



Asian Journal of Epidemiology

ISSN 1992-1462

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Checklist Cuts Lethal Ventilator-Associated Lung Infections

Cases of ventilator-associated pneumonia -- the most lethal and among the most common of all hospital-associated infections -- dropped by more than 70 percent in Michigan hospitals where medical staff used a simple checklist designed by Johns Hopkins researchers. Such pneumonias kill an estimated 36,000 Americans each year.

The findings, published online in the journal *Infection Control and Hospital Epidemiology*, show how a relatively simple series of steps, coupled with an education program and a culture that promotes patient safety, can save tens of thousands of lives and millions of dollars in health care costs.

“Far too many patients continue to suffer preventable harm from these respirator-linked pneumonias,” says study lead author Sean M. Berenholtz, M.D., M.H.S., an Associate Professor of Anesthesiology and Critical Care Medicine at the Johns Hopkins University School of Medicine. “Health care organizations need to be held accountable for ensuring that patients get safe and effective treatments to prevent these infections. Broad use of this intervention could prevent the vast majority of those 36,000 deaths.”

Severely ill or injured intensive-care patients who can't breathe on their own need ventilators, but they're at serious risk for infections such as ventilator-associated pneumonia (VAP), which afflicts an estimated 250,000 patients each year. The risk of VAP increases about one to three percent for every day on a ventilator, Berenholtz says.

For the new study, caregivers in 127 ICUs at 82 hospitals in Michigan were instructed to use a group of evidence-based therapies for the prevention of VAP and other ventilator-related complications. The therapies, known as the ventilator bundle, became a checklist for caregivers to follow for patients on breathing machines.

The five therapies include elevating the head of the bed more than 30 degrees to keep bacteria from migrating into the lungs; giving antacids or proton pump inhibitors to

prevent stomach ulcers; giving anticoagulants to prevent blood clots; lessening sedation to allow patients to follow commands; and daily assessment of readiness to remove the breathing tube. While only the first intervention specifically addresses bacteria that can cause pneumonia, all are designed to shorten the length of time on the ventilator -- a key to reducing risk of infection, the researchers say.

“If we evaluate patients every day with objective tests to see how well they are breathing on their own, patients will come off ventilators sooner,” Berenholtz says. “And the less time they spend on the ventilator, the lower their risk of developing an infection.”

Checklists, the Hopkins patient safety team cautioned, do not tell the whole story. As part of the VAP reduction program, staff members also were trained to use teamwork and better communication to ensure that the bundle was being properly administered and that the focus was on getting patients off respirators as early as possible. A program was put in place to allow caregivers to learn from their mistakes. Another strategy in developing a “culture of safety” involved educating patients' families about the therapies and encouraging them to ask questions to ensure that their loved ones were getting the appropriate care, a measure that can help keep caregivers on their toes, Berenholtz says.

The study encompassed data from 112 ICUs at 72 Michigan hospitals from October 2003 through September 2005 and then for up to 30 months after the checklist-implementation period. At the beginning of the study, the percentage of ventilator days on which patients received all five therapies was 32 percent. At 16-to-18 months post-

implementation, the proportion rose to 75 percent and it was 84 percent at 28-to-30 months post-implementation.

Those figures coincide with what Berenholtz calls a “dramatic and unprecedented reduction” in ventilator-associated pneumonia in Michigan, with rates falling up to 71 percent and more than half of ICUs reporting no infections within months after the checklist-implementation period. Those reductions were sustained for up to two and a half years.

Berenholtz’s VAP research was conducted as part of the Keystone ICU Project, which also found that a cockpit-style checklist could virtually eliminate catheter-associated bloodstream infections in hospital intensive-care units throughout the state of Michigan, saving many lives and many millions of dollars. The results from that intervention have received widespread attention and are being replicated in hospitals across the country as more and more states adopt the Hopkins program.

“We hope that we can replicate these results nationally, reducing ventilator-associated pneumonia just as we have reduced bloodstream infections,” says Peter J. Pronovost, M.D., Ph.D., a professor of anesthesiology and critical care medicine at the Johns Hopkins University School of Medicine and the VAP study’s senior author.

The study was funded by the Agency for Healthcare Research and Quality and conducted in partnership with the Michigan Health and Hospital Association.

Other Johns Hopkins researchers involved in the study include Julius C. Pham, M.D., Ph.D.; David A. Thompson, D.Sc.N., R.N.; Dale M. Needham, M.D., Ph.D.; Lisa H. Lubomski, Ph.D.; Sara E. Cosgrove, M.D.; Elizabeth Colantuoni, Ph.D.; and Christine A. Goeschel, Sc.D., R.N., M.P.A., M.P.S.

Source: Berenholtz et al. Collaborative Cohort Study of an Intervention to Reduce Ventilator-Associated Pneumonia in the Intensive Care Unit. *Infection Control and Hospital Epidemiology*, 2011; [link]