Section B. Infection Control

Chapter 12. Practices to Improve Handwashing Compliance

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Background

Hospital-acquired infections exact a tremendous toll, resulting in increased morbidity and mortality, and increased health care costs.[1,2] Since most hospital-acquired pathogens are transmitted from patient to patient via the hands of health care workers,[3] handwashing is the simplest and most effective, proven method to reduce the incidence of nosocomial infections.[4] Indeed, over 150 years ago, Ignaz Semmelweis demonstrated that infection-related mortality could be reduced when health care personnel washed their hands.[5] A recent review summarized the 7 studies published between 1977 and 1995 that examined the relationship between hand hygiene and nosocomial infections.[6]

Most of the reports analyzed in this study reveal a temporal relation between improved hand hygiene and reduced infection rates.[6] Despite this well-established relationship, compliance with handwashing among all types of health care workers remains poor.[7-11] Identifying effective methods to improve the practice of handwashing would greatly enhance the care of patients and result in a significant decrease in hospital-acquired infections.

Practice Description

This chapter focuses on practices that increase compliance with handwashing, rather than the already proven efficacy of handwashing itself.[4] The term "handwashing" defines several actions designed to decrease hand colonization with transient microbiological flora, achieved either through standard handwashing or hand disinfection.[4] Standard *handwashing* refers to the action of washing hands in water with detergent to remove dirt and loose, transient flora. *Hand disinfection* refers to any action where an antiseptic solution is used to clean the hands (ie, medicated soap or alcohol). Handwashing with bland soap (without disinfectant) is inferior to handwashing with a disinfecting agent.[12] *Hygienic hand rub* consists of rubbing hands with a small quantity (2-3mL) of a highly effective and fast acting antiseptic agent. Because alcohols have excellent antimicrobial properties and the most rapid action of all antiseptics, they are the preferred agents for hygienic hand rub (also called waterless hand disinfection). Also, alcohols dry very rapidly, allowing for faster hand disinfection.[4]

Given health care workers' documented low compliance with recommended handwashing practices,[7-9] improving compliance represents a more pressing patient safety concern than does the choice of different disinfectants, or attention to other specific issues such as choice of drying method, removal of rings, etc. Of the 14 studies reviewed in this chapter (Table 12.1), all study sites utilized hygienic hand rub and/or another method of hand disinfection as standard practice. However, only 2 studies assessed the specific characteristics of handwashing practice (eg, duration of washing, method of drying) according to established hospital guidelines,[13,14] while the other 12 studies assessed only whether or not handwashing occurred after patient contact.

Prevalence and Severity of the Target Safety Problem

Nosocomial infections occur in about 7-10% of hospitalized patients[1] and account for approximately 80,000 deaths per year in the United States.[15] Although handwashing has been proven to be the single most effective method to reduce nosocomial infections, compliance with recommended hand hygiene practices is unacceptably low.[7-9] Indeed, a recent review of 11 studies noted that the level of compliance with basic handwashing ranged from 16% to 81%.[4] Of these 11 studies, only 2 noted compliance levels above 50%.[4] One reason for poor handwashing compliance may be that the importance of this simple protocol for decreasing infections is routinely underestimated by health care workers.[2] Recent surveys demonstrate that although most health care workers recognize the importance of handwashing in reducing infections, they routinely overestimate their own compliance with this procedure.[10] A survey of approximately 200 health care workers noted that 89% recognized handwashing as an important means of preventing infection.[10] Furthermore, 64% believed they washed their hands as often as their peers, and only 2% believed that they washed less often than their peers did.[10]

Opportunities for Impact

Given these findings, opportunities for improvement in current practice are substantial, and efforts to improve current practice would have vast applicability. Many risk factors for non-compliance with hand hygiene guidelines have been identified, including professional category (eg, physician, nurse, technician), hospital ward, time of day or week, and type and intensity of patient care.[8] These results suggest that interventions could be particularly targeted to certain groups of health care workers or to particular locations, to increase the likelihood of compliance. Importantly, this study demonstrates that the individuals with the highest need for hand hygiene (ie, those with the greatest workloads) were precisely the same group least likely to wash their hands. Finally, another recent study noted that approximately 75% of health care workers surveyed reported that rewards or punishments would not improve handwashing, but 80% reported that easy access to sinks and availability of hand washing facilities would lead to increased compliance.[10]

