

# Culture Change in Infection Control

## Applying Psychological Principles to Improve Hand Hygiene

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Hand hygiene occurs at the intersection of habit and culture. Psychological and social principles, including operant conditioning and peer pressure of conforming social norms, facilitate behavior change. Participatory leadership and level hierarchies are needed for sustainable patient safety culture. Application of these principles progressively and significantly improved hand hygiene compared with the hospital aggregate control. Changes to hand hygiene auditing and response processes demonstrate ability to improve and sustain adherence rates within a clinical microsystem. **Key words:** *clinical audit, culture, feedback, hand washing, infection control, psychology*

**T**HE CENTERS FOR DISEASE CONTROL AND PREVENTION reports hospital adherence to hand hygiene as abysmal.<sup>1</sup> Observational studies find rates of 5% to 81%.<sup>1</sup> A 2010 systematic review confirmed median adherence of only 40%, with lower rates being seen in intensive care units, by physicians compared with nurses, and before compared with after patient contact.<sup>2</sup> Even a recent, well-designed, randomized controlled trial of infection control was hampered by poor adherence to hand hygiene, with only

69% adherence demonstrated in an intensive care unit trial to reduce the spread of resistant bacteria.<sup>3</sup> The World Health Organization, The Joint Commission, and professional societies have called for increased hand hygiene compliance by health care workers.<sup>1,4,5</sup>

Conceptually, nonadherence occurs at the intersection of the system, the individual, and the local culture. System-level barriers include time pressure from inadequate staffing, lack of availability of sinks, and poor placement of alcohol-based hand antiseptics.<sup>2,6</sup> There also are provider-level barriers to effective adherence, which can include deficits in education on proper hand hygiene techniques and indications to perform hand hygiene.<sup>7</sup> Clinician attitudes toward the product's effect on their own skin and provider characteristics such as low self-efficacy predict poor adherence.<sup>8-10</sup> It is increasingly recognized that elements of the social environment can influence hand hygiene adherence, in a positive or negative fashion, including role models, leadership buy-in, social pressure, and cultural norms.<sup>8,9</sup> Relatively little attention has been paid to the psychological and cultural determinants of hand

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hygiene and how to operationalize interventions on these factors in applied quality improvement (QI).<sup>2</sup>

Failure of hand hygiene fundamentals directly impacts the ability to reduce iatrogenic infection. Hand hygiene represents the foundation of hospital infection control measures and is incorporated into bundles of interventions to reduce catheter-associated bloodstream infections, urinary catheter infections, *Clostridium difficile* infection, and spread of drug-resistant organisms such as vancomycin-resistant enterococci and methicillin-resistant *Staphylococcus aureus*.<sup>7</sup> While study design limitations make it difficult to isolate the impact of hand hygiene alone on hospital-acquired infections, hand hygiene is widely thought to be the most important factor in reducing nosocomial infections.<sup>11</sup> Mathematical models suggest that an increase in hand hygiene adherence from 60% to 80% can reduce the rates of infection by multidrug-resistant organisms by 8%.<sup>12</sup> Research demonstrates that improvements in hand hygiene rates are correlated with reductions in a variety of hospital-acquired infections including central line and urinary catheter infections.<sup>13</sup>

Addressing systems-based barriers appears to be effective in improving adherence. Introduction of, and ready access to, alcohol-based hand antiseptics increases compliance with hand hygiene.<sup>2,14</sup> In contrast, educational initiatives may be capable of transiently increasing adherence rates, but efficacy is limited and maintaining the gain is challenging.<sup>6,13</sup> Observation and feedback have been demonstrated to be an effective method of improving hand hygiene performance.<sup>13,15,16</sup> Prior publications suggest that participation in audits and delivering feedback by all unit staff members can create a positive influence on each individual's awareness of his or her own hand hygiene behavior.<sup>16</sup> Limited evidence supports the use of positive reinforcement and rewards in improving hand hygiene adherence. One study found a 15.5% increase in adherence with the use of stickers as token positive reinforcement paired with deferred small monetary and meal rewards.<sup>6</sup> However, as a sole

intervention, this also lacked a sustained effect over time.<sup>6</sup>

Our premise is that infection control is first and foremost a product of habit amenable to change and that unit culture will be the dominant factor that promotes and sustains improvement. Psychological principles are rarely used explicitly in studies on improving hospital-acquired infections.<sup>2,17</sup> We describe the application of generalizable psychological principles to improve hand hygiene as a means to reduce iatrogenic infections as part of a unit-based QI program.

