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## Reduction in Acute Respiratory Infection Among Military Trainees: Secondary Effects of a Hygiene-Based Cluster-Randomized Trial for Skin and Soft-Tissue Infection Prevention

Military trainees are at increased risk for acute respiratory infection (ARI).<sup>1,2</sup> ARI outbreaks interrupt training and compromise troop readiness. Mitigating the risk requires prevention strategies. A skin and soft-tissue infection (SSTI) prevention trial was conducted among Army trainees.<sup>3</sup> Training companies were randomized to 1 of 3 groups with incrementally increasing education- and personal hygiene-based measures. The principal components were promotion of handwashing in addition to a once-weekly application of chlorhexidine-based body wash. Anticipating that these SSTI prevention measures would reduce the burden of other infections,<sup>4</sup> we evaluated their impact on ARI. We observed a reduction in ARI among trainees who were educated on personal hygiene practices. The use of a chlorhexidine-based cleanser had no impact on ARI.

### METHODS

We conducted a cluster-randomized SSTI prevention trial among Army trainees at Fort Benning, Georgia.<sup>3</sup> There were 3 study groups (standard, enhanced standard, and

chlorhexidine [CHG]), each with ~10,000 trainees. Each group was assigned an intervention consisting of incrementally increasing education- and personal hygiene-based measures.<sup>3</sup> The standard group trainees received a SSTI prevention brief upon entry. The enhanced standard group trainees received the standard group components in addition to supplemental materials (ie, a pocket card and posters in the barracks). The CHG group trainees received the enhanced standard group components in addition to a CHG-based body wash (Hibiclens, Mölnlycke Health Care, Norcross, Georgia). Trainees were instructed to use the wash once weekly for the entire training period. All trainees sought care at a single outpatient clinic.

For a planned secondary objective of the trial, we reviewed an electronic database (Armed Forces Health Longitudinal Technology Application, AHLTA) to identify medically attended, outpatient cases of ARI in the study population. The case definition was any occurrence of the following International Classification of Disease, 9<sup>th</sup> 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 group assignment.

Rate calculations included all ARI-associated visits, allowing multiple visits per individual. Rates are the number of cases per 1,000 person weeks. Binomial distributions were used to generate 95% confidence intervals (CIs). Rate ratios (RRs) were compared using Fisher's exact test.

Statistical analyses were performed using Microsoft Excel (Microsoft Corporation, Redmond, WA), Stata 12.1 (StataCorp, College Station, TX), and SAS 9.3 (SAS Institute, Cary, NC).

### RESULTS

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).

Overall rates were highest in winter. By season, 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).

Case characteristics are presented in the Table 1. The most common code was acute upper respiratory infection not

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, No.<br>(95% CI) | Chlorhexidine, No.<br>(95% CI) |
| No. of episodes   | 4,365            | 4,426                              | 5,158                          |
| Incidence density (95% CI) <sup>a</sup>                             | 35.3 (34.3–36.3) | 29.3 (28.5–30.2)                   | 37.7 (36.7–38.7)               |
| Rate ratio (95% CI) <sup>b</sup>                                    | ...              | 0.82 (0.80–0.87)                   | 1.07 (1.03–1.11)               |
| No. of cases  | 2,803            | 2,941                              | 3,353                          |
| Median (range) no. of days from training start to first ARI episode | 26 (2–98)        | 36 (6–98)                          | 31 (3–89)                      |
| No. (%) of subjects with >1 visit for ARI                           | 975 (34.8)       | 954 (32.4)                         | 1,177 (35.1)                   |

NOTE. CI, confidence interval.

<sup>a</sup>Reported as the number of cases per 1,000 person weeks.

<sup>b</sup>Standard group as reference.

otherwise specified ( $n = 7,182$ ; 52.9%). Other frequent diagnoses were acute pharyngitis ( $n = 1,749$ ; 12.9%), acute nasopharyngitis ( $n = 1,694$ ; 12.5%), and pneumonia, organism unspecified ( $n = 1,458$ ; 10.9%). The distribution of diagnoses did not differ by study group.

## DISCUSSION

In the context of an SSTI prevention trial, we observed a reduction in ARI rates among military trainees who received educational briefs and materials on personal hygiene practices. When compared with the standard group, ARI rates in the enhanced standard group were ~20% lower, strengthening the evidence that promotion of good hand hygiene can reduce the burden of ARI in the military training setting, where crowded living conditions and frequent physical contact puts trainees at increased risk for disease. Use of a chlorhexidine-based cleanser had no impact on ARI.

The findings of our study are consistent with other military-based ARI prevention interventions. Promotion of hand hygiene (ie, frequent handwashing, use of hand sanitizer) among military recruits was associated with 40%–45% reductions in respiratory illness.<sup>5,6</sup> While the primary focus of our trial was SSTI prevention, it is likely that overall improvement in personal hygiene practices, namely handwashing, interrupted the transmission of respiratory pathogens and prevented secondary ARI cases in this vulnerable population.<sup>7</sup>

This investigation had both strengths and weaknesses. This study was nested in a large field-based, randomized controlled trial and utilized clinic-based medical records. Because trainees sought care at a single medical clinic, we captured all clinical encounters. However, we did not capture cases for those who either did not seek care for their illness, or who presented directly to the hospital, nor did we have information on etiology. Lastly, we did not measure the trainees' frequency of personal hygiene practices during the training period.

In summary, we observed a reduction in ARI rates among military trainees who received additional education on

personal hygiene practices. These same measures were associated with a reduction in acute gastroenteritis in this population.<sup>4</sup> We conclude that routine promotion of personal hygiene, especially hand hygiene, remains an important strategy for the prevention of infectious diseases among military trainees.

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