



## Service Delivery Innovation Profile

### Electronic Hand Hygiene Monitoring System Significantly Reduces Health Care–Associated Infections

#### Snapshot

##### Summary

An electronic monitoring system confirms that providers engage in proper hand hygiene before patient contact. After providers apply soap or gel, they place their hands under conveniently located, wall-mounted sensors that verify that hand washing has taken place by detecting alcohol content on the skin. If appropriate hand hygiene has been followed, the sensor sends a signal to a specially designed badge worn by all staff and physicians. When the clinician approaches the bedside, a bed monitor determines the status of the badge and causes it to vibrate if appropriate hand hygiene has not taken place, thus reminding the provider to wash his or her hands before coming into contact with the patient. The system also generates customized reports used by infection prevention personnel and clinical leaders to inform individualized provider education on hand hygiene. The program has generated high levels of adherence to appropriate hand hygiene, leading to significant reductions in overall health care–associated infections (by 61 percent) and in non-*Clostridium difficile* (commonly known as *C. difficile*) infections (91 percent).

##### Evidence Rating (What is this?)

**Moderate:** The evidence consists of pre- and post-implementation comparisons of total and non-*C. difficile* health care–associated infections (HAIs), along with provider adherence to appropriate hand hygiene over a 6-month period after implementation on a pilot unit.

##### Developing Organizations

Miami Children's Hospital

Miami, FL

##### Date First Implemented

2010

October

##### Patient Population

Age > Adolescent (13-18 years); Child (6-12 years); Vulnerable Populations > Children; Age > Infant (1-23 months); Newborn (0-1 month); Preschooler (2-5 years)

#### What They Did

[Back to Top](#)

#### Problem Addressed

Hand hygiene guidelines established by the Centers for Disease Control and Prevention (CDC) require hospital staff to disinfect their hands before and after every contact with a patient or a patient's environment. However, many employees do not follow these guidelines, leading to HAIs that drive up costs, length of stay (LOS), morbidity, and death. Electronic systems offer a promising alternative to surveillance of health care workers, yet few organizations use them.

- **Failure to follow appropriate hand hygiene:** Health care staff adherence to appropriate hand hygiene remains low, with multiple studies showing that providers fail to follow established protocols roughly half the time.<sup>1</sup>
- **Leading to preventable, costly, and potentially deadly infections:** HAIs represent a major problem, resulting in extended LOS and excessive costs, morbidity, and mortality. An estimated 1.7 million HAIs occur in the United States each year, leading to 99,000 deaths.<sup>2</sup> At least one-third of such infections could have been prevented, with provider hand hygiene being the single most effective prevention strategy due to its ability to reduce transmission of organisms that cause infections.<sup>1</sup>
- **Unrealized potential of electronic systems:** Most hospitals use surveillance programs in which health care workers secretly observe the hand hygiene habits of their peers on a periodic basis. Such programs may not be effective, because workers can tell when they are being watched (and hence may adhere only at these times) and not all workers are observed.<sup>3</sup> In June 2009, the U.S. Department of Health and Human Services published an action plan that highlighted the use of information technology systems to prevent HAIs.<sup>4</sup> Electronic systems that track the hand hygiene behaviors of every worker at every patient interaction can be effective in promoting adherence to established guidelines, but relatively few organizations use such systems today.

#### Description of the Innovative Activity

An electronic monitoring system confirms that providers engage in proper hand hygiene before patient contact. After providers apply soap or gel, they place their hands under wall-mounted sensors that verify that hand washing has taken place by detecting alcohol content on the skin. If appropriate hygiene has been followed, the sensor sends a signal to a specially designed badge worn by all physicians and staff. When the clinician approaches the bedside, a monitor causes the badge to vibrate if appropriate hygiene has not taken place. The system also generates customized reports used to educate individuals on hand hygiene as necessary. Key program elements include the

following:

