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Author(s): Andreas Voss and Andreas F. Widmer

Source: *Infection Control and Hospital Epidemiology*, Vol. 18, No. 3 (Mar., 1997), pp. 205-208

Published by: The University of Chicago Press

Stable URL: <http://www.jstor.org/stable/30141985>

Accessed: 29/03/2010 19:57

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## Readers' Forum

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# No Time for Handwashing!? Handwashing Versus Alcoholic Rub: Can We Afford 100% Compliance?

Andreas Voss, MD; Andreas F. Widmer, MD, MS

### ABSTRACT

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Handwashing is the most important and least expensive measure to prevent transmission of nosocomial infections. However, compliance rarely exceeds 40% under study conditions. Alcoholic hand disinfection (AHD) generally is used in Europe. In contrast, handwashing with medicated soap is practiced most frequently in the United States. Healthcare workers often explain the failure to comply with handwashing or AHD as due to the limited time available for this practice. We calculated a time consumption for handwashing and AHD in a representative model intensive-care unit with 12 healthcare workers, based on different compli-

ance levels (40%, 60%, and 100%), duration of handwashing (40-80 seconds), and AHD (20 seconds). Comparing the extremes of our model, given 100% compliance, handwashing consumes 16 hours of nursing time per day shift, whereas AHD from a bedside dispenser requires only 3 hours ( $P=.01$ ). We conclude that 100% compliance with handwashing may interfere with patient care and partly explains the low compliance. In contrast, AHD, with its rapid activity, superior efficacy, and minimal time commitment, allows 100% healthcare-worker compliance without interfering with the quality of patient care (*Infect Control Hosp Epidemiol* 1997;18:205-208).

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Over a century ago, Ignaz Semmelweis demonstrated the importance of hand disinfection in preventing nosocomial infection, thus saving lives. When he attempted to implement the simple measure of disinfection with chlorinated lime, he was confronted by the all-but-invincible ignorance of his colleagues. Rightfully, although undiplomatically, he denounced his unenlightened colleagues as killers and thereby began the tradition of blaming all healthcare workers for their lassitude, a tradition continued by hospital epidemiologists up until the present. Everyone acknowledges that handwashing is the *sine qua non* for preventing the transmission of pathogens and nosocomial infections, but compliance rarely exceeds 40%.<sup>1-5</sup>

Healthcare workers fail to wash their hands because of lack of time, a shortage of sinks (often inconveniently placed), forgetfulness, or disagree-

ment with the recommendations, but they rarely fail due to negligence. Education and monitoring can improve compliance, but only temporarily.<sup>6</sup> Even if healthcare workers wash their hands, they may not do so thoroughly, because guidelines recommend a washing time of 15 to 30 seconds, whereas the mean observed duration is 8.6 seconds and less than 10 seconds in approximately 90% of cases.<sup>2,7</sup> Furthermore, an excessive work load in terms of the patient:worker ratio can influence compliance, as can the choice of disinfectant or soap.

It is easy to accuse healthcare workers of paying only lip service to the principles of hospital hygiene, but do we infection control officers really realize the implications of what we are asking of them? Our hypothesis was that the time required for proper handwashing might interfere with patient care and partly may explain the low compliance with handwashing.

*From the Department of Medical Microbiology (Dr. Voss), Division of Hospital Epidemiology and Infection Control, University Hospital Nijmegen, The Netherlands; and the Department of Clinical Epidemiology (Dr. Widmer), University Hospital, Basel, Switzerland.*

96-RF-110. Voss A, Widmer AF. No time for handwashing!? Handwashing versus alcoholic rub: can we afford 100% compliance? *Infect Control Hosp Epidemiol* 1997;18:205-208.

TABLE 1

TOTAL NUMBER OF HANDWASHES PER 8-HOUR SHIFT PER UNIT (12 HEALTHCARE WORKERS), BASED ON A HANDWASHING FREQUENCY OF TWO AND THREE TIMES PER HEALTHCARE WORKER PER HOUR, RESPECTIVELY

No. HW Per Hour	Compliance (%)	No. HW/HCW Per Hour	No. HW/HCW Per Shift (×8)	No. HW/Unit Per Shift (×12)
2	40	2	16	192
	60	3	24	288
	100	5	40	480
3	40	3	24	288
	60	4.5	36	432
	100	7.5	60	720

Abbreviations: HW, handwashes; HCW, healthcare worker.

