

Current Handwashing Issues

The age-old subject of handwashing lifts its hoary head from time to time throughout the decades. Although many issues surrounding the subject of handwashing have been put to rest, such as the clear-cut evidence of its importance in infection control, other issues still need resolution. Two such important issues which have come to the forefront recently are: 1) some qualitative aspects of hand bacteriology, ie, evidence that many types of bacteria (especially gram-negative bacteria) are commonly spread by the hands, and 2) the ever-present rarely resolved issue of compliance with handwashing behavior among health care personnel. This article is an update on the status of current issues regarding handwashing. Those issues which have been "resolved" will be discussed first, and then a discussion on the aspects of handwashing that currently need clarification or more widespread acknowledgement will follow (Table).

ACCEPTABLE STANDARDS FOR HANDWASHING AND SCRUBBING

Techniques for evaluating quantitative and qualitative bacteriology of the hands are numerous. The most common technique used in clinical studies is the contact plate or fingerstreak method in which the subject merely places the fingers on the surface of a petri plate filled with a general or selective bacteriologic sampling medium.¹⁻⁴ Despite the fact that this is not a very sensitive technique,⁵ it is simple and inexpensive. The swab technique has been shown to provide accurate counts of superficial bacteria on the hands but has the disadvantage of covering only a small surface at one time so that quantitation of the total hand flora is not possible.⁷⁻⁸ The most accurate, but also most sophisticated and expensive method, is the gloved hand, sterile bag, or rinse technique in which the bacteria shed from the entire hand can be identified and counted.^{5,9-11}

In studies related to handwashing and scrub techniques, different sampling methods are used. Data obtained from various studies should be interpreted in light of variations in sampling techniques. If consistent

findings are reported when several sampling techniques have been used, the probability increases that results of handwashing studies are reliable. For example, there have been several studies comparing the impression plate method and the swab method which demonstrate that a five- rather than a ten-minute surgical scrub is quite adequate for maximal skin disinfection.^{1,6} Thus, the five-minute scrub belongs in the realm of "acceptable standards for hand scrubbing."

Whether one scrubs for a specified duration of time or with a mandated number of strokes for each area of the anatomy, it is the care with which the scrub is performed rather than the actual method that affects the results.¹² One can be inattentive during the performance of either stroke or timed method, and can terminate the scrub with hands which are bacteriologically unacceptable. The important factor in the surgical scrub is that one learns a technique well enough to be efficient and thorough.¹³

It is equally clear that the agent with which one washes has an important effect on efficiency. Bar, powdered, leaflet, or liquid soaps which do not contain an antibacterial agent are unacceptable for surgical scrub. The transient contaminants are removed, but there is no significant reduction of normal skin flora.¹⁴ Hexachlorophene has limited use for routine hand scrub because of its narrow range of activity which does not include gram-negative bacteria.¹⁵ Acceptable agents include those which contain povidone-iodine and chlorhexidine. Alcohol, though acceptable as a skin degerming agent, is too drying for constant use.^{16,17} In addition, there is good evidence that alcohol-based lotions are not only adequate skin degerming agents, but also decrease shedding of viable bacteria from the skin. Such agents can be useful adjuncts to soap-and-water handwashing in areas where handwashing facilities are not readily accessible or where there are frequent contacts between patients with minimal opportunity for handwashing.¹⁸

We know that skin cannot be sterilized and that there is a low equilibrium level beyond which further bacterial reduction does not readily occur,¹⁹ that surgical gloves often have microscopic "leaks" through which bacteria can pass,^{12,20} that organisms which are part of the normal skin flora such as *Staphylococcus epidermidis*, *Acinetobacter*, *Enterobacter*, and coryneform bacteria, are causing an increasing proportion of nosocomial infections,²¹ that

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TABLE
CURRENT HANDWASHING ISSUES

| Known | Needs More Study or Emphasis |
|---|---|
| Five-minute surgical scrub is adequate | Bacteriology of hands: |
| Hands cannot be sterilized | Gram-negative bacteria as well as gram-positive cocci are present on the hands, even after "social" handwashing |
| Flora of the skin can cause nosocomial infections | There are tremendous individual variations in bacterial counts on skin, unexplained by current knowledge |
| Handwashing is efficacious for preventing spread of infection | Methods to increase compliance with adequate handwashing practices |

gram-negative bacteria are often transmitted by the hands of health care personnel,²² and that there is a significant correlation between the frequency of handwashing and the presence of disease-causing organisms on the hands.²³ All of this is evidence for the premise on which handwashing practices are based: handwashing is the primary, essential, and efficacious method for preventing the spread of infection.