## PROBLEM

On the study unit during the first quarter of 2010, the rate of urinary catheter-associated infection was 4.8 per 1000 catheter-days. Central line infection was 4.3 per 1000 line-days. The average rate of adherence to hand hygiene on the unit for the first 2 quarters of 2010 was only 78%. In September 2010, the unit convened a Leadership Committee of frontline staff, including nursing, physicians, social work, therapists, and quality staff, interested in performing metric-driven QI.

## SPECIFIC AIM

The interprofessional committee attempted to reduce iatrogenic infections by increasing hand hygiene rates from the baseline rate of 78% to more than 90%. Interventions would be proposed during monthly meetings, based on ongoing performance evaluation of monthly results and 6-month rolling averages. Interventions were adopted by consensus of the committee.

## METHODS

### Design, setting, and subjects

We performed a unit-based QI initiative with an untreated control group using pre- and posttest samples. The study unit was the 13-bed Acute Care for the Elderly Medicine Unit of the University of Colorado Hospital. Unit nursing staff consisted of 23 registered

nurses, 5 certified nursing assistants, and 4 advanced care partners (nursing students who are certified nursing assistants). On the unit, a sink with soap dispenser is located immediately inside each patient room, and 2 sinks are located in the unit hallway along with 1 immediately inside each room. Dispensers of alcohol-based antiseptics were mounted immediately outside of every patient room. The hospital-wide aggregate performance on hand hygiene was used as a control to assess whether improvements were a product of temporal changes or systemwide improvements unrelated to this unit-based initiative. The University of Colorado Hospital is a 425-bed urban tertiary care hospital and the major teaching affiliate of the University of Colorado School of Medicine.

### Measures

The primary outcome was hand hygiene adherence rate, with a secondary outcome of catheter-associated urinary tract infection and catheter-associated central line infection rates. To assess the primary outcome, the behavior of interest was presence or absence of a hand hygiene event (alcohol-based waterless antiseptic agent or soap and water hand washing) by any direct patient care provider for an appropriate trigger. Appropriate triggers included entering or leaving a patient room (hand hygiene was required even if no patient contact occurred). A hand hygiene event was also required before, and after removal of, gloves for insertion of central venous catheters or urinary catheters. The World Health Organization's Five Moments for Hand Hygiene was used as an educational tool and framework for audit triggers.<sup>18</sup>

Monthly hand hygiene audits were reported to the hospital infection control department by every inpatient unit. A minimum of 75 observations in a month were required for audit results to be included in the analysis. Audits were performed using hospital policy definitions of adequate hand antiseptics or hand washing with soap and water. If hands were not visibly soiled, hospital policy recommended an alcohol-based waterless antiseptic

agent for routine hand hygiene. Soap and water hand washing is recommended over the use of alcohol-based hand antiseptics by policy for certain situations (including hands visibly soiled, contact with body fluids, and *Clostridium difficile* contact precautions).

Hand hygiene was audited as adherent if performed correctly by use of the alcohol-based antiseptic on all surfaces of the hand, or by soap and water washing for a minimum of 15 seconds. Audit observations would occur immediately after an appropriate trigger such as entering or leaving a patient room. Any event that would be a trigger for a hand hygiene event, per hospital policy, not accompanied by correct use of the alcohol-based antiseptic or washing with soap and water was audited as a nonadherence event. After the start of direct feedback, nonadherence events with correction after feedback continued to be recorded as nonadherence events. There were no limits on how many adherence/nonadherence events could be audited by the provider or per patient admission.

