A UMF Corporation White Paper

Doing Everything

Multimodal Intervention to Prevent Healthcare-Associated Infections

Donald Berwick, the former administrator of the Centers for Medicare and Medicaid Services, once asked Göran Henrik, chief executive of learning and innovation in Jönköping County, Sweden, how his county was achieving world-leading results in total health system performance. Henrik told him: "Here's the secret: We do everything."

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DOING EVERYTHING: MULTIMODAL INTERVENTION

INTRODUCTION

Despite some evidence of progress – much of it a result of government payment initiatives – infections acquired during a hospital stay remain the source of most preventable harm to patients, with devastating effects on personal lives, the national economy, and hospital reputations and financial sustainability.

According to the Centers for Disease Control and Prevention (CDC), about 1 in every 20 inpatients gets infected during a hospital stay, and 99,000 people die each year as a result, making healthcare-associated infections (HAIs) the fourth-leading cause of death in the United States.[1]

HAIs lead to longer hospitalizations; a recent analysis by UMF Corp. estimates that these infections accounted for more than 27 million additional hospital patient days annually. The study extrapolated data from a 2002 CDC report and a 2010 report from the Pennsylvania Department of Public Health, the only governmental entity that has consistently tracked all HAIs.[2]

During those longer hospital stays, an infected patient requires greater use of intensive care, diagnostic imaging and newer antibiotics that cost at least four times as much as conventional drugs. No wonder a 2009 CDC report estimated that HAIs account for $40 billion in excess healthcare costs each year, with the average infection costing a hospital $20,000 to $25,000 to treat.[3] Due to health reform, much of that is now unreimbursed expense.[4]

Healthcare facilities are breeding grounds for an array of infectious diseases caused by methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococcus (VRE), Acinetobacter baumannii, Clostridium difficile (C. difficile), norovirus, influenza virus and severe acute respiratory syndrome. These infections result from bacteria, fungi and viruses that dwell in the hospital environment – often for months – in dust and on floors, bedrails, telephones, call buttons, curtains and other surfaces. The majority of HAIs are urinary tract infections, surgical site infections, bloodstream infections and pneumonia.

These infections have developed resistance to antibiotics, a result of decades of well-intentioned overuse by physicians and other prescribers that has had the effect of selecting strains of bacteria that are able to evade the desired killing action of the drugs. In 1974, 2 percent of staph infections were MRSA. By 2004, that number increased to 64 percent.[5]

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[1] *Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002*, Centers for Disease Control and Prevention

[2] Healthcare-Associated Infections (HAI) in Pennsylvania Hospitals: 2010 Report, Pennsylvania Department of Public Health

[3] *The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention*, Centers for Disease Control and Prevention, March 2009

[4] *The Financial Impact of Antibiotic Resistance*, Joint Commission Resources (online)

[5] "Methicillin-Resistant *Staphylococcus Aureus*: A Pervasive Pathogen Highlights the Need for New Antimicrobial Development," *Yale Journal of Biology and Medicine,* December 2010; 83(4): 223–233

A result of antibiotic resistance is markedly higher morbidity and mortality among those who contract an infection. For example, a study of patients with drug-resistant Acinebacter baumannii – a bacterium that can cause severe pneumonia and infections of the urinary tract and bloodstream – found 30-day mortality rates that were more than twice as high as patients with strains that could be treated with conventional antibiotics. This emerging threat in hospitals has a stunning 58 percent mortality rate.

Research shows that nearly three quarters of patients' rooms are contaminated with MRSA and VRE. A 1997 study found that 42 percent of personnel who had had no direct contact with infected patients had contaminated their gloves with MRSA merely by touching hospital room surfaces.[6]

Proper hand hygiene, cited by many as the most important solution to nosocomial infections, is only moderately effective. If bacteria and viruses are not eliminated from the hospital environment, hands quickly become contaminated again.

Patients can contract an HAI throughout the cycle of care. They can get it from an injection in the ER, a physician's well-meaning touch of a patient's hand, a brush with a contaminated gown during a surgical procedure or improper handling of a urinary catheter in a patient's room.

Hospital rooms are visited by a dizzying array of people, from nurses to medical technicians to housekeeping to maintenance workers to family and friends. Protocols followed by some medical personnel are not often followed by others.

With the equivalent of a jumbo jet's worth of people dying each day from HAIs, this contagion in our nation's hospitals is a national emergency. A growing array of evidence-based research finds that breaking the "chain of infection" requires the kind of approach described above by Göran Henrik – a multimodal "do everything" approach led by well-resourced and certified infection control professionals backed by the active support of hospital leadership. This paper describes such an intervention.

