making VAP a major risk factor for death from nosocomial infection. Zhang et al. [7] stated that VAP patients had an average increase in ICU stay of 21 d and hospital stay of 2 weeks compared to other hospitalized patients. Therefore, reducing the healthcare-associated infections has become an unavoidable and important topic of healthcare institutions.

Some studies have pointed out that applying the concept of combined care, such as elevating the head of the bed by 30–45°, performing oral cleaning, daily assessment of whether sedative use can be interrupted, and evaluation of

the indicators of detachment from the ventilator, can effectively prevent VAP [8]. Caregivers in critical care units play an important role in this regard, but clinical implementation is a big challenge. Therefore, it is extremely important to explore the factors that influence ICU ward nursing staff to perform measures to prevent VAP [9]. This study aims to understand the knowledge, attitude, and behavior of clinical nursing staff on ICU ward for preventing VAP, comprehensively think, master, and overcome the influencing factors, and then effectively reduce the health-care-related infections and upgrade nursing profession and quality.

2. Materials and Methods

2.1. General Data. A total of 90 nurses working in the adult internal medicine ICU, adult surgery ICU, subacute respiratory care ward, etc. from January 2018 to June 2019 were chosen as the subjects. The study met the World Medical Association Declaration of Helsinki [10]. Figure 1 shows the technical roadmap of the study.

2.2. Enrollment of Study Subjects. Inclusion criteria were as follows: ① nurses who directly provided services for ICU patients; ② nurses who engaged in continuous ICU nursing work for over 1 year; ③ nurses on the regular payroll or contract nurses who engaged in the ICU work in a Grade III Level A hospital; ④ nursing personnel who served in the ICU, had a length of providing care service for over 3 months, and took care of patients using ventilator for not less than 48 hours, those who were willing to join the study and sign the informed consent, and those who were able to fill in the questionnaire by themselves; and ⑤ nurses who were at their post during the research.

Exclusion criteria were as follows: ① nurses who were not at their post due to taking a vacation, going on a field trip, engaging in advanced studies, or other reasons; ② persons in charge of nursing administration, including deputy head nurse, head nurse, supervisor, and director, who provided interdisciplinary support to ICU work for less than 3 months; ③ those who experienced stressful events such as serious disease, divorce, and losing their spouse; ④ those who had obvious psychological illness; and ⑤ those who were participating in other trails.

2.3. Methods

2.3.1. Research Tools. The general data of 90 subjects were collected, including gender, age, nationality, education background, job title, years of clinical work, years of ICU work, monthly income, religious faith, living condition, whether they had received medical ethics education and training, whether they had experience in providing VAP care, whether they had qualification certificate of specialist nurse, and the level of qualification certificate of specialist nurse.

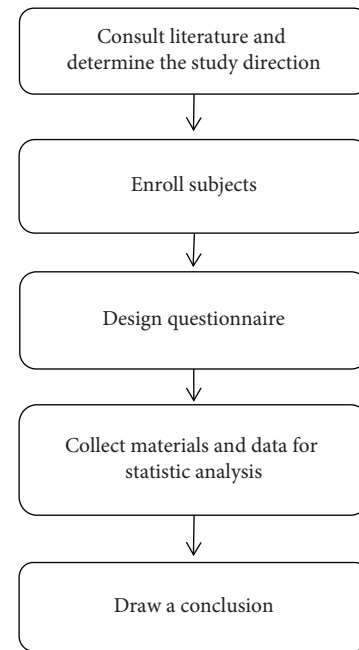


FIGURE 1: Technical roadmap.

2.3.2. Questionnaire Design. This study used a self-designed structured questionnaire, which referred to the optimal nursing evidence for preventing VAP recommended by American Association of Critical-Care Nurses (AACN) [11] and the clinical practice guideline for preventing VAP published by Centers for Disease Control and Prevention (CDC) [12], including keeping the semireclining position (elevating the head of the bed by 30°~45°), sustained subglottic secretion suction, washing hands, inferior pylorus feeding, maintaining the tracheal cuff pressure continuously at ≥ 20 cmH₂O, performing oral care, and only replacing the ventilator tubes in the case of fault or tube contamination. Based on the above empirical evidence and in combination with clinical experience, the following content of the questionnaire was determined: ① the general data of the subjects; ② the cognition investigation for VAP prevention care: 10 questions in total, with 1 correct answer getting 10 points and 1 wrong answer getting 0 point, and on a scale of 0–100 points, higher scores indicating better cognition of the subjects; ③ questionnaire for attitude toward VAP prevention: 13 items in total, each item was scored by 5-Point Likert Scale, with the options of strongly disagree (1 point), disagree (2 points), no opinion (3 points), agree (4 points) and doubtful (5 points), and the full score was 65 points, with higher scores indicating better attitude of the subjects; ④ survey for VAP prevention behaviors: 13 items in total, each item was scored by 4-Point Likert Scale, with the options of never (1 point), seldom (2 points), sometimes (3 points), and often (4 points), and the full score was 52 points, with higher scores indicating better behaviors; ⑤ the questionnaires were reviewed and evaluated by 4 senior nursing experts and considered to have

