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### Major article

## A multifactorial action plan improves hand hygiene adherence and significantly reduces central line–associated bloodstream infections



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Health care-associated infections  
Patient safety  
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**Background:** Although hand hygiene (HH) is key to reducing health care–associated infections, it is well documented that health care worker (HCW) adherence to appropriate HH protocols is relatively low.

**Methods:** This was a collaborative quality improvement project with multiple interventions conducted in a 570-bed academic hospital in Columbia, MO between April 2006 and September 2012. A multimodal action plan to improve HH adherence among all HCWs was developed, addressing 4 key areas: staff education, staff accountability, hand sanitizer product selection and accessibility, and organizational culture. HH adherence and central line–associated bloodstream infection (CLABSI) rates were monitored as outcome measures.

**Results:** The overall HH adherence rate increased from 58% in April 2006 to 98% in September 2012. The adherence rates increased among all hospital units and among all HCW categories; in September 2012, HH adherence was 96% for physicians, 99% for nursing staff, and 99% for food services staff. CLABSI rates decreased over the same period, from 4.08 per 1000 device-days to 0.42 per 1000 device-days.

**Conclusions:** This multifactorial quality improvement project resulted in an institution-wide increase in HH adherence and a significant decrease in CLABSIs.

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Hand hygiene (HH) remains one of the most effective ways to reduce health care–associated infection (HAI) transmission.<sup>1–5</sup> The relationship between HH and the reduction of infections in hospitals is well known; however, in a systematic review of 96 empirical studies, including 65 studies in intensive care units, the median HH adherence rate was only 40%.<sup>6</sup> Several other studies<sup>7–9</sup> have reported similarly poor adherence to HH recommendations by health care workers (HCWs). This is surprising considering the issuance of extensive HH guidelines and monographs by the World Health Organization, Centers for Disease Control and Prevention,<sup>10–12</sup> Joint Commission,<sup>13</sup> and all major HCW professional organizations.

Several factors contribute to HCWs' low HH adherence rates. Lack of knowledge and appropriate training on why, when, and how to

perform HH during routine care are barriers to proper HH.<sup>13–16</sup> In a multivariate analysis,<sup>17</sup> high workload and certain medical specialties were found to be factors in noncompliance as well. Other factors affecting HH adherence include lack of suitable products,<sup>18</sup> insufficient time,<sup>19</sup> inaccessible handwashing supplies,<sup>19</sup> forgetfulness,<sup>14</sup> and understaffing.<sup>9</sup>

In our academic health center, improving HH adherence has been an area of focus for many years. Despite efforts by infection prevention personnel in education, monitoring, and reporting, overall HH adherence among all HCWs, as determined by direct observation using trained staff, was around 58% in April 2006. This level of HH adherence was deemed unacceptable and necessitating significant attention and correction. A collaborative quality improvement project was initiated with the objective of improving HH adherence among all HCW disciplines to a stated goal of at least 95%.

### METHODS

An analysis of the existing HH process was conducted, and a comprehensive multifactorial action plan was developed to address

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**Table 1**  
HH action plan

| Problem                | Action   | Implementation time frame |
|------------------------|--|---------------------------|
| Lack of education      | New screen savers on computers and other electronic devices to remind staff about HH between glove changes.  | September 2006            |
|                        | Develop and provide training modules on HH for annual educational purposes and for quick access where appropriate.   | January 2008              |
|                        | Reeducate nursing staff regarding use of HH between glove changes.   | May 2009                  |
| Lack of accountability | Reeducate dietary staff regard use of hair netting and HH when dealing with food.  | March 2011                |
|                        | Compliance monitoring of HH to be done by observers trained to do HH surveillance. Observers were selected by the Infection Control Department and trained on data collection methodology and reporting methodology.   | December 2007             |
| Product selection      | Team will analyze data and submit data back to the appropriate unit on a monthly basis for their review.   |                           |
| Product availability   | Individual disciplinary action will be applied for failure to properly complete HH procedures.   |                           |
| Organizational culture | Change all sanitizers to 85% w/w ethyl alcohol product (Sterillium Comfort Gel).   | March 2011                |
|                        | Review location of HH stations hospital-wide to ensure their convenience and availability.   | March 2011                |
|                        | Affix stickers on every hand sanitizer to provide a phone number to call for a refill or repair.   | March 2011                |
|                        | Include HH education in medical student and resident education.  | March 2011                |
|                        | Engage patients and families in HH efforts by providing patient safety "tip sheets" outlining appropriate HH and glove practices. Incorporate this as part of patient/family-centered care, explaining to patients that we take HH very seriously and invite them to advise us or to remind HCWs of these standards where appropriate. | March 2011                |

