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# Hand hygiene in the dermatologist's office: To wash or to rub?

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Hand hygiene is a central factor in preventing the spread of disease in the dermatologist's office. The role of hand washing and alcohol-based hand rubs is considered with emphasis on compliance, effectiveness, side effects, and cost. Specific recommendations highlight the importance of using alcohol-based hand rubs as an adjunct to traditional hand-washing methods. (J Am Acad Dermatol 2008;59:1043-9.)

**H**and hygiene has been a topic of considerable attention ever since Semmelweis stressed the importance of hand washing in 1847.<sup>1</sup> Hospitals saw a rapid decline in the transmission of infectious agents when physicians and staff began washing their hands. Even today, however, hospital-acquired infections in the United Kingdom cost more than £1 billion per year and affect nearly 10% of patients, resulting in 5000 deaths per year. Methicillin-resistant *Staphylococcus aureus* (MRSA) infection has been responsible for 47% of all cases of *S aureus* bacteremia and surgical wound infections in that country.<sup>2</sup> In the United States, it is estimated that health care—associated infections affect about 2 million patients and result in about 80,000 deaths each year. Of course, this problem is not restricted to hospitals. Physicians and nurses have contact with thousands of patients every day in their offices. This is increasingly important with the emergence of a variety of highly virulent, community-acquired multiple drug-resistant bacteria. Outbreaks of community-acquired MRSA in Chicago, IL, and Los Angeles, CA, in 2004 were linked to improper hand hygiene of one doctor and one nurse.<sup>3</sup> The most important causal factor in these preventable infections is improper hand hygiene.

#### Abbreviations used:

ABHR: alcohol-based hand rub  
CAR: cutaneous adverse reaction  
CDC: Centers for Disease Control and Prevention  
IPA: isopropyl alcohol  
MRSA: methicillin-resistant *Staphylococcus aureus*

## HAND HYGIENE IN CLINICAL DERMATOLOGY PRACTICE

The use of proper hand hygiene is of particular concern in the clinical practice of dermatology. A perfect storm of potential aggravating factors exist in this environment. The dermatologist's or their assistants' skin, clothing, and equipment can be easily contaminated when patients present with cutaneous bacterial, viral, and fungal diseases including MRSA. Our patients are often more susceptible to infectious disease because of depressed barrier function associated with a variety of skin diseases such as atopic dermatitis (eczema) and defects in the physical skin barrier created by office procedures.<sup>4</sup> Finally, the large numbers of patients examined each day in the dermatology office require a greater number of hand-hygiene interventions and a greater commitment of time and effort. Inattention to hand hygiene in the dermatology office could certainly lead to significant outbreaks of health care—acquired infections. Tailoring a personalized approach to hand hygiene in each dermatologist's office requires an understanding of issues that relate to compliance, effectiveness, side effects, and cost.

### Compliance

Compliance is a critical issue in determining protocols for hand hygiene because studies demonstrate that clinicians routinely ignore recommended

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Funding sources: None.

Conflicts of interest: None declared.

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Published online October 13, 2008.

0190-9622/\$34.00

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doi:10.1016/j.jaad.2008.07.033

**Table I.** Factors associated with hand-hygiene compliance<sup>3,12,21,36</sup>

Positive factors	Negative factors
<ul style="list-style-type: none"> <li>• Convenient and accessible hand-hygiene facilities</li> <li>• Preparations with good tolerability</li> <li>• Perceived effectiveness of ABHR vs standard hand washing</li> <li>• High risk of transferring infectious agents</li> <li>• Perceived benefit for patient</li> <li>• Being female</li> <li>• Educational background</li> <li>• Being a nurse</li> </ul>	<ul style="list-style-type: none"> <li>• Being a doctor</li> <li>• Being male</li> <li>• Working in high demand and stress environment</li> <li>• Working on a weekday</li> <li>• Wearing gloves or gowns</li> <li>• Skin irritation</li> <li>• Inaccessible supplies</li> <li>• Too busy or lack of time</li> <li>• Inconveniently located sinks</li> <li>• Insufficient number of sinks</li> <li>• Low risk of acquiring infection from patient</li> <li>• Interference with patient-worker relationship</li> <li>• Forgetfulness</li> <li>• Ignorance of or disagreement with guidelines</li> <li>• Perceived ineffectiveness of ABHR vs standard hand washing</li> </ul>

