BD Global Public Policy Position

Prevention and Control of Healthcare-Associated Infections (HAIs)

ISSUE: Healthcare-Associated Infections (HAIs) are a serious but preventable healthcare problem worldwide

Healthcare-associated infections (HAIs) are infections that patients contract in a healthcare facility, from bacteria, viruses and other pathogens which are frequently resistant to antimicrobial treatment.[i] They result in serious clinical, public health, and economic costs, including prolonged hospital stays, long-term disability, preventable deaths, increased antimicrobial resistance, excess financial costs to healthcare systems, and high costs for patients and their families. They affect hundreds of millions of patients annually. [1,2,ii] Fortunately, many HAIs can be prevented when public policy requires and incentivizes healthcare facilities to implement comprehensive infection prevention and control practices.

POSITION: BD supports public policy that advances comprehensive infection prevention by requiring healthcare facilities to implement the essential elements of infection control. Governments should also establish HAI reduction targets and implement compliance measures and incentives to drive change.

Effective frameworks to advance HAI prevention should include the following key elements:

1. **Requirements for implementation of comprehensive infection prevention and control measures in healthcare facilities**
   Healthcare facilities should be required to implement the essential elements of infection prevention and control - driving toward programs that follow established guidelines – and consistent with best practices. These include:
   - ✓ Designation of an infection control officer in each hospital
   - ✓ Collection, analysis, management and reporting of HAI incidence rates
   - ✓ Policies and procedures to prevent HAIs including:
     - Hand-hygiene
     - Environmental disinfection
     - Education of healthcare workers and patients
     - Management of interventions to protect patients
     - An antibiotic stewardship program
     - Healthcare facility evaluation and application of medical technologies including:
       - *Medical devices* engineered to help prevent infections.
       - *Rapid diagnostics* to identify patients colonized or infected with HAI-associated pathogens. Where MRSA is identified as a pathogen of concern, active surveillance should be employed.[iii]
       - *Information technology* to enhance HAI surveillance and standardize data collection and reporting.

[i] HAIs, also referred to as nosocomial infections, are infections that were not present or incubating at the time of admission. They are the most common serious adverse event from healthcare delivery and a leading cause of preventable morbidity and mortality.

[ii] According to the World Health Organization (WHO), HAIs affect hundreds of millions of patients worldwide each year and are a "hidden, cross-cutting problem."

[iii] Active surveillance refers to the practice of using diagnostic testing on individual patients to determine if they are colonized with MRSA. If a patient is colonized, procedures should be implemented to isolate and decolonize the patient in advance of hospital admission and surgery.

2. **Healthcare facility surveillance and public reporting of HAIs**
   Hospitals and other healthcare facilities should be required to monitor infection rates to inform their infection control strategies. They also should be required to report their HAI rates to a credible public entity and the data should be publicly available. This enhances accountability and provides patients and policymakers with access to individual healthcare facility quality measures.

3. **Defined HAI reduction targets**
   Policymakers should establish measurable HAI reduction targets that are to be achieved over a defined period of time. Baseline HAI rates should be established in each hospital so that individual hospitals can be measured in their progress in reducing HAIs.

4. **Incentives for achieving progress in reducing HAIs**
   Policymakers should develop incentives for healthcare facilities that are directly linked to progress toward achieving established HAI prevention goals. Health ministries and other relevant agencies should have oversight of healthcare facilities and should have the ability to sanction facilities that fail to implement a comprehensive infection control program. Positive incentives that include an appropriate financial reward (increase in payment, insurance credits, etc) also help drive action at the hospital level.

5. **Public Investment in infection prevention and control**
   Governments should invest in the professional, technology and physical infrastructure needed to prevent and control infection. Without these, healthcare workers will not be able to effectively implement the essential elements of infection control.