Performance of the unit was delivered as part of the quality dashboard to the interprofessional unit leadership team on a monthly (hand hygiene rates) or quarterly (infection rates) basis. Hospital-wide performance was included in this report, reflecting the aggregate performance on every inpatient unit.

### Analysis

We used 2 methods to evaluate the effect of the intervention on the primary outcome. First, as is common in QI, we used a statistical process control approach. Run chart analysis was used to look for nonrandom change as a result of the initiative. In general, if 5 consecutive data points are in a consistent trend, or if 6 consecutive points are all above the baseline, then this represents a process alteration resulting in a significant change with a *P* value of less than .05.<sup>19</sup> Second, we used conventional statistical methods. To do so, we calculated the mean hand hygiene adherence on the intervention unit and hand hygiene adherence hospital-wide for both the pre- and postintervention periods. The means were compared

using a *t* test. All analyses were carried out using SAS version 9.0 (SAS Institute Inc, Cary, North Carolina). This project was carried out as a QI initiative and did not meet the definition of research per the US Department of Health and Human Services Regulations.

### Conceptual model

We used Lewin's theory of change to guide interventions.<sup>20</sup> To move from the current state to the desired state, a clinical microsystem must move through 3 phases. An opportunity for unfreezing the current state must be realized, mechanisms for change must be implemented, and processes must be refrozen in the desired state. Leadership style influences culture and performance, and the product of QI cannot be divorced from the social milieu in which it is occurring. On an individual level, operant conditioning can be used to re-form habits congruent with a desired behavior.

A mismatch between the perception of being a unit that excelled in the conscientious and meticulous care of patients and objective data demonstrating staff members were not living up to their own expectations creates "dissonance." In response to cognitive dissonance, individuals will seek to either rationalize away the conflicting views, or the dissonance can drive fundamental change to bring perception and reality back into harmony.<sup>21</sup> We used the cognitive dissonance produced by the quality performance metrics and the affirmative choice of this as a metric for targeted change by the team as the driver for unfreezing. Consistent with Lewin's work, we used a participative "democratic" leadership model to select interventions for implementation.

### Interventions

To create change related to the culture of hand hygiene on the unit, we implemented a series of interventions over a 9-month period: (1) real-time feedback—change from surreptitious auditing to immediate feedback and request for correction for all observed nonadherence events; (2) shared responsibility for hand hygiene—change from audits by a single infection control champion to random as-

signment of auditing responsibility to all members of the nursing staff; (3) level hierarchy—follow-up communication by unit leadership for failure to correct or repeated nonadherence by any individual, regardless of role or rank; and (4) punishment and rewards—delivery of nonadherence "tickets" and reinforcement of adherence with individually wrapped hard candy "lifesavers."

#### *Intervention 1: Real-time feedback*

The first intervention was to raise awareness of hand hygiene adherence through immediate feedback. To allow individuals to recognize their personal adherence rate, the goal was to have any observed nonadherence event be pointed out in real time. In effect, this would promote a transition of the act of hand hygiene from an unconscious act, not fully habituated, to conscious awareness. Psychological principles explain the impact of this intervention.<sup>22</sup> It uses the power of peer pressure through immediate feedback on hygiene performance at the level of the individual.

#### *Intervention 2: Shared responsibility for hand hygiene*

Prior practice had been to assign a single "champion" who performed surreptitious audits of hand hygiene adherence. The process was changed such that the champion now assigns any unit staff member to be the auditor of the day. In essence, the unit is always under observation, and any staff member could be the observer.<sup>23</sup> An important effect of the new system of rotating auditors is the shared responsibility for monitoring hand hygiene on the unit. This is thought to influence the staff member's own hand hygiene awareness on days in which he or she is not responsible for auditing.<sup>16</sup>