Study Designs

A structured search of the PubMed database (including MEDLINE) and review of the bibliographies of relevant articles identified 14 studies that have examined methods to improve handwashing compliance (Table 12.1). Three studies were non-randomized controlled trials (Level 2) that directly compared separate units, or parts of units, in which one area received the intervention and another did not.[14,16,17] Eleven studies were before-after studies (Level 3), in which baseline data regarding handwashing rates were obtained during an initial observation period, and then measured again in the time period after a particular intervention. Regardless of the type of study design, details regarding the comparability of the groups under observation were reported in only 4 studies.[13,16,18,19]

Study Outcomes

All of the studies reported changes in percent compliance with handwashing, assessing whether or not handwashing took place (Table 12.1). While 13 studies assessed handwashing through observation of health care worker behavior (Level 2), one study assessed soap usage as an indicator of handwashing frequency (Level 3).[20] Two studies also assessed changes in the quality of handwashing.[13,14] Several studies reported results of surveys conducted following

interventions to assess effectiveness and potential adverse events related to the interventions.[14,20,21] One study also assessed changes in 2 clinical outcomes (incidence of nosocomial infections and newly detected cases of methicillin-resistant *Staphylococcus aureus*) as a result of interventions (Level 1).[18]

Evidence for Effectiveness of the Practice

Since many different risk factors have been identified for non-compliance with handwashing, it is not surprising that a variety of different interventions have been studied in an effort to improve this practice. While most of the reviewed studies demonstrated significant improvement in handwashing compliance,[9,13,17,18,20-22] some did not.[14,19,23,24] No single strategy has consistently been shown to sustain improved compliance with handwashing protocols.[11] In fact, of the studies which assessed longer-term results following intervention,[16,21,25] all 3 found that compliance rates decreased from those immediately following the intervention, often approaching pre-intervention levels.

Potential for Harm

While no harm is likely to befall a patient as a result of handwashing, one potential adverse effect of handwashing for health care workers is skin irritation. Indeed, skin irritation constitutes an important barrier to appropriate compliance with handwashing guidelines.[27] Soaps and detergents can damage the skin when applied on a regular basis. Alcohol-based preparations are less irritating to the skin, and with the addition of emollients, may be tolerated better.[6]

Another potential harm of increasing compliance with handwashing is the amount of time required to do it adequately. Current recommendations for standard handwashing suggest 15-30 seconds of handwashing is necessary for adequate hand hygiene.[28] Given the many times during a nursing shift that handwashing should occur, this is a significant time commitment that could potentially impede the performance of other patient care duties. In fact, lack of time is one of the most common reasons cited for failure to wash hands.[11] Since alcohol-based handrubs require much less time, it has been suggested that they might resolve this concern. In fact, a recent study which modeled compliance time for handwashing as compared with alcoholic rubs, suggested that, given 100% compliance, handwashing would consume 16 hours of nursing time per standard day shift, while alcohol rub would consume only 3 hours.[29]

Costs and Implementation

Interventions designed to improve handwashing may require significant financial and human resources. This is true both for multifaceted educational/feedback initiatives, as well as for interventions that require capital investments in equipment such as more sinks, automated sinks, or new types of hand hygiene products. The costs incurred by such interventions must be balanced against the potential gain derived from reduced numbers of nosocomial infections. Only one study addressed the cost implications of handwashing initiatives.[20] The implementation of a patient education campaign, when compared to the estimated $5000 per episode cost of each nosocomial infection, would result in an annual savings of approximately $57,600 for a 300-bed hospital with 10,000 admissions annually.[20] As others have estimated that the attributable cost of a single nosocomial bloodstream infection is approximately $40,000 per survivor,[30] the potential cost savings of interventions to improve handwashing may be even greater.