BACKGROUND: HAIS ARE A SERIOUS PROBLEM WORLWIDE. THEY RESULT IN AVOIDABLE DEATHS AND DISEASE AND SIGNIFICANTLY INCREASE THE COSTS OF HEALTHCARE. YET HAIS CAN BE CONTROLLED AND PREVENTED IF APPROPRIATE POLICIES AND BEST PRACTICES ARE IMPLEMENTED.

The World Health Organization (WHO) reports that HAIs affect hundreds of millions of patients worldwide each year and estimates the prevalence in hospitals to be 5-12% in developed countries and 5-19% in developing countries.[3] Moreover, HAIs result in massive avoidable healthcare costs. In the United States, the overall direct medical costs associated with treating HAIs ranges from $28.4 billion to $33.8 billion each year.[4] Similarly, an Organisation for Economic Co-operation and Development (OECD) study of three countries revealed that HAIs added $7-8 billion annually to healthcare costs in the countries surveyed.[5] It is important to note that these figures do not account for lost healthcare worker productivity or opportunity costs due to resources being directed away from other healthcare initiatives. Because HAIs often cause significantly longer hospital stays for patients – three to fives times as long according to some studies[6,7] - they can lead to additional financial and emotional costs to patients and their families.

Many of the organisms that cause HAIs can survive on routine healthcare equipment including medical devices, surgical tools, unwashed hands, and on surfaces that both patients and healthcare workers touch. Consequently, these pathogens are easily transmitted from patient to patient when healthcare professionals and facilities do not comply with infection prevention and control practices HAIs are a serious problem in most healthcare settings, but they are particularly dangerous for high-risk patients and patients in intensive care units (ICUs), who are at higher risk of both contracting infections and suffering serious complications.[8] In one study involving ICUs from 75 countries, the proportion of ICU patients with infections was as high as 51%, and the majority of these infections were acquired in the hospital.[9] Depending on the country and site of infection, HAI rates in ICUs and neonatal facilities can be 3-20 times higher than the rate in the United States.[10,11]

Although these data are compelling, the true magnitude of the global HAI problem is not known because surveillance and reporting are inadequate in many countries. The WHO has referred to HAIs as a "hidden, cross-cutting problem,"[12] and has concluded that there is a lack of quality studies on the issue and an insufficient number of functional surveillance systems. [13,14]

The clinical, economic, and public health costs that accompany the global HAI crisis are severe. For example, the European Centre for Disease Prevention and Control (ECDC) has estimated that over four million people in the European Union acquire an HAI each year, and approximately 37,000 die as a direct result.[15] Similarly, the United States Centers for Disease Control and Prevention (CDC) has identified HAIs as one of the top ten leading causes of death in that country, accounting for approximately 99,000 deaths annually. A 75-country study showed that the mortality rate of infected patients was more than twice that of non-infected patients, both in ICUs and for overall hospital settings.[16] Several other worldwide studies have demonstrated the impact of infections specific to ICU settings, identifying infection and related sepsis as the leading cause of death in non-cardiac ICUs, with mortality rates that reach 60% and account for 40% of total ICU expenditures.[17]

In addition to the adverse clinical and economic consequences of HAIs, these infections present a public health concern because they promote the spread of antimicrobial-resistant organisms.[18,19] Analysis by the ECDC revealed that the proportion of drug resistant *Staphylococcus aureus, Enterococcus faecium, and Escherichia coli*, all of which are major HAI pathogens, increased substantially between 2003 and 2007.[20] Globalization and the increasing mobility of patients - across healthcare settings and communities - can further accelerate the spread of antimicrobial-resistant organisms.[21, iv]

HAIs can be controlled with effective policies and appropriate actions. For example, a comprehensive approach in Western Australia that included active surveillance and screening of high-risk patients has been credited with significant reductions in the rates of MRSA HAIs in that region.[22] Similarly, in the United States, the "Michigan Keystone Project" - a partnership between a major hospital association and university – achieved a 66% reduction in catheter-related bloodstream infections in ICUs, saving an estimated 1,500 lives and $200 million in the first eighteen months. While hand hygiene was a component of the Michigan program and is an essential element of success, comprehensive programs cannot rely on hand hygiene alone. Worldwide, studies have shown that compliance with hand hygiene policy is poor, often ranging from 20-50%.[23,24] Importantly, the Michigan effort focused on driving changes in culture and practice along with incentives for cooperation.[25]

