Title

The Effects of Staff Education on Ventilator-Associated Pneumonia in the Intensive Care Unit: A Literature Review

Permalink

https://escholarship.org/uc/item/9g86w925

Author

Braun, Suzanne Ellen

Publication Date

2019-04-05

The Effects of Staff Education on Ventilator-Associated Pneumonia in the Intensive Care Unit: A

Literature Review

Suzanne E. Braun

University of California, Irvine

Abstract

Background: Mechanically ventilated patients in the ICU are at a high risk for ventilator-associated pneumonia (VAP), and the rate of this hospital-acquired infection (HAI) is problematic. Nursing interventions utilize evidence-based practice (EBP) VAP prevention guidelines to decrease the incidence. The purpose of this paper is to examine the effects of staff education on the reduction of VAP in the critical care setting.

Methods: Literature search was performed on two databases, CINAHL and PubMed. Search results were narrowed based on type of research article, relevance, and publication date, and eventually three studies were chosen.

Results: In two of the studies, VAP incidence was shown to have decreased after staff education and one study had insignificant results, although there was a trend towards decreased VAP incidence. Length of stay significantly decreased post-intervention in two studies. Nurse adherence/concordance significantly increased in all studies.

Conclusions: These findings show that staff education may decrease VAP incidence in ICUs, but further research needs to be performed to confirm these findings, as well as to determine the best form of education. Nurses are the primary individuals to prevent mechanically ventilated patients from acquiring VAP, and thus the next step would be focusing on how to improve long-term nurse adherence to preventative interventions and how to implement them into bedside practice.

Keywords: staff education, nursing education, ventilator-associated pneumonia, prevention

The Effects of Staff Education on Ventilator-Associated Pneumonia in the Intensive Care Unit: A

Literature Review

Ventilator associated pneumonia (VAP) is a clinical issue that is prevalent in intensive

care units around the world, leading to increased hospital stay and morbidity in patients (Perez-

Granada et al., 2013). VAP is a hospital-acquired infection (HAI) in which pneumonia is

contracted by a patient on mechanical ventilation for at least forty-eight hours (Bingham, Ashley,

Jong & Swift, 2010). The prevalence of VAP is 0.1-0.4%, and it is shown to have a mortality rate

of 10-65%, prolong the length of patient stay, and increase hospital costs (Parisi et al., 2016). In

2011, there were 157,500 reported cases of VAP in the United States (CDC, 2018).

Guidelines for the prevention of VAP have been published by the Centers for Disease

Control and Prevention (CDC), and many hospitals have designed their own protocols based off

these recommendations. The CDC not only lists specific preventative interventions when caring

for mechanically ventilated patients, but also recommends that healthcare workers should be

educated to ensure knowledge and compliance to those measures (Centers for Disease Control

and Prevention [CDC], 2003).

Research has thus far focused on specific interventions that have been shown to prevent

ventilator-associated pneumonia in intensive care units. Current practices that have shown to be

beneficial include use of a closed endotracheal suctioning system, subglottic drainage, and

semirecumbent positioning at forty-five degrees, among others (Muscedere et al., 2008).

Although guidelines may be present in outlining preventative interventions, these alone will not

lead to a reduction in VAP unless hospital staff are educated about them and apply them in their

practice. The vast majority of facilities have a VAP prevention protocol, yet studies show that

care provider knowledge is low and therefore adherence to the guidelines is low as well.

Continuous education for staff members and reminders, such as checklists, improves patient care processes, and thus should be a focus for hospitals (Klompas et al., 2014). Studies have shown that when institutions and staff actively take measures to prevent specific HAIs, they can decrease by more than 70% (CDC, 2018).

Current gaps in literature are still evidenced by a shortage of research on the relationship between nurse education about VAP and preventative measures and VAP incidence. Limitations in current studies include lack of a control group, relatively small sample size, and very few studies performed on pediatric patients. Further research is necessary on this topic about which type of education is most effective, how often, and how long the increase in compliance lasts. There is also a need for more exploration about nursing-specific education and VAP reduction, since nurses have the most patient contact and are responsible for performing many of the preventative interventions. In order for hospitals to fund education programs for their employees, they must be assured that the training is beneficial in reducing VAP.

The purpose of this literature review is to examine the effects of staff education on the reduction of VAP in the critical care setting and to direct future research by means of identifying gaps in the literature.