ABHR, Alcohol-based hand rub.

hand-washing practices. Hand-hygiene compliance rates are rarely reported above 40% to 50%.<sup>5</sup> Observational studies in intensive care departments demonstrate hand-washing compliance is particularly poor among doctors. Although 73% of physicians self-report compliance with hand-washing guidelines, observed compliance was as low as 9%.<sup>6</sup> Senior physicians in ward rounds washed their hands only twice on average in a 21-hour period despite frequent patient contact.<sup>6</sup> Despite instruction in proper hand hygiene, rates of compliance of junior staff and students were lower when senior staff failed to exhibit good hand hygiene.<sup>6</sup> Although nurses perform better, their compliance in routine hospital practice is still less than 50%.<sup>5,7</sup> Unfortunately, observational studies of hand hygiene in outpatient settings have not been performed.

Parameters that might increase or decrease compliance with hand hygiene have been identified (Table I). Of course, attacking just one or a few of these factors may not be effective. For instance, increasing the number of sinks and educating health care workers about the importance of traditional hand washing provided little improvement in compliance.<sup>7</sup> Alternatives to hand washing, such as alcohol-based hand rub (ABHR), offer many advantages when compared with hand washing including accessibility, ease of use, the short time required for effective use, and improved skin tolerance.<sup>7-9</sup> Accessibility is critical because ABHR dispensers can be inexpensively placed in examining rooms, hallways, nursing stations, and other convenient locations where it would be impractical to install a sink. Although proper use of both hand washing and ABHRs takes 10 to 30 seconds, ABHRs can be used while walking and talking to patients. Interestingly,

patients appreciate the concern shown by health care providers who care enough to minimize the potential for the transmission of infection.<sup>5</sup>

In fact, hand-hygiene compliance rates in one study increased from 48% to 66% after hospital workers switched from a reliance on washing with soap and water to ABHRs.<sup>10</sup> Ultimately, it is essential to overcome the perception of many clinicians that ABHRs are ineffective. Only then will they make the investment required to incorporate this approach in their clinical practices.

### Effectiveness

Hand-washing products are not uniformly equal in their ability to prevent the spread of infection. Mechanical hand-wash products most often contain esterified fatty acids with sodium or potassium hydroxide and are used for social hand washing. These detergent/surfactant products remove loosely adherent micro-organisms and viruses from the hands by mechanical means. They have no effect on resident hand flora after 2 minutes of hand washing.<sup>5,11</sup> In fact, contamination of the hands may occur in the process of hand washing with nonmedicated bar soaps by contacting the surrounding environment, faucet, paper towel handle, or the sink edge.<sup>11</sup> Furthermore, bacteria adhere more readily to wet hands, increasing the risk of cross-contamination.<sup>5</sup>

Chemical hand-wash products are highly effective and use antimicrobial/antiseptic soaps. Wearing rings may slightly decrease the efficacy of hand washing with these products.<sup>12</sup> Chlorhexidine is commonly used in soaps as an antiseptic ingredient for health care settings. At lower concentrations, it is bacteriostatic against most gram-positive organisms, many gram-negative bacteria, and bacterial spores.

