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# Impact of Hand Washing Instructions on Hand Hygiene Practices at the University of Central Oklahoma

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**Abstract:** Washing hands with soap and water has long been considered an effective way to reduce the spread of infectious disease, yet hand washing compliance has historically been low, even in health care institutions. Studies conducted in health care institutions have shown that compliance can be improved with intervention, principally through the potential for punishment. In a public setting, the threat of punishment is not a viable option; therefore other methods are employed to promote hand washing compliance. Over a period of two months hand washing practices were observed in various restrooms on the UCO campus before and after hand washing instructions were placed in the restrooms. The percentage of subjects who washed their hands for at least 30 seconds, which is the Centers for Disease Control (CDC) recommendation, improved from 23% to 27% after hand washing instructions were placed in designated restrooms. This improvement was not statistically significant and indicates that placing signs in restrooms is not sufficient to improve hand washing practices on the UCO campus. ©2016 Oklahoma Academy of Science

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## Introduction

Washing hands with soap and water has long been considered an effective way to reduce the spread of infectious disease. In 1861 Semmelweis was the first to demonstrate the role of hand hygiene in reducing the risk of transmitting disease from person-to-person (Wiese 1930). Since that time there have been several studies that have demonstrated the benefits of hand washing to inhibiting the spread of disease. For example, several studies demonstrated that a variety of hand washing approaches in areas of low income or limited access to piped water were effective at reducing the level of coliform contamination from hands (Hoque 1991, Hoque 1995, Burton, 2011). Hand washing has also been suggested to potentially reduce the risk of spreading diarrheal diseases

(Ejemot 2008) and according to the Centers for Disease Control and Prevention (CDC) poor handwashing practices contributes to almost 50% of all foodborne illness outbreaks (Mead et al., 1999). A meta-analysis of hand washing studies by Aiello and colleagues in 2008 found that the incidence of respiratory illness was reduced by an average of 21% in various environments (Aiello et al, 2008). A field study conducted in Tanzania demonstrated that hand washing with soap reduced the presence of *E. coli* and fecal streptococci by 0.50 and 0.25 log per hand, respectively (Pickering et al. 2010). A study published in 2011 demonstrated that hand washing with water alone reduced the prevalence of bacteria on the hands of study volunteers by 21%, whereas washing with soap and water reduced the prevalence of bacteria by 36% (Burton 2011). Mortimer and colleagues demonstrated that hand washing reduces

*Staphylococcus aureus* transmission several fold. They found that the transmission rate of *S. aureus* from nurses to babies when nurses did not wash their hands was 43%, while the transmission rate was only 14% when nurses did wash their hands (Mortimer 1962).

Self-reporting of hand washing practices in the U.S. tends to be exaggerated. Surveys conducted in 2009 and 2010 involving approximately 3,500 people indicated that about 95% of those surveyed stated that they always wash their hands after using public restrooms (QSR Magazine 2009, Harris Interactive 2010). However, actual studies of handwashing practices conducted by The American Society for Microbiology and the American Cleaning Institute in public restrooms across the country showed that roughly 85% of the observed adults washed their hands to some degree after using a public restroom. (Harris Interactive 2010). The Center for Disease Control (CDC) recommends and publishes guidelines for hand washing using soap and water for at least thirty seconds (CDC 2015). The number of people who actually wash their hands following these guidelines is likely very low. Indeed one report in which roughly 3,300 subjects were observed washing their hands after using the restroom, only 6% washed their hands for at least 15 seconds (Borchgrevink et al. 2013). The impact of washing time on the reduction of bacteria from the hands has been studied. For example, Rotter and colleagues demonstrated that hand washing with plain soap and water for 15 seconds reduced bacterial counts by 0.6-1.1  $\log_{10}$ , whereas washing for 30 seconds reduced counts by 1.8-2.8  $\log_{10}$  (Rotter 1999) while Fuls et al. demonstrated that washing hands with nonantibacterial soap for 15 or 30 seconds specifically reduced the level of *Shigella flexneri* by approximately 1.7  $\log_{10}$ /hand (Fuls et al. 2008).

The purpose of this study was to determine the impact of placing hand washing instructions in UCO restrooms on the hand hygiene practices of people on the UCO campus. The hypothesis was that placing instructions in the rest rooms would significantly improve hand washing practices.