Government Action

As a result of health reform and earlier laws, the Centers for Medicare and Medicaid Services (CMS) has issued regulations that have stopped Medicare payment for many HAIs, including catheter-associated urinary tract infection; vascular catheter-associated infection; and surgical site infections following coronary artery bypass grafts, bariatric surgery and orthopedic procedures. CMS has the right to extend this policy to other infections.

The Medicare rules will soon amount to "double jeopardy." Starting on Oct. 1, 2013, HAIs will become a factor in determining hospital scores under the Hospital Inpatient Value-based Purchasing Program, in which up to 2 percent of payment is at risk.

Medicaid will soon follow suit. Starting July 1, 2012, states are required to implement non-payment polices for healthcare-associated conditions. The CMS rule sets Medicare policy as the baseline, allowing states some flexibility to make additional conditions subject to the policy.

[6] "Environmental Contamination Due to Methicillin-Resistant Staphylococcus aureus: Possible Infection Control Implications," *Infection Control and Hospital Epidemiology,* September 1997

The payment implications are perhaps even more daunting when it comes to readmissions. Hospital readmissions and HAIs are strongly correlated, according to a study published in the June 2012 issue of the journal *Infection Control and Hospital Epidemiology*, which found that patients with MRSA, VRE, or C. difficile more than 48 hours after admission to the hospital were 60 percent more likely to be readmitted within 30 days than patients without HAIs.

Effective Oct. 1, 2012, hospitals with observed readmission rates exceeding the expected level will be subject to a 1 percent payment loss of all Medicare payment, a penalty that will rise to 3 percent by fiscal year 2015.

Some Progress

Nonpayment policies for HAIs have pushed hospitals to increase surveillance and prevention efforts, a study in the May 2012 issue of the *America Journal of Infection Control* found.[7] Harvard Pilgrim Health Care Institute and Harvard Medical School researchers surveyed head infection officials – called "preventionists" – at more than 300 U.S. hospitals. Four out of five respondents reported increased focus on HAIs covered by the 2008 policy, noting a particularly strong focus on catheter-associated urinary tract infections.

In particular:

- 71 percent of the preventionists felt that staff members remove urinary catheters more quickly than before.
- 50 percent felt that staff members remove central venous catheters more quickly.
- 56 percent reported increased use of antiseptic-containing dressings for central venous catheters.

Despite the increased attention to HAIs following the nonpayment policy, only 15 percent of preventionists reported an increase in funding for infection control. However, 67 percent reported greater hospital collaboration through interdisciplinary teams to reduce HAI rates.

This work may be having an incremental impact. A 2012 report by the CDC that found that for HAIs subject to reporting in the National Healthcare Safety Network in calendar year 2010, there was a 33 percent reduction in central line-associated bloodstream infections, an 18 percent drop in MRSA and a 7 percent reduction in catheter-associated urinary tract infections throughout hospitals.[8] The report, however, is limited to those infections, and other infections appear to be on the rise. For example, infection rates for C. difficile, a severe gastrointestinal infection, have climbed to historic highs, and 14,000 Americans now die from it every year.

THE MULTIMODAL APPROACH

A review of current literature and recommendations from the CDC, the Joint Commission and leading infection control professionals suggests that a comprehensive approach to comprehensive infection control should include:

- A dedicated infection control team

[7] "Perceived impact of the Medicare policy to adjust payment for health care-associated infections," *American Journal of Infection Control,* May 2012

[8] National and State Healthcare-associated Infections Standardized Infection Ratio Report, Centers for Disease Control and Prevention, 2012 (online)

- Risk assessment
- Active surveillance
- Isolation precautions
- Hand hygiene
- Effective environmental cleaning
- Education and training
- Antibiotic stewardship

In any infection prevention modality, the support of top leadership and institutional flexibility are necessary to achieve success, and sustainability requires an ongoing organizational effort.

A Dedicated Infection Control Team

Creating an infection control department or office is an example of an ounce of protection being worth a pound of cure.

A 2007 study examined infection control budgets in 28 community hospitals in the Southeastern United States. The study cited a median departmental budget of $129,000, including $100,000 for hospitals under 220 beds and $212,000 for over 220 beds. For larger tertiary care hospitals over 500 beds, the annual infection control office budget is $350,000 to $500,000.[9]

Contrast that with the average annual cost of treating HAIs at a hospital, which runs 4.6 times greater than typical infection control budgets, according to a report by the Joint Commission.

