Handwashing and Respiratory Illness Among Young Adults in Military Training

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Objectives: In response to increasing concerns about respiratory illness in military recruits, a simple handwashing program was developed and evaluated at a large Navy training center.

Methods: Clinical records from 1996 through 1998 were reviewed to determine weekly rates of respiratory illness before and after program implementation (1,089,800 person-weeks reviewed). A supplemental survey was given to a sample of recruits to assess self-reported respiratory illness and compliance with the handwashing program.

Results: A 45% reduction in total outpatient visits for respiratory illness was observed after implementation of the handwashing program. No change was noted in hospitalization rates for respiratory illness, which remained low during the observation period. Survey data supported clinical observations, as frequent handwashers self-reported fewer respiratory illness episodes when compared to infrequent handwashers. Surveys also revealed challenges with handwashing compliance.

Conclusions: Implementation of a handwashing program in this population of healthy young adults was associated with a marked reduction in outpatient visits for respiratory illness. Despite its success, maintenance of the handwashing program has been challenging in the time-constrained setting of military training.

Medical Subject Headings (MeSH): handwashing, infection control, military hygiene, respiratory tract infections (Am J Prev Med 2001;21(2):79–83)

Background

Respiratory illness is a common cause of infectious morbidity and lost time from work in the United States,[1] and is the most common cause of lost time from duty among young adults in the military.[2–4] When surveyed, almost 90% of all military recruits report symptoms of respiratory illness at some point in their first months of basic training.[5] Although most cases of illness are mild and treated in the outpatient setting, hospitalizations for pneumonia and other complications are not uncommon. When such cases become part of an outbreak at a training site, military readiness is compromised.

Many factors may contribute to the apparent vulnerability of military recruits to infectious respiratory diseases. The crowded, close-contact training environment may facilitate transmission of pathogens.[6] The physical and psychological stresses of military training may predispose young adults to illness.[5] In addition, many new recruits may be immunologically naive and more vulnerable to infectious disease when first brought together as a group.

Historically, preventive medicine professionals have explored many strategies to combat respiratory infections among recruits. Attempts to use dust suppression,[7] ultraviolet radiation,[8] disinfectant vapors,[9] and mass prophylaxis[10–12] have had variable success. The development of adenovirus vaccine, on the other hand, has had a dramatic and lasting impact on reducing respiratory illness in recruits.[13] In 1995, after almost 25 years of use, production of adenovirus vaccine was discontinued, prompting concern that recruit respiratory illness rates would increase to the extremely high levels of the prevaccine era.

At the Navy's single enlisted accession site in Great Lakes, Illinois, preventive medicine staff shared this concern with the training community. A review of training practices was undertaken to explore ways to improve infection control efforts, given an inevitable break in the supply of adenovirus vaccine. Evaluation revealed that handwashing and general hygiene appeared to be chronic challenges for recruits. The term Operation Stop Cough was coined to represent programmatic improvements in these areas, emphasizing their importance to military readiness.

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Table 1. Characteristics of the period before (1996) and after (1997, 1998) implementation of Operation Stop Cough

Characteristic	1996	1997	1998
Recruits trained[a]	44,797	47,300	44,128
Gender (% male)	86.8	86.1	81.0
Age (mean, in years)	19.9	20.0	19.9
Race/ethnicity of recruits			
Caucasian (%)	57.8	58.6	55.6
African American (%)	18.4	18.5	18.5
Other (%)	23.8	22.9	25.9
Home of origin			
Northeast U.S. (%)	26.4	23.6	23.1
Southeast U.S. (%)	18.0	18.1	17.1
Northwest U.S. (%)	24.8	25.0	23.6
Southwest U.S. (%)	30.8	33.3	36.2
Training facilities	12 large barracks	Unchanged	Unchanged
Mean daily temperature[b]			
October–March	30.0°F	31.8°F	37.0°F
April–September	60.2°F	60.3°F	65.0°F

[a] Demographic information from Sailors' Health Inventory Program.[13]
[b] Midwestern Climate Center data for Waukegan, Illinois.

Methods

Elements of the Operation Stop Cough program were implemented at the Great Lakes Recruit Training Command beginning in September 1996. Specific initiatives included: (1) directive from the commanding officer that recruits would wash hands at least 5 times daily; (2) directive from the commanding officer that "wet sinks" would be allowed to pass inspection (prior to this direction, recruit handwashing sinks were kept clean and dry in order to pass spot inspections); (3) installation of liquid soap dispensers at all sinks in the training spaces; (4) provision for the ongoing purchase of liquid handwashing soap; (5) monthly education of drill instructors by preventive medicine personnel on the importance of handwashing; and (6) monthly inspections of barracks spaces to include assessment of soap and sink availability, and to reinforce the handwashing message.