## Methods

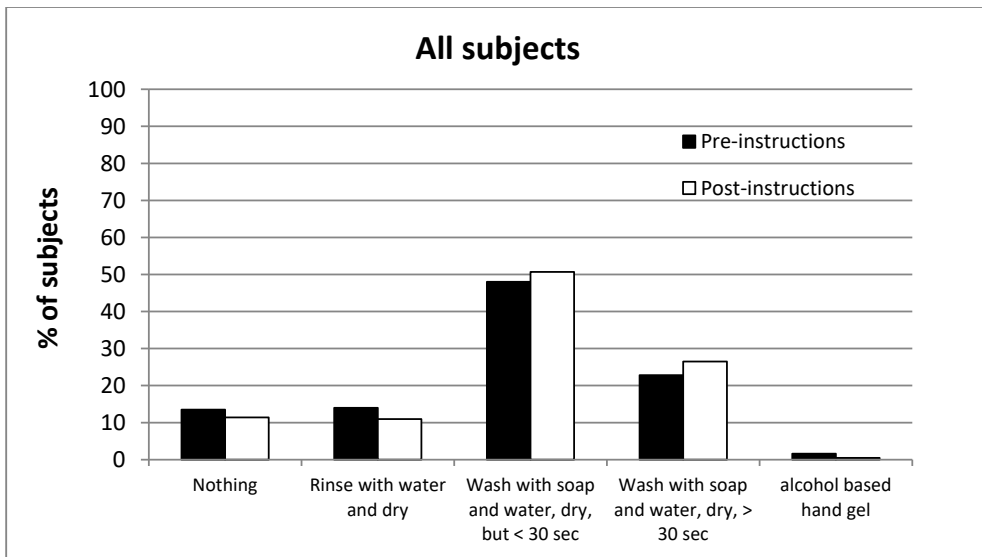
**Data collection.** This study was carried out as part of an active learning exercise in a Microbiology for Majors course in the fall of 2012 after students had completed the NIH training for Protecting Human Research Participants and under UCO IRB approval. After using the rest rooms, subjects were observed as to how they washed their hands before exiting the rest room. Student researchers used a data collection sheet to mark a box corresponding to how the subjects washed their hands. Hand washing practices were recorded into five categories: nothing, rinse with water and dry, wash with soap and water and dry, but < 30 seconds, wash with soap and water and dry > 30 seconds, and alcohol based hand gel. Hand washing practices were observed before and after instructions were posted in the rest rooms. Before and after data was collected in the same rest rooms for a period of 4 to 5 weeks respectively. Student researchers did not interact with the rest room users in any way.

**Statistical analysis.** Two sample t-tests between percents were used to determine if there were statistically significant differences between hand washing practices between groups before and after placing instructions in the designated restrooms.

## Results and Discussion

Before hand washing instructions were placed in restrooms a total of 312 adult subjects (157 males and 155 females) were observed for their hand washing practices. After hand washing instructions were placed in restrooms at total of 219 adult subjects (115 males and 104 females) were observed for their hand washing practices. Prior to instructions being placed in the designated restrooms 13.5% of all subjects did not wash their hands after using the restroom, 70.8% of all subjects washed their hands with soap and water to some degree, and only 22.8% of all subjects washed their hands with soap and water for at least 30 seconds per CDC recommendations (Figure 1).

These results are not too dissimilar from



**Figure 1. Hand washing results for all male and female subjects pre and post-instructions. Pre-instructions n = 312. Post-instructions n = 219.**

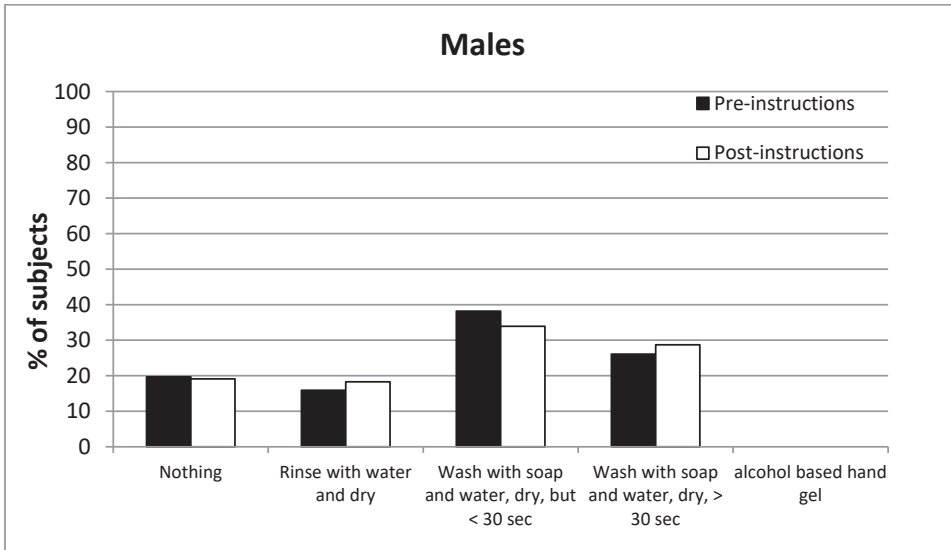
a study of hand washing practices in public restrooms in a Michigan college town. The authors of that study found that approximately 11% of subjects did not wash their hands at all, and when they did wash their hands, approximately 64% used soap and water to some degree (Borchgrevink et al. 2013). We also found that in general women tend to exhibit better hand washing practices than males. Prior to instructions being placed in the restrooms, 19.7% of males did not wash their hands at all, while only 7.1% of the females did not wash their hands at all (Figures 2 and 3). This too is in agreement with previous reports (Judah et al. 2009, Borchgrevink et al. 2013).

