Handwashing Compliance by Health Care Workers

The Impact of Introducing an Accessible, Alcohol-Based Hand Antiseptic

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Context: Under routine hospital conditions handwashing compliance of health care workers including nurses, physicians, and others (eg, physical therapists and radiologic technicians) is unacceptably low.

Objectives: To investigate the efficacy of an education/feedback intervention and patient awareness program (cognitive approach) on handwashing compliance of health care workers; and to compare the acceptance of a new and increasingly accessible alcohol-based waterless hand disinfectant (technical approach) with the standard sink/soap combination.

Design: A 6-month, prospective, observational study.

Setting: One medical intensive care unit (ICU), 1 cardiac surgery ICU, and 1 general medical ward located in a 728-bed, tertiary care, teaching facility.

Participants: Medical caregivers in each of the above settings.

Interventions: Implementation of an education/feedback intervention program (6 in-service sessions per each ICU) and patient awareness program, followed by a new, increasingly accessible, alcohol-based, waterless hand antiseptic agent, initially available at a ratio of 1 dispenser for every 4 patients and subsequently 1 for each patient.

Main Outcome Measure: Direct observation of handwashing for 1575 potential opportunities monitored over 120 hours randomized for both time of day and bed locations.

Results: Baseline handwashing compliance before and after defined events was 9% and 22% for health care workers in the medical ICU and 3% and 13% for health care workers in the cardiac surgery ICU, respectively. After the education/feedback intervention program, handwashing compliance changed little (medical ICU, 14% [before] and 25% [after]; cardiac surgery ICU, 6% [before] and 13% [after]). Observations after introduction of the new, increasingly accessible, alcohol-based, waterless hand antiseptic revealed significantly higher handwashing rates ($P<.05$), and handwashing compliance improved as accessibility was enhanced—before 19% and after 41% with 1 dispenser per 4 beds; and before 23% and after 48% with 1 dispenser for each bed.

Conclusions: Education/feedback intervention and patient awareness programs failed to improve handwashing compliance. However, introduction of easily accessible dispensers with an alcohol-based waterless handwashing antiseptic led to significantly higher handwashing rates among health care workers.

Arch Intern Med. 2000;160:1017-1021
technical improvements that increased accessibility and ease of use of handwashing products.

RESULTS

OBSERVATION DATA

The handwashing compliance of health care workers was monitored for over 120 hours with a total of 1575 potential handwashing opportunities. Most patients in the MICU were intubated, and therefore respiratory care was the preponderantly observed event (37% of activities) followed by vascular line care (35%), urinary tract care (11%), and others (17%). In contrast, in the CSICU most of the observed events were related to vascular line care (51% of activities), whereas respiratory care (19%), urinary tract care (14%), and others (16%) were less frequent.

Prior to any intervention, health care workers washed their hands before and after patient care events at rates of 10% (before patient contact) and 22% (after patient contact) in the MICU, and 4% (before patient contact) and 13% (after patient contact) in the CSICU (Table 1). After the in-service education/feedback intervention sessions, the handwashing compliance in the MICU was 16% (before patient care) and 25% (after patient care), and in the CSICU 7% (before patient care) and 14% (after patient care).

The introduction of an alcohol-based waterless hand disinfectant in the MICU resulted in a significant improvement in handwashing compliance among health care workers ($P < .05$, $\chi^2$ for linear trend. Figure 2). With 1 alcohol dispenser available for every 4 beds, the handwashing rate was 19% prior to patient contact and 41% afterward. Still higher rates were noted with a dispenser-bed ratio of 1:1—23% before patient contact and 48% afterward.

The handwashing compliance rates were stratified by health care providers, ie, nurses, physicians, and others (eg, physical therapists and radiologic technicians). Prior to patient contact there was no difference among the professions (nurses and others 9%, physicians 13%). After patient contact, physicians washed their hands more often than nurses and others (nurses and others 16%, physicians 46%), but opportunities for physicians accounted only for approximately 5% of the total.

SOAP, CHLORHEXIDINE, AND AN ALCOHOL-BASED ANTIMICROBIAL AGENT UTILIZATION DATA

During the study period, 298 884 dispenser utilizations were registered in MICU, CSICU, and the general medical ward (Table 2). Within the first study phase prior to...
interventions, health care workers' use (number of uses per patient-day) in the MICU was 126 with soap and 17 with chlorhexidine. In the CSICU, where chlorhexidine was not used, the handwashing rates were 109 for soap. On the general medical ward the baseline utilization was 34 for soap and 4 for chlorhexidine. After the in-service education/feedback intervention program sessions, an insignificant increase of dispenser counts was noted in the MICU: soap 135 and chlorhexidine 23. A decrease was detected in the CSICU with 91 soap utilizations per patient-day. On the general medical ward after patient awareness education/feedback intervention, social pressures, and the alcohol-based waterless hand disinfectant was handwashing compliance, calculated by dividing the number of handwashing episodes by the number of potential handwashing opportunities. Comparisons between study periods were performed using Fisher's exact test, $\chi^2$ statistic, and $t$ test for equal variances (Epi Info Version 6.04a; Centers for Disease Control and Prevention, Atlanta, Ga; JMP Version 3.1.5, SAS Institute, Carey, NC). All tests of statistical significance were 2 sided, and $\alpha$ level was set at .05.

**EDUCATION/FEEDBACK INTERVENTION PROGRAM**

After the first study phase, 6 educational in-service sessions were conducted in each ICU. All nurses working in the ICUs during the study were included at least once. The efficacy of handwashing was reviewed, rates of the unit-specific baseline handwashing compliance were presented, and health care workers were strongly encouraged to wash their hands before and after patient contact.

