



Food Workers' Perspectives on Handwashing Behaviors and Barriers in the Restaurant Environment

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Abstract

Food handler focus groups in two Oregon counties discussed knowledge, practices, and barriers related to handwashing in the restaurant environment. Current knowledge-based handwashing training programs do not address the internal and external barriers that affect handwashing practice. According to the focus groups, important barriers were time pressure, inadequate facilities and supplies, lack of accountability, lack of involvement of managers and coworkers, and organizations that were not supportive of handwashing. Because barriers to handwashing are multi-dimensional in nature, the authors recommend that future educational and training programs include 1) a hands-on training program that orients new employees to correct handwashing practice and more advanced education about foodborne illness; 2) involvement of both managers and coworkers in the training; 3) easily accessible handwashing facilities stocked with necessary supplies; 4) continued handwashing training and support involving the food service industry, managers, and coworkers; and 5) involvement of health departments and inspectors in providing managers and food workers with advice and consultation on improvement of handwashing practice.

Introduction

As the purchase and consumption of meals from restaurants increase, proper and adequate hand hygiene at food preparation facilities is of increasing importance. Foodborne disease has both public health and economic impacts at the local, national, and international levels. Approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths are caused in the United States each year by foodborne diseases (Mead et al., 1999). For more than a

century, handwashing has been recognized as an essential component in the prevention of the spread of microbial infection (Fendler, Dolan, & Williams, 1998). Poor personal hygiene, including inadequate handwashing among food handlers, is a common practice that contributes to foodborne illness in retail establishments (De Waal, 1996; Lynch, Elledge, Griffith, & Boatright, 2003; Food and Drug Administration [FDA], 2004). Improvement of food workers' handwashing practice is, there-

fore, crucial to reducing the incidence of foodborne illness.

Few studies have been carried out specifically among food workers to determine the barriers and problems that may prevent them from implementing good handwashing practices in restaurants (Clayton, Griffith, Price, & Peters, 2002; Green & Selman, 2005; Green et al., 2006). Food-handling practices, food handler perceptions, restaurant kitchen policies, lack of supervisory or peer support, and lack of proper equipment such as sinks, hot water, and soap are all factors that have been suggested as barriers (Clayton et al., 2002; Dippold, Lee, Selman, Monroe, & Henry, 2003; Green & Selman, 2005; Howes, McEwen, Griffiths, & Harris, 1996). Observational studies have found unacceptably low rates of hand hygiene practices (Clayton & Griffith, 2004; FDA, 2004; Green et al., 2006). Given the paucity of information on this important topic, we developed a study to directly ask food handlers in Oregon about their knowledge, their practices, and barriers related to handwashing in the restaurant environment. The study also sought to identify positive influences that promote handwashing in restaurant kitchens. The research was developed by the Environmental Health Specialists-Net (EHS-Net) with support by the Centers for Disease Control and Prevention (CDC), the Oregon Department of Human Services (ODHS), and Oregon State University (OSU).

TABLE 1**Focus Group Questions**

Question Type	Question	Intent of the Question
Opening question		
	Would you please briefly introduce to us what kind of restaurant you work for, what kind of work you do in that restaurant, and how long you have been working in restaurant kitchens?	The intent of the opening question was to help people feel comfortable and begin conversation. The question began the process of encouraging all participants to contribute to the discussion.
Introductory question		
	What do you do to wash your hands in the workplace?	The intent of the introductory question was to identify the primary topic of handwashing and provide a way for participants to give a description of their handwashing practice, handwashing knowledge, and personal connection to the issue. This question also gave the focus group facilitator and researcher an indication of what major themes would emerge.
Key questions		
	What gets in the way of you washing your hands or others washing their hands?	The intent of the key questions was to examine the focus group topics of handwashing attitudes and barriers. Because these questions were more exploratory, they were given the majority of discussion time and required the greatest amount of time during analysis.
	What do people need in your workplace to wash their hands the way the guidelines recommend?	
Ending question		
	Are there any last comments or questions before we wrap up this evening?	The intent of the ending question was to bring closure to the focus group and to elaborate on main themes identified by participants. This question ensured that all participants had had the opportunity to include additional comments and remark on key areas that might have been overlooked.