satisfactory content validity. The factor analysis (i.e., by means of collective study, determine the objectives selected according to various factors that should be taken into account in value engineering and based on the knowledge and experience of the analysts) result of the cognition, attitude, and behavior included in the questionnaires indicated a good construct validity. The Cronbach's α coefficient of the questionnaires was 0.8524. The anonymous questionnaires were distributed by the researcher, the unified instruction was applied to inform the subjects of the method of filling in the questionnaires in detail, the study subjects were asked to complete it independently, and then the questionnaires were retracted on the spot. A total of 90 questionnaires were distributed, and 90 valid questionnaires were retracted, resulting in a 100% response rate.

The cognition investigation for VAP prevention care included the following items: (1) aspiration of sputum should be performed to mechanically ventilated patients in a timely manner; (2) the cuff pressure of the tracheal cannula should be maintained at 20–30 cmH₂O; (3) condensate water from ventilator tubing should be poured into medical waste bags or handled by centralized processing; (4) enteral nutrition should be discontinued when the gastric residual volume reaches 150–190 ml; (5) compared with cotton balls, a soft-bristle toothbrush can better remove dental plaque; (6) persistent subglottic secretion drainage prevents early VAP occurrence; (7) the cuff pressure of the tracheal cannula should be detected with the cuff pressure gauge; (8) the mechanically ventilated patients should be detected for gastric residual volume once every 5 hours; (9) the ventilator tubing should be changed only if tubing fails or is contaminated; (10) chlorhexidine products should be used for oral care when patients have poor oral hygiene or dental plaque.

The questionnaire for attitude toward VAP prevention included the following items: (1) implementing nursing measures for patients is necessary to preventing VAP; (2) good nursing measures work better in guiding the prevention of VAP; (3) ICU nurses should learn relevant theoretical knowledge of VAP nursing; (4) ICU nurses should learn the relevant operation skills of VAP nursing; (5) rich nursing knowledge greatly benefits the nursing operations of preventing VAP; (6) departments should develop guidelines for nursing operations to prevent VAP; (7) departments should develop measures to effectively supervise the implementation of VAP prevention nursing; (8) the nursing operations for preventing VAP should be completed by ICU nurses; (9) the nursing operations for preventing VAP should be completed by the trained nurses; (10) nurses should actively participate in relevant training of nursing to prevent VAP; (11) nurses should actively learn the latest information of VAP prevention nursing; (12) with or without

supervision, ICU nurses should be able to implement VAP prevention nursing; and (13) ICU nurses should carefully implement nursing to prevent VAP regardless of the workload.

2.4. Observation Indicators. After gathering all subjects, the researcher distributed and collected the questionnaires on the spot, and the ICU nurses' scores on cognition, attitude, and behavior toward preventing VAP were recorded.

The correlation of ICU nurses' cognitive level of preventing VAP with their attitude was analyzed.

The correlation of ICU nurses' cognitive level of preventing VAP with their behavior was analyzed.

2.5. Statistical Processing. The experimental data were statistically analyzed and processed by SPSS21.0, the picture drawing software was GraphPad Prism 7 (GraphPad Software, San Diego, USA), the enumeration data were examined by the χ^2 test and expressed by $(n(\%))$, the measurement data were examined by the t -test and expressed by $(\bar{x} \pm s)$, and differences were considered statistically significant at $P < 0.05$.

3. Results

3.1. General Data of Subjects. Table 1 shows the statistics of general data of subjects.

3.2. Scores on ICU Nurses' Cognitive Level, Attitude, and Behavior toward Preventing VAP. Scores on ICU nurses' cognitive level, attitude, and behavior toward preventing VAP are given in Table 2.

3.3. Linear Fitting Analysis of Cognitive Level and Attitude Score and Behavior Score. The linear fitting analysis found that the cognitive level was positively correlated with the attitude score and behavior score ($R^2 = 0.668, 0.734$) (see Figure 2).