Barbara Russell, RN, MPH, director of infection control at Baptist Health in Miami, told *HealthLeaders* magazine that one of the best things a hospital can do to improve infection control monitoring is to hire a certified infection prevention official, as she is. A recent study in California showed that only 89 of 174 control directors, about half, were certified in infection control.

A study published in the March 2012 issue of the *America Journal of Infection Control* found that hospitals whose infection prevention and control programs are led by a director who is board certified in infection prevention and control have significantly lower rates of MRSA than those that aren't led by such a professional.[10]

The Certification in Infection Prevention and Control credential is administered by the Certification Board of Infection Control and Epidemiology. Most certified infection control leaders are nurses, but the category also includes microbiologists and physicians. Certification requires up to two years of training.

Russell estimates that only about one-third of hospitals nationwide have certified infection prevention officials.

Risk Assessment

A first step for a hospital leader is to determine the scope of the problem: Where are the pathogens and in what quantity and type? How many patients are carriers or have infections? Did they bring them into the hospital? One way to find the true incidence rate is to use chart-abstracted data to, for example, assess serious infection with VRE over a three-month period. Compiling and promulgating reports that track infections by unit and type over time can inform improvement efforts.

[9] Anderson D., et al.: Under-resourced hospital infection control and prevention programs: Penny wise, pound foolish? *Journal of Infection Control and Hospital Epidemiology*, July 2007.

[10] "Certification in infection control matters: Impact of infection control department characteristics and policies on rates of multidrug-resistant infections," *American Journal of Infection Control*, March 2012

A second is to head out into the hospital to assess contamination levels. Karen Martin, MPH, RN, director of infection prevention at Advocate Christ Medical Center in Oak Lawn, Ill., wrote in the January 2012 issue of the *American Journal of Infection Control* that her hospital monitors hospital surfaces for adenosine triphosphate, which can be indicator of viable living cells.[11] Staff also measure colony-forming units of disease organisms on environmental surfaces, a costly but reliable evidence based practice.

Active Surveillance

Patients can be carriers of drug-resistant organisms even in the absence of symptoms of infection. In fact, carriers play a critical role in the spread of infections in hospitals. For every one patient known to be colonized or infected with MRSA, VRE or C. difficile, there are three to five patients on the same unit with undetected colonization by the resistant species.

Active surveillance involves collecting specimens from patients regardless of whether they have signs or symptoms of infection. This typically involves swabbing different body sites depending on the organism of interest. Swab specimens are then submitted to the microbiology laboratory and undergo one or more culture- or molecular-based tests to detect the presence of relevant organisms. Patients found to be colonized with an organism are then placed in isolation rooms and may also be treated with systemic or topical antibiotic agents in an attempt to decolonize them.

The data on the efficacy of this solution are mixed. Implementation of a universal active surveillance for all newly admitted patients led to an 80 percent reduction in MRSA bloodstream infections across three Midwestern hospitals, according to research published in the March 18, 2008 edition of the *Annals of Internal Medicine*.[12]

However, a 2011 Mayo Clinic study of 18 ICUs at major academic medical centers around the country came to a nearly opposite conclusion.[13] The analysis of active surveillance for ICU patients found to be carriers of MRSA or VRE and the use of barrier precautions (gloves and gowns) by healthcare providers found no difference in the frequency of new colonization or infection events when comparing intervention ICUs to control ICUs.

The researchers suggested that better adherence to isolation precautions is important, but may need to be complemented by interventions that reduce colonization on body sites and improved environmental cleaning.

Isolation Precautions

Infected patients are the primary source for the spread of HAIs in hospitals. It is considered a standard of care to place all hospitalized patients found to be colonized or infected with MRSA, VRE, C. difficile and other bacteria under contact precautions. Studies have shown that patients colonized with an organism who are placed in contact isolation are much less likely to transmit these pathogens to other hospitalized patients. At some facilities, droplet precautions may also

[11] "Asking the Right Questions Guides Solutions to Improving Cleanliness," *Infection Control Today*, Jan. 30, 2012

[12] "Universal surveillance for methicillin-resistant Staphylococcus aureus in three affiliated hospitals," *Annals of Internal Medicine*, March 18, 2008.

[13] "Intervention to Reduce Transmission of Resistant Bacteria in Intensive Care," *New England Journal of Medicine*, April 14, 2011

be applied if the patient has an infection in the respiratory tract.

