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Major articles

Simulation education as a single intervention does not improve hand hygiene practices: A randomized controlled follow-up study

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Background: To evaluate how critical nurses' knowledge of and adherence to current care hand hygiene (HH) guidelines differ between randomly allocated intervention and control groups before and after simulation education in both a simulation setting and clinical practice during a 2-year follow-up period. It was hypothesized that intervention group knowledge of and adherence to current HH guidelines might increase compared with a control group after simulation education.

Methods: A prospective, parallel, randomized controlled trial with repeated measurements was conducted in a 22-bed adult mixed medical-surgical intensive care unit in Oulu, Finland. Thirty out of 40 initially randomized critical care nurses participated in the baseline measurements; of these, 17 completed all the study procedures. Participants' HH adherence was observed only in high-risk contact situations prior to and postendotracheal suctioning events using a direct, nonparticipatory method of observation. Participants' HH knowledge was evaluated at the end of each observational session.

Results: The overall HH adherence increased from a baseline value of 40.8% to 50.8% in the final postintervention measurement at 24 months ($P = .002$). However, the linear mixed model did not identify any significant group ($P = .77$) or time-group interactions ($P = .17$) between the study groups after 2 years of simulation education. In addition, simulation education had no impact on participants' HH knowledge.

Conclusions: After a single simulation education session, critical care nurses' knowledge of and adherence to current HH guidelines remained below targeted behavior rates.

Health care–associated infections (HAIs) are a continuing problem in intensive care and critical care, which remain a leading cause of morbidity, mortality,[1-3] and excessive length of stay, leading to high health care costs.[3] In developed countries, HAIs concerns 9%-37% of those patients admitted to intensive care units (ICUs). Although ICUs account for a relatively small proportion of hospitalized patients, infections acquired in these units accounted for >20% of all HAIs.[4]

According to different estimates, approximately 55%-70% of cases of catheter-associated bloodstream infections and catheter-associated urinary tract infections and 55% of cases of ventilator-associated pneumonia and surgical site infections could be preventable through intensive infection control programs.[3] Despite previous educational intervention studies,[5-8] most of the effects have remained small to moderate and have often been short term.[9]

Proper hand hygiene (HH) has been cited as the single most effective measure for preventing HAI.[10,11] However, critical care nurses' adherence to HH guidelines has ranged from a low of 6% to a high

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of 65%,[5,6,12-16] whereas the self-reported adherence has ranged from 59%-92%.[14,16-18] In addition, critical care nurses' awareness of HH guidelines has been limited.[17,19]

In the recent years, advanced, high-fidelity teaching methods that require the participants to behave as they would in real life have been associated with improved learning (eg, cognitive, behavior, psychomotor skills)[20,21] and clinical outcomes (eg, fewer placement failures, arterial punctures, needle passes, and pneumothoraxes; decreased incidence of catheter-associated bloodstream infections).[22-24] Accordingly training via simulation could also provide an ideal learning environment with hands-on experience while promoting HH behavior. However, the effectiveness of simulation education with verbal feedback in improving infection control practices on nursing continuing education is still uncertain because of the lack of published studies and robust evidence.[25]

In this study, we aimed to evaluate how critical care nurses' knowledge of and adherence to current HH guidelines differ between randomly allocated intervention and control groups before and after simulation education in both the simulation setting and clinical practice. The hypothesis was that in the intervention group, knowledge of and adherence to current HH guidelines might increase compared with a control group after simulation education.

MATERIAL AND METHODS

Study design

A longitudinal, single-center, parallel, randomized controlled trial with repeated measurements was conducted in a single academic center in a 22-bed adult mixed medical-surgical ICU in Finland from February 2012-March 2014.

Sample and ethical considerations

The study population, eligibility criteria for participants, sample size, type of randomization, random allocation, and recruitments have been described elsewhere.[21] Because of the nature of the intervention, a blinded experiment was not possible. However, the research assistant and biostatistician who collected the data and assessed the outcomes were blinded to group assignment. According to the Medical Research Act (488/1999 and amendments 295/2004), approval of the local ethics committee was not required for studies focusing on health care workers. However, the study protocol was approved by the relevant academic center in Fall 2011 and 2013. In addition, written informed consent from participants was obtained prior to inclusion in the study (Declaration of Helsinki 2013).