HAIs are a serious problem for healthcare systems worldwide that must be addressed through comprehensive policies that include the implementation of the essential elements of infection prevention and control, healthcare facility oversight, investment in infrastructure including technology and incentives to drive change. As the WHO concluded in its report, we must "alert policy and decision makers to the fact that health-care-associated infection represents a hidden and serious burden for systems and patients alike – and that action is now required."[26]

[iv] Implementing robust infection control measures to address HAIs will also help improve preparedness to address other public health threats, such as an influenza pandemic.

Appendix 1

The Most Prevalent Healthcare-Associated Infections

Pathogen-specific and Medical Device-Related

Pathogen-specific

Clostridium difficile

C. difficile infection (CDI) is caused by toxin-producing strains of the *C*. *difficile* bacteria in the intestine. About 3% of healthy adults are carriers of *C. difficile*, but the rate is higher in patients and elderly people being treated in hospitals with antibiotics. Antibiotics kill many of the normal gastrointestinal bacteria allowing toxigenic *C. difficile* to grow unchecked which can then cause *C. difficile* infection (CDI). Symptoms of CDI can include severe diarrhea, nausea, abdominal pain, loss of appetite, dehydration, fever, bowel inflammation and in its worse cases, colonic perforation, sepsis, and death. In addition to the adverse health effects of CDI infections, they lead to excess costs. One estimate in the United Kingdom is that each case costs the National Health Service between USD $9,000 and $11,200, which translates to up to $486 million per year.[27]

Methicillin-resistant *Staphylococcus aureus* (MRSA)

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a particularly prevalent organism causing HAIs. People can be colonized with MRSA but show no sign of clinical infection. The most recent population-based estimates of MRSA colonization in the United States from 2001 are approximately 1%, but in patients who are in healthcare facilities the colonization rate can be as high as 10% – 15%. MRSA carriers can serve as a source of MRSA that can be passed along to vulnerable populations in the hospital or to healthcare professionals who then transmit it to those in their care. In the hospital, colonization and infection with MRSA is often acquired during or after surgery or by patients in the ICU, and can lead to systemic infections in the bloodstream, hospital-acquired pneumonia, surgical site infection and other infections, all of which are difficult to treat. For example, one patient who contracted MRSA after minor laparoscopic surgery became septic and spent four months in an intensive hospital care battling her infection. Studies have found that MRSA alone causes more than 94,000 cases of invasive infections in the United States annually, and close to 19,000 deaths.[28]

Multi-drug resistant gram-negative bacilli

Gram-negative bacteria that are resistant to many antibiotics are being increasingly identified as pathogens causing healthcare-associated infections worldwide.[v] A few of the most problematic pathogens are noted below:

- ***Acinetobacter baumannii***

  Antibiotic-resistant *Acinetobacter baumannii* is an increasing source of healthcare-associated infections in many regions of the world.[29] Outbreaks of acinetobacter infections typically occur in intensive care units and healthcare settings housing very ill patients and rarely occur outside of healthcare settings. The bacterium may cause a variety of infections, ranging from pneumonia to serious bloodstream or wound infections, and the symptoms vary depending on the site of the infection. Colonization may also occur in vulnerable hospitalized patient without causing infection or symptoms. The site of colonization may be the gastrointestinal tract, tracheostomy sites or open wounds. Although acinetobacter poses very little risk to healthy people, hospitalized patients, especially very ill patients on a ventilator, those with a prolonged hospital stay, or those who have open wounds are at greater risk for acinetobacter infection. Acinetobacter is spread the same way that MRSA is spread: via person-to-person contact, on the hands of healthcare workers or contact with contaminated surfaces. Because Acinetobacter may survive in the environment for several days, careful attention to infection control procedures, such as hand hygiene and environmental cleaning, is imperative to reduce the risk of transmission. These bacteria are the most common cause of HAI in China and are a growing problem in Australia and New Zealand.[30]

[v] "Gram-negative" and "gram-positive" are classifications of bacteria based on their cell wall structure and how they respond to a staining process used in analysis.