Methods

Research articles that focused on providing some form of education to nurses and/or other hospital staff relating to ventilator-associated pneumonia (VAP) with the purpose of decreasing VAP in intensive care units were targeted during the literature search. Relevant articles published between January 2012 and December 2017 were searched in two databases, CINAHL and PubMed. Key words used for the search include "education or staff education or nursing education," "ventilator associated pneumonia or ventilator acquired pneumonia or VAP,"

and "prevention." Limiters used were publication of article in 2012 or more recent and English language. Inclusion criteria included (1) quasi-experimental, prospective, or intervention study, (2) staff education for implementing VAP guidelines or preventative practices in ICUs, (3) VAP incidence/rate measured as a key outcome, and (4) performed in the United States, Canada, and other countries with similar healthcare levels (e.g. Spain and Greece). Patients must have been on mechanical ventilation for greater than 48 hours. Studies were excluded if they were a review or survey study, if they focused on only one preventative VAP intervention, or performed in countries with a much lower level of healthcare than the United States. Initially, CINAHL yielded 56 search results and PubMed 8 results, and articles were chosen based on the inclusion and exclusion criteria. Studies were selected based on more recent publication and the country the research was performed. The final selection of the three articles reviewed in this paper was performed using a Table of Evidence (TOE) to determine the quality and relevance of the research.

Results

All three of the studies selected for this review focus on the effects of staff prevention on ventilator-associated pneumonia (VAP) in ICUs. Parisi et al. (2016) investigated the effects of all-staff education on VAP using a three-phase prospective intervention study including a baseline period, intervention period, and a post-intervention period. Gatell et al. (2012) focused only on nurse education on VAP preventative measures, using a prospective, quasi-experimental pre- and post-study. Lastly, Sinuff et al. (2013) directed its education interventions on the collective interdisciplinary team in multiple hospitals and findings were assessed periodically every few months. All three studies measured either VAP density or incidence. Parisi et al. (2016) and Sinuff et al. (2013) measured duration of mechanical ventilation, which had

statistically nonsignificant results, and ICU length of stay as secondary outcomes. All three

studies tracked concordance or nurse adherence to the VAP guidelines, which are similar

concepts. The latter study also found that nurse knowledge significantly increased after education

(p = 0.002). Nonsignificant variables were minor and will not be discussed further in this section.

Ventilator-Associated Pneumonia

Parisi et al. (2016) and Sinuff et al. (2013) both found VAP density/incidence to have

decreased significantly from 21.6 to 11.6 events per 1000 ventilator days (p = 0.01) and 47 to 29

cases (p = 0.03), respectively, during the study. However, Gatell et al. (2012) did not have a

statistical change in VAP. Although the study did not show a significant reduction, there was a

progression towards a lower incidence, which may be due to flaws in the study insufficient time.

Since two out of the three studies show a decrease in VAP after an educational intervention, this

may demonstrate that education is in fact beneficial, but perhaps the type and length of education

may play a role.

Length of stay

Length of stay can be related to the presence of VAP in the ICU, since acquiring

pneumonia will decrease the health of the patient and therefore increase hospital stay. Length of

stay decreased after the staff education intervention from 36 days to 27 days (p = 0.04) in Parisi

et al. (2016) and from 62.0 to 43.5 days (p = 0.02) in Sinuff et al. (2013). Decreased length of

stay may correlate with more positive patient outcomes as well as decreased hospital costs,

especially when the cause is due to a HAI. These findings correlate with decreased VAP incidence

in the same studies, as described in the previous section.

Concordance/Nurse Adherence

In Sinuff et al. (2013), concordance was described as the ratio of patients that were eligible for and received a recommended VAP guideline intervention. After implementation of multidisciplinary staff education, concordance significantly increased by 58.7% (p = 0.007) after two years (Sinuff et al., 2013). Concordance is a similar concept to nurse adherence to VAP prevention guidelines, which was measured in the other two studies. In Gatell et al. (2012), the educational intervention was aimed specifically at nurses, and an increase in adherence was found in use of smallest nasogastric tube (p = 0.001), proper head of bed (HOB) elevation (p = 0.001), correct endotracheal (ET) tube pressure (p = 0.001), and oral chlorhexidine cleaning (p = 0.001). Parisi et al. (2016) found that adherence to the VAP bundle improved from 13% to 28% (p= 0.02). Although methods of measuring these variables were not standardized across the three studies, the same result is seen. Based on these outcomes, staff education may lead to higher compliance to VAP preventative measures among healthcare providers.