After placing instructions in the designated bathrooms, the percentage of all subjects who did not wash their hands dropped to 11.4%, those who washed their hands with soap and water to some degree increased to 77.2%, and the percentage of subjects who washed their hands for at least 30 seconds increased to 26.5%. These changes in hand washing practices were not statistically significant (Figure 1). In fact there were no significant differences in any of the hand washing practices of all the subjects. The percentage of subjects who only rinsed their

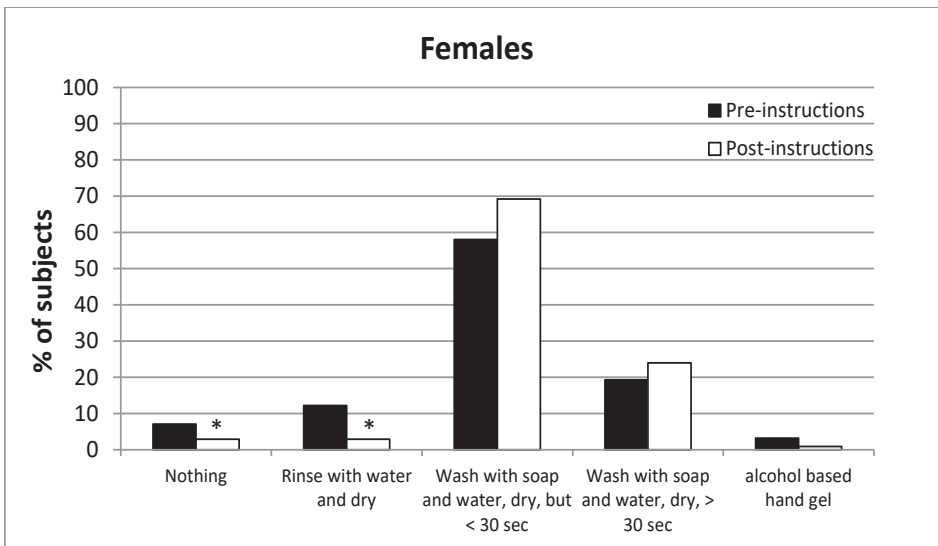
hands with water dropped from 14.0% to 11.0% ( $p = .308$ ). The percentage of subjects who used soap and water for less than 30 seconds rose from 48% to 50.7% ( $p = .496$ ). A previous study to evaluate the efficacy of various electronic messages in public restrooms to improve hand washing practices found that these forms of intervention only modestly improved hand washing practices and was dependent on the type of electronic message being used (Judah et al. 2009).

In our study, males demonstrated no significant changes in hand washing behavior after instructions were posted (Figure 2). The percentage of males who washed their hands with soap and water for at least 30 seconds increased only 2%. The percentage of males who did nothing or just rinsed with water was essentially unchanged. The percentage of males who washed their hands with soap and water for less than 30 seconds dropped from 38.2% to 33.9%. The percentage of males who used soap and water for some period of time went from 64.3% to 62.6%.

Unlike males, females did demonstrate some significant changes in hand washing behavior



**Figure 2. Hand washing results for all male subjects pre and post-instructions. Pre-instructions n = 157. Post-instructions n = 115.**



**Figure 3. Hand washing results for all female subjects pre and post-instructions. Pre-instructions n = 155. Post-instructions n = 104.**

after instructions were posted (Figure 3). The percentage of females who washed their hands with soap and water for at least 30 seconds increased 4.7%. The percentage of females who did nothing or just rinsed with water dropped significantly from 7.1% down to 2.9% ( $p < 0.05$ ). The percentage of females who washed

their hands with soap and water for less than 30 seconds increased from 58% to 69.2%. The percentage of females who used soap and water for some period of time significantly increased from 77.3% to 93.2%.

Although placing hand washing instructions

in the restrooms did not significantly improve the percentage of people washing their hands according to CDC recommendations, there was a slight improvement in the percentage of people using soap and water. A similar study conducted on the campus of Pennsylvania State University approximately a decade earlier reported that in general hand washing practices were better in the presence of signs (Johnson et al. 2003). However, the authors of that study did not determine the length of hand washing time, which makes it impossible to know if the hand washing that did take place before or after signage was placed in the restrooms was in accordance with CDC recommendations. Therefore, our study provides a more in depth look at the quality of hand washing. Our findings that females in general demonstrated better hand washing practices than males and showed the greatest improvement in hand washing practices after signs were posted is consistent with previous studies (Judah et al. 1999, Johnson et al. 2003, Borchgrevink et al. 2013). While this study was intended to evaluate the impact of placing hand washing signs in restrooms on hand washing practices, we did not take into consideration the design, size, or number of signs placed. Additionally we did not survey individuals exiting the restrooms to determine whether or not they even saw the signs. Therefore we are not able to make any comparisons between the way men and women respond to hand washing signs in restrooms. In order to better understand the impact of signage on hand washing practices, these factors would need to be taken into consideration in future research.

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