RESEARCH BRIEFS

The Growing Importance of Non-Device-Associated Healthcare-Associated Infections: A Relative Proportion and Incidence Study at an Academic Medical Center, 2008–2012

Healthcare-associated infections (HAIs) remain a major source of morbidity and mortality in the United States. Overall, 40%–60% of HAIs have been thought to result from device-associated infections with endogenous flora, including central line–associated bloodstream infections (CLA-BSIs), ventilator-associated pneumonia (VAP), and catheter-associated urinary tract infections (CA-UTIs).[1] The nosocomial infection surveillance systems managed by the Centers for Disease Control and Prevention (CDC), including the National Nosocomial Infections Surveillance (NNIS) system and, more recently, the National Healthcare Safety Network (NHSN), have long focused on device-associated infections.

Over recent decades, there has been a dramatic decrease in the incidence of device-associated infections. Comparison of the NNIS data from 1992–2004 with the NHSN data from 2011 for similar hospital units demonstrates an impressive decrease in the incidence of device-associated infections.[2,3] This decrease has been driven by surveillance focused on device-associated infections;[2,3] guidelines that detail specific measures to reduce CLA-BSI,[4] VAP,[5] and CA-UTI;[6] introduction of bundles for CLA-BSI and VAP with feedback of process measures;[7] and introduction of new technology, such as antibiotic- or antiseptic-impregnated central venous catheters.[4]

We have previously reported that device-associated infections account for only 38.7% of pneumonia cases, 62.3% of bloodstream infections (BSIs), and 77.7% of urinary tract infections (UTIs) in an academic hospital.[8] Here we extend our analyses to assess how the focus on preventing device-associated infections has affected the incidence of both device-associated and non-device-associated HAI.

This study was conducted at University of North Carolina (UNC) Hospitals, an 806-bed tertiary care facility, with use of surveillance data collected over a 5-year period (2008–2012). Comprehensive hospital-wide surveillance for all HAIs that included all CDC-defined sites was performed in accordance with CDC criteria by 5 infection preventionists and 3 full-time faculty members.[8] All surveillance data were entered into an electronic database. Incidence of CLA-BSI, VAP, and CA-UTI was calculated as infections per 1,000 device-days. Incidences of non-device-associated BSI, pneumonia, and UTI were calculated as infections per 1,000 patient-days. Denominator data were collected according to CDC criteria.[9] Generalized linear models (normal distribution) in SAS, version 9.3 (SAS), were used to examine decreases in the incidence rates by infection type over time. Statistical significance was assessed by comparing these regression lines to a line with a zero slope. This study was approved by the institutional review board of UNC Chapel Hill.