Discussion

Level of Evidence

Although all three studies examined the impact of staff education on ventilator-associated pneumonia (VAP) and related variables, certain strengths and weaknesses are present. For this type of research question, a randomized controlled trial may be unethical and thus not appropriate, so the studies were either prospective cohort or quasi-experimental without a control group, a Level IV in study strength (Melnyk & Fineout-Overholt, 2011, p. 12). Parisi et al. (2016) was a prospective intervention study performed in three phases. Gatell et al. (2012) utilized a prospective, quasi-experimental pre-and post-study design. Lastly, Sinuff et al. (2013) was a prospective, time-series study performed across thirty hospitals. All studies utilized the

same level of evidence, and performed the study with a baseline and at least one post-intervention phase.

Feasibility and Acceptability

The educational intervention utilized by Parisi et al. (2016) included leaflets about VAP, lectures, oral hygiene, and patient data cards displaying the VAP bundle, targeting multiple disciplines. Gatell et al. (2012) deployed a series of 60-minute training sessions about VAP, as well as training and practical exercises, and informative posters put up in the unit, targeted only at the nurses. Sinuff et al. (2013) established 14 evidence-based practice VAP guidelines were developed by a multidisciplinary panel, and education on these was provided in electronic, paper, and web-based formats. Bedside rounds checklist and newsletters were also included, and the intervention was targeted at all disciplines in the ICU. All of these interventions are feasible since they are both time and cost effective. These are realistic plans that could be implemented relatively easily in a hospital unit, since most units have similar structure. Education that is time efficient is important due to the busy nature of the ICU. Reminders in the workplace are not only uncomplicated to put up but also effective and accessible to staff.

Generalizability

Parisi et al. (2016) and Sinuff et al. (2013) were both large scale studies with 362 and 330 participants enrolled, respectively, with no participant drop out, since the patients were not required to actively participate in the intervention. Gatell et al. (2012) performed their study differently and monitored the effects of the intervention on the nurses' performance, and thus 52 nurses were enrolled as subjects. Because this study was performed in a 16-bed ICU, the number of patients observed was very limited, causing the study to be relatively small-scale. This is a weakness since the variables measured in this study were done so differently compared to the

other two studies and is likely not as generalizable due to the small-scale study design. Another

discrepancy between the studies are that Parisi et al. (2016) and Sinuff et al. (2013) targeted the

educational intervention at multiple disciplines in the ICU whereas Gatell et al. (2012) only

included nurses. This may have affected the results since although the nurse is a key preventer of

patient complications in the acute care setting, other healthcare professionals such as physicians

and respiratory therapists also take part in patient care and may impact a patient's risk for VAP.

The studies by Parisi et al. (2016) and Gatell et al. (2012) were performed in hospitals in Greece

and Spain, respectively, and Sinuff et al. (2013) was performed in hospitals in the U.S. and

Canada. Lastly, the educational interventions lacked standardization, which may have affected

the results since one form of education may have different effectiveness. Strengths of the studies

include being performed over relatively long study periods and having a baseline and at least one

comparable phase. VAP guidelines were utilized across all studies.

Nursing Implications and Further Research

Based on the three studies analyzed, education for healthcare staff, including physicians

and nurses, may decrease VAP incidence in the ICU, as well as improve nurse knowledge and

adherence to VAP guidelines, and decrease hospital length of stay. Research performed by Parisi

et al. (2016) and Sinuff et al. (2013) show that staff education decreases VAP incidence, and

although Gatell et al. (2012) did not have a significant result, there was a trend towards

decreasing VAP, and therefore will still be used in the implications.

The prevention of hospital-acquired infections has always been the responsibility of the

nurse. Nurses are constantly at the bedside and implementing interventions for their patients.

Thus, it is the role of the nurse to perform tasks to prevent their patients from acquiring VAP. In

order to do this, nurses must be educated on the preventative strategies and be able to translate

that knowledge into bedside care. Reinforcement of VAP guidelines, including bedside

checklists, posters in the unit, and follow-up education sessions will increase nurse knowledge

and may lead to higher adherence to preventative interventions, which in turn may decrease the

incidence of VAP in critical care units. This decrease will not only improve patient outcomes and

satisfaction, but also decrease costs for the hospital.

Facilitators for implementing an educational intervention in hospitals may include

hospitals that are at a similar level as those in the study. Similar structure of the healthcare team

may also be helpful. Barriers include different healthcare systems, since the studies were

performed in Spain, Greece, and the United States (U.S.) and Canada, and they all may have

slightly differing healthcare structures. Another barrier may be the lack of a standardized VAP

protocol implementation, as the studies utilized different VAP prevention guidelines.