**Table II.** Some commercially available alcohol-based hand rubs in the United States

Brand name product	Ingredients	Manufacturer
Purell	62% Ethyl alcohol	GOJO (Akron, OH)
Avant original	60% Ethyl alcohol	B4 Brands LLC (Lisbon, IA)
Dial	62% Ethyl alcohol	Henkel Group (Düsseldorf, Germany)
Germ-X	62% Ethyl alcohol	Vi-Jon Laboratories (St Louis, MO)
Sterillium Gel	85% Ethyl alcohol	BODE Chemie GmbH & Co (Hamburg, Germany)
Avagard	61% Ethyl alcohol with 1% chlorhexidine gluconate	3M (St Paul, MN)
Instant hand sanitizer with aloe vera	64.5% Ethyl alcohol	McKesson (San Francisco, CA)
Avant original instant hand sanitizer	60% Ethyl alcohol	B4 Brands LLC (Lisbon, IA)
Antiseptic hand gel	70% Ethyl alcohol	Triad Disposables (Hartland, WI)
Isopropyl alcohol gel hand sanitizer	70% Isopropyl alcohol	Aplicare Inc (Meriden, CT)
Viraguard antiseptic hand gel	70% Isopropyl alcohol	Veridien Corp (Largo, FL)

At concentrations that exceed 20 µg/mL, it is bactericidal and is effective against yeast. It has good activity against enveloped viruses such as HIV, cytomegalovirus, influenza virus, respiratory syncytial virus, and herpes simplex virus, but its activity against naked viruses such as rotavirus, adenovirus, and enteroviruses is low.<sup>5</sup> Chlorhexidine has no sporicidal activity nor does it have activity against dermatophytes.

Triclosan (a phenol derivative) and a chemically related compound, triclocarban, are antimicrobial/antibacterial agents that block lipid synthesis by inhibiting the enzyme enoyl-acyl carrier protein reductase. They are found in toothpastes, deodorants, and mouthwashes, and in a 1% concentration in antiseptic soaps. Triclosan has bacteriostatic actions at low concentrations, and is bactericidal at higher concentrations. Activity is good against gram-positive bacteria, including MRSA, but less effective against gram-negative bacteria, in particular, *Pseudomonas aeruginosa*. Recently, it has been suggested that increased antibiotic resistance is caused by the overuse of antibacterial soaps in community settings. The resistance is thought to occur via mutation on the *fabI* gene, which then stops the blockage of lipid synthesis that triclosan exhibits. These concerns were validated in a study when *P aeruginosa* was exposed to triclosan and subsequently developed multiresistance to various antibiotics, included the commonly prescribed ciprofloxacin.<sup>5</sup> Triclosan is a good fungicide with good activity against yeasts and dermatophytes. Its antiviral activity has not been fully characterized. Unfortunately, the dermal tolerance of triclosan is poor.<sup>5</sup>

ABHRs use ethanol, isopropanol, and *n*-propanol as antimicrobial agents (Table II). Their effectiveness is related to the ability to denature proteins.<sup>13</sup> Ethanol has a strong bactericidal activity at concentrations of 60% and higher. Its spectrum of activity is

broad, including against gram-positive organisms, gram-negative organisms, multidrug-resistant pathogens (eg, MRSA and vancomycin-resistant *Enterococcus*), mycobacteria, fungi (including yeast and dermatophytes), and some enveloped viruses such as herpes simplex virus, HIV, influenza virus, respiratory syncytial virus, and vaccinia virus.<sup>5,11</sup> Hepatitis B and C viruses are less susceptible but are killed by 60% to 70% alcohol. Hepatitis A virus and enteroviruses may require 70% to 80% alcohol to be reliably inactivated. Alcohols have very poor activity against bacterial spores (eg, *Clostridium difficile*), protozoan oocysts, and certain nonenveloped viruses.<sup>11</sup> Ethanol-based formulations containing 60% to 70% ethanol are most effective.<sup>11</sup> Higher concentrations have less water content and alcohol needs water to be effective.<sup>9,14</sup> Isopropanol 13, and *n*-propanol have bactericidal activity starting at 30% concentrations and increases in activity as the concentration increases until a significant decrease in activity at 90%.<sup>5</sup>

With respect to all ABHRs, at least 3 mL is required with each application, applied to dry not wet hands, and rubbing should last for at least 10 to 30 seconds until hands are dry.<sup>9,13</sup> The Centers for Disease Control and Prevention (CDC) Guidelines for hand washing suggest a vigorous 10- to 15-second hand washing.<sup>15</sup> The effectiveness of both ABHRs and hand washing can be judged by microbiologic studies of skin after intervention and an analysis of nosocomial infection rates.