- **Extended-spectrum Beta-Lactamase (ESBL)- producing bacteria**

ESBL-producing bacteria are different from other superbugs, because "ESBL" does not refer to one specific kind of bacteria. ESBLs are proteins that are produced by a large spectrum of genes found in various gram-negative bacilli. These proteins confer resistance to many antimicrobials. ESBL-producing gram-negative bacilli have been reported from all parts of the world. However, prevalence varies widely because it is difficult to detect ESBL production and because testing and reporting are inconsistent. The most common ESBL-producing bacteria are *E. coli* and Klebsiella species which can cause many kinds of HAIs, such as bloodstream infections, urinary tract infections (UTIs) and surgical site infections. Treatment of infections due to gram-negative bacilli with ESBLs is very challenging and patients may experience a delay in appropriate treatment because the antimicrobial resistance is not identified correctly. Delays in treatment may lead to extended and costly hospital stays as well as death.

- ***Klebsiella pneumoniae* Carbapenamase *(KPC)***

Klebsiella pneumoniae carbapenamase is an enzyme that confers resistance to the carbapenam class of antibiotics. This is significant because carbapenam antibiotics are often the drug of last resort for infections that don't respond to other treatments. The gene responsible for this enzyme was first found in *Klebsiella pneumoniae* but has since been identified in *E. coli* as well. KPC-containing organisms have been documented to cause a wide range of healthcare-associated infections, including pneumonia, bloodstream infections, wound or surgical site infections, and meningitis. In healthcare settings, patients at risk for infections due to KPC-containing organisms are similar to those at risk for infections due to ESBL-producing organisms and multidrug resistant *Acinetobacter baumannii*. Healthy people usually do not get infections due to KPC-containing organisms. Organisms containing KPC genes can be transmitted in the healthcare setting via direct person to person contact, on the hands of healthcare workers, and contact with contaminated environments in the same way as multidrug resistance *Acinetobacter baumannii* and MRSA

- **Vancomycin-resistant *Enterococcus* (VRE)**

HAIs caused by vancomycin-resistant enterococci are increasingly common and difficult to treat. Enterococci are bacteria that are normally present in the human intestines. Vancomycin-resistant enterococci are, as the name suggests, resistant to vancomycin and many other antibiotics, leaving patients infected with VRE with few treatment options. As with MRSA, patients may become colonized with VRE, but may show no signs of clinical infection. Ultimately, some of these carriers will be at risk of infection from VRE, particularly if their immune systems are weakened from cancer or cancer treatments or following surgery. Symptoms from VRE infection are related to the type of infection that the pathogen causes which include sepsis, bloodstream, urinary tract and surgical site infections.

Medical Device-related

Catheter-Related Bloodstream Infections (CR-BSI)

A catheter-related bloodstream infection (CR-BSI) occurs when a patient develops a bloodstream infection with the site of the infection being an intravascular catheter. This may happen when bacteria or fungus grow in or around the catheter and spread to the patient's bloodstream. When these infections are associated with central vascular catheters they are called central-line associated bloodstream infections (CLABSI). CLABSI account for the majority of BSI in the healthcare setting and the attributable mortality of CLABSI is estimated to be between 12% - 25%. It has been shown that a coordinated infection control approach which includes hand hygiene, appropriate skin preparation and catheter line care, and removal of lines when they are no longer needed can significantly impact the occurrence of these HAIs.

Hospital-Acquired Pneumonia (HAP) / Ventilator-Associated Pneumonia (VAP)

HAP is defined as pneumonia that occurs 48 hours or more after admission and that was not incubating at the time of admission. VAP refers to pneumonia that occurs more than 48 hours after naso- or endotracheal intubation.