The program was assessed by tracking overall respiratory illness rates among recruits. The single medical clinic where recruits receive primary care collected weekly counts of new cases of respiratory illness. Similar data for the year prior to program implementation were collected by review of clinic logs. Additional data on recruit demographics, hospitalizations, and streptococcal infections were obtained from sources maintained at Naval Hospital Great Lakes and the Naval Health Research Center.[14–16]

Weekly rates of illness were compared from the year before Operation Stop Cough (fiscal year [FY] 1996) and 2 years after implementation (FY 1997 and FY 1998). Simple rate differences were evaluated by chi-square testing; differences in means were evaluated by Student *t*-test.

To assess for potential temporal bias in disease trends over the observation period, respiratory illness rates in a "control" population were similarly evaluated. Students in advanced Navy schools (not basic training) lived on the same base as recruits in a separate dormitory-like setting, but they were not exposed to any special handwashing program during this period. Outpatient and inpatient respiratory disease rates among these students were calculated using available clinic logs and electronic databases, in the same manner that rates were calculated for recruits.

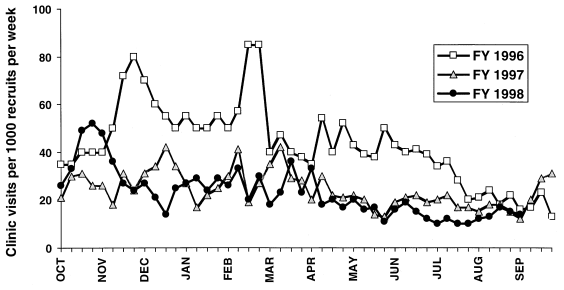

Figure 1. Respiratory illness in Navy recruits, as clinic visits per 1000 persons per week, October 1995 through September 1998.

The Operation Stop Cough program was also assessed by surveying stratified random samples of recruits at the end of basic training. A questionnaire collected data on self-reported respiratory symptoms, use of medical resources, lost time from training, frequency of handwashing, and challenges with handwashing while in basic training. Associations within the questionnaire were evaluated by determining 95% confidence intervals (CIs) about odds ratios (ORs).

Results

Review of the demographic characteristics of Navy recruits from 1996 through 1998 revealed few differences within the population over time (Table 1). An increasing proportion of women recruits was noted in 1998, but overall, the population included more than 80% of men, with an average age of 20 years. The training facility at Great Lakes did not change between

Table 2. Respiratory illness among Navy trainees before (1996) and after (1997, 1998) implementation of Operation Stop Cough

	1996	1997	1998
Recruits in basic training (handwashing program in effect after 1996)			
Outpatient respiratory illness (visits/1000/wk)	42.5	24.3*	22.8*
Inpatient respiratory illness (admissions/1000/yr)	3.6	3.4	2.9
Students in advanced training (no special handwashing program in effect)			
Outpatient respiratory illness (visits/1000/wk)	22.1	23.1	21.2
Inpatient respiratory illness (admissions/1000/yr)	3.9	3.5	2.7

* Statistically significant difference from reference year (1996) rate, $p<0.001$ by χ^2 testing.

1996 and 1998, although the winter of 1998 was somewhat milder with a slightly higher average outdoor temperature (Table 1).

The overall incidence of outpatient respiratory illness among Navy recruits, before and after implementation of Operation Stop Cough, is shown in Figure 1. The overall rate of illness in 1997 and 1998 (23.4 cases per 1000 person-weeks) was 45% lower than the average rate in the preceding year (42.5 cases per 1000 person-weeks). The difference was statistically significant when evaluated by chi-square testing ($p<0.001$).

Rates of recruit hospitalizations for pneumonia did not significantly change during the years under review. In 1996, thirty-one recruits were hospitalized; in 1997 and 1998, twenty-two and twenty-seven recruits were hospitalized, respectively. Tracking of cultures revealed no consistent trend in the incidence of Group A streptococcal pharyngitis over the period of observation; the average incidence was 1.3 cases per 1000 person-weeks, accounting for <5% of all outpatient respiratory illness. The prophylactic use of benzathine penicillin G was followed, as per Navy instructions throughout this period.[16]

Rates of respiratory illness in recruits are summarized and compared to rates in the "control" population of students in Table 2. Students were housed in a separate section of the same base as recruits, with an average daily census of approximately 10,000. Inpatient and outpatient rates of respiratory illness in students appeared unchanged over the observation period (Table 2).

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Three stratified random samples of recruits ($n=1445$) were surveyed regarding their experiences in basic training in 1997 and 1998. More than 99% (1442) completed the survey. Among respondents, 48.8% reported washing their hands at least 5 times per day, 38.9% reported washing 3 to 5 times per day, and 12.3% reported washing fewer than 3 times per day. Infrequent handwashers had more self-reported respiratory illness than frequent handwashers (4.7 episodes/recruit vs 3.2 episodes/recruit; OR 1.5, 95% CI 1.2–1.8). Infrequent handwashers were also more likely to report hospitalization for respiratory illness than frequent handwashers (OR 10.9, 95% CI 2.7–46.2). There was no difference in self-reported lost time from training between frequent and infrequent handwashers.