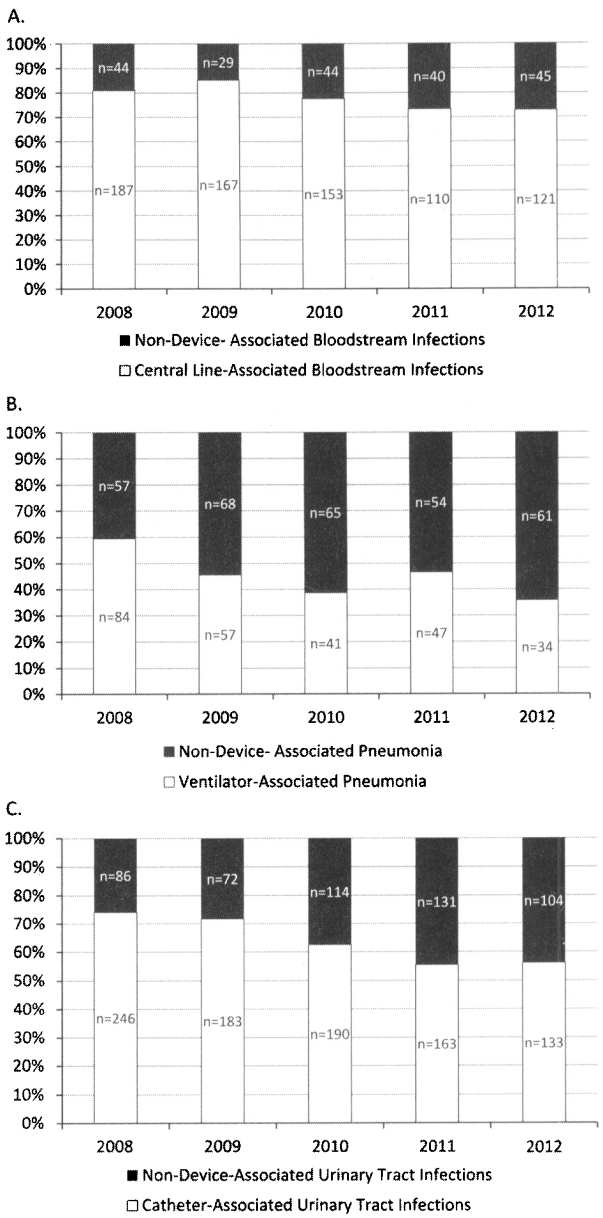

FIGURE 1. Relative proportion of device-associated and non-device-associated infections, University of North Carolina Hospitals, 2008–2012. *A*, Non-device-associated bloodstream infections versus central line–associated bloodstream infections. *B*, Non-device-associated pneumonia versus ventilator-associated pneumonia. *C*, Non-device-associated urinary tract infections versus cather-associated urinary tract infections.

https://doi.org/10.1086/674847 Published online by Cambridge University Press

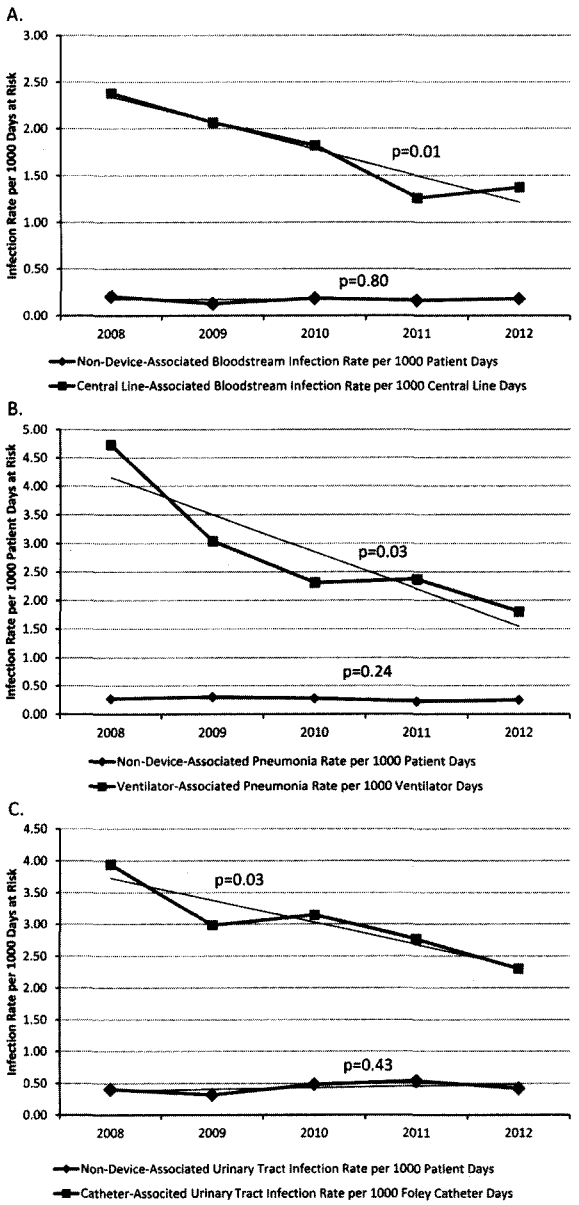

FIGURE 2. Incidence of device-associated and non-device-associated infections with 5-year trend lines, University of North Carolina (UNC) Hospitals, 2008–2012. *A*, Non-device-associated bloodstream infection and central line–associated bloodstream infection rates per 1,000 days at risk, UNC Hospitals, 2008–2012. *B*, Non-device-associated pneumonia and ventilator-associated pneumonia rates per 1,000 days at risk versus UNC Hospitals, 2008–2012. *C*, Non-device-associated urinary tract infection and catheter-associated urinary tract infection rates per 1,000 days at risk, UNC Hospitals, 2008–2012.

