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Major Article

Does educating nurses with ventilator-associated pneumonia prevention guidelines improve their compliance?

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Nosocomial infection
Mechanical ventilator
Evidence based guidelines

Background: This study aimed to compare the compliance with ventilator-associated pneumonia (VAP)-prevention guidelines between nurses who underwent an intensive educational program and those who did not, and to investigate other factors that influence nurses' compliance.
Method: A 2-group posttest design was used to examine the effect of the VAP-prevention guidelines education on nurses' compliance. Participants were randomly assigned to experimental and control groups.
Results: The overall nurses' compliance scores were moderate. There was no statistically significant difference in compliance between the nurses who received VAP education and those who did not ($t[100] = -1.43$; $P = .15$). The number of beds in the unit and the nurse–patient ratio were found to influence nurses' compliance.
Conclusion: Education in VAP-prevention guidelines will not improve nurses' compliance unless other confounding factors, such as their workload, are controlled. It is imperative to reduce nurses' workload to improve their compliance and enhance the effectiveness of education.

Mechanical ventilators are widely used as a respiratory assistance device. Although a significant proportion of critically ill patients need mechanical ventilators as a life-saving measure, their use is associated with a variety of complications. These include increased cost of care,[1] increased consumption of resources, comorbidity,[2] and nosocomial infection.[3]

Ventilator-associated pneumonia (VAP) is considered among the most common nosocomial infections. It is an infection of the lung that occurs 48 hours after insertion of an endotracheal tube,[4] and studies have reported that 27% of intubated patients develop VAP during hospitalization.[5] VAP results in a significant increase in the cost of care,[6] prolonged hospitalization,[5] an extended number of days in need of the mechanical ventilator,[7] and a significant increase in the rate of mortality.[8]

The prevalence of VAP varies across the world. In the United States, the incidence is as low as 3-5 cases per 1,000 ventilator-days,[5] but this increases to 41 cases per 1,000 ventilator-days in Tunisia.[9] The cost of care for each episode of VAP is $40,000.[7] In the Middle East, mechanically ventilated patients have twice the risk of developing VAP as in the Western world,[10] and overall VAP results in significantly higher mortality in developing countries in comparison with the rest of the world. For example, the VAP mortality rate in India was found to be 37%,[11] compared with only 4.6% in the United States.[5] VAP is a preventable disease; however, translation of the findings from these studies in developing countries is challenging for several reasons,[12] including lack of resources, shortage of staff, and lack of compliance with infection-control standards.[3,13]

In Jordan, very few studies have investigated VAP, although a study by Khuri-Bulos et al[14] revealed a rate of 29 cases per 1,000 ventilator-days, and the rate of mortality related to VAP is 53%.[15] Several factors contribute to the high level of VAP, including lack of resources, insufficient compliance with infection-control standards,[16] and inadequate knowledge about VAP among health care providers.[17]

Professional organizations such as the Centers for Disease Control and Prevention and the American Thoracic Society released evidence-based guidelines to prevent VAP and improve mechanical ventilation outcomes. Studies report a significant reduction in the prevalence of VAP when these guidelines are applied correctly.[18,19] However, nurses' implementation of the VAP-prevention guidelines is uncertain,[20] contributing to a high level of VAP. The extent to which educating nurses about VAP prevention can achieve a significant

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improvement in their compliance and the amount of this improvement is still unclear. Thus, the aim of this study is to evaluate nurses' compliance with VAP-prevention guidelines following an educational program and the factors that influence their compliance.

METHODS

Design

This study was a randomized clinical trial (2-group posttest only design) in which participants were randomly assigned to either an experimental group or a control group. Participants in the control group underwent an intensive VAP education course, whereas the control group participants received nothing. Following the educational program, participants in both groups were observed. A nonparticipatory approach was used in which the observers documented the phenomena under investigation using a structured observation sheet.

Setting

The study was conducted in the intensive care units (ICUs) of 5 hospitals in Jordan. The participating hospitals were selected from different geographic locations and different sectors. One of the ICUs has 5 beds, 2 have 6-10 beds, and 2 have a total bed capacity ≥11. The nurse to patient ratio in these hospitals varies from 1:1 to 1:2. Permission to conduct this study was obtained from the institutional review boards of the researcher's university and the participating hospitals. Informed consent was obtained from all participants before the study.