Several microbiologic studies have compared the effectiveness of hand washing with ABHR. In a prospective randomized blinded trial (n = 23), the median percentage reduction in bacterial contamination was significantly higher using 3 to 5 mL of ABHR for 30 seconds (3-5 mL of 45% 2-propanol, 30% 1-propanol, and 0.2% mectronium ethyl sulphate) versus hand washing (chlorhexidine gluconate 4%)

during routine patient care (83% vs 58%,  $P = .012$ ).<sup>7</sup> Of note, whereas participants in the hand-washing group were instructed to wash for 30 seconds, 65% were observed to wash for less than 30 seconds. A similar study ( $n = 46$ ) showed ABHR (61% ethyl alcohol) to be equivalent to hand washing with an antimicrobial soap.<sup>16</sup> Again, in this study, health care workers achieved 30-second hand washing only 35% of the time. Finally, ABHRs (60% isopropyl alcohol [IPA] with emollients, 70% IPA plus 0.5% chlorhexidine gluconate with emollients, and 70% IPA) were found to be equivalent to hand washing (4% chlorhexidine gluconate plus 4% IPA) in a study measuring reduction of aerobic and anaerobic bacterial flora ( $n = 50$ ). In this study, volunteers washed their hands 15 times per day for 5 days under supervision to insure a standardized technique. The ABHRs, however, showed more rapid reduction in flora on day 1. All groups outperformed a nonantiseptic liquid soap and water, which served as a control.<sup>17</sup>

Just as the effectiveness of hand washing with antiseptic soaps is dependent on technique, ABHRs must be used as directed. One milliliter of ABHR is substantially less effective than 3 mL.<sup>11</sup> If hands feel dry after rubbing hands together for 10 to 15 seconds, an insufficient amount of product was applied. It should be noted that none of the ABHRs have long-term antimicrobial effectiveness because after drying there is little residual antimicrobial activity.<sup>11</sup>

Ultimately, ABHRs must be measured against their ability to affect patient outcomes and actually reduce health care–related nosocomial infections. In one study, ABHRs are associated with reductions in the incidence of nosocomially acquired infections from 16.9% to 9.9%.<sup>5</sup> Other studies are not so reassuring. Recent microbiologic studies suggest that ABHRs do not eliminate *C difficile* and hand washing.<sup>7</sup> In one hospital from 2000 to 2003, a 10-fold increase in the use of ABHR was associated with an increased incidence of pseudomembranous colitis associated with *C difficile* infections. The authors of this study, however, concluded that a causal relationship was not present.<sup>18</sup>

### Side effects

Hand-hygiene preparations should be designed to protect the skin from damage that might increase the risk of colonization with pathogenic organisms. Health care workers with dermatitis are also more likely to harbor *S aureus* and other pathogenic bacteria than are those with healthy skin.<sup>13</sup> Furthermore, the more irritation experienced by the health care provider, the less they will comply with the protocol. Hand washing with soap and water commonly results

in skin irritation and dryness (irritant contact dermatitis) as this act removes natural oils and emollients. When the concentration of chlorhexidine is 4% or greater in an ABHR, the frequency of irritant contact dermatitis is also higher.<sup>5</sup> This is especially true in patients with eczema who have highly sensitive skin. A small study showed the prevalence of irritant contact dermatitis of health care workers' hands in hospitals varies between 20% to 70%.<sup>19</sup>

ABHRs cause less irritation than soaps.<sup>5,20-22</sup> Detergents were shown to dry the skin to a higher degree than alcohol-based disinfectant with detergent and alcohol-based disinfectant applied separately, when assessed for skin barrier function impairment (transepidermal water loss) and skin redness (colorimetry).<sup>22,23</sup> Another study using electrical capacitance measurements showed that nurses had more skin dryness when washing with soap and water rather than if they used an ABHR.<sup>24</sup> A prospective randomized controlled double-blind trial with 35 participants showed that the addition of emollients to a propanol-based solution resulted in significantly less dryness and erythema after frequent applications.<sup>25</sup> This supports the existing recommendation by the CDC. This can enhance compliance in hand hygiene by preventing irritant contact dermatitis.