4. Discussion

ICU is an important department in hospitals, and maintaining the life of patients using ventilator is one of the common treatment modalities used in ICU. VAP is the most frequent complication in ICU, which is associated with the destruction of respiratory mucosa by invasive procedures, poor patient immunity, the medical workers' cognitive level, attitude, and behavior, and ward environment [13]. Relevant studies have reported that once VAP occurs to ICU patients, it leads to further aggravated condition and increases the risk of mortality [14]. In addition, some scholars have pointed out that in preventing VAP, ICU nurses' cognitive level, attitude, and behavior have important implications for

TABLE 1: General data of subjects (*n*(%).

Item	Number of cases (<i>n</i>)	Proportion (%)
Gender		
Male	10	11.11
Female	80	88.89
Age (years)		
20–29	31	34.44
30–39	50	55.56
≥ 40	9	10.00
Nationality		
Han	80	88.89
Others	10	11.11
Educational degree		
Junior college and below	20	22.22
Undergraduate and above	70	77.78
Job title		
Nurse	47	52.22
Senior nurse	27	30.00
Nurse-in-charge	11	12.22
Cochief superintendent nurse and above	5	5.56
Length of clinical work (years)		
1–5	40	44.44
6–10	35	38.89
11–15	10	11.11
≥ 16	5	5.56
Length of ICU work (years)		
1–3	35	38.89
4–6	24	26.67
7–9	14	15.56
10–12	10	11.11
≥ 13	7	7.78
Monthly income (yuan)		
<4,000	29	32.22
4,000–6,000	30	33.33
>6,000	31	34.44
Religious faith		
Yes	28	31.11
No	62	68.89
Living condition		
Alone	30	33.33
With families	55	61.11
Others	5	5.56
Received medical ethics education and training		
Yes	30	33.33
No	60	66.67
Experience of taking care of patients using ventilator		
Yes	80	88.89
No	10	11.11
Qualification certificate of specialist nurse		
Yes	65	72.22
No	25	27.78
Level of qualification certificate of specialist nurse		
National level	5	5.56
Provincial/autonomous region level	17	18.89
Hospital level	43	47.78
Unrated	25	27.78

patients' outcomes [15]. In this study, the ICU nurses' VAP prevention cognitive level score was (65.68 ± 17.60) points, indicating a general level that was lower than the findings of Kao et al. [16] and slightly higher than the findings of Camargo et al. [17] and Mahmoodpoor et al. [18]. The results

showed that the ICU nurses' attitude score was (33.11 ± 7.19) points, which was good, and that the behavior score was (28.89 ± 6.82) points, implying ICU nurses' general cognitive level and good scores on their attitude and behavior toward preventing VAP, and the reason may be related to the lower

TABLE 2: Scores on ICU nurses' cognitive level, attitude, and behavior toward preventing VAP ($\bar{x} \pm s$).

Item	Minimum value (points)	Maximum value (points)	Mean score (points)
Cognitive value	0	100	65.68 \pm 17.60
Attitude	13	65	33.11 \pm 7.19
Behavior	13	52	28.89 \pm 6.82

