Reduction in Acute Respiratory Infection among Military Trainees: Secondary Effects of a Hygiene-based Cluster-Randomized Trial for SSTI Prevention

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Abstract

Background. Strategies to prevent acute respiratory infection (ARI) among military trainees are needed. In a group-randomized trial of personal hygiene measures for skin and soft tissue infection (SSTI), we evaluated the secondary impact on ARI.

Methods. A group-randomized SSTI prevention trial was conducted among US Army Infantry trainees (Fort Benning, GA) from 5/2010-1/2012. There were three groups, each with ~10,000 trainees. Each group (Standard [S], Enhanced Standard [ES], and Chlorhexidine [CHG]) was assigned an intervention consisting of incrementally increasing personal hygiene measures. S received a briefing on personal hygiene practices and SSTI prevention. ES received the S components in addition to supplemental educational materials. CHG received the ES components in addition to CHG-based body wash (Hibiclens) they were instructed to use once weekly during training. We reviewed ICD-9 codes in an electronic, outpatient database to identify cases of medically-attended ARI. Data abstractors were blinded to group assignment.

Rates are reported as the number of cases per 1000 person-weeks. Binomial distributions were used to generate 95% confidence intervals (CI). Rate ratios (RR) were compared using Fisher's test. Analysis was performed using Microsoft Excel (Microsoft Corporation, Redmond, WA) and Stata® 12.1 (StataCorp, College Station, TX).

Results. The population was all male, 17-42 years of age, and in generally good physical condition. Over a 20-month period and among ~30 000 trainees, 13,949 episodes of ARI were identified, 4,365 (31.3%) in the S group, 4,426 (31.7%) in the ES group, and 5,158 (36.9%) in the CHG group. The overall rate of ARI was 33.9 (95% CI: 33.3, 34.5) cases per 1000 person-weeks. By study group, ARI rates were 35.3 (95% CI: 34.3, 36.3), 29.3 (95% CI: 28.5, 30.2), and 37.7 (95% CI: 36.7, 28.7) per 1000 person-weeks in the S, ES and CHG groups, respectively. When compared to the S group, ARI rates were lower in the ES (RR: 0.82; 95% CI: 0.80, 0.87) group but not in the CHG (RR: 1.07; 95% CI: 1.03, 1.11) group. ARI rates were lower in the ES as compared to the CHG groups (RR: 0.78; 95% CI: 0.75, 0.81). Rates were highest during the winter, 38.3 (95% CI: 36.8, 40.0) cases per 1000 person-weeks. ARI rates in the winter did not differ between the ES and S groups (RR: 0.93; 95% CI: 0.84, 1.03), but were higher in the CHG as compared to the S groups (RR: 1.33; 95% CI: 1.20-1.48).

Conclusions. Promotion of personal hygiene-based measures among military trainees was associated with a reduction in ARI. CHG did not have added benefit for ARI prevention. Routine application of preventive measures, especially hand hygiene, may reduce rates of ARI and other infectious diseases (e.g. diarrheal diseases) that are common to congregate military populations.

Background

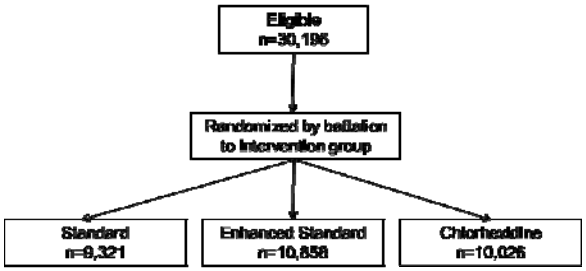
- Military personnel in congregate settings (e.g. training environments) are at increased risk for acute respiratory infection (ARI), due to crowded living conditions, frequent physical contact, and inadequate access to hygiene. Because outbreaks of ARI can interrupt training cycles and compromise troop readiness, effective strategies for the prevention of ARI among military populations are needed.
- Routine immunization of military recruits for influenza and adenovirus has led to dramatic declines in rates of febrile respiratory illness in the training setting and remains an important strategy for ARI prevention in this population. However, there are several other common respiratory pathogens for which vaccines do not currently exist.
- In the absence of vaccination for all common causes of ARI, the promotion of personal hygiene practices (e.g. frequent handwashing, utilization of alcohol-based hand sanitizers, etc.) remains a central component of current ARI prevention strategies among military recruits.