The use of ABHR is not without the potential of cutaneous adverse reaction (CAR). In one study, 2750 health care workers were evaluated for the incidence of CARs and 13 (0.47%) reported such an event.<sup>26</sup> There were zero non-CARs. Irritant contact dermatitis was found in all 13 participants, of whom 9 had previous skin problems (dermatitis/eczema or adverse reactions to various skin products). Symptoms of CARs were reported within the first week in 50% of health care workers, and only one occurred outside of a month.<sup>26</sup> A pre-existing skin condition has been linked to a susceptibility to irritation by alcohol.<sup>26</sup> Those with a CAR were advised to increase the use of hand moisturizers. Twelve of the 13 health care workers with a CAR were able to begin using ABHR within 9 months. One health care worker with irritant contact dermatitis found that ABHR use actually improved the condition of her hands. This study concluded that a CAR occurs once every 72 years that a health care worker is exposed to ABHR, and long-term use of ABHR did not correlate with higher rates of CARs.<sup>26</sup> Dermatologists and their assistants with hand eczema should use gloves with wet activities, limit hand washing with antiseptics to instances when their hands are soiled, use ABHRs frequently, and avoid the common mistake of washing before or after the use of ABHRs.<sup>27,28</sup> Washing hands less than

**Table III.** Current recommendations for the dermatology office-based practice

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- I. Multimodal approach
    - A. Hand washing with antiseptic soap
      - Chemical removal: kills and inhibits growth of micro-organisms
      - Use after restroom, before eating, and when hands are visibly soiled by blood or body fluids
    - B. Alcohol-based hand rubs
      - After contact with intact skin or mucous membranes, wound dressings (if hands not visibly soiled), moving from contaminated to clean site on same patient, or contact with environmental surfaces near patient
    - C. Wear gloves and use other barrier devices when procedures are performed or clinical site contains known infectious materials
  - II. Multidisciplinary approach
    - A. Compliance starts from the top; all physicians should comply and serve as role models
    - B. Nurses, physician assistants, and other clinical assistants
  - III. Accessibility
    - A. Convenient placement of sinks and or alcohol-based hand rub dispensers
    - B. Easy-to-use touch-free sinks (ie, automated on/off) or automated alcohol-based hand rub dispensers
  - IV. Ongoing education and promotion
    - A. Teach evidence-based hand hygiene to be used by all medical personnel
    - B. Emphasize the use of alcohol-based hand rubs for medical personnel with hand dermatitis
    - C. Be alert to identify incidents when faulty hand sanitation leads to outbreak of infections
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Based on recommendations by the Centers for Disease Control and Prevention,<sup>30</sup> the Joint Commission on Accreditation of Healthcare Organizations,<sup>31</sup> the Handwashing Liaison Group,<sup>4</sup> the Healthcare Infection Control Practices Advisory Committee,<sup>32</sup> the Society for Healthcare Epidemiology of America,<sup>32</sup> the Association for Professionals in Infection Control,<sup>33</sup> the Infectious Diseases Society of America,<sup>32</sup> the Hand Hygiene Task Force,<sup>10</sup> and the National Institute of Clinical Excellence.<sup>34</sup>

**Table IV.** A comparison of alcohol-based hand rubs and hand washing

	ABHR	Mechanical hand wash	Chemical hand wash
Ease of use	+++	++	++
Accessibility	+++	+	+
Short time required	+++	++	++
Overall compliance	++	+	+
Effectiveness in killing many communicable pathogens	+++	++	—
Effective against <i>C difficile</i>	—	++	—
Use in patients with hand dermatitis	+++	+	+
Use in dirty skin	—	+++	+++
Use in skin soiled after contact with wounds/bandages	—	+++	—

ABHR, Alcohol-based hand rub; C, *Clostridium*; +++, highly recommended; ++, moderately recommended; +, less recommended; —, not recommended.