Additionally, a changing sample size in the studies may be due to a possible barrier in data

collection. Lack of time to complete the education may also be an obstacle for intervention

implementation.

Future research should be focused on utilizing a standardized educational intervention,

since education style may affect the results. Also, using a larger sample size and having a longer

intervention, since the longest intervention period for direct education was forty days excluding

posted reminders, may show more significant results and produce more generalizable outcomes.

Since lack of time to complete the education may be an issue, it may be useful to have it

available in an online format so nurses and staff may access it when they have time, and

incentives may increase participation as well. If online education is used, a technical support

team may need to be utilized to ensure that the staff are actually spending time on the slides

instead of skipping through the education solely for completion. In general, there is a need for

more research on this topic, considering only one study performed in the U.S. was found. More specifically, there is a lack of nursing research in this country, likely due to a lack of funding, since research performed here is more medical-oriented. Nurses play an integral role in patient outcomes and thus it is crucial to divert more resources into producing nursing-targeted research.

Conclusion

The findings from the reviewed studies show some evidence that education targeted at staff decreases VAP incidence in the ICU, and has effects on other factors such as decreased length of stay and increased nurse knowledge. Nurses play a major role in preventing their patients from developing hospital-acquired infections, such as VAP. Nurses must perform all appropriate preventative evidence-based practice interventions as presented in multiple VAP guidelines and individualized hospital protocols to better the health outcomes of their patients. Further research needs to be performed to solidify these findings and determine the best form of education. The next phase would focus on improving long-term adherence to VAP preventative measures and their implementation into bedside practice.

References

Bingham, M., Ashley, J., Jong, M.D., Swift, C. (2010). Implementing a unit-level intervention to

    reduce the probability of ventilator-associated pneumonia. *Nursing Research, 59*(1S),

    S40-S47.

Centers for Disease Control and Prevention. (2003). Guidelines for preventing health-care –

    associated pneumonia. Retrieved from

    https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Centers for Disease Control and Prevention. (2018). HAI data and statistics. Retrieved from

    https://www.cdc.gov/hai/surveillance/index.html

Gatell, M. R. J., Santé Roig, M., Hernández Vian, Ó., Carrillo Santín, E., Turégano Duaso, C.,

    Fernández Moreno, I., & Vallés Daunis, J. (2012). Assessment of a training programme

    for the prevention of ventilator-associated pneumonia. *Nursing in Critical Care*, *17*(6),

    285-292. doi:10.1111/j.1478-5153.2012.00526.x

Klompas, M., Branson, R., Eichenwald, E., Greene, L., Howell, M., Lee, G., . . . Berenholtz, S.

    (2014). Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals:

    2014 Update. *Infection Control and Hospital Epidemiology, 35*(8), 915-936.

    doi:10.1086/677144

Melnyk, B. M., & Fineout-Overholt, E. (2011). *Evidence-based practice in nursing and

    healthcare: A guide to best practice* (2nd ed.). Philadelphia, PA: Lippincott Williams &

    Wilkins.

Muscedere, J., Dodek, P., Keenan, S., Fowler, R., Cook, D., Heyland, D. (2008). Comprehensive

    evidence-based clinical practice guidelines for ventilator-associated pneumonia:

    prevention. *Journal of Critical Care, 23*(1), 126-137. doi: 10.1016/j.jcrc.2007.11.014

Parisi, M., Gerovasili, V., Dimopoulos, S., Kampisiouli, E., Goga, C., Perivolioti, E., … Nanas,

    S. (2016). Use of ventilator bundle and staff education to decrease ventilator-associated

    pneumonia in intensive care patients. *Critical Care Nurse*, *36*(5), e1-e7.

    doi:10.4037/ccn2016520

Pérez-Granda, M. J., Muñoz, P., Heras, C., Sánchez, G., Rello, J., & Bouza, E. (2013).

    Prevention of Ventilator-Associated Pneumonia: Can Knowledge and Clinical Practice Be

    Simply Assessed in a Large Institution? *Respiratory Care, 58*(7), 1213-1219.

    doi:10.4187/respcare.01854

Sinuff, T., Muscedere, J., Cook, D., Dodek, P., Anderson, W., Keenan, S., ... Heyland, D. (2013).

    Implementation of clinical practice guidelines for ventilator-associated pneumonia: a

    multicenter prospective study. *Critical Care Medicine*, *41*(1), 15-23.

    doi:10.1097/CCM.0b013e318265e874