Methods

The study used focus groups to interview food workers actively employed in restaurants in two Oregon counties. Focus groups are unstructured interviews with small groups of people who are interviewed as a group by a group facilitator. The discussion concentrates on a particular issue or topic (the “focus”). The investigator, who has a specific research agenda, uses the responses from the group interview as data (Lobdell, Gilboa, Mendola, & Hesse, 2005). Focus groups have been particularly effective in providing information about why people think or feel the way they do, and group interaction provides more insight into why certain opinions are held (Redmond & Griffith, 2003; Lobdell et al., 2005). The impetus for using a focus group design in our study was the desire not only to involve food workers in exploring handwashing knowledge, attitudes, practices and barriers, but also to start a collaborative action to formulate solutions (Chioncel, Van der Veen, Wildemeersch, & Jarvis, 2003). Food workers participating in the two focus groups served as “panels of experts” involved in a cooperative exploration of handwashing practices based on participants’ experience

in restaurants. Approval from both OSU’s Institutional Review Board for the Protection of Human Subjects and the ODHS Institutional Review Boards was received before we initiated the study.

Focus Group Recruitment

Food workers were invited to participate in a focus group through recruitment phone calls to their restaurants. Restaurants to which recruiting calls were placed were randomly chosen from lists of all restaurants in Multnomah and Benton Counties; the lists were provided by county environmental health supervisors in each of the two counties. Multnomah County is a densely populated metropolitan area, while Benton County is a less populated, more rural area. The recruitment call invited food workers to attend an evening focus group during their personal, nonwork time. The call outlined the study design, the risks, the benefits, the compensation, and the informed-consent process. Food workers were not asked to make an immediate decision about participation, but were instead provided with the researcher’s phone number so that they could call if they desired to participate. Criteria for partici-

tion were that the food worker speak English, be currently working in a restaurant kitchen handling food, have been doing so for at least three months, and be 18 years of age or older.

Food workers who agreed to participate in the focus group received an informational packet including the informed-consent document. Several days before the scheduled focus group, participants received a reminder letter and a reminder telephone call.

Restaurant managers in the two counties were sent a letter describing the study and informing them of the possibility that one of their employees might be participating. To protect the confidentiality of the employee, only general information about the recruiting call and focus groups was provided to the managers. Managers also were informed of whom to contact if they had questions or concerns about the study.

Focus Group Sessions

Recruitment calls made to 150 randomly selected restaurants garnered 18 food workers as study participants. The 18 participants were assembled into two focus groups with nine food workers from each county per group.

Participants were not asked to provide demographic information about themselves. The researcher was, however, able to observe that participants ranged in age from 20 to 65 years and included both males and females.

Each focus group was assembled in a location convenient for participants (Portland, Oregon, in Multnomah County and Corvallis, Oregon, in Benton County), and the sessions were convened in January 2004. A trained facilitator with previous experience leading focus groups asked participants a set of questions concerning handwashing knowledge, attitudes, practices, and barriers. The questions were designed to follow an open-ended, conversational sequence that proceeded from the category of opening questions to the categories of introductory, key, and ending questions (Table 1). Each focus group session lasted approximately one and a half hours, and the sessions were tape-recorded.

Transcripts of the focus groups were used as the basis for the analysis, along with field notes taken by the researcher. The long-table approach was used to identify themes and categorize results (Krueger & Casey, 2000).

Results

Three general themes—handwashing knowledge, barriers to handwashing, and factors that promote handwashing—emerged from the focus group sessions. Participants provided detailed and personal descriptions of the challenges facing food workers when they attempted to practice proper and adequate handwashing in the restaurant environment. Because responses generated from both focus groups were similar, findings for these groups were consolidated.

Handwashing Knowledge

The first line of questioning sought to determine food workers' knowledge of handwashing practices. Participants discussed handwashing materials, handwashing practice, situations, and glove use in relation to handwashing. When asked to describe materials used to wash their hands at work, participants named soap and hot water, paper towels, hand sanitizers, and bleach. Some participants had observed other workers using hand sanitizers without washing their hands: "A lot of people think once they sanitize their hands they don't have to wash their hands. They use it as an alternative."