Intervention and study protocol

Each simulation session was carried out via the following 4 phases: (1) an orientation to the simulation center (SimLab, Oulu University of Applied Science, Oulu, Finland) and high-fidelity simulation setting; (2) an orientation to mannequin (HAL, Gaumard, Miami, FL) capabilities; (3) an actual simulated scenario; and (4) a postscenario debriefing session where the participants received verbal feedback (only the intervention group participated in this phase). A structured, 60-minute debriefing took place in small groups (n = 8) and was carried out by 2 independent educators who specialized in simulation pedagogy and key areas (eg, indications for HH, duration of handrubbing, HH technique, other aspects of HH) (Table 1). All groups received the same amount of educational input concerning current HH guidelines[11] and the role of HH in reducing cases of ventilator-associated pneumonia.[26]

The baseline (initially before the intervention) and initial postintervention (3 months after the intervention) measurements were conducted in the high-fidelity simulation setting (follow-up I). The final postintervention measurements (6 and 24 months after the intervention) were made in clinical practice (follow-ups II and III) during the morning shift. Critical care nurses' HH adherence (eg, HH indications before and after patient contacts, HH technique, duration of handrubbing after applying disinfectant, use of gloves, other aspects of HH) was measured only during endotracheal suctioning events (high-risk contacts) using a direct, nonparticipatory method of observation, which is defined as the gold standard by the World Health Organization.[11]

The method was guided by a validated (S-CVI = .99), highly structured ventilator bundle observation schedule. Identical measurements were taken for the intervention and control groups by the same trained and experienced observers. If a participant behaved correctly, they were assigned 1 point, yielding a HH adherence score ranging from 0-12.[27] The intraclass correlation coefficient, including the 95% confidence interval and Cohen κ coefficient of each item, and the average scale score (ventilator bundle observation schedule) were tested using a second observer during data collection. The intraclass correlation coefficient of the average scale score was >0.9 (95% confidence interval, 0.9-1.0). In addition, the Cohen κ of each item varied from 0.7-1.0, demonstrating substantial or perfect agreement.[28]

The level of critical care nurses' knowledge of current HH guidelines[11] was evaluated at the end of each observational sessions using a validated (S-CVI = 1) ventilator bundle questionnaire. The method was guided by a blinded research assistant, who arranged an appropriate time and venue to gather the responses. If a participant answered correctly, they scored 1 point, yielding a HH knowledge score ranging from 0-2.[27]

Statistical analysis

The statistical analysis was performed using SPSS 18.0 for Windows (SPSS, Chicago, IL) or SAS (version 9.3; SAS Institute, Cary, NC). The repeated measurement data were analyzed using a linear mixed model with a covariance pattern model (continuous variables) or a generalized linear mixed model (categorical/dichotomous variables). The *P* values reported for repeated measurement data are as follows: time (the overall change over time), group (the average between-group difference), and time × group (the interaction between time and group). All participants were included in the groups to which they were originally assigned (intention-to-treat analysis). A 2-tailed *P* value <.05 was considered statistically significant.

RESULTS

Thirty out of 40 initially randomized critical care nurses participated in the baseline measurements; of these, 17 completed all of the study procedures. Most of the participants were women (70%), had a bachelor's degree in nursing (96.7%), and had permanent employment status (66.7%). The mean age was 35.0 ± 10.4 years. The mean experience in the current ICU was 9.5 ± 8.7 years. In addition, 50.0% of participants had received education on infection control within the last 12 months. After baseline measurement, the reasons for withdrawal from the intervention group were sudden illness (n = 1), job transfer (n = 1), declining to participate (n = 1), and not known (n = 1). The main reasons for withdrawal from the control group were declining to participate (n = 3), sudden illness (n = 2), other reasons (n = 2), and job transfer (n = 2).