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

Lauren M. DiBiase, MS¹, David J. Weber, MD, MPH^{1,2}, Emily E. Sickbert-Bennett, PhD^{1,2}, Deverick J. Anderson, MD, MPH³, and William A. Rutala, PhD, MPH^{1,2}

¹Department of Hospital Epidemiology, University of North Carolina Health Care, Chapel Hill, North Carolina

²Division of Infectious Diseases, UNC School of Medicine, Chapel Hill, North Carolina

³Department of Medicine, Duke University School of Medicine, Durham, North Carolina

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

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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).

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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.

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

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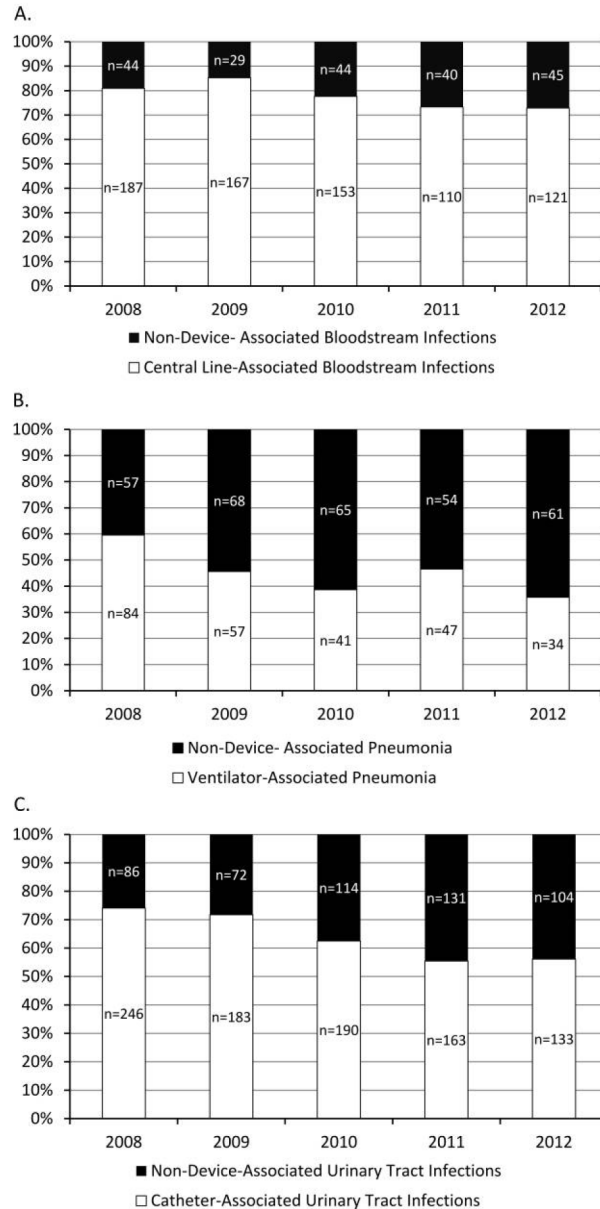


Figure 1. Relative proportion of device-associated and non-device-associated infections, University of North Carolina Hospitals, 2008–2012. *A*, Non-device-associated bloodstream infections versus central line–associated bloodstream infections. *B*, Non-device-associated pneumonia versus ventilator-associated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

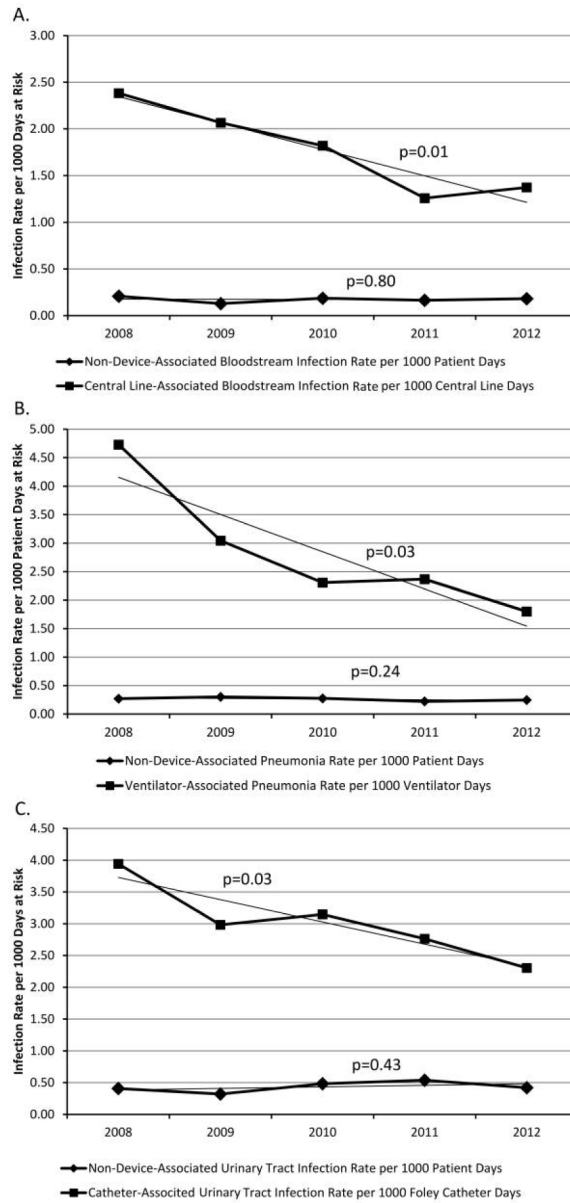


Figure 2. Incidence of device-associated and non-device-associated infections with 5-year trend lines, University of North Carolina (UNC) Hospitals, 2008–2012. *A*, Non-device-associated bloodstream infection and central line-associated bloodstream infection rates per 1,000 days at risk, UNC Hospitals,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