American Journal of Infection Control 44 (2016) 652-6

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major article

A systematic approach for developing a ventilator-associated pneumonia prevention bundle

Kathleen Speck MPH [a,b,*], Nishi Rawat MD [a,b,c], Noah C. Weiner BS [a,b], Haddis G. Tujuba BS [a,b], Donna Farley MPH, PhD [a], Sean Berenholtz MHS, MD [a,b,d]

[a] Armstrong Institute for Patient Safety and Quality, Johns Hopkins University School of Medicine, Baltimore, MD
[b] Department of Anesthesia and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, MD
[c] Johns Hopkins Community Physicians, Baltimore, MD
[d] Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

Key Words:
Ventilator-associated pneumonia
quality improvement
prevention
bundle

Background: Ventilator-associated pneumonia (VAP) is among the most common type of health care–associated infection in the intensive care unit and is associated with significant morbidity and mortality. Existing VAP prevention intervention bundles vary widely on the interventions included and in the approaches used to develop these bundles. The objective of this study was to develop a new VAP prevention bundle using a systematic approach that elicits clinician perceptions on which interventions are most important and feasible to implement.

Methods: We identified potential interventions to include through a review of current guidelines and literature. We implemented a 2-step modified Delphi method to gain consensus on the final list of interventions. An interdisciplinary group of clinical experts participated in the Delphi process, which was guided by a technical expert panel.

Results: We identified 65 possible interventions. Through the Delphi method, we narrowed that list to 19 interventions that included 5 process and 14 structural measures.

Conclusions: We described a structured approach for developing a new VAP prevention bundle. Obtaining clinician input on what interventions to include increases the likelihood that providers will adhere to the bundle.

Ventilator-associated pneumonia (VAP) is among the most common type of health care–associated infection in the intensive care unit (ICU) and is associated with significant morbidity and mortality.[1-3] Between 10% and 20% of patients ventilated for a duration of >48 hours develop VAP.[1] In addition, VAP is associated with a longer duration of mechanical ventilation, longer hospital length of stay, longer ICU length of stay, and higher hospital charges.[1,4,5]

Several published guidelines summarize effective interventions and infection control practices and provide recommendations to prevent VAP.[6-9] Some of these guidelines are now close to 10 years old and fail to include more recent evidence. Some recommendations are inconsistent across these guidelines. Furthermore, despite these guidelines, many patients do not receive the recommended interventions because translation of evidence into practice remains challenging.[10] Effective strategies to increase adherence to the guidelines and reduce related public health consequences associated with VAP are paramount.

* Address correspondence to Kathleen Speck, MPH, 750 E Pratt St, 15th Fl, Baltimore, MD 21202.
E-mail address: kspeck2@jhmi.edu (K. Speck).

Author Contributions: Ms. Speck carried out the literature and guideline review, coordinated the modified Delphi method, and helped draft the manuscript. Dr Rawat interpreted the results of the modified Delphi method and helped draft the manuscript. Mr. Weiner and Mr. Tujuba carried out the literature and guideline review, implemented the modified Delphi method, and carried out data collection. Dr Farley participated in the design of the study and analysis and interpretation of its results. Dr Berenholtz conceived the study, participated in its design, participated in interpretation of results, and helped draft the manuscript. All authors read and approved the final manuscript.

Funding/Support: This work has been funded by the National Institutes of Health (grant no. R01HL105903).

Conflicts of Interest: Dr Berenholtz receives support from the National Institutes of Health and Agency for Healthcare Research and Quality for grants and contracts focused on improving patient safety and quality, including ventilator-associated pneumonia prevention, and receives honoraria and travel expenses from various hospitals and hospital associations for consulting and speaking on topics related to improving patient safety and quality. The other authors have nothing to disclose.

0196-6553/
http://dx.doi.org/10.1016/j.ajic.2015.12.020

One commonly used approach to increase adherence to VAP guidelines is to aggregate care processes into a bundle of care. The use of bundles improves process reliability and clinical outcomes.[11] Implementation of bundles designed to improve care for mechanically ventilated patients has been associated with significant reductions in VAP rates.[11-15] Nevertheless, the specific care processes included in these bundles vary,[16,17] and the approach to select specific bundle components in the United States has not been well articulated. Furthermore, the most widely used ventilator bundle in the United States was originally developed to reduce various complications associated with mechanical ventilation, not just VAP.[11,18] As a result, concerns exist regarding the internal validity of this bundle and its use as a potential quality indicator for reducing VAP rates.[16,18]

In this article we describe a systematic approach for developing a VAP prevention bundle. Specifically, we focus on the process we used to summarize guideline recommendations and systematically seek clinician perspectives in identifying interventions for inclusion in a new VAP prevention bundle. The Institutional Review Board at The Johns Hopkins University School of Medicine approved this study.