TABLE 2

MINIMUM AND MAXIMUM TOTAL HOURS USED FOR HANDWASHING AND ALCOHOLIC HAND DISINFECTION PER SHIFT PER UNIT, RESPECTIVELY

HWs Per Hour	Compliance (%)	Time Used for HW (h)			Time Used for AHD (h)
		40 s	60 s	80 s	20 s
2	40	2.1	3.2	4.3	1.1
	60	3.2	4.8	6.4	1.7
	100	5.3	8.0	10.7	2.7
3	40	3.2	4.8	6.4	1.6
	60	4.8	7.2	9.6	2.4
	100	8.0	12.0	16.0	4.0

Abbreviations: HW, handwash; h, hour; AHD, alcoholic hand disinfection; s, second.

## METHODS

Based on handwashing publications in MEDLINE (1965-1996; National Library of Medicine, Bethesda, MD) and the standard structure of an intensive-care unit at the University Hospital Nijmegen, we developed a model to predict the time spent daily by a healthcare worker on handwashing, depending on the level of compliance, the duration of hand disinfection, and the use of medicated soap or alcoholic rub.

Results of a handwashing literature review and repetitive measurements at our institution were used to describe baselines for various variables. A previously published model intensive-care unit was adapted to 14 beds and 12 healthcare workers per day.<sup>8</sup>

The model used the following baseline variables: compliance of 40%, two to three hand disinfections per healthcare worker per hour, and a duration of hand disinfection of 40 to 80 seconds for handwashing and 20 seconds for alcoholic hand disinfection (AHD).

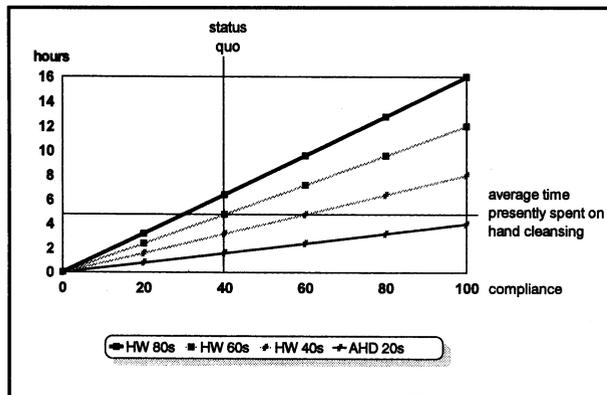
The duration of handwashing included walking from the patient to the sink, turning on and adjusting the tap, washing and drying hands, and returning to the patient, whereas AHD times were based on a bed-

side dispenser. In both groups, standardized contact times (10-second scrub for handwashing and 15-second contact time for AHD) were used for the estimation.<sup>9</sup> Other time factors were calculated from our own measurements in the unit. Healthcare workers were asked to wash their hands after patient contact. The time was clocked from the moment their bedside work ended until they returned to their starting point. We measured the duration, starting from all 14 beds in the unit, in triplicate. All data were summarized, and the minimum and maximum average duration was used for the model.

## RESULTS

### Calculation of Handwashing Duration

We performed 42 time measures. The mean total time used by a healthcare worker to walk from the patient to the sink, to wash hands according to the above instructions, and to return to the patient was 61.7 seconds (standard deviation, 14.2 seconds; range, 37-84 seconds). Based on these data, we chose for our model minimum, average, and maximum times of 40 seconds, 60 seconds, and 80 seconds, respectively.



**FIGURE.** Total time required for handwashing for a 12-person team working 8 hours. The present average total time reflects 40% compliance and 60 seconds devoted to each handwash.

### Calculation of the Total Number of Handwashes

The model was used to calculate the total number of handwashes of all healthcare workers during an 8-hour shift, based on reported handwashing rates of two to three handwashes per hour. Therefore, per healthcare worker, the number of handwashes per shift would be 16 ( $2 \times 8$ ) to 24 ( $3 \times 8$ ), or, for all 12 healthcare workers, 192 ( $12 \times 2 \times 8$ ) to 288 ( $12 \times 3 \times 8$ ), respectively (Table 1). These totals reflect baseline compliance of 40%; if compliance were to increase to 60% or 100%, the total number of handwashes per shift per unit would rise to 288 to 480, based on two handwashes per hour per healthcare worker, and 432 to 720, based on three handwashes per hour per healthcare worker, respectively.

### Calculation of Time Used for Handwashing or Alcoholic Hand Disinfection

Based on the total number of handwashes per shift, the minimum and maximum time (in hours) was calculated for handwashing and AHD, for 40%, 60%, and 100% compliance (Table 2). Given the status quo in the intensive-care unit, ie, 40% compliance, between 2.1 and 6.4 hours per shift are devoted solely to handwashing, whereas only 1.1 to 1.6 hours would be necessary if only an alcoholic rub were used. For 100% compliance to be attained, handwashing would demand up to 16 hours, or two full-time nurse equivalents, whereas simple disinfection with alcohol would require only 4 hours, thus approximately 1 hour less than presently needed for handwashing at 40% compliance (Figure).