Comment

While many studies have investigated a variety of interventions designed to improve compliance with handwashing, the results have been mixed. Even when initial improvements in compliance have been promising, long-term continued compliance has been disappointing. Future studies should focus on more clearly identifying risk factors for non-compliance, and designing interventions geared toward sustainability. Some investigators postulate that better understanding of behavior theory, and its application to infection control practices, might result in more effectively designed interventions.[26] In addition, any intervention must target reasons for non-compliance at all levels of health care (ie, individual, group, institution) in order to be effective. A more detailed study of the cost (and potentially cost savings) of handwashing initiatives would also foster greater enthusiasm among health care institutions to support such initiatives.

Table 12.1. Fourteen studies of practices to improve handwashing compliance*

Study Setting; Practice	Study Design, Outcomes	Handwashing Compliance (unless otherwise noted)†
All medical staff in a neurologic ICU and a surgical ICU in a 350-bed tertiary care teaching hospital in Washington, DC, 1983-84; multifaceted intervention (education, automatic sinks, feedback)[16]	Level 2, Level 2	69% vs. 59% (p=0.005)
Medical staff in 2 ICUs in a university teach hospital in Philadelphia; increase number of available sinks[17]	Level 2, Level 2	76% vs. 51% (p<0.01)
Medical staff in a 6-bed post-anesthesia recovery room and a 15-bed neonatal ICU in a tertiary care hospital in Baltimore, 1990; automatic sink compared with standard sink[14]	Level 2, Level 2	Mean handwashes per hour: 1.69 vs. 1.21 on unit 1; 2.11 vs. 0.85 on unit 2; (p<0.001)
All staff at a large acute-care teaching hospital in France, 1994-97; hand hygiene campaign including posters, feedback, and introduction of alcohol-based solution[18]	Level 3, Level 1	Noscomial infections: 16.9% vs. 9.9% Handwashing: 66.2% vs. 47.6% (p<0.001)
Medical staff in a 6-bed pediatric ICU in a large academic medical center in Virginia, 1982-83; mandatory gowning[19]	Level 3, Level 2	29.6% vs. 30.7%
Medical staff in 2 ICUs in a community teaching hospital in Tennessee, 1983-84; sequential interventions of lectures, buttons, observation, and feedback[24]	Level 3, Level 2	29.9% vs. 22% (p=0.071)
Medical staff in an 18-bed ICU in a tertiary care hospital in Australia; introduction of chlorhexidine-based antiseptic handrub lotion[9]	Level 3, Level 2	45% vs. 32% (p<0.001)
12 nurses in a 12-bed ICU in Mississippi, 1990; education/feedback intervention[31]	Level 3, Level 2	92% vs. 81%
Medical staff in an 18-bed pediatric ICU in a children's teaching hospital in Melbourne, 1994; 5-step behavioral modification program[25]	Level 3, Level 2	Handwashing rates after patient contact: 64.8% vs. 10.6%
Medical staff in a 3000-bed tertiary care center in France, 1994-95; 13-step handwashing protocol [13]	Level 3, Level 2	18.6% vs. 4.2% (p<0.0001)

Table 12.1. Fourteen studies of practices to improve handwashing compliance (cont.)

Medical staff in two ICUs at a teaching hospital in Virginia, 1997; 6 education/feedback sessions followed by introduction of alcohol antiseptic agent[22]	Level 3, Level 2	Baseline 22%; Education/feedback 25%; Alcohol antiseptic 48%; ($p<0.05$)
Medical staff in a 14-bed ICU in a tertiary care hospital in France, 1998; introduction of alcohol-based solution[21]	Level 3, Level 2	60.9% vs. 42.4% ($p=0.0001$)
All staff in a medical ICU and step-down unit in a large teaching hospital in Virginia; installation of alcohol-based solution[23]	Level 3, Level 2	52% vs. 60% ($p=0.26$)
Medical staff on 2 general inpatient floor at each of 4 community hospitals in New Jersey; patient education intervention[20]	Level 3, Level 3	Soap usage (as an indicator of handwashing) increased by 34% ($p=0.021$)

* ICU indicates intensive care unit.
† Results are reported as intervention group vs. control group.

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