Almost half (49%) of survey respondents reported challenges with washing hands during recruit training. Among those who cited challenges, 81% reported that there was not enough time to wash hands, 31% reported that there were not enough sinks, and 28% reported that there was not enough soap to wash hands well during basic training.

Discussion

The implementation of this simple handwashing program in a Navy training camp was associated with a marked reduction in the incidence of outpatient respiratory illness that was sustained over a 2-year period. The value of handwashing as an infection control measure has been well established in past studies performed in hospitals.[17–20] This work augments the growing literature assessing handwashing outside of healthcare settings,[21–24] and evaluates such an intervention in the largest population described to date.

When interpreting the results of this work, it is important to consider its inherent limitations. Since the handwashing program affected all basic trainees, there was no designated control group that would deliberately limit hygiene practices. The primary outcome depended on a comparison of the experiences of different recruit cohorts before and after the program was implemented. Temporal changes in the environment, the population, or circulating pathogens could have accounted for differences in disease incidence. Data from a comparison population of students at the same site who were not exposed to the handwashing program were included to partially address this concern. It was notable that there was no apparent change in respiratory disease within this comparison group over the observation period. There were also no substantial changes in recruit demographics or the training environment that would clearly account for the decrease in recruit respiratory illness.

The outcome measure of respiratory disease incidence was captured by retrospective record review prior to the fall of 1996, and by weekly monitoring of clinic visits after that time. The change from a passive to a more active system of surveillance should also be considered a limitation, but actually may have allowed more cases to be captured after 1996, underestimating the impact of the program. It should be noted that available data on advanced-training students could have been similarly affected by any changes in collection or reporting over the observation period. There were no apparent changes in clinic availability or disease diagnosis and treatment protocols during this time. Therefore, the marked decrease in respiratory disease incidence in recruits after 1996 appears to be primarily attributable to the implementation of the handwashing program.

Caution should be used in interpreting our questionnaire data because of the relatively small number of recruits surveyed. The high response rate (99%) implies that recruits considered this survey, which was included in a set of routine graduation questionnaires, to be mandatory. This may have led to some response bias even though the survey was anonymous. It is still

interesting to note that the survey data supported the efficacy of handwashing, since frequent handwashers self-reported less illness than infrequent handwashers. Frequent handwashers also self-reported fewer hospitalizations than infrequent washers, although the low incidence of objective hospitalizations was unchanged throughout the study period.

It would have been optimal to determine pathogen-specific rates of illness throughout this period. Unfortunately, we had access only to culture-derived data on Group A streptococcal pharyngitis, a pathogen that accounted for a relatively small proportion of the respiratory disease observed. Surveillance for viral pathogens was initiated in 1997, after the handwashing program began.[15] It is notable that a large epidemic of adenoviral illness was observed in the fall of 1997, after the first prolonged break in supply of adenovirus vaccine. Re-introduction of the last supplies of vaccine brought the outbreak under control. The handwashing program may have attenuated, but did not prevent, this outbreak. It is probable that the efficacy of handwashing varies against different pathogens in different environments. Handwashing may be more effective against the less-virulent rhinoviruses,[25] for example, explaining our observed reduction in total illness without a quantifiable reduction in hospitalizations or severe illness.

Further study is needed to determine the pathogen-specific utility of handwashing in this kind of high-risk community setting. Further study may also help to quantify the amount and type of handwashing that is most cost effective in reducing morbidity. Waterless, alcohol-based hand cleansing has recently shown promise in reducing absenteeism in schools,[26,27] and this may be well worth studying in more controlled military training populations. It should be recognized that research to quantify handwashing's utility has been difficult in hospital settings[17–19] and is even more challenging in dynamic community environments. Such work is vital, nonetheless, in a world of emerging infectious disease threats.

A final note should be made on the difficulty of implementing Operation Stop Cough at Great Lakes. It is interesting that less than half of the recruits surveyed reported washing their hands as frequently as their commanding officer had directed. Most cited difficulty in having enough time to wash hands in their busy training schedule. Failure to wash hands may also be considered a reflection of the lack of commitment by the organization to emphasize and make time for hygiene. In fact, data are not included after 1998 in this report because there was inconsistent application of all aspects of the handwashing program at the site after that time.

When Semmelweiss[28] suggested handwashing as a simple means of infection control almost 150 years ago, he was met with the same kind of reluctance that remains today. Challenges with handwashing compliance, despite hygiene knowledge, are quite prevalent in the medical field and the general civilian community.[29,30] Because hygiene may be even more problematic in military operational settings,[31] establishing sound handwashing practices in basic training recruits is especially critical. Increasing and sustaining compliance with handwashing may be best accomplished through a multifaceted organizational commitment.[32,33] Quantifying the effect of all such interventions on respiratory disease outcomes will be important to both military and civilian public health programs.

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