According to a 2004 report by a team from Simon Fraser University, in Vancouver, B.C., ventilation is also critical in the control of airborne pathogens for protective isolation[14]. The movement of air relative to adjacent areas must be positive and for infectious isolation, it must be negative. In particular, patients suspected of having an airborne infectious disease should be placed in negative pressure rooms that receive numerous air changes per hour. During an outbreak of airborne infection, whole units of single rooms may need to be converted to negative pressure rooms in order to minimize transfer to other parts of the hospital.

Although the standards for isolation precautions are fairly straightforward, studies show that the implementation of this basic measure remains a challenge at many institutions. Similar to poor compliance with hand hygiene standards, much has been written about the failure of healthcare workers to make use of appropriate protective equipment to prevent the transmission of drug resistant organisms.

Hand Hygiene

As caregivers must touch patients and use invasive devices on them, the risk of spreading drug-resistant organisms via unclean hands isn't hard to fathom. Proper hand hygiene is often called the single most important tool to prevent transmission of HAIs. Most hospitals have adopted some form of monitoring program, with limited effectiveness. Some hospitals have resorted to relying on patients to confront doctors and nurses about improper hand hygiene.

Alcohol-based, waterless hand hygiene products are more bactericidal than soap and water, effectively reduce the need for sinks, and greatly reduce the amount of time required to effectively disinfect hands. Many hospitals are placing dispensers outside and inside patient rooms.

A multicenter study published in the *American Journal of Medical Quality* in 2009 of hand hygiene in preventing healthcare-associated infections found that even with the most intense interventions, compliance remained at or below 50 percent, even in intensive care units, the most vulnerable places for infection.[15]

Why won't more healthcare workers wash their hands in accordance with policy? "Simply put, many personnel don't realize when they have germs on their hands because they underestimate transmission from various surfaces," Advocate Christ Medical Center's Martin writes. The problem is a result of hundreds of unconscious actions. One example is using a hallway hand sanitizer, then using a bare hand to open a patient room door, then shaking hands with the patient.

Environmental Cleaning

No hand hygiene program will be effective if patient rooms remain contaminated with a multitude of pathogens. Significant improvements in disinfection cleaning can be achieved in most hospitals without a substantial added fiscal commitment through the use of

[14] Report: The Use of Single Patient Rooms versus Multiple Occupancy Rooms in Acute Care Environments (online).

[15] "Hand Hygiene Compliance Rates in the United States—A One-Year Multicenter Collaboration Using Product/Volume Usage Measurement and Feedback," *American Journal of Medical Quality*, May/June 2009

evidence-based practices and properly trained and rewarded environmental services staff.

During the past several years, new standards and regulations have emerged to help improve environmental hygiene in healthcare settings. In 2003, the CDC's *Guidelines for Environmental Infection Control in Healthcare Facilities-Environmental Surfaces* recommended that hospitals clean and disinfect all ''high-touch surfaces."[16] In 2007 CMS issued an interpretative guideline for its infection control standard, requiring that hospitals' infection prevention and control programs ''must include appropriate monitoring of housekeeping activities to ensure that the hospital maintains a sanitary environment.''

The Association for the Healthcare Environment's *Practice Guidance for Healthcare Environmental Cleaning* recommends that to ensure consistent quality of cleaning and adequate staffing resources for infection prevention, a total facility cleaning standard should be agreed upon in advance by environmental services, infection control, and operations or administrative management. By following all of the recommended steps, cleaning an occupied patient room should take approximately 25-30 minutes. A "terminal clean" after a patient is discharged or transferred requires 40-45 minutes.

Unfortunately, a 2011 survey by UMF Corp. of environmental services managers found that their departments were, on average, short by five to nine full-time employees. Managers said that despite hospital expansions, expanded services, increased patient admissions and shorter lengths of stay (creating more room turnover), many hospitals have found housekeeping an easy means of budget-cutting, leaving housekeepers to simply dump the trash and move on to the next room.

Even when the room is cleaned, the wrong cleaning materials are often employed. The Environmental Protection Agency said in June 2009 that approximately one-third of 325 registered hospital disinfectants and 36 of the 72 tuberculocides tested thus far under its Antimicrobial Testing Program failed to meet its standards for effectiveness against bacteria.

The most common disinfectant used in hospitals is quaternary ammonium. When used in conjunction with cotton string mops, the solution is rendered ineffective. Cotton and other organic matter bind and inactivate "quat," rendering it relatively ineffective unless used in large amounts. A string mop reused in the next room simply aids the spread of bacteria.

