

The association between handwashing practices and illness symptoms among college students living in a university dormitory

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We describe handwashing practices, the association of handwashing with upper respiratory and gastrointestinal symptoms, and the effects of gender on handwashing practices among male ($n = 215$) and female ($n = 243$) college students. Self-reported frequency of handwashing was not associated with infectious illness symptom reporting. Only a small proportion of males (10%) and females (7%) reported "always" washing their hands before eating. Females were more likely than males to always wash their hands after urinating (69% vs 43%; $P < .0001$) and after a bowel movement (84% vs 78%; $P = .14$). Identifying new strategies to increase handwashing may help prevent infectious disease transmission in residence hall environments. (Am J Infect Control 2008;■:■■■■-■■■.)

Handwashing prevents the direct transfer of infectious pathogens on the hands from reaching a portal of entry and the indirect transfer through food preparation and fomite transmission pathways.^{1,2} Handwashing may make the difference between a successful recovery and a health care-associated infection, which account for ~1.7 million infections and 99,000 associated deaths each year in American hospitals alone.³ Although several studies have examined handwashing in daycare centers and elementary schools,⁴⁻⁸ few studies have been conducted in college-aged students. One study of 391 students living in 4 university residence halls used an educational message campaign to promote hand hygiene.^{9,10} Students in the experimental group washed their hands and used gel sanitizers more often than those in the control group and reported significantly fewer upper respiratory illness symptoms. Several design issues limit the inference of these study findings, however, including lack of

formal randomization and adjustment for clustering of subjects within a residence hall.

In the present study, we evaluated handwashing practices among 468 college students, the association with upper respiratory and gastrointestinal symptoms, and the effects of gender on handwashing practices.

METHODS

Handwashing practices were assessed among participants in a study of group B *Streptococcus*.¹¹ In brief, 738 male and female college students living a single first-year dormitory at the University of Michigan, Ann Arbor during January and February 2001 were invited to participate, through a flyer placed in dormitory mailboxes. Participants were sampled by dorm floor. A total of 463 of the 738 students (63%) elected to participate. After providing consent, each participant was given a self-administered questionnaire regarding hand hygiene practices. The study protocol was approved by the University of Michigan's Human Subjects Institutional Review Board.

Data analysis

The frequency of categorical variables, including gender, age, race/ethnicity, antibiotic use, and different handwashing practices, was evaluated using simple descriptive statistics and χ^2 tests to assess differences in the proportions of participants reporting specific handwashing practices by gender. The associations between different handwashing practices were assessed using the Cochran-Armitage trend test. Associations between self-reported illness and handwashing practices were assessed using logistic regression models, with

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Table 1. Self-reported frequency of handwashing practices during the previous 2 weeks, by gender, in 215 men and 243 women living in a first-year dormitory, University of Michigan, Ann Arbor, 2001

Characteristic	Female, % (n)	Male, % (n)	P value*
Handwashing frequency			
≤ 3 times/day	24 (60)	42 (91)	
3.1 to 5.9 times/day	39 (95)	39 (83)	< .0001
≥ 6 times/day	36 (88)	19 (41)	
Handwashing before eating			
Never	7 (17)	8 (17)	
Rarely	45 (109)	49 (105)	.41
Frequently	41 (99)	33 (72)	
Always	7 (18)	10 (21)	
Handwashing after urinating			
Never/rarely	6 (14)	21 (45)	
Frequently	25 (61)	36 (77)	< .0001
Always	69 (168)	43 (93)	
Handwashing after bowel movement			
Never/rarely	3 (7)	6 (12)	
Frequently	13 (31)	17 (36)	.14
Always	84 (205)	78 (167)	
Good handwasher [†]			
No	62 (153)	77 (166)	
Yes	38 (93)	23 (50)	.0007

* χ^2 test for homogeneity P value, testing equality of proportions over males and females for different handwashing practices.

[†]“Good handwashers” washed their hands “frequently/always” before eating and “always” after urinating and after a bowel movement.

generalized linear mixed models to adjust for cluster sampling and control for potential confounders.

RESULTS

Overall, 246 female students and 217 male students enrolled in the study, and 243 females and 215 males reported their handwashing practices. Most participants were age 18 to 19 years and identified themselves as Caucasian (87%). More females than males washed their hands 6 or more times per day (36% vs 19%; $P < .0001$). There were no significant differences by gender in handwashing before eating ($P = .40$); only small proportions of males (10%) and females (7%) reported “always” washing their hands before eating. Females were more likely than males to report always washing their hands after urinating (69% vs 43%; $P < .0001$) and after a bowel movement (84% vs 78%; $P = .14$) (Table 1).

