

# Healthcare-Associated Infections (HAI): The Perfect Storm has Arrived!

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**ABBREVIATIONS:** CAUTI – Catheter-associated urinary tract infection, CDC – Centers for Disease Control and Prevention, CLABSI – Central line-associated blood stream infection, EVS – Environmental services, HAI – Healthcare-associated infections, HCW – Healthcare Worker, MRSA – Methicillin resistant *Staphylococcus aureus*, SSIs – Surgical site infections

**INDEX TERMS:** Antibiotic resistance, *C. difficile*, CDI, Healthcare-associated infections, HAI, Healthcare worker safety, Multiple drug resistant organisms, MDROs, MRSA, Patient safety

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## INTRODUCTION

On any given day approximately 1 of every 25 inpatients in U.S. acute care hospitals has at least one healthcare-associated infection (HAI), adding up to about 722,000 infections in 2011. Pneumonia and surgical-site infection are the most common infection types, and *Clostridium difficile* is the most common pathogen.<sup>1</sup>

The CDC Multistate Point-Prevalence Survey of Healthcare-Associated Infections, published in the New England Journal of Medicine, used 2011 data from 183 U.S. hospitals to estimate the burden of a wide range of infections in hospital patients. That year, about 721,800 infections occurred in 648,000 hospital patients. About 75,000 patients with HAI died during their hospitalizations. The most common healthcare-associated infections were pneumonia (22%), surgical site infections (22%), gastrointestinal infections (17%), urinary tract infections (13%), and bloodstream infections (10%).

The most common germs causing HAI by rank were *C. difficile* (12%), *Staphylococcus aureus*, including Methicillin Resistant *S. aureus* (MRSA, 11%), *Klebsiella* (10%), *E. coli* (9%), *Enterococcus* (9%), and *Pseudomonas* (7%). *Klebsiella* and *E. coli* are members of the Enterobacteriaceae bacteria family, which has become increasingly resistant to last-resort antibiotics known as carbapenems, typically referred to as carbapenem resistant Enterobacteriaceae (CRE).<sup>1</sup>

Practically, what this means is that over 200 patients will die the day you read this article and every day until the global community is able to address this healthcare

crisis. If you do the simple math you will realize this results in about 4% of hospitalized patients who developed one or more HAI due to the care received in the hospital and of those, about 75,000 died during their hospital stay each year in the United States from HAI. Imagine a jet airliner going down every day in this country and the American public accepting it without much notice. In reality, that is what is happening with HAI. This FOCUS series of articles has been dedicated to three current, cutting edge topics concerned with contemporary issues regarding HAI.

As the United States population ages, the number of people in need of healthcare services will increase. Between 2000 and 2050, the percent of the population aged 85 and over is projected to increase by up to 350%.<sup>2</sup> By this estimated increased use of healthcare services, the risk of developing an HAI becomes greater. These types of infections, caused by microorganisms that a patient is exposed to while receiving medical care at a healthcare facility, affect approximately one in every 20 patients during their hospital stay. Healthcare workers (HCWs) caring for patients can be exposed to the same microorganisms during the course of their work shift which can result in an occupational illness or infection. In fact, 2% - 15% of HCWs are themselves already colonized or infected by MRSA.<sup>3,4</sup>

HAI are a significant cause of morbidity and mortality in the United States. Each year, these infections are responsible for \$28 to \$33 billion dollars in avoidable healthcare expenses.<sup>5</sup> In our first article of this FOCUS series, readers will be updated on the current state of affairs in regards to HAI with respect to (1) vulnerable populations, (2) diverse healthcare sites and levels of healthcare workers, (3) increased pathogens and their resistance, and (4) responses by our national healthcare strategy to reduce HAI.

Annually, millions of patients will acquire an infection in healthcare environments creating an enormous burden on healthcare systems and public health. In 1999, the Institute of Medicine published the report, *To Err is Human* which called for a national effort to make healthcare safer. The report documented that about 98,000 patients die needlessly from preventable medical harm particularly HAI.<sup>6</sup> This report garnered national attention and put healthcare safety in the spot light. Since this report was published, efforts have been

taken to reduce HAI risk in healthcare facilities. Increased public awareness and understanding that these infections can be prevented has prompted consumers and policymakers to take action. The Patient Safety and Quality Improvement Act of 2005 was passed to improve patient safety by encouraging voluntary reporting of events that adversely affect patient outcomes.<sup>7</sup> Such HAI reporting legislation that requires facilities to publically disclose their HAI incidence, works to encourage facilities to implement effective infection prevention measures to reduce their HAI risk. As our second article in this FOCUS series will detail, in the years that followed, many state legislatures passed laws that mandated public reporting of HAI. We will pay particular attention to federal influences on state – level HAI program initiatives and reporting, the progression of state – level initiatives to reduce HAI, the core provisions of state HAI reporting laws, and healthcare worker infection and illness reporting mandates.

One of the most logical and reasonable aspects to understanding, and more importantly, addressing HAI is the role of the healthcare environment. Environmental surfaces, medical devices, healthcare uniforms, and laundry practices are all being critically examined in regards to how they can expose a patient or healthcare worker to harmful microorganisms that cause HAI. Concurrently, we must not lose sight of the enormous impact that the environmental services (EVS) professionals play in offering a solution for the overall reduction of HAI. EVS professionals, long a hidden part of the healthcare team, are now being brought to the forefront of the HAI table for insight and valuable contributions to the national strategy for HAI reduction.<sup>8,9</sup> In our third and final article of this FOCUS series, we will discuss the healthcare environment in the context of its role in (1) acquisition and transfer of microbial populations, (2) relationship to the risk of infection and illness in both patient and healthcare worker populations, (3) recently published scientific evidence related to transmission of microbes from environmental surfaces including textiles, (4) laundering practices and procedures of healthcare textiles and uniforms, and (5) new technologies and programs that can address reducing risk associated with contaminated environmental surfaces.