Over the 5-year study period, the relative proportions of CLA-BSI, VAP, and CA-UTI as a function of all healthcare-associated infections (ie, both device-associated and non-device-associated infections) at that body site decreased by 8.1%, 23.8%, and 18.0%, respectively (Figure 1). Importantly, even in 2008, only 60% of hospital-acquired pneumonia cases were associated with receipt of mechanical ventilation. By 2012, almost 50% of UTIs were not catheter associated, and less than 40% of pneumonia cases were ventilator associated.

Our analyses demonstrated that the incidence of the device-associated infections (CLA-BSI, VAP, and CA-UTI) decreased significantly during the period 2008–2012. The incidence rate difference for CLA-BSI, VAP, and CA-UTI was −1.13 infections per 1,000 central line–days ($P = .01$), −2.61 infections per 1,000 ventilator-days ($P = .03$), and −1.40 infections per 1,000 catheter-days ($P = .03$), respectively. In contrast, the rates of BSI, pneumonia, and UTI remained essentially the same over the same 5-year time frame. The incidence rate difference for BSI, pneumonia, and UTI was −0.01 infections per 1,000 patient-days ($P = .80$), −0.05 infections per 1,000 patient-days ($P = .24$), and +0.10 infections per 1,000 patient days ($P = .43$), respectively (Figure 2).

The focus on preventing device-associated infections has led to dramatic decreases in the incidence of these infections nationally and at our hospital. Our data demonstrate that the incidence of these infections continues to be above that for non-device-associated infections. However, the rapidly decreasing incidence of device-associated infections, especially for VAP and, to a lesser extent, CLA-BSI, suggests that, if the reduction trends continue, these devices may no longer subject patients to a higher risk of infection per device-day than that engendered per hospital-day. Importantly, less than 40% of healthcare-associated pneumonia cases and less than 60% of healthcare-associated UTIs are now device associated.

In conclusion, 35% of HAIs are currently not device associated. Furthermore, device-associated HAIs are decreasing in relative proportion and incidence. Therefore, the infection control community should devote research and develop guidelines to reduce the prevalence and incidence of non-device-associated HAI

ACKNOWLEDGMENTS

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

Lauren M. DiBiase, MS;[1] David J. Weber, MD, MPH;[1,2]
Emily E. Sickbert-Bennett, PhD;[1,2]
Deverick J. Anderson, MD, MPH;[3]
William A. Rutala, PhD, MPH[1,2]

Affiliations: 1. Department of Hospital Epidemiology, University of North Carolina Health Care, Chapel Hill, North Carolina; 2. Division of Infectious Diseases, UNC School of Medicine, Chapel Hill, North Carolina; 3. Department of Medicine, Duke University School of Medicine, Durham, North Carolina.

Address correspondence to Lauren DiBiase, MS, UNC Health Care System,

1001 West Wing, CB #7600101, Manning Drive, Chapel Hill, NC 27514 (ldibiase@unch.unc.edu).

Received August 16, 2013; accepted September 27, 2013; electronically published January 8, 2014.
Infect Control Hosp Epidemiol 2014;35(2):200-202
 0899-823X/2014/3502-0017$15.00. DOI: 10.1086/674847