HAP is the second most common HAI in the United States. There are 300,000 cases of HAP annually, and it carries an associated mortality rate of 30% to 70%.[31] It is difficult to determine the fraction of patients with HAP whose mortality is directly attributable to their pneumonia (the attributable mortality), but this rate is estimated to be between 27% and 50%. HAP lengthens the hospital stay by 7 to 9 days and is associated with a higher cost of medical care. It is the most common infection occurring in patients requiring care in an intensive care unit (ICU) and accounts for almost 25% of all HAIs in ICU patients, with incidence rates ranging from 6% up to 52%. This increased incidence is because patients located in an ICU often require mechanical ventilation, and mechanically ventilated patients are 6 to 21 times more likely to develop HAP than non-ventilated patients.[32]

Surgical Site Infection (SSI)

A surgical site infection (SSI) is an infection that develops within 30 days after an operation or within one year if an implant was placed and the infection appears to be related to the surgery.[33] In the United States, SSIs result in 13,000 deaths annually and $3 – $8 billion in associated healthcare costs. Research suggests that 26% - 54% of SSIs are preventable through comprehensive pre-operative and intra-operative management of skin antisepsis, prophylactic antimicrobials, and attention to other measures as outlined by the Surgical Care Improvement Project (SCIP).[34]

Catheter-associated Urinary Tract Infections (CAUTI)

A urinary tract infection (UTI) is an infection involving any part of the urinary system, including the urethra, bladder, ureters, and kidneys. Among UTIs acquired in the hospital, approximately 75% are associated with a urinary catheter, which is a tube inserted into the bladder through the urethra to drain urine. These are referred to as catheter-associated urinary tract infections (CAUTIs). The most important risk factor for developing a CAUTI is prolonged use of the urinary catheter.[35] CAUTIs comprise 40% of all institutionally acquired infections.[36]

Resources for Healthcare-Associated Infection Prevention and Control

The following are leading governmental and professional organizations that have developed guidelines useful in the development of comprehensive infection prevention and control measures. This is not an exhaustive list, and more region-specific organizations and guidelines can provide other useful resources.

Governmental Organizations

Australian National Health and Medical Research Council:
Australian Guidelines for the Prevention and Control of Infection in Healthcare (2010)
http://www.nhmrc.gov.au/publications/synopses/cd33syn.htm

Community and Hospital Infection Control Association -Canada (CHICA-Canada)
http://www.chica.org/
http://www.chica.org/links_evidence_guidelines.html

European Centre for Disease Prevention and Control (ECDC)
http://www.ecdc.europa.eu/en/healthtopics/Healthcare-associated_infections/Pages/index.aspx

United States Centers for Disease Control and Prevention (CDC):
Guidance documents: http://www.cdc.gov/HAI/settings/settings.html

United States Department of Health and Human Services (HHS):
HHS Action Plan to Prevent Healthcare-Associated Infections:
http://www.hhs.gov/ash/initiatives/hai/actionplan/index.html

Vereniging voor Hygiëne & Infectiepreventie in de Gezondheidszorg (The Netherlands)
http://www.vhig.nl/

World Health Organization (WHO):
Global Patient Safety Challenge: Clean Care is Safer Care
http://www.who.int/gpsc/en/
http://www.who.int/patientsafety/events/05/global_challenge/en/index.html

Professional Organizations

Association of Professionals in Infection Control and Epidemiology (APIC):
Guidelines and Standards: http://www.apic.org/AM/Template.cfm?Section=Practice

International Federation of Infection Control (IFIC)
http://www.theific.org/default.asp

Institute for Healthcare Improvement (IHI)
http://www.ihi.org/IHI/Topics/HealthcareAssociatedInfections/

Society for Healthcare Epidemiology of America (SHEA)
Guidelines and Resources: http://www.shea-online.org/about/compendium.cfm

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Rev. 04/2011