Because antibacterial hand soap was the only type of soap available in dormitory bathrooms, about 97% of the students reported using it. Students reported frequent use of antibacterial hand lotion (56%). Females were more likely than males to frequently or always use antibacterial hand soap (84% vs 75%; $P = .06$) and antibacterial hand lotion (25% vs 12%; $P < .0001$).

Association between handwashing practices and illness symptoms

No significant associations were found between handwashing frequency and gastrointestinal, upper respiratory, urinary, or vaginal symptoms. Moreover, no statistically significant associations were found between selected general illness symptoms and good handwashing practices in both unadjusted analyses and analyses adjusted for gender, antibiotic use, antibacterial hand lotion, and recent sexual activity (Table 2). Finally, no significant associations were found between antibacterial hand soap/antibacterial hand lotion use and illness symptoms; good handwashers and others reported the same frequency of doctor visits (12% vs 13%; $P = .7$).

DISCUSSION

No statistically significant association was found between selected illness symptoms and good handwashing practices, although trends suggested some reduction in selected upper respiratory infection symptoms. Adjustment for daily handwashing frequency, antibiotic use, antibacterial hand lotion use, and recent sexual activity did not influence the effect of good handwashing practices on upper respiratory infection symptoms. Consistent with other observational studies of handwashing practices in hospitals and public areas,¹²⁻¹⁵ females were more likely to wash their hands at critical points and to wash their hands more frequently than males.

There is much controversy regarding the added benefit of handwashing for reducing respiratory illnesses, such as influenza. Some studies showed a stronger effect of handwashing in reducing gastrointestinal rather than respiratory illnesses.^{16,17} The multiple modes of respiratory infection transmission may render the effectiveness of handwashing interventions suboptimal unless they are combined with methods to reduce airborne or aerosol transmission. Our study found no protective effects of handwashing practices on gastrointestinal illness symptoms, however. Many gastrointestinal illnesses are food-borne and may be related to food preparation. Because these students were not preparing food, the absence of association between handwashing and gastrointestinal illness symptoms is not surprising.

Although the response rate was good for an observational study (63%), it was lower than desirable, particularly if nonresponses were associated with both handwashing and illness reporting. We have no reason to believe that this occurred, however. Other factors that we did not assess, such as frequency of showering and the cleanliness of the immediate living environment, also may be associated with illness.

Table 2. Associations among selected symptoms and good handwashing practices adjusted for gender, antibiotic use, antibacterial hand lotion, and recent sexual activity in 215 men and 243 women living in a first-year dormitory, University of Michigan, Ann Arbor, 2001

General symptom	Good handwasher*		Association of good handwashing with symptom		
	Yes (n = 143), % (n)	No (n = 319), % (n)	Overall	Females	Males
			OR (95% CI)	OR (95% CI)	OR (95% CI)
Runny nose	66.2 (94)	66.8 (213)	0.97 (0.64 to 1.49)	0.92 (0.49 to 1.07)	1.03 (0.68 to 1.56)
Itchy eyes	12.7 (18)	11.9 (38)	0.97 (0.53 to 1.79)	1.30 (0.73 to 2.31)	0.93 (0.51 to 1.70)
Fever	6.3 (9)	4.1 (13)	0.61 (0.25 to 1.47)	0.81 (0.34 to 1.93)	0.63 (0.26 to 1.50)
Cough	36.2 (51)	34.8 (111)	0.98 (0.65 to 1.50)	1.29 (0.87 to 1.91)	0.94 (0.62 to 1.42)
Sore throat	33.1 (47)	40.3 (128)	1.42 (0.93 to 2.16)	1.26 (0.86 to 1.84)	1.36 (0.90 to 2.06)
Earache	7.0 (10)	9.1 (29)	1.42 (0.66 to 3.02)	1.53 (0.77 to 3.01)	1.32 (0.63 to 2.79)
Vomiting	5.6 (8)	4.4 (14)	0.85 (0.34 to 2.10)	1.90 (0.75 to 4.80)	0.77 (0.32 to 1.88)
Diarrhea	21.8 (31)	21.9 (70)	1.06 (0.66 to 1.73)	1.40 (0.89 to 2.20)	1.01 (0.62 to 1.62)

CI, confidence interval; OR, odds ratio.

*"Good handwashers" washed their hands "frequently/always" before eating, and "always" after urinating and after a bowel movement.

In conclusion, we found significant differences between male and female handwashing practices in our college students. Self-reported frequency of handwashing was not associated with infectious illness symptom reporting. Less than half the students frequently or always washed their hands before eating. Identifying new strategies to increase handwashing may help prevent infectious disease transmission in residence hall environments.

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