10 times per day will limit irritant contact dermatitis in health care workers.<sup>29</sup>

Other side effects are less common. ABHR may cause a transient stinging sensation in skin that is dry or fissured. ABHRs with isopropanol may sting less.<sup>30</sup> Health care workers with respiratory allergies may not tolerate ABHR with strong fragrances. Allergic dermatitis or contact urticaria occur rarely. Because alcohol is flammable, it is important to make sure that hands are rubbed until the alcohol evaporates before continuing with tasks to avoid ignition of unevaporated alcohol on the hands.<sup>11</sup> Finally, the ethyl glucuronide test used to insure that alcoholics have not consumed alcohol may yield a false-positive test in health care providers using ABHRs.<sup>31</sup> Blood alcohol levels, however, are not elevated in

individuals who frequently use ethanol-ABHRs according to labeling.<sup>32</sup> Low, but measurable, levels of IPA were detected in one study of ABHR containing this active ingredient.<sup>33</sup>

#### Cost

In an era where many physicians are receiving decreased reimbursement for their services, the cost of ABHR must be carefully considered. A 2001 analysis by Boyce<sup>24</sup> found that 2% chlorhexidine gluconate detergent is 1.7 times more expensive than nonmedicated liquid soap, and ABHRs are twice as expensive. These numbers may be offset by the reduced time it takes to rub rather than wash and, therefore, more patient encounters can occur in a given office day. It is important to consider the

financial benefit incurred from decreased rates of unnecessary infections, which may make the use of a more expensive ABHR financially acceptable.<sup>11</sup> Yet a 2006 prospective study in two dental offices demonstrated that the use of a daily hand-hygiene protocol using a Food and Drug Administration–cleared ABHR is less costly, less time-consuming than traditional hand washing, and easier to use.<sup>34</sup>

An example of how much an ABHR may cost your practice is demonstrated by the following: A Purell NXT Space Saver Dispenser (GOJO, Akron, OH) cost is \$12.00/dispenser. The dispenser contains a NXT 1000-mL solution pouch and costs \$15.29. The average dispenser puts out approximately 3 mL, and each application of 3 mL would cost approximately \$0.05. The total cost for a dermatologist and two clinical staff to each apply 3 mL of Purell (GOJO) 20 times per day is approximately \$3.00. By this calculation, 2 L of Purell (GOJO) (\$32.25) would last about 33 days.<sup>35</sup>

### CURRENT RECOMMENDATIONS

See Table III. Hand washing will always play a key role in hand hygiene in the dermatology clinical setting, particularly when hands are visibly soiled. Considering the evidence supporting the ease of use, compliance, and effectiveness of ABHRs, they should play an increasing role. In addition, patients are beginning to understand the importance of hand hygiene in preventing health care–associated infections and surveys show they prefer to witness the physician perform this procedure.<sup>5</sup>

ABHRs should be introduced into the dermatology clinical setting as part of a multimodal approach. Educational programming emphasizing the value of both hand washing and ABHRs is of critical importance. Survey-based studies of patients and health care workers in the emergency department demonstrate that, by a wide margin (88%–12%), both groups believe hand washing is more effective in reducing the transmission of infectious diseases than ABHR.<sup>5</sup> In the dermatology office where *C difficile* is not a common pathogen, ABHRs are a highly effective component of a hand-hygiene program.

### SUMMARY

ABHRs are preferred over standard hand washing with soap and water and should serve as a primary mode of hand disinfection in dermatology offices (Table IV). They have excellent antimicrobial coverage (including *S aureus*, *P aeruginosa*, *Klebsiella* species, and rotavirus<sup>1</sup>), work very rapidly, spread easily, a sink is not required for their use, and they can be made readily available at the patient bedside. Compared with other hand-hygiene products

(chlorhexidine and triclosan), ABHRs are at least as effective and are better tolerated with fewer adverse skin events and a reasonable cost.<sup>36,37</sup> The Epic systematic review and the CDC support the use of ABHRs,<sup>38</sup> however, hand washing with antiseptic soaps is still preferred when hands are visibly or grossly soiled.

We would like to extend a special thanks to James Arbogast, PhD, for his help and creative ideas.

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