## DISCUSSION

Recently, Joel Ehrenkranz<sup>10</sup> raised the question: "Bland Soap Handwash or Hand Antisepsis? The Pressing Need for Clarity." Although the question never was answered, others aggravated the problem

by adding: "Wash Hands, Disinfect Hands, or Don't Touch? Which, When, and Why."<sup>11</sup> Obviously, there are multiple methods to prevent transmission of pathogens from healthcare workers to the patient. Failure to comply with any of the methods, however, will increase the risk of transmission. We therefore questioned whether a hospital can expect 100% compliance with handwashing, given the workload and limited resources.

The two major hand antiseptics in use today are alcoholic rubs and medicated soaps or foams containing chlorhexidine. Alcohols have the most rapid antimicrobial effect and are, in contrast to chlorhexidine, equally effective against gram-positive and gram-negative microorganisms.<sup>12-14</sup> A disadvantage of pure alcohol is its drying effect on the skin and the absence of a residual antimicrobial activity. These problems are resolved in modern AHDs containing different alcohols, additional antimicrobial compounds with residual activity, and refatting agents. However, choice of AHD may be important; some AHDs (especially liquids) take longer to rub into the skin and may be felt to leave a slimy residue.

Before promoting AHD to replace handwashing, the question of equal efficacy must be addressed. Only two clinical studies have been designed to evaluate the clinical effect of different hand antiseptics.<sup>5,15</sup> Doebbeling et al<sup>5</sup> compared chlorhexidine and isopropyl alcohol. The results, which favored chlorhexidine, were based on the observed nosocomial infection rates. This measure reflects both the antimicrobial effect of the handwashing agents and compliance with their use. The markedly lower compliance with AHD use that they observed confounds the interpretation of the differing rates of nosocomial infections and does not allow conclusions to be drawn concerning the reactive efficacy of the products.

The question remains: "Is 100% compliance with hand-cleansing routines attainable, and, if so, can we afford it?" Comparing the extremes of our intensive-care-unit model, handwashing with water and (medicated) soap would consume 16 hours' nursing time (2 of 12 nurses, or 17% of the total work force), whereas bedside hand disinfection with an alcoholic rub would require only 2.7 hours (<3% of the work force). Work loads only increase, and time is both a precious and costly commodity; both markedly influence the quality of care. Clearly, we must not ask the impossible in our stride against nosocomial infections, nor can we allow ourselves to become less vigilant. In times of managed care, we could improve compliance with hand antisepsis by replacing handwashing with bedside AHD, without increasing human resources or decreasing compliance. This not only will conserve

human resources but finally will put an end to the reflex response that healthcare workers are neglectful of hand hygiene, which, far from helping, only demoralizes them further.

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## Risk Factors for Nursing Home Outbreaks

Gina Pugliese, RN, MS  
Martin S. Favero, PhD

Nosocomial infections are an important cause of preventable morbidity and mortality among residents of nursing homes. Outbreaks of infectious disease in nursing homes also have been reported frequently, and most of these outbreaks involve respiratory or gastrointestinal infections. Prevention of outbreaks of communicable diseases in nursing homes is especially important, because infections, and especially respiratory or gastrointestinal infections, may spread rapidly in these settings and involve many residents.

Researchers from the State University of New York at Albany and the New York State Department of Health recently reported the result of a case-cohort study of nursing homes in New York State in 1993 that looked at the institutional risk factors that were

found to be associated with the occurrence of nosocomial respiratory and gastrointestinal disease outbreaks. Facility size, staffing patterns, and employee sick-leave policies were found to be the principal risk factors in an unconditional logistic regression model. The risk of having respiratory or gastrointestinal disease outbreaks was greater in larger nursing homes for each 100-bed increase in size, for nursing homes with a single nursing unit, or for those with multiple nursing units with shared staff. The risk was less for nursing homes with paid employee sick-leave policies. Other potential risk factors that were not significantly associated with the risk of disease outbreaks included the ratio of beds per unit, type of sponsorship, daily review of laboratory test results, and the proportion of private beds and patient-to-staff ratio.

Nursing homes with single units (wards) or with multiple units and shared staff were found to have twice the risk of communicable disease outbreaks as those with multiple units

with separate staff on each unit. The authors suggest that this might be due to a greater number of patients and staff coming into contact in the former settings, thus increasing the risk of both introduction and transmission of disease. Shared staff on all shifts, or at night and weekends, also may increase the number of different staff with which the patient comes in contact.

Based on these findings, the authors recommend that increased emphasis be placed on proper infection control measures, especially in large nursing homes. The institution of policies for paid employee sick leave and the development of separate staffing patterns in different nursing units also may be beneficial to prevent communicable disease outbreaks in long-term-care facilities.

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