For several decades now, the high incidence of HAI and

the dangerously low levels of literacy regarding antibiotic resistance in the general public have been on a collision course. The “Perfect Storm” has arrived and is painfully evident in the numbers of illnesses and deaths due to HAI. Moreover, the general public seems to be more worried about headline diseases such as Ebola than the one right under their noses (or their hospital bed). While global outbreaks such as Ebola are worthy of our most heroic public health efforts, in reality more United States citizens will die this year and every year from HAI – a preventable infection!

Progress is being made per CDC’s *National and State Healthcare-associated Infection Progress Report* such as these reported findings:

- A 46 percent decrease in CLABSI between 2008 and 2013
- A 19 percent decrease in SSIs related to the 10 select procedures tracked in the report between 2008 and 2013
- A six percent increase in CAUTI between 2009 and 2013; although initial data from 2014 seem to indicate that these infections have started to decrease
- An eight percent decrease in hospital-onset MRSA bacteremia between 2011 and 2013
- A 10 percent decrease in hospital-onset *C. difficile* infections between 2011 and 2013.<sup>10</sup>

The ultimate goal, however, is Zero preventable HAI! It will take a multi-modal approach on multiple fronts of the battlefield.<sup>8,9</sup> We are still experiencing thousands of needless deaths each year. It’s time for all of us – global healthcare professionals of all walks of life, private and public government agencies, professional organizations, and the general public – to join hands and confront this war head on! If we do not, the consequences will be tragic and potentially unwind all of the past public health advances that our parents, grandparents and great-grandparents enjoyed.

Together, this FOCUS series of articles on HAI is aimed to inform laboratory professionals, business thought leaders, medical/health educators, healthcare professionals, healthcare facilities experts, EVS professionals, government agencies, professional organizations, philanthropists, and the clinical diagnostics field at large about the past, current and future paradigms for HAI detection, management and

national and state strategies for reduction of these deadly infections. In each article, our HAI subject matter experts have included a very brief summary and explanation of the public health and clinical rationale that has led us to the current practices in the field.

Medical laboratory professionals play an integral role in the healthcare system by providing diagnostic services that not only directly impact therapeutic management of patients, but also by offering their expertise in interpretation of the results in the mounting numbers and types of HAI identification. Further, medical laboratory professionals must inform physicians and others in the sometimes difficult and cloudy interpretation of antibiotic susceptibility assays and menus of tests available to physicians. In that light we should all have a basic grasp of the basis and rationale for interpreting HAI testing, and generally appreciate the downstream effects of reporting a result. Finally, educators must become leaders in preparing clinically competent laboratory professionals by providing them with opportunities to expand their training and understanding of antibiotic-resistant microorganisms in general, and HAI in particular. These topics are discussed in the context of three important HAI articles with the goal of highlighting timely and pertinent affairs in the fast-paced and evolving field of HAI and where they intersect with all of us.

## REFERENCES

1. Magill SS, Edwards JR, Bamberg W, et al. Multistate point-prevalence survey of healthcare-associated infections. *N Engl J Med* 2014;370:1198-1208.
2. Wiener JA. Population ageing in the United States of America: implications for public programmes. *Int. J. Epidemiol* 2002; 31:776-781.
3. Hawkins G, Stewart S, Blatchford O, Reilly J. Should HCWs be screened routinely for methicillin-resistant *Staphylococcus aureus*? A review of the evidence. *J. of Hospital Infection* 2011; 77(4):285-289 DOI: 10.1016/j.jhin.2010.09.038.
4. Kassis C, Hachem R, Raad I, et al. Outbreak of community-acquired methicillin-resistant *Staphylococcus aureus* skin infections among health care workers in a cancer center. *American J. of Infection Control* 2011; 39(2):112-117 DOI: 10.1016/j.ajic.2010.04.220.
5. US Department of Health and Human Services. (2010). National action plan to reduce healthcare-associated infections. Available from <http://www.hhs.gov/ash/initiatives/hai/action-plan/index.html>. Accessed 5/19/2015.
6. Institute of Medicine. (2000). *To err is human: building a safer health system*. Washington, DC: National Academies Press.
7. Agency for Healthcare Research and Quality. (2008, June). *The Patient Safety and Quality Improvement Act of 2005*.

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Available from <http://www.ahrq.gov/qual/psoact.htm>. Accessed 5/19/2015.

8. Rohde RE. A Secret Weapon for Preventing HAI: A scientist's message to hospitals trying to rid themselves of healthcare-associated infections. Elsevier Connect, July 15, 2014. Available from <http://www.elsevier.com/connect/a-secret-weapon-for-preventing-HAI>. Accessed 5/19/2015.
9. Rohde RE. Healthcare Facilities Today – published written interview, Scholar bringing EVS role in infection prevention to the forefront. Q2, April 2015. Available from <http://www.healthcarefacilitiestoday.com/posts/Scholar-bringing-ES-role-in-infection-prevention-to-the-forefront-9115>. Accessed 5/19/2015.
10. Centers for Disease Control and Prevention. (2012) Healthcare-associated Infections (HAI) Progress Report. Available from <http://www.cdc.gov/hai/progress-report/index.html>. Accessed 5/19/2015.



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