Participants discussed the use of "bleach buckets" as a replacement for handwashing and mentioned that bleach buckets were

primarily used when they were working on the "cook line" or at the "grill." Participants preferred washing their hands, however, because of the damage bleach did to their skin. When asked to describe how they wash their hands at work, participants described similar practices—using warm water, scrubbing with soap, rinsing with water for 10 to 20 seconds, and drying hands with a disposable towel. Participants indicated that they usually washed their hands after touching their face, nose, eyes, or hair. Several workers said that they routinely washed their hands before food prep, after touching raw food, after making salads, after using the restroom, and after smoking. Participants from both groups emphasized the importance of handwashing when ill. To a lesser degree, workers also said that they washed their hands before handling money, after washing dishes, after using cleaning products, and before putting on gloves.

Participants indicated that they used gloves when handling raw meat, when they had cuts on their hands, and when handling sticky food products. A few participants said that they washed their hands before and after glove use, but most said that consistent handwashing during glove use was not a common practice. Several participants from both groups said that they found glove use to be a nuisance: "Gloves are difficult to deal with because you have to take them off a lot; they get really dirty." Other reasons given for the lack of glove use included concern that gloves slow down the food preparation process, that they make hands sweat and break out into blisters, and that it is dangerous to use gloves near an open flame.

Barriers to Handwashing

A second line of questioning targeted barriers to handwashing. Problems with the availability of supplies and the accessibility of sinks; time pressure, high volume of business, and stress; lack of accountability; type of restaurant; insufficient training received at the restaurant; and inadequate food handler training were barriers mentioned most frequently by participants.

Food workers noted frequent neglect of handwashing facilities, including broken towel and soap dispensers, and lack of hot water and sanitation solutions. Time pressure was consistently mentioned as a negative factor, regardless of how conscientious food workers were about handwashing. Having to complete multiple tasks during a work shift

was also mentioned as a barrier to adequate handwashing. Participants said there was not enough time to visit the sink area after each food preparation task.

Lack of adequate handwashing training at restaurants and the perception that employers did not make training a priority added to the participants' skepticism that handwashing is viewed as a vital practice. Food handler training, as it currently exists for these workers, was not regarded by the majority of participants as an effective method of learning proper handwashing. The food handler's test was referred to as a "memorization thing." Participants commented that "hands-on training" would be more effective in promoting proper handwashing practice.

Factors That Promote Handwashing

Participants discussed positive influences on handwashing within the restaurant environment, including kitchen design and environment, proactive health department and food inspectors, education and training, customer influence, development of good handwashing habits, and personal beliefs and attitudes.

Several design and environmental factors were identified as positively affecting handwashing. Participants reported that handwashing occurred more frequently in kitchens with sinks in close proximity to work stations. Cleanliness of the kitchen and sink areas, and visual reminders such as posters and signs hanging above the sink and in the restrooms were identified as positive reinforcers of the importance of handwashing.

Participants noted that facilities visited by involved and proactive health departments were more likely to be supportive of proper handwashing. They defined food inspectors with positive traits as those who 1) take time to educate during inspections, 2) provide consultation and problem solving, 3) have enough experience to make suggestions for improving handwashing compliance, 4) don't hesitate to say what is wrong, and 5) give updates on forthcoming changes in regulations. Food workers also indicated that time spent on inspecting restaurants and providing education should be increased. A participant commented, "We have that one inspection and then we start to slack."

Food workers were eager to receive additional education and training about the foodborne illnesses that result from not washing their hands during food preparation: "I am very curious. I know germs exist and they are out there. We hear about *Salmonella* and

all that stuff. But I'm curious as to if we don't wash our hands, what is the result? I think we should be educated because I don't really know what happens. I mean yeah, you get sick. But what does *Salmonella* do to a person?"

The lack of accountability was also an issue that participants perceived as important. "I don't think I could tell anyone I work with that they need to wash their hands. I'd get some swear words back in my face." Food workers believed that accountability had to be instilled by managers and by peers. Participants identified several situations in which managers took an active "coaching-style" approach to promoting handwashing: "The manager observes handwashing when you return from the bathroom." "Goals and expectations are explained, including handwashing." "My manager paid for the cost of food handlers' training." "Strict rules are in place about handwashing." "The manager educates new employees on when handwashing is necessary."