ISSUES WHICH NEED MORE STUDY OR EMPHASIS

Bacteriology of Hands

The skin of the hands has bacterial flora similar to other skin sites, with coagulase-negative staphylococci and coryneform bacteria being predominant. However, various parts of the hand such as the nail fold and the interdigital space offer unique microenvironments which could support organisms with varying growth requirements.^{24,25} Numbers of organisms harvested from the skin have been shown to remain relatively constant for an individual over extended time periods and even after abstinence from washing from five to seven days.²⁶ Probably the most accurate estimate of total numbers of aerobic bacteria on the hands and forearms was made by Price in 1938. Using a series of 14 sterile basins for sequential handwashing, he was able to determine that there were from 3 to 5 million aerobic colony-forming units on the area washed.²⁷ Hann substantiated Price's findings and demonstrated that a major portion of "resident" hand flora is contributed by the area around the nail folds.²⁸ Anaerobic organisms such as propionibacter outnumber aerobic flora by ten- to 100-fold on normal skin.^{29,30}

Price reported five decades ago that:

"Bacilli placed on the writer's hands did not disappear. Certain of these transient bacteria are able to change their status and become permanent residents. This process seems to be a slow one, and just how it takes place is not altogether clear, but the fact that it can occur is important."²⁷

Increasing evidence suggests that certain gram-nega-

tive bacteria such as *Moraxella*, *Acinetobacter*, and members of the tribe Klebsiellae may reside and proliferate on the skin. Such organisms have been shown to reside in moist skin areas such as axilla and groin,³¹ and have now been demonstrated to be consistently carried on the hands of both the normal population and health care personnel.²³

Factors known to influence hand flora include exposure to contaminants, skin acidity, moisture content of the skin, and the inhibitory effects of other resident microorganisms on the skin.³²⁻³⁴ Increased humidity facilitates the establishment of gram-negative bacteria on the skin.^{8,35} Casewell found that *Klebsiella* artificially inoculated on the hands could survive for long periods of time.¹¹ Persons exposed to heavy environmental contamination can apparently develop a carrier state of gram-negative bacteria on the hands, though it is unclear whether persistent colonization occurs with organisms endogenously acquired from the individual's own intestinal flora.^{36,37}

The prevalence of gram-negative organisms on the skin seems to be related to general health status. In a cross-sectional study of 407 volunteers aged 65 and over, oropharyngeal colonization with gram-negative bacteria increased from 9% in healthy apartment dwellers to 60% in hospitalized individuals.³⁸ The same has been demonstrated on hands of persons with malignancy or prolonged hospitalization.^{39,40} Despite what is known about the physiologic bases for variations in hand flora, much remains unexplained. Persistent differences in individuals cannot be fully accounted for by factors currently understood. Persons with continuously low or high bacterial counts, despite various handwashing regimens, have been identified.^{10,41} Though it has been well-documented that the skin and mucous membranes of hospitalized patients become increasingly colonized with gram-negative bacteria,⁴²⁻⁴⁴ the mechanisms are poorly understood, and the extent to which this may occur in healthy individuals exposed to the hospital environment is not known.

COMPLIANCE WITH ADEQUATE HANDWASHING PRACTICES

Despite the indisputable evidence regarding the importance of handwashing, we are far from ideal in terms of practice. In recent observational studies, the handwashing behavior of health care personnel has been assessed and found to be unacceptable,^{45,46} especially among physicians.⁴⁵ Despite this, there appears to be no significant difference in cognitive awareness or appreciation of the role of handwashing in infection control between health care personnel who wash their hands frequently or infrequently.⁴⁷

In some of our recent studies we were discouraged to find that even when patients were in containment isolation, health care personnel in direct contact with them left the isolation room with unwashed hands in more than half of observed instances.⁴⁸ We were encouraged, however, to find that the handwashing practices of medical housestaff improved when an attending physician, serving as an experimental role model, washed his hands conscientiously after each patient contact.⁴⁹

Clearly, it is not knowledge that determines handwashing practice. In a profession where compliance of clients (patients) and peers (health care professionals) is so important for the attainment of desired therapeutic outcomes, we have very little skill in influencing behavior. Handwashing, of course, is only one example of this broader issue. Surely, techniques from the social sciences—decision theory, behavior modification, and change theory—have much to offer us as we attempt to tackle issues related to compliance. Indeed, we still have much to learn. We cannot continue to consider handwashing practices to be a clinical issue for which cognitive teaching methods have the answer. The clinical mentor and role model may be one important key to “learning” such behaviors as handwashing.

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