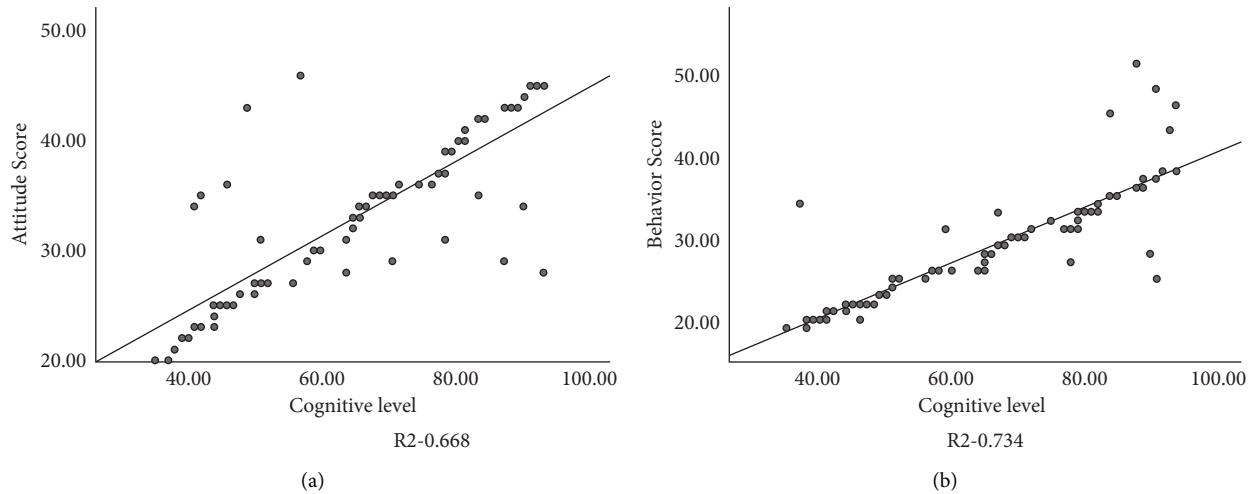


FIGURE 2: Linear fitting analysis of cognitive level and attitude score and behavior score. (a) The linear fitting analysis of cognitive level and attitude score: the horizontal axis denotes the cognitive level and the vertical axis denotes the attitude score. (b) The linear fitting analysis of cognitive level and behavior score: the horizontal axis denotes the cognitive level and the vertical axis denotes the behavior score.

prevalence of clinical ICU, the shorter length of clinical work and ICU work, and the medical professional construction in the primary stage. Jacobs Pepin et al. [19] pointed out that enhancing the cognitive level of ICU nurses was beneficial to improve their attitude and behavior and reduce the occurrence of adverse events, so ICU nurses should pay more attention to the learning of VAP prevention knowledge while maintaining their own attitude and behavior and strive to improve their own cognitive level and reduce the occurrence of unnecessary medical accidents and disputes. As the key role of medical career development, nurses spend the longest time with patients in clinic, and there are more ethical problems in treatment and nursing work, so related training means should be adopted in hospital management to improve ICU nurses' cognitive level, service attitude, and nursing behavior, thus creating a good internal ethical atmosphere in hospitals [20–22]. Hospitals can establish an intensive care collaborative network and adopt horizontal training to enable transfer of ICU nurses in relevant ICUs, and the nurses receive short-term and effective training to study ICU-related professional English, so that the more mature nursing knowledge and information can be collected, and at the same time, evaluation standards of knowledge and practice for the prevention of VAP are developed to further improve ICU nurses' awareness. The improvement of the nursing attitude of ICU nurses should start with self-assessment to further improve nurses' understanding of basic nursing care; the efforts to publicity and education should be increased to conduct multichannel, multilevel, and multiform training and education on the

importance of nursing quality, strengthen the ICU nurses' awareness of the effect of nursing quality, improve their deep understanding of the connotation of nursing quality, form a new value orientation, and transform their nursing attitudes and ideas. In addition, some published works indicated that male ICU nurses had slightly lower cognitive level, attitude, and behavior scores than female nurses, which may be related to the fact that male nurses suffered from more severe psychological and social stress and limitations and intensity of working in ICU nursing, making them more negative in attitude towards perceiving things [23, 24]. Wei et al. [25] indicated that the ICU nurses with higher education level, with longer working years in ICU, who had received medical ethics education and training, acquired experience of taking care of patients using ventilator, and obtained the qualification certificate of specialist nurse tend to have better cognitive level, nursing attitude, and behavior because nurses with higher education have a broader range of knowledge and more comprehensive understanding of things, and longer working years mean more rich experience for them to directly deal with emergencies and effectively improve their nursing quality. The experimental results indicated that the ICU nurses' cognitive level of preventing VAP was positively correlated with their attitude score and behavior score ($R^2 = 0.668, 0.734$), which fully demonstrated that with higher cognitive level of preventing VAP, the ICU nurses had better nursing attitude and their nursing behaviors and their measures could be more standardized and professional. The deficiencies of the study are as follows: first, the selected subjects were all nurses from the departments of

our hospital, so the subject source lacked diversity; second, there was a lack of long-term follow-up observation of the subjects; third, the ratio of male to female nurses had a large difference; and finally, scales were still the method for clinical evaluation, so there must be certain subjective and intentions when patients were answering the questions, which might affect the final results of the clinical trial to some extent. Therefore, it is necessary to improve the research design, prolong the follow-up time, expand the sample size, and select more male nurses in the future studies for deeper exploration, so as to deeply and carefully explore the correlation of ICU nurses' cognitive level with their attitude and behavior toward the prevention of VAP in multiple angles and aspects.

In conclusion, the ICU nurses' cognitive level of preventing VAP needs to be improved and their nursing attitude and behavior are in a good state. Improving the cognitive level of ICU nurses is beneficial to the improvement of their attitude and behavior because the three elements are in positive correlation.

Data Availability

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

Conflicts of Interest

The authors have no conflicts of interest to declare.

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