Customers also play an important role in food workers' handwashing practices. Participants said they are acutely aware of customers watching them to see if they had washed their hands prior to preparing their food, and that this awareness makes them more conscious of proper handwashing. Participants also said, however, that they were aware when customers didn't notice if they washed their hands: "I notice that people don't even care. Every once in a while somebody will say, 'Oh, did you wash your hands?' And I'll be able to turn around and say, 'Yes I did.' But very rarely do you have anybody say, 'Did you wash your hands?'"

Participants noted that correct handwashing must be practiced on a daily basis so that it becomes a habit: "I would say that one thing is that as I go through my day, it's awareness. It's almost like you have different eyes when you enter the restaurant. You have to be conscientiously aware of where your hands are going, what they're doing." Participants also said that bad habits, such as "wiping your nose" and "rubbing hands on your apron" were difficult to break. Workers said it was very important for new food workers to develop good handwashing habits early in their careers.

Personal beliefs and attitudes such as concern for customers' health, concern for one's own health, pride in one's work, and choices made by individual workers serve as positive influences with respect to handwashing: "It comes down to the consciousness of the guy who knew that he just took out a chicken breast and put it on the grill and then went over and made a salad. He knew that, and

he didn't care." Workers also said that when they took pride in their work they were more likely to wash their hands.

Discussion

Despite having extensive knowledge about correct handwashing practice, food workers in this study reported various situations in which handwashing was not implemented. These findings are consistent with previous work confirming that food workers are knowledgeable about the food safety actions they perform but are unable to implement these practices because of barriers in their work environment (Green et al., 2006; Clayton & Griffith, 2004). Barriers identified in our study are also comparable to those that have been recognized in the health care industry, such as inaccessible supplies, insufficient time, high workload and understaffing, and insufficient scientific information showing how improved handwashing reduces infection rate (Kretzer & Larson, 1998; Larson & Killien, 1982; Larson & Kretzer, 1995; Pittet, Mourouga, & Peneger, 1999). Barriers similar to the ones identified in our study have also been identified in a limited number of food worker studies and include lack of supervisory or peer support, demanding schedules, and inadequate facilities (Clayton et al., 2002; Green et al., 2006; Howes et al., 1996; Witten, 2001).

Additional barriers identified by participants were related to the role of management and the organizational "climate." The absence of support from managers and coworkers for handwashing was believed to negatively influence practice. This finding is comparable to one made by a study conducted in a health care setting, in which workers were much less likely to perform hand hygiene if a peer or higher-ranking person in the room did not perform handwashing (Dubbert, Dolce, Richter, Miller, & Chapman, 1990). In comments related to the concept of organizational "climate," participants remarked that a "close connection" between staff and management encourages employees to care about the organization and wish to contribute to its success, and therefore to adhere to handwashing protocol. These results are consistent with those of research by Ehiri and Morris (1994), who suggested that management support, employee motivations, and environmental constraints must be considered in handwashing training programs. Participants outlined several ways in which managers can successfully promote handwashing. These recommendations included explaining goals and

expectations, paying for training such as the food handlers' training, having strict rules in place about handwashing, and educating new workers about handwashing.

Overall, handwashing education and training was the factor most frequently identified as an influence on handwashing. Participants identified the importance of teaching new employees correct handwashing practice to assist them in developing good handwashing habits early in their careers. Participants also revealed that handwashing lessons learned at an early stage in their career provided them with a conscientious awareness of the need to wash hands during food preparation. Because many individuals begin employment as food workers during their teenage years, future research should involve teens in focus group discussions about effective ways to promote handwashing education, training, and interventions. Future studies should also conduct handwashing focus groups with different ethnic groups to identify the unique education, training, and intervention needs of individuals from various cultures.

Handwashing interventions may be more effective if perceptions of food workers are considered. For example, concern for customers' health, concern for personal health, and taking pride in providing a quality product were factors seen by participants as positively influencing handwashing practice. Developing an understanding of how these factors could be incorporated into handwashing training could enable development of behavioral interventions to encourage handwashing. Much of the current handwashing training relies on the knowledge, attitude, and practice (KAP) model (Clayton et al., 2002), which assumes that an individual's behavior or practice is dependent on his or her knowledge, and that providing information will result in a change in attitude or behavior. Our research suggests that knowledge alone is not sufficient and implies that other behavioral models should be considered in the design and implementation of education and training programs. One example is the theory of planned behavior, which has been helpful in understanding and predicting health care workers' handwashing behavior and has been used to examine food workers' beliefs and self-reported food safety practices (Clayton et al., 2002; Jenner, Watson, Miller, Jones, & Scott, 2002). Another alternative may be the use of active handwashing training that educates food handlers to understand and correctly follow the FDA *Food Code* handwashing procedures (FDA, 2005; Lillquist, McCabe, & Church, 2005).