METHODS

We reviewed current VAP prevention guidelines and recently published literature to identify candidate interventions, convened an interdisciplinary group of experts, and implemented a 2-step modified Delphi method to gain consensus on a final set of interventions to include in our VAP prevention bundle. To provide guidance throughout the bundle development process, we convened a 15-member technical expert panel (TEP) in August 2011. The TEP was made up of experts from the disciplines of critical care, pulmonary, and infectious disease and researchers with an expertise in basic measurement and implementation science. The TEP met via a conference call on a quarterly basis and as needed.

Review of VAP prevention guidelines and literature

We examined and summarized all interventions listed in VAP prevention guidelines published during the last 15 years by the American Thoracic Society,[6] Society for Healthcare Epidemiology of America/Infectious Diseases Society of America,[8] Canadian Critical Trials Group,[7] and Centers for Disease Control and Prevention.[9] We tracked articles cited in each of these sources back through 3-4 generations to identify additional original research, scientific reviews, and meta-analyses.

Using relevant key words, we searched the literature to identify relevant articles published after the release of each guideline previously referenced above and articles not cited in the guidelines. Additionally, we researched articles referencing particular interventions to identify competing findings or opinions in the field. To ensure that we received information published by all health care provider types, we searched PubMed, CINAHL, and Google Scholar.

We sorted the VAP prevention interventions into 5 topic groups based on the framework used in the Society for Healthcare Epidemiology of America/Infectious Diseases Society of America guideline.[8] These groups were (1) prevention of transmission of bacteria; (2) aspiration prevention; (3) reduce colonization of the aerodigestive tract; (4) prophylactic procedures for prevention of pneumonia; and (5) minimize contamination of equipment. We chose to limit categorization of each intervention to the most appropriate group; however, some could have been included in >1 group.

Modified Delphi technique

We used a 2-step modified Delphi method developed by the RAND Corporation to determine which interventions to include in our proposed VAP prevention bundle (Fig 1). The modified Delphi method obtains a reliable consensus among a group of experts by eliciting individual opinions on the subject of interest, providing feedback about these initial opinions to the participants, allowing the opportunity for individual reassessment, and assuring anonymity of individual responses. The Delphi method allows participants to express their opinions independently and avoid confrontation that can hinder arriving at an accurate consensus. Each participant's opinion has an equal weight in the consensus reached by the group.[19,20]

An interdisciplinary group of clinical experts completed the 2-step modified Delphi method. We first recruited known experts in the field of VAP prevention, and then we used a snowball invitation process. Clinicians who had agreed to participate were asked to forward information regarding the project to other clinicians they felt might be interested in participating in the project. We also e-mailed potential participants via LISTSERVs of national professional societies, including the Society of Critical Care Medicine, Society of Healthcare Epidemiology of America, and American Association for Respiratory Care. Participants were self-selected, based on their own interest and expertise. We restricted participation predominantly to U.S. providers to capture U.S. perceptions of VAP prevention interventions. We collected from each Delphi participant demographic information, including age, sex, health care role, primary department, size of hospital, hospital location (urban, suburban, and rural), experience treating VAP, perceived knowledge of both original and current literature on VAP prevention, and potential conflicts of interest.

Delphi participants completed 2 rounds of rating VAP prevention interventions. Prior to each round, we provided participants with the list of VAP prevention interventions, organized by the 5-group framework previously described, a summary of recommendations in the guideline for each specific intervention, and

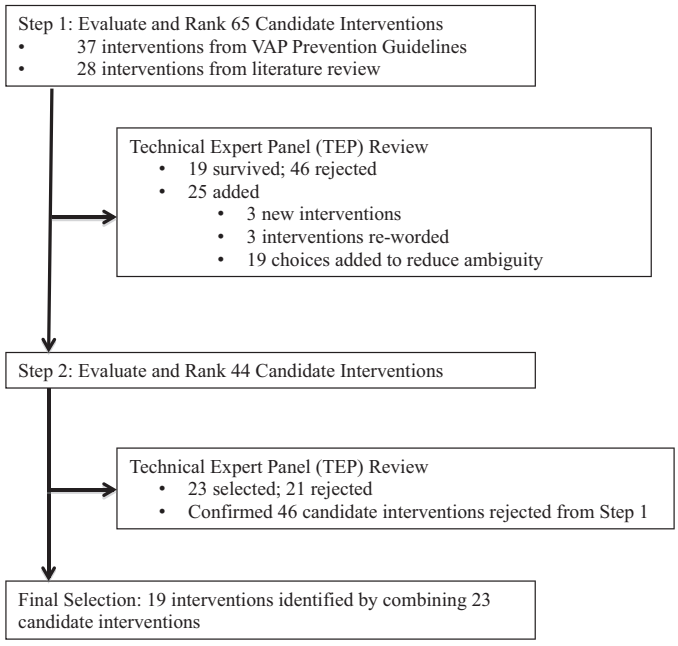

Fig 1. Schematic of 2-step modified Delphi method used to develop proposed VAP prevention bundle. *VAP*, ventilator-associated pneumonia.