**PATIENT AWARENESS**

To improve handwashing compliance among health care workers, pamphlets describing the importance of handwashing were distributed initially to all patients on the general medical ward and then to every new admission for a 6-week period. There was no feedback of the patient attitudes to the patient awareness flyers.

**STATISTICAL ANALYSIS**

The primary measure of the efficacy of education/feedback intervention, social pressures, and the alcohol-based waterless hand disinfectant was handwashing compliance, calculated by dividing the number of handwashing episodes by the number of potential handwashing opportunities. Comparisons between study periods were performed using Fisher's exact test, $\chi^2$ statistic, and $t$ test for equal variances (Epi Info Version 6.04a; Centers for Disease Control and Prevention, Atlanta, Ga; JMP Version 3.1.5, SAS Institute, Carey, NC). All tests of statistical significance were 2 sided, and $\alpha$ level was set at .05.

**COMMENT**

Several studies, including our own, have revealed an unacceptably low baseline rate of handwashing compliance by health care workers, particularly in ICUs.18-22 The...
Table 1. Effect of Education/Feedback Intervention Program on Handwashing Compliance

<table>
<thead>
<tr>
<th>Type of Intensive Care Unit</th>
<th>Opportunity</th>
<th>Directly Observed Handwashing Compliance, No. of Handwashes/No. of Potential Opportunities (%)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Period</td>
<td>After Education/Feedback Intervention Program</td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>Before patient contact</td>
<td>17/173 (10)</td>
<td>.17</td>
</tr>
<tr>
<td></td>
<td>After patient contact</td>
<td>42/188 (22)</td>
<td>.63</td>
</tr>
<tr>
<td>Cardiac surgery</td>
<td>Before patient contact</td>
<td>6/170 (4)</td>
<td>.26</td>
</tr>
<tr>
<td></td>
<td>After patient contact</td>
<td>23/182 (13)</td>
<td>.82</td>
</tr>
</tbody>
</table>

Table 2. Effect of an Education/Feedback Intervention Program and Patient Awareness Program on the Rates of Dispenser Uses per Patient-Day

<table>
<thead>
<tr>
<th>Type of Unit</th>
<th>Detergents</th>
<th>Baseline</th>
<th>After Education/Feedback Intervention Program and Patient Awareness Program</th>
<th>P†</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICU</td>
<td>Soap</td>
<td>126</td>
<td>135</td>
<td>.72</td>
</tr>
<tr>
<td></td>
<td>Chlorhexidine gluconate</td>
<td>17</td>
<td>23</td>
<td>.08</td>
</tr>
<tr>
<td>CSICU</td>
<td>Soap</td>
<td>109</td>
<td>91</td>
<td>.38</td>
</tr>
<tr>
<td></td>
<td>Soap</td>
<td>34</td>
<td>30</td>
<td>.08</td>
</tr>
<tr>
<td>General ward</td>
<td>Chlorhexidine</td>
<td>4</td>
<td>5</td>
<td>.60</td>
</tr>
</tbody>
</table>

*P value calculated using the Fisher exact test; statistically significant at P < .05.

Figure 2. The effect of an easily accessible alcohol-based waterless hand disinfectant (Purell; Gojo Industries, Akron, Ohio) on handwashing compliance in the medical intensive care unit (MICU) (number of washes/number of potential opportunities). Compliance did not change after 6 in-service education/feedback intervention sessions, but increased with the introduction of an accessible, alcohol-based waterless hand disinfection system.

For a patient to reliably access a disinfectant agent, an even 1:4 ratio of dispenser uses per patient-day is necessary. Only during use of an easily accessible, alcohol-based waterless hand antiseptic agent did handwashing compliance significantly improve. Our data confirm the observations of Graham,15 who used a waterless, handrub lotion and observed a 13% increase in hand decontamination frequency in an ICU. Previously, Kaplan and McGuckin35 demonstrated improved handwashing by providing easier access to sinks. Accessibility may eventually be shown to be the most reliable variable predicting handwashing rates.
Previous studies have shown total handwashing compliance ranging from 14% to 48% or even higher. However, these studies have measured handwashing only after a healthcare worker touches a patient. We measured handwashing compliance both before and after patient contact to investigate handwashing behavior more fully. At baseline extremely low rates of 6% to 10% were observed before patient contact and 13% to 22% after patient contact. It is possible that unobserved handwashing occurred before patient contact, however. Nevertheless, even with our best efforts in our most compliant group, the handwashing rates improved only to 23% before and 48% after patient contact. Although the latter rates are higher than many previously reported rates, opportunities exist for developing better strategies for handwashing.

We thought that an unobservable counting device might be a crude surrogate for handwashing compliance. However, perhaps because it cannot correct for the number of dispenser uses per handwash, it did not predict the increased compliance we noted with the introduction of an alcohol-based waterless antiseptic agent. This might also be the reason for the low amount of alcohol-based waterless antiseptic dispenser uses compared with soap or chlorhexidine uses.

This investigation has some limitations including the lack of a long-term observational follow-up period after the last study phase. Previous studies have shown that interventions have a limited influence on the behavior of health care workers. 16,19,21,31,37,38 A second limitation relates to the short-term feedback intervention program to health care workers. As part of long-term interventions, repeated feedback, including supervision, use of role models, and administrative regulations could be helpful in the continued improvement of handwashing compliance.

In summary, education/feedback intervention and patient awareness programs failed to influence handwashing compliance favorably. However, the introduction of a new, easily accessible, alcohol-based waterless antiseptic handwashing product significantly improved handwashing rates.

Accepted for publication August 3, 1999.

This project was funded by a grant from the Procter & Gamble Co, Mason, Ohio.


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REFERENCES

ARCH INTERN MED/VOL 160, APR 10, 2000 WWW.ARCHINTERNMED.COM

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