Participants

G*power 3.1 software (Heinrich-Heine University of Dusseldorf, Dusseldorf, Germany) was used to calculate the required sample size. Based on a medium effect size ([d] = 0.6; $\alpha = 0.05$; power = 0.8 based on 2 groups independent sample t test) the required sample size was estimated at 90. The study recruited a random sample of 120 participants from those nurses who agreed to participate; 60 were assigned to the experimental group and 60 to the control group, using a random-number generator. Participants in the experimental group underwent an intensive course in VAP-prevention guidelines, whereas the control group received nothing. Of participants in the control group, 17 withdrew from the study, whereas only 1 participant dropped out of the experimental group, resulting in 59 participants in the experimental group and 43 in the control group. The participants who dropped out of the study were of different ages, genders, and education levels. According to the continuing education departments in the participating hospitals, no VAP education courses had been given to the participants in any of those hospitals.

Inclusion criteria

All participants were registered nurses working full time in ICUs.

Data collection

The data collectors were knowledgeable ICU registered nurses who were not staff of the participating hospitals and who had at least 3 years of ICU experience. Each was involved in infection control activities at his or her own hospital. They received a short training course on the VAP-prevention guidelines. The course covered the development of VAP, the guidelines, the conduct of observations, how to maintain consistency of the observations, and documentation. Advertisements about the study were placed in each of the participating hospitals. Nurses were told about the observations but not when they would be observed. Observations were deliberately conducted over a 6-month period (June-December 2016) during day and night shifts to minimize the Hawthorne effect.

Educational course

The VAP-prevention guidelines course included 4 sessions of 2 hours per session. The first introduced mechanical ventilator management and VAP, and the remaining sessions covered the most up-to-date guidelines. The guidelines included oral care, handwashing, suction, mechanical ventilator management, patient position, prophylactic use of antibiotics, peptic ulcer prophylaxis, and deep venous thrombosis prophylaxis. The sessions took place in classrooms at the researcher's university. The educational strategies included classroom presentations, class discussion, and videotapes. The participants were provided with hard copies of the presentation's slides.

Observation sheet

A 9-item structured observation sheet was developed based on VAP-prevention guidelines from the American Thoracic Society,[21] the Centers for Disease Control and Prevention,[22] and the Institute for Health Care and Improvement.[23] The observation sheet had 2 parts: demographic characteristics and the 9 VAP-prevention guidelines items with 3 options per item: "done correctly and completely" gained 2 marks, "done but not completely or not accurately" only 1 mark, and "not done" gained no marks. During the observations, for each guideline the data collector documented "done completely and accurately" if the nurse correctly applied an intervention consistent with the updated VAP-prevention guidelines at every opportunity to do so. If the nurse demonstrated an intervention not based on the guidelines, or missed an opportunity to do perform an intervention, the data collector recorded "done but not completely or incorrectly." If the nurse failed to apply the guidelines at all in any of the opportunities to do so, "not done" was recorded. The highest score on the observation sheet was 18 and the lowest zero. A panel of 3 experts in infection control and 3 critical-care nurses validated the content of the observation sheet. Items that were found not to be nursing responsibilities were deleted on the recommendation of the panel. A pilot study was conducted to identify obstacles that might be encountered, but no necessary changes were found.

Observations

Participants were required to provide their work schedule each month to facilitate the observations. A data collector attended each ICU/critical care unit in the participating hospitals, asking participants for the demographic data before observing them and completing the observation sheet. Each nurse was observed for an entire shift. After the observation was completed, the nurse was informed of the fact. A monthly rotation of observers between the participating hospitals was made to minimize bias. Observations were made during both day and night shifts.

Different methods were used during the observations to evaluate the nurses' compliance with the VAP-prevention guidelines (Table 1).

Statistical analysis

SPSS version 21 (IBM-SPSS Inc, Armonk, NY) was used to analyze the study data. Descriptive statistics were used to evaluate the par-