challenges identified with respect to staff education, staff accountability, hand sanitizer product selection and accessibility, and organizational culture. The effectiveness of the action plan was assessed by continuous monitoring of HH adherence rates. In addition, central line-associated bloodstream infection (CLABSI) rates after implementation of the various action plan components were monitored and assessed. These results were then compared with historical rates before action plan implementation.

#### Study setting

The collaborative quality improvement project was conducted at University of Missouri Health Care, a 570-bed academic health center in Columbia, MO that comprises 7 hospitals and more than 50 clinics. Medical specialties and services provided include a burn center, family practice, inpatient and outpatient surgery (trauma, bariatric, cardiac, orthopedic, general, gynecologic, oncologic, urologic, plastic, otolaryngologic, vascular, neurologic, and ophthalmologic), internal medicine, obstetrics and gynecology, oncology services, orthopedic specialties and related rehabilitation services, pediatric (including a level 4 newborn intensive care unit) and adolescent care, psychiatric services, and a level I trauma center.

This was a descriptive time series project involving a multitude of interventions and extending from April 2006 to September 2012. The main goal was to substantially improve HH across all different hospital units and among all HCW categories. This project was a quality improvement initiative; no identifiable private health information was collected, and the direct effect of a treatment or intervention on the health and welfare of individual human subjects was not assessed. Thus, the project was not submitted to the hospital's Institutional Review Board for approval.

After securing senior leadership approval, a team of personnel from the Infection Prevention and Control Department conducted an evaluation of the existing HH process by direct observation (with whether or not observed staff was compliant during a HH opportunity recorded as "yes" or "no" on a standardized form) and by a review of HH-related comments on patient satisfaction surveys, review of complaints filed with respect to staff HH practices, and review of observations recorded by regulatory agencies (eg, Center for Medicare and Medicaid Services, Joint Commission). This baseline evaluation was limited to existing HH processes within the intensive care units because of already established monitoring and reporting relationships with the intensive care unit teams.

Several areas for improvement were identified, including staff education, staff accountability, hand sanitizer product selection and accessibility, and organizational culture. A comprehensive plan to address each of these key areas was developed (Table 1), and actions were implemented over the course of the intervention period. The plan included educational presentations, communication campaigns, HH adherence monitoring and frequent feedback, leadership commitment, selection of a new hand sanitizer and improved accessibility of that product, and promotion of a culture in which all HCWs recognize the importance of HH and in which all HCWs at all levels are held equally accountable. Feedback to all stakeholders was provided by sharing the HH adherence data on a monthly basis with the supervisor of each hospital unit monitored and by posting the data on each unit's bulletin board. Senior leadership involvement included tracking monthly HH adherence rates and communicating those rates to the various levels of hospital management and hospital staff during periodic meetings.

#### Education

Reeducation on the importance of HH was provided through newsletters, screen savers, posters, in-person education, and computer-based training modules. Computer-based training modules on HH, combined with follow-up test questions, provided annual review opportunities and met the need for continuing education.

#### Compliance and accountability

Adherence to HH protocols was measured by covert monitoring of HCWs via observation. Observation of HCWs involves directly watching HH behavior and allows for proactive recording of the number of HH indications, opportunities, and actions. Starting in April 2006, the observers were personnel from the Infection Prevention and Control Department. After March 2011, additional unit-based observers were selected to represent 58 hospital units and departments, as well as 12 different HCW categories, including physicians, nurses, respiratory technicians, social services, pastoral workers, housekeeping, patient transport, radiology technicians, food services, hospitality, paramedical/EMT, and other (eg, occupational therapists, physical therapists, speech therapists, patient registration personnel, any others with patient contact). These unit-based observers were primarily supervisory HCW personnel (eg, nurse managers, shift supervisors, nursing education leaders,

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