REFERENCES

1. Weinstein RA. Epidemiology and control of nosocomial infections in adult intensive care units. *Am J Med* 1991;91(suppl 3B): S179–S184.
2. Centers for Disease Control and Prevention. National Nosocomial Infections Surveillance (NNIS) system report, data summary from January 1992 through June 2004, issue October 2004. *Am J Infect Control* 2004;32:470–485.
3. Dudeck MA, Horan TC, Peterson KD, et al. National Healthcare Safety Network (NHSN) report, data summary for 2011, device-associated module. *Am J Infect Control* 2013;41:286–300.
4. O'Grady NP, Alexander M, Burns LA, et al. Guideline for the prevention of intravascular catheter-related infections, 2011. http://www.cdc.gov/hicpac/BSI/BSI-guidelines-2011.html. Accessed July 11, 2013.
5. Coffin SE, Klompas M, Classen D, et al. Strategies to prevent ventilator-associated pneumonia in acute care hospitals. *Infect Control Hosp Epidemiol* 2008;29(suppl 1):S31-S40.
6. Gould CV, Unscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention of catheter-associated urinary tract infections, 2009. Centers for Disease Control and Prevention. http://www.cdc.gov/hicpac/cauti/002_cauti_toc.html. Accessed July 11, 2013.
7. Berwick DM, Calkins DR, McCannon CJ, Hackbarth AD. The 100,000 lives campaign: setting a goal and deadline for improving health care quality. *JAMA* 2006;295:324–327.
8. Weber DJ, Sickbert-Bennett EE, Brown V, Rutala WA. Completeness of surveillance data reported by the National Healthcare Safety Network: an analysis of healthcare-associated infections ascertained in a tertiary care hospital, 2010. *Infect Control Hosp Epidemiol* 2012;33:94–96.
9. Centers for Disease Control and Prevention; National Healthcare Safety Network. Key terms. http://www.cdc.gov/nhsn/PDFs/pscManual/16pscKeyTerms_current.pdf. Accessed September 11, 2013.

More Cleaning, Less Screening: Evaluation of the Time Required for Monitoring versus Performing Environmental Cleaning

Effective cleaning and disinfection of contaminated surfaces is necessary to prevent transmission of healthcare-associated pathogens.[1] In addition to cleaning of rooms after discharge of the patient from the hospital, daily disinfection of surfaces in isolation rooms may be beneficial as an adjunctive measure.[2,3] In recent years, a number of studies have demonstrated that monitoring of cleaning with feedback to environmental services personnel can result in sustained improvements in cleaning.[4-6] Methods of monitoring have included observation, use of fluorescent markers to monitor the thoroughness of cleaning, and adenosine triphosphate bioluminescence testing to evaluate for the presence of residual organic material after cleaning.[4-6] Because of factors such as frequent environmental staff turnover and variability in cleaning performance of environmental services personnel,[7,8] optimizing and maintaining improvements in cleaning may require significant ongoing efforts by infection control and/or environmental services programs, particularly if monitoring includes both daily cleaning and cleaning after discharge. One potential strategy to reduce the impact of variability in cleaning performance is to form dedicated teams of highly motivated workers for isolation rooms.[9,10] Here, we evaluated the time required to conduct monitoring and feedback to maintain improvements in daily cleaning and disinfection of *Clostridium difficile* infection (CDI) isolation rooms in the presence and absence of a dedicated environmental services team for daily disinfection of CDI isolation rooms.

The Cleveland Veterans Affairs Medical Center includes a 215-bed hospital and 165-bed long-term care facility. The hospital's institutional review board approved the study protocol. During the study, germicidal wipes (Clorox) were used for disinfection of CDI rooms daily and after discharge of the patient. Environmental services department policies required that high-touch surfaces in CDI rooms be disinfected daily. For monitoring of daily disinfection, fluorescent marker (DAZO; EcoLab) was applied by infection control staff members to 6 high-touch surfaces (bed rails, bedside table, call button, telephone, bathroom hand rail, and toilet seat) in patient rooms, and thoroughness of cleaning was assessed on the basis of marker removal.[4] Education and feedback were provided to individual housekeepers and at monthly environmental services staff meetings.

During two 8-week periods, we calculated the time spent by a single infection control team member for monitoring and providing feedback on daily cleaning of CDI rooms. Monitoring was performed daily for 5 days per week (Monday through Friday). In period 1, all housekeepers were expected to perform daily disinfection of CDI rooms on their wards; in period 2, a dedicated team of 3 housekeepers was responsible for daily disinfection of all CDI rooms 7 days per week. The dedicated housekeepers were selected by environmental services supervisors and were rewarded only by receiving recognition from the infection control and environmental services programs. No new personnel were hired. The time spent on monitoring and feedback included time for placement of fluorescent marker and reading of results, feedback to housekeepers, contacting environmental services supervisors, and preparing reports. Monitoring of daily cleaning was performed daily; however, if 90% removal of marker was achieved for 1 week, the frequency of monitoring was decreased to 1 day per week.