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Evaluation of how different signs affect poultry processing employees' hand washing practices

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ABSTRACT

Signs can provide repetitive training on specific food safety practices for multicultural food processing employees. Posted signs for workers in many food processing facilities tend to be text-heavy and focus specifically on occupational hazard safety. The purpose of this study was to evaluate the effectiveness of newly-developed hand washing pictograms on employees' hand washing behavior using video observation. Five employee hand washing behaviors (soap use, wash completeness, wash time, complete rinsing, and towel use) were evaluated with (a) no intervention, company signs posted and considered the baseline; and compared to (b) hand washing behavior the next day (short term) and two weeks (long term) after experimental hand washing signs were displayed at a raw poultry slaughter facility (Facility A) and a poultry further processing facility (Facility B). Both facilities showed a significant increase ($p < 0.05$) in soap use after the new sign was introduced at both short and long term time periods. There was a significant increase ($p < 0.05$) in washing, time of washing, and rinsing observed by Facility B employees, when baseline data was compared to the short term. This indicates that a new sign could increase hand washing compliance at least in the short term. Sign color also had a significant effect ($p < 0.05$) on employee behavior for washing and time of washing. Behavior for four of the five variables (soap, wash, time of wash, and towel use) was significantly different ($p < 0.05$) between baseline and either experimental observation period. While signs can be a useful tool to offer as recurring food safety training for food processing employees, employees tend to revert back to old habits after several weeks.

1. Introduction

The United States workforce, particularly food industry employees, is diverse and multicultural. The Bureau of Labor Statistics (2010) noted that 38% of animal slaughtering and processing workers were Hispanic or Latino. With an estimated 58% of food system workers (food production to food service) in the United States holding a high school degree or less, and many of these employees not native English speakers, teaching these employees food safety concepts can be difficult (Food Workers Chain Alliance, 2012). Understanding the target population's education level and cultural distinctions are crucial when providing training to a diverse workforce. Typically, food safety training is conducted by direct, in-person lecture in English, which can lead to miscommunication or misinterpretation (Fraser & Alani, 2009).

In 2001, the World Health Organization (WHO) introduced the "Five Keys to Safer Food" including: personal hygiene through cleanliness, separation of cooked and uncooked food, thorough cooking, keeping food at safe temperatures, and using clean food and water (Mwamakamba et al., 2012). In poultry processing facilities, concern for microbial contamination from *Salmonella* and *Campylobacter* are paramount. Worker hygiene practices, such as appropriate hand washing, need to be more frequently completed and improved (Green et al., 2006). Though recommendations are available from the Center for Disease Control and Prevention (CDC), hand washing signs vary widely across the healthcare and food service industries with discrepancies in wash time, water temperature, and number of steps for completion (CDC, 2014; Jenson & Schaffner, 2015).

Pictograms, which offer a language-free medium, are "a diagrammatic representation using pictures rather than words"

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(Davies, Haines, & Norris, 2000). Pictograms can attract the readers' attention and encourage a behavior change based on the intended message. Wogalter (1999) suggests that there are four processing stages that must be sequentially followed in order for a behavior change to occur as a result of a sign. A sign must first be 1) noticed and attract attention. If noticed, the sign must be 2) comprehended and followed by 3) agreement with the attitudes and beliefs of the observer. Finally, the user must be 4) motivated to act upon the intended message. Because these stages are sequential, a roadblock at one stage could prevent the ultimate goal of a behavior change. For example, if an observer does not notice a sign, the process to a behavior change is halted. The comprehension stage will never occur, thus eliminating the possibility of a behavior change.

Signs conveying a variety of messages have been used in the healthcare, transportation, construction, and pharmaceutical industries (Tijus, Barcenilla, Cambon de Lavalette, & Meunier, 2007). Well-situated/designed pictograms offer an inclusive, innovative, and user-friendly training tool (Davies et al., 2000; Nicol & Tuomi, 2007). Currently, hand washing pictograms are widely used in foodservice applications; however, pictograms and other training materials should be designed with employee input (Jenson & Schaffner, 2015; Shirley, 2000). A relevant sign, developed with employee input may improve food safety behavior (Chapman, Eversley, Fillion, MacLaurin, & Powell, 2010; Schroeder et al., in press).

Signs must be evaluated for effectiveness, and there are several ways to evaluate observational data to determine if signs are an effective tool to change employee behavior. Observational data can be participatory or non-participatory (Redmond & Griffith, 2006). Participatory data involves the researcher being present during data collection; whereas, non-participatory data is captured and then viewed at a later time. Participatory observation can have limitations such as observer bias and Hawthorne effect (Chapman, MacLaurin, & Powell, 2013). The Hawthorne effect occurs when a target population changes their behavior because they know they are being studied (Payne & Payne, 2004). Some of these challenges can be overcome through non-participatory observation like video observation. Though sometimes expensive, video observation has been used in several studies to assess safe food handling practices (Anderson, Shuster, Hansen, Levy, & Volk, 2004; Bruhn, 2014; Chapman et al., 2010, 2013; Jay, Comar, & Govenlock, 1999). Jay et al. (1999) and Bruhn (2014) found that prior to meal preparation, personal hygiene practices were insufficient. In an observational study, Bruhn (2014) reported 65% of preparers did not wash their hands. Jay et al. (1999) found that improper hand washing techniques was a common unhygienic practice in domestic kitchens. Anderson et al. (2004) found that 20.4% of participants did not wash their hands after handling raw meat and poultry. Video observation is less intrusive on participants and allows researchers to study behaviors without being directly in range of participants. Additionally, multiple angles and multiple participants can be studied, thus reducing coding bias (Chapman et al., 2013). Coding bias can also be reduced through video observation by using several researchers to analyze the recorded video.

Our previous research utilized survey and focus group data to analyze worker semantic preferences for pictograms to create hand washing signs based on feedback (Schroeder et al., in press). The objective of the current study was to evaluate whether the hand washing pictograms influenced employee behavior change immediately after the pictogram was posted (short term) and after a period of two weeks (long term).

2. Materials and methods

2.1. Pictogram design

Two hand washing pictograms were designed for this study. Pictograms (11″ by 17″) were designed by Food Safety Consulting and Training Solutions, LLC based on focus group data collected from a previous study (Schroeder et al., in press). Except for color differences, the two hand washing pictograms were the same (Fig. 1). The main colors of green or blue were selected based on employee feedback. Some employees expressed that a sign in company colors might influence how closely they examine the sign (Schroeder et al., in press).

2.2. Site selection

Sites for video observations were based on selection criteria from a previous study (Schroeder et al., in press). For the current study, a convenience sample of two poultry facilities that participated in the previous survey and follow-up focus group were selected to participate based on size of facility (>500 employees) and having Spanish-speaking employees. More than one-third of the employees spoke Spanish at each facility. Facility A was a poultry slaughter plant and facility B was a poultry further processing (not slaughter, ready-to-cook and ready-to-eat product) plant.

2.3. Camera placement

All video observations were collected by a GoPro® Hero 3 White

Fig. 1. Hand washing pictograms evaluated by video observation.