#### *Intervention 3: Level hierarchy*

Repeat nonadherence, or failure to correct, prompted a written response by the unit medical director and the nurse manager to the offending individual regardless of rank or role. Rotating auditors performing real-time

correction has potential to violate perceptions of hospital hierarchy. In response to correction events, defensive behavior, or rarely frankly unprofessional behavior, was observed. Such events included examples of a senior attending physician rounding with his team failing to perform hand hygiene after having a nonadherence event pointed out by a certified nursing assistant. For a culture of patient safety, every individual should be an equal in ability to raise concerns about unsafe behavior. If episodes of willful nonadherence are ignored or minimized, the message sent to unit staff is counterproductive. The agreed-on written response was jointly delivered by the unit medical director and the unit nurse manager. Subsequent high-level responses also enlist the head of hospital-wide infection control to individuals who are repeat offenders, fail to correct, or respond unprofessionally. Rather than keep these episodes quiet, every staff member on the unit knows about the response to unprofessional individuals.

#### ***Intervention 4: Punishment and rewards***

For the final interventions, we began giving out “tickets,” small cards with a stop sign and strongly worded instruction to immediately correct behavior, for observed nonadherence events. The tickets do not come with consequences other than the pressure inherent in the public correction. They serve as social punishment.<sup>22</sup> Individuals, by and large, do not like being singled out for failing to adhere, creating motivation to attend to hand hygiene to avoid this negative social interaction.

Maintaining a positive culture is critical for sustaining improvements. Nonadherence tickets have potential to create a negative culture, and a ceiling effect may be experienced as higher rates of adherence lead to fewer opportunities to maintain awareness. In response, “positive tickets” were created to recognize adherence events. This promotes conditioned reinforcement and allows the auditor for the day to have many more positive than negative interactions.<sup>22</sup> Later, the reward of individually wrapped “lifesaver” candy was provided for observed adherence

events, creating what is, in effect, operant conditioning.<sup>22</sup> The positive effect on the individual being rewarded, and perhaps on unit culture, created by intermittently rewarding with a small sweet treat is less prone to wane with time.<sup>22</sup> The interventions represent new standard operating procedures on the unit, which increase the probability that the improvements will sustain at the new level (refreezing).

## **RESULTS**

Hand hygiene adherence has progressively improved from a baseline of 78% in the first half of 2010 to 97.2% in the second quarter of 2012 (Figure). Analysis of the run chart reveals that changes are not consistent with random variation, with 7 consecutive quarters above the baseline performance at the same time as hospital average performance remained unchanged.

Next, we examined mean pre-post intervention changes. During the preintervention baseline period (January 2010–June 2010), the study unit’s mean hand hygiene adherence (78%) was 7.9% lower than that of the entire hospital (86%). This difference was not statistically significant ( $P = .12$ ). Over the entire intervention period (October 2010–June 2012), the mean hand hygiene adherence on the study unit (90%) was 6.6% higher than that of the entire hospital (83%). This difference was statistically significant ( $P = .0005$ ). There has not been a single iatrogenic infection on the unit for the 2 years since the beginning of this QI initiative.

## **DISCUSSION**

Hand hygiene is a sociocultural phenomenon that occurs at the intersection of individual habit and the cultural norms of the unit. The strength of this series of interventions is derived from utilization of simple psychological principles to enhance patient safety. Four structural changes to hand hygiene observation and subsequent response resulted in a substantial absolute