Collaboration between health departments and the industry is important to improvement of handwashing practices. Difficulties encountered in recruiting food workers both for the focus group and for surveys indicate that handwashing remains a very sensitive issue in the food service industry. Because an open dialogue is necessary to the development of new ways of promoting handwashing, proactive state and local food protection programs can set the stage for a forum in which the food service industry is a joint partner in the local education and training of food service workers. In addition, food safety programs may wish to explore the use of a business model to communicate the importance of handwashing interventions to restaurants. Owners and managers understand the concept of business continuity and the ways in which a foodborne-illness incident could have serious implications for the success of their establishment.

The findings of our study are limited, given that participants were recruited from a limited geographic region, and that the responses were generated from only two focus groups. In addition, despite vigorous attempts by the researcher to ensure participant confidentiality, recruitment was difficult, and that difficulty contributed to the small number of focus group participants. Finally, the focus group discussions included only English-speaking participants, and thus may not represent the sentiments of non-English-speaking food workers.

Conclusions

The potential risks of foodborne illness warrant continued exploration of innovative ways to improve handwashing education, training, and interventions in the restaurant environment. From the perspective of the food workers, current knowledge-based handwashing training programs do not address the internal and external barriers that affect handwashing practice. Because a safe restaurant environment involves appropriate handwashing by all food workers, additional research should focus on ways of training managers and workers to recognize handwashing barriers in their restaurants and to make organizational changes to minimize or eliminate these barriers.

Because barriers to handwashing are multidimensional in nature, a program that addresses the factors identified by the focus group participants is needed. The program might include the following: 1) a hands-on training program to orient new employees to correct handwashing practice; 2) involvement of both managers and coworkers in new-employee handwashing training; 3) emphasis on providing an attractive and clean sink for handwashing, equipped with necessary supplies; 4) continued handwashing training and support involving the food service industry, managers, and coworkers; and 5) involvement of health departments and inspectors in providing managers and food workers with advice and consultation regarding improvement of handwashing practice.

Measures should be taken to involve food workers, restaurant owners, kitchen managers, health departments, and inspectors in a dialogue about ways of improving handwashing interventions. Our study demonstrated the effectiveness of research that seeks to include the experience and knowledge of food workers currently working in the restaurant environment, and showed that the qualitative approach of group dialogue provides rich and detailed data about barriers that food workers perceive to handwashing. This information is rarely considered in the development of education and training programs. Continued research with involvement from food workers should improve the effectiveness of these programs as well as contribute to a broader understanding of effective handwashing strategies. ■■■

Acknowledgments: This research was made possible by funding from the Oregon Department of Human Services, the Oregon Environmental Health Specialists Network, and the Centers for Disease Control and Prevention. We also thank the focus group members who participated. This paper was prepared by the authors alone and does not necessarily represent the views of ODHS or CDC.