Methods

- We conducted a large-scale, field-based, cluster-randomized trial for the prevention of skin and soft tissue infection (SSTI) among US Army trainees at Fort Benning, GA from 5/2010-1/2012. The study population was comprised of US Army soldiers undergoing 14-week Infantry training at Fort Benning, Georgia. The population was all male, between 17-42 years of age, ethnically diverse, and in generally good physical condition.
- There were three study groups, each comprised of two battalions of trainees (~10,000 soldiers per group; Figure 1). Each group (Standard [S], Enhanced Standard [ES], and Chlorhexidine [CHG]) was assigned an intervention consisting of incrementally increasing personal hygiene measures.
  - S group received a preventive medicine briefing on methicillin-resistant *Staphylococcus aureus* (MRSA) SSTI prevention upon entry.
  - ES group received the components of the S group in addition to supplemental MRSA SSTI prevention materials (e.g. a pocket card and posters in the barracks).
  - CHG group received the components of the ES group in addition to a CHG-based body wash (Hibiclens®, Mölnlycke Heath Care, Norcross, Georgia) to use once-weekly while showering.
- We reviewed the Armed Forces Health Longitudinal Technology Application (AHLTA), a military health system electronic database for outpatient visits, for medically-attended cases of ARI presenting to the troop medical clinic at Fort Benning during the time of the trial (5/2010-1/2012).
- Specifically, the ARI case definition was any occurrence of the following International Classification of Disease, 9th Revision, Clinical Modification (ICD-9) symptom or disease-specific codes: 460-466, 480-488, and specifically 465.9, 482.9, 486 and 487.1. Data abstractors were blinded to the study group assignment of cases.
- Rate calculations included all ARI-associated visits, allowing multiple visits per individual. Overall and seasonal incidence rates were reported as the number of cases per 1000 person-weeks of training. Binomial distributions of incidence rates were used to generate 95% confidence intervals (CI). Incidence density ratios were compared using Fisher's test.
- Analysis was performed using Microsoft Excel (Microsoft Corporation, Redmond, WA), Stata® 12.1 (StataCorp, College Station, TX), and OpenEpi.

Results

Figure 1. Numbers of US Army trainees participating in a three-group cluster-randomized trial at Fort Benning, GA



- Over a 20-month period and among ~30,000 trainees, a total of 13,949 ARI episodes were identified, 4,365 (31.3%) in the standard group; 4,426 (31.7%) in the enhanced standard group; and 5,158 (36.9%) in the CHG group (Table 1).
- The overall ARI rate was 33.9 cases per 1,000 person weeks (95% CI, 33.3, 34.5). By study group, ARI rates were 35.3 per 1,000 person weeks in the standard group (95% CI, 34.3, 36.3); 29.3 in the enhanced standard group (95% CI, 28.5, 30.2); and 37.7 in the CHG group (95% CI, 36.7, 38.7).
- When compared with the standard group, ARI rates were lower in the enhanced standard group (RR, 0.82; 95% CI, 0.80, 0.87) and marginally higher in the CHG group (RR, 1.07; 95% CI, 1.03, 1.11). The enhanced standard:CHG group RR was 0.78 (95% CI, 0.75, 0.81). (Table 1).

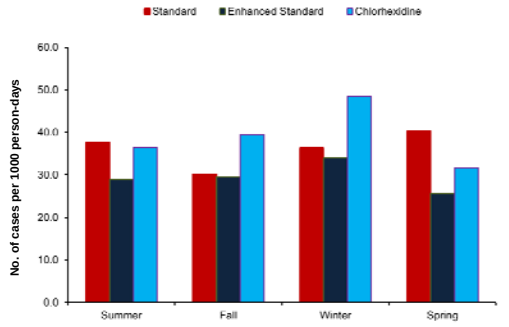
Table 1. Incidence density and case characteristics of acute respiratory infection among US Army trainees participating in a cluster-randomized trial utilizing personal hygiene-based measures

	Study Group		
	Standard	**Enhanced Standard**	**Chlorhexidine**
Number of Episodes	4,365	4,426	5,158
Incidence Density (95% CI) ‡	35.3 (34.3, 36.3)	29.3 (28.5, 30.2)	37.7 (36.7, 38.7)
Rate Ratio (95% CI) ¢	-	0.82 (0.80, 0.87)	1.07 (1.03, 1.11)
Number of Cases	2,803	2,941	3,353
Median (range) number of days from training start to first ARI episode	26 (2-98)	36 (6-98)	31 (3-89)
Number (%) of subjects with >1 visit for ARI	975 (34.8)	954 (32.4)	1,177 (35.1)

‡ Reported as the number of cases per 1,000 person-weeks; CI: confidence interval; ¢Standard group as reference

- Overall ARI rates were highest during the winter months. By season (Figure 2), enhanced standard:standard RRs were as follows: summer (RR, 0.77; 95% CI, 0.72–0.83), fall (RR, 0.97; 95% CI, 0.91–1.05), winter (RR, 0.93; 95% CI, 0.84–1.03), and spring (RR, 0.63; 95% CI, 0.57–0.70). When compared to the standard group, ARI rates in the CHG group were lower only in the spring (RR, 0.79; 95% CI, 0.72–0.86).

Figure 2. Incidence of acute respiratory infection among US Army trainees, by study group and season, 2010-2012



ES:S Rate Ratio (95% CI)	0.77 (0.72, 0.83)	0.97 (0.91, 1.05)	0.93 (0.84, 1.03)	0.63 (0.57, 0.70)

Conclusions

- We observed a beneficial secondary effect of the intervention, namely a reduction in rates of ARI among groups randomized to receive additional education-based prevention components.
- There did not appear to be a protective effect attributable to Chlorhexidine alone. The supplemental education of trainees on personal hygiene practices for SSTI may have conferred cross-protection against ARI. Increased frequency of handwashing would likely interrupt the transmission of pathogens and minimize the occurrence of secondary cases of ARI.
- This study lends further evidence that routine application of hygiene measures, especially hand hygiene, may reduce rates and prevent outbreaks of ARI and other infectious diseases (e.g. diarrheal disease) that are common to congregate military populations.

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