- **Hand hygiene monitoring:** Providers who wash their hands with soap or gel place them under the hand wash sensors, which are mounted on the wall adjacent to all alcohol hand gel dispensers and sinks inside and outside patient rooms. All providers wear a badge with a light-emitting diode (LED) indicator. The sensor identifies the provider via the badge and verifies that hand washing has taken place by detecting alcohol content on the skin. It then sends an infrared signal to the badge, activating its green LED light.
- **Verification as clinician approaches bedside:** When the clinician approaches the bedside, a proximity-sensing monitor (mounted on the wall behind the bed) determines the status of the provider's badge. The bed monitor creates a 7-foot field around the bed that recognizes if the badge is green. If the badge is not green, the monitor causes the badge to vibrate, which serves as a reminder to the clinician to clean his/her hands and use the hand wash sensor. After the third reminder, the system records the instance as a nonadherent event.
- **Documentation of hand hygiene:** A wireless signal transmits information to a central database that documents the event. Information sent includes the provider's name and the time and location where the hand hygiene did or did not occur. Documentation of all hand hygiene events takes place, including instances when providers adhere to guidelines and when they do not.
- **Performance reports and as-needed interventions:** The Infection Prevention and Control Department can generate customized performance reports sorted by unit, provider, room, and/or time of day. If a staff member consistently does not adhere to appropriate hygiene, department staff first investigate to determine if a mechanical failure has occurred (such as with the badge). If not, the department contacts the unit manager so that he or she can discuss with the individual how to incorporate appropriate hand hygiene into his/her everyday workflow. The reporting system also automatically sends a weekly e-mail to unit managers with information on hand hygiene adherence for the unit, along with reports to the chiefs of each physician division so that they can intervene with nonadherent physicians as necessary.

### References/Related Articles

O'Reilly KB. Hospitals' high-tech tools track who's washing their hands. American Medical News. April 25, 2011. Available at: <http://www.ama-assn.org/amednews/2011/04/25/prsa0425.htm>.

Study Using the HyGreen Hand Hygiene Reminder System Shows Infection Reduction at Miami Children's Hospital. Xhale Innovations, Inc. Press Release. April 5, 2011. Available at: <http://www.reuters.com/article/2011/04/05/idUS215519+05-Apr-2011+BW20110405>.

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**Did It Work?**

[Back to Top](#)

### Results

**The program has generated high levels of provider adherence to appropriate hand hygiene, which, in turn, has led to significant reductions in overall HAIs and in non-*C. difficile* infections.**

- **High adherence:** During the first 6 months after implementation of the program on a pilot unit, providers adhered to appropriate hand hygiene 94 percent of the time.
- **Significantly fewer infections:** During the first year after implementation, the pilot unit averaged 1.75 HAIs each quarter, 61 percent below the 4.45 average during the 11 quarters (33 months) before implementation. The electronic system represented the only meaningful change that could have accounted for this decline. Over the same time period, the average rate of non-*C. difficile* HAIs (including, but not limited to, bloodstream infections, upper and lower respiratory infections, skin and soft tissue infections, catheter infections, and urinary tract infections) decreased by 91 percent, from 2.90 to 0.25 infections per quarter. *C. difficile* HAIs were not meaningfully reduced, likely because these infections live on environmental surfaces for long periods of time; thus, they would have to be targeted by other types of infection prevention initiatives in addition to hand hygiene initiatives.

### Evidence Rating (What is this?)

**Moderate:** The evidence consists of pre- and post-implementation comparisons of total and non-*C. difficile* health care-associated infections (HAIs), along with provider adherence to appropriate hand hygiene over a 6-month period after implementation on a pilot unit.