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REFERENCES

- Chioncel, N.E., Van Der Veen, R.G., Wildemeersch, D., & Jarvis, P. (2003). The validity and reliability of focus groups as a research method in adult education. *International Journal of Lifelong Education*, 22, 495-517.
- Clayton, D., & Griffith, C. (2004). Observations of food safety practices in catering using notational analysis. *British Food Journal*, 106, 211-227.
- Clayton, D., Griffith, C., Price, P., & Peters, A. (2002). Food handlers' beliefs and self-reported practices. *International Journal of Environmental Health Research*, 12(1), 25-39.
- De Waal, C.S., & Dahl, E. (1996). *Dine at your own risk: The failure of local agencies to adopt and enforce national food safety standards for restaurants*. Washington, DC: Center for Science in the Public Interest.
- Dippold, L., Lee, R., Selman, C., Monroe, S., & Henry, C. (2003). A gastroenteritis outbreak due to norovirus associated with a Colorado hotel. *Journal of Environmental Health*, 66(5), 13-17.
- Dubbert, P.M., Dolce, J., Richter, W., Miller, M., & Chapman, S. (1990). Increasing ICU staff handwashing: Effects of education and group feedback. *Infection Control Hospital Epidemiology*, 11, 191-193.
- Ehiri, J., & Morris, G. (1994). Food safety control strategies: A critical review of traditional approaches. *International Journal of Environmental Health Research*, 4(3), 254-263.
- Food and Drug Administration. (2004). *FDA report on the occurrence of foodborne illness risk factors in selected institutional foodservice, restaurant, and retail food store facility types (2004)*. College Park, MD: FDA/Center for Food Safety and Applied Nutrition, Office of Compliance. Retrieved May 10, 2006, from <http://www.cfsan.fda.gov/~dms/retrsk2.html>.
- Food and Drug Administration. (2005). Management and personnel, In *Food code: 2005 recommendations of the United States Public Health Service* (chap. 2). Springfield, VA: U.S. Department of Commerce. Retrieved March 26, 2007, from <http://www.cfsan.fda.gov/~dms/fc05-toc.html>.
- Fendler, E.J., Dolan, M.J., & Williams, R.A. (1998). Handwashing and gloving for food protection, Part I: Examination of the evidence. *Dairy, Food and Environmental Sanitation*, 18, 814-823.
- Green, L., & Selman, C. (2005). Factors impacting food workers' and managers' safe food preparation practices: A qualitative study. *Food Protection Trends*, 25, 981-990.

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- Green, L., Selman, C., Radke, V., Ripley, D., Mack, J., Reimann, D., Stigger, T., Motsinger, M., & Bushnell, L. (2006). Food worker handwashing practices: An observational study. *Journal of Food Protection*, 69, 2417-2423.
- Howes, M., McEwen, S., Griffiths, M., & Harris, L. (1996). Food handler certification by home study: Measuring changes in knowledge and behavior. *Dairy, Food and Environmental Sanitation*, 16, 339-343.
- Jenner, E.A., Watson, P.W., Miller, L., Jones, F., & Scott, G.M. (2002). Explaining hand hygiene practice: An extended application of the theory of planned behavior. *Psychology, Health and Medicine*, 7(3), 311-326.
- Kretzer, E.K., & Larson, E.L. (1998). Behavioral interventions to improve infection control practices. *American Journal of Infection Control*, 10, 245-253.
- Krueger, R.A., & Casey, M.A. (2000). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage Publications, Inc.
- Larson, E., & Killien, M. (1982). Factors influencing handwashing behavior of patient care personnel. *American Journal of Infection Control*, 10, 93-99.
- Larson, E., & Kretzer, E.K. (1995). Compliance with handwashing and barrier precautions. *Journal of Hospital Infection*, 30, 88-106.
- Lillquist, D.R., McCabe, M.L., & Church, K.H. (2005). A comparison of traditional handwashing training with active handwashing training in the food handler industry. *Journal of Environmental Health*, 67(6), 13-16.
- Lobdell, D.T., Gilboa, S., Mendola, P., & Hesse, B.W. (2005). Use of focus groups for the environmental health researcher. *Journal of Environmental Health*, 67(9), 36-42.
- Lynch, R.A., Elledge, B.L., Charles, P.H., Griffith, C.C., & Boatright, D.T. (2003). A comparison of food safety knowledge among restaurant managers, by source of training and experience, in Oklahoma County, Oklahoma. *Journal of Environmental Health*, 66(2), 9-14.
- Mead, P.S., Slutsker, L., Dietz, V., McCaig, J.S., Shapiro, C., Griffin, P.M., & Tauxe, R.V. (1999). Food-related illness and death in the United States. *Emerging Infectious Diseases*, 5(5), 607-622.
- Pittet, D., Mourouga, P., & Perneger, T. (1999). Compliance with handwashing in a teaching hospital. *Annals of Internal Medicine*, 130(2), 126-130.
- Redmond, E.C., & Griffith, C.J. (2003). Consumer food handling in the home: A review of food safety studies. *Journal of Food Protection*, 66(1), 130-161.
- Witten, M.L. (2001). *Influence of an incentive program on handwashing practices and handwashing prevalence among university food workers*. Unpublished master's thesis, Texas Woman's University, Denton, TX.