A study by Mayo Clinic researchers, published in the September 2010 edition of *Infection Control Today,* found that consistent daily cleaning of all high-touch surfaces with a spore-killing bleach disinfectant cloth for all patients on units with high endemic rates of C. difficile infection almost eliminated the problem.[17]

Microfiber technology is significantly improving cleaning and decontamination capacity because fibers are split and form a knitted fabric that allows 40 times more surface area coverage than cotton fiber and chemically bonds with bleach. Assuming a hospital is using string mops and changing solution every three rooms, the use of microfiber cleaning surfaces can reduce water

[16] *Guidelines for Environmental Infection Control in Health-Care Facilities*, Centers for Disease Control and Prevention (online)

[17] "Cleaning Intervention Cuts C. difficile Acquisition Rates by One-Third," *Infection Control Today*, Sept. 7, 2010

usage by 94 percent and chemical use by more than 74 percent.

Roseland Community Hospital in Chicago reduced its rate of C. difficile infection on surgical units to zero within six months of replacing cotton string mops with a system of chlorine stable, color-coded microfiber cloths and mops and a sodium hypochlorite solution as recommended by the CDC. Roseland's environmental services staff members also replace the microfiber wipes after each room cleaning.

Education and Training

Effective environmental cleaning and hand hygiene require extensive education. For example, the program at Roseland included comprehensive training of all environmental services staff.

Training starts by impressing upon staff that infection prevention is an organizational priority. For example, studies have shown that facilities with well-established cultures of safety led by an actively engaged senior leadership are able to achieve and maintain high hand hygiene adherence rates. One best practice is having the chief executive or chief medical officer round on patients and take each opportunity to wash hands in plain sight of staff. Another is for the CEO to vocally promote hand hygiene and its link to lower infections at every opportunity. Most health care workers believe that hand hygiene is important, but they often fail to appreciate how dramatic an effect it can have on institutional rates of infection.

Leaders should apply best practices for effective infection prevention, in-service education and effective hygiene management in patient rooms and all other areas of the hospital.

At University of Chicago Hospitals, all 450 members of the environmental services department were trained in 2009 to apply a customized, color-coded system to designate everything from operating-room-specific products to color-coded wipers and flat mops for use in bathrooms, patient rooms and other areas. Color-coding is also used to indicate which wipers are to be used wet or dry.

Team leaders provided input into the new system and were instrumental in carrying it out. Based on their input, additional training, including one-on-one sessions and group presentations, was undertaken.

Antibiotic Stewardship

The use of antibiotics, even when clinically appropriate, promotes the advance of multidrug resistant organisms in the healthcare environment. In the hospital setting, it has been estimated that as much as 50 percent of antibiotic use is unnecessary. As with other modalities, proper use of antibiotics takes an organizational commitment.

Antibiotic stewardship is described by the Joint Commission as a multisystem team approach that involves limiting inappropriate use of antibiotic agents while optimizing the selection, dose, duration, and route of therapy with the most appropriate drug for the patient's condition. Institutions that implement antibiotic stewardship programs commonly reduce antibiotic use between 22 percent and 36 percent.[18]

[18] MDRO Toolkit, Joint Commission Resources (online)

Some hospitals provide an antibiotic guidelines booklet that is published annually and disseminated to all of the medical staff, including resident house staff, students and other clinical trainees. The handbook, which can fit in a lab coat pocket, is a summary of the guidelines for empiric treatment of some of the most common conditions that the clinician is likely to encounter.

CONCLUSION

Government payment reforms and the rising costs of care in the United States are putting pressure on the health system to stem the rising tide of healthcare-associated infections. Though there is some evidence of progress, clearly much more needs to be done. Many, if not most, HAIs are preventable through the kinds of efforts described in this paper.

Several of the interventions come at little extra cost to hospitals. Proper education and leadership action can improve hand-washing. Maintaining a sufficient environment services staff, training them in proper procedures and providing them with cleaning materials that actually remove and contain pathogens costs little more than is currently spent on housekeeping. And yet reports find that room cleaning has been sacrificed to budget cutting in many organizations.

Few actions in a hospital carry such an obvious return on investment as infection control. Without reimbursement, the hospital is absorbing an average of more than $20,000 in added costs per care episode involving an HAI. Adding in the HAI penalties under value-based purchasing and excess readmissions, and the financial case for taking action is clear.

Setting cost aside, controlling infections is the right thing to do for patients. With multidrug resistant organisms gaining ground on available antibiotics, the current estimated rate of infection of roughly five percent of all patients may be growing, even with reported advances on a few infections. Saving patients and their loved ones from such needless suffering should be a top priority for all healthcare providers.