**How They Did It**

[Back to Top](#)

### Context of the Innovation

Miami Children's Hospital is a 289-bed, stand-alone acute care facility with a medical staff of more than 650 physicians and over 2,000 employees. The hospital admits approximately 1,000 patients and handles roughly 7,000 emergency department visits each month. Beginning in 2008, the hospital's Infection Prevention and Control Department developed "Blue Chip

Initiatives” related to reducing central line-associated bloodstream infections, surgical site infections, and respiratory infections. Understanding that proper hand hygiene could reduce all of these infections, the hospital's chief executive officer (CEO) suggested that the department evaluate electronic hand hygiene monitoring systems.

### **Planning and Development Process**

Selected steps included the following:

- **Setting criteria:** The Infection Prevention and Control Department outlined criteria for choosing an electronic system, which included easy installation, ability to remind personnel to perform hand hygiene between patients, real-time reporting, uncomplicated maintenance, and cost effectiveness.
- **Researching systems:** In December 2008, the director of the department began researching electronic monitoring systems. She identified many potential systems and seriously investigated two of them.
- **Presenting recommendation:** The director made a presentation to the hospital's capital budget committee, proposing adoption of a system (Hygreen®) that met all established criteria. She also presented an analysis of the system's return on investment (ROI) informed by use of the vendor's software.
- **Receiving approval:** The director received approval by the committee to pilot test the system on one unit. She selected the hospital's 26-bed hematology/oncology unit, where patients tend to be immunocompromised and therefore at high risk of infection.
- **Notifying providers:** The director held information sessions for the unit's physicians, nurses, and other providers to describe the system and its use.
- **Initial launch and subsequent expansion:** The system was installed in August 2010 and went live in October 2010. After the successful pilot test, use of the system expanded to all medical-surgical units during August and September 2011. Hospital leaders are considering further expansion to the intensive care and neonatal intensive care units.

### **Resources Used and Skills Needed**

- **Staffing:** The program requires no new staff, as existing staff incorporate it into their daily routines.
- **Costs:** Data on program development costs are unavailable. Analyses are currently ongoing, but early data suggest that the system will produce a positive ROI.

### **Funding Sources**

Miami Children's Hospital

### **Adoption Considerations**

[Back to Top](#)

### **Getting Started with This Innovation**

- **Secure and leverage senior leadership support:** The support of senior leaders, including the CEO, chief medical officer, and members of the capital budget committee, can help overcome resistance to monitoring systems that will likely be expressed by some providers. To convince providers, these leaders need to emphasize the program's potential to improve patient health and safety.
- **Obtain provider buy-in early:** Once senior management approves the approach, program leaders should educate providers about the system and its use, well in advance of actual implementation. This step will help providers acclimate to the idea and mitigate any negative feelings regarding monitoring of practice patterns.
- **Emphasize patient safety:** In all education sessions, program adopters should emphasize that patient safety remains paramount and that the monitoring system can have a significant, positive impact on safety.

### **Sustaining This Innovation**

- **Be patient:** Full adherence to hand hygiene protocols requires a culture change that will occur gradually over time.
- **Share data:** Sharing performance data with providers helps encourage them to improve their hand hygiene adherence.
- **Hold providers accountable:** Ensure that providers are held accountable for their hand-washing behaviors, such as by having unit managers approach those who fail to consistently wash their hands. This strategy will support behavior change over time.

<sup>1</sup> Centers for Disease Control and Prevention. Guideline for hand hygiene in healthcare settings. 2002. Available at: <http://www.cdc.gov/handhygiene/Guidelines.html>.

<sup>2</sup> Kleven RM, Edwards JR, Richards CL Jr, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. Public Health Rep. 2007;122(2):160-6. [PubMed]

<sup>3</sup> O'Reilly KB. Hospitals' high-tech tools track who's washing their hands. American Medical News. April 25, 2011. Available at: <http://www.ama-assn.org/amednews/2011/04/25/prsa0425.htm>.

<sup>4</sup> HHS Action Plan to Prevent Healthcare-Associated Infections. Available at: <http://www.hhs.gov/ash/initiatives/hai/actionplan/>.

Comment on this Innovation

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