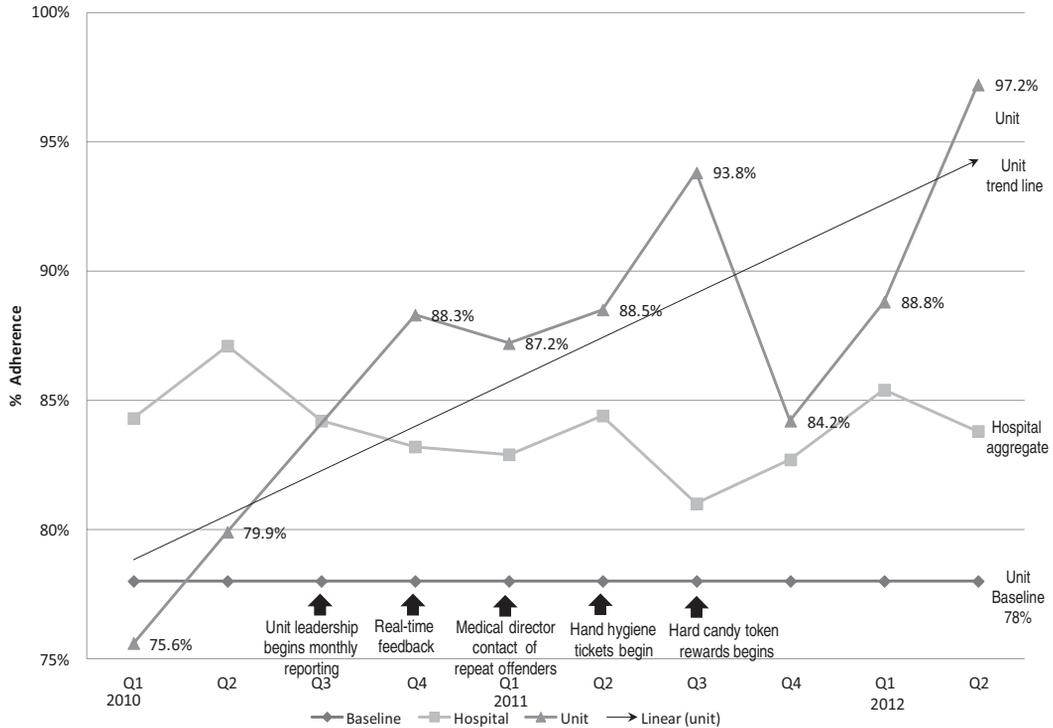


Figure. Hand hygiene rates.

increase in hand hygiene adherence, and the results have proven durable. Because these elements are now built into the standard work of the unit, they are less subject to the transient rises in adherence, which can be a result of episodic educational initiatives. Simple, inexpensive interventions such as this can be maintained with minimal resources or additional staff time.

Some important limitations of this work deserve mention. External validity is challenging for studies involving culture change, which are inextricably linked to local factors. The impact of role modeling by influential staff members on the leadership team may have created changes that are specific to this milieu. It was not possible to objectively verify the interrater reliability of auditor assessments. There is potential for discomfort in delivering negative feedback to change auditor behavior. This initiative was performed on a smaller unit within the hospital, and it is interesting to consider whether culture

change is more difficult when attempted with a larger population. Prior research demonstrates the impact of role models and local culture on provider behavior, and attempts to use these same interventions on larger units or hospital systems need to consider how to take these factors into consideration.<sup>23,24</sup> A small unit with participation by senior clinical staff and physician faculty may have lower barriers to culture change. That said, even large complex organizations are composed of clinical microsystems from which effective practices can be disseminated.<sup>25</sup> Unit infection incidence was low, and it is not possible to draw firm conclusions from reduction in iatrogenic infection rates. With those caveats in mind, the positive slope of hand hygiene improvement from the baseline for the unit compared with the steady rate of adherence at a lower level of performance for the rest of the hospital supports that these interventions were creating meaningful change.

## CONCLUSION

Immediate feedback takes awareness from the level of the unit to the level of the individual and changes hand hygiene from unconscious to conscious behavior. Rotating staff assignment to perform observations may alter their own hand hygiene behavior and can be a potent tool in its own right. Peer pressure and conforming norms can be harnessed

to drive improvement through social punishment and intermittent immediate rewards. Visible support from leadership early in confronting unprofessional responses to the initiative is needed to effectively level the hierarchy. Hand hygiene adherence at the level of the individual is a product of habituated behaviors and should be interpreted in the context of the social milieu but is amenable to change using simple psychological principles.

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