

The Development of an Observational Instrument Assessing Food Safety Practices in Temporary Foodservice Establishments

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ABSTRACT

Temporary foodservice establishments, such as are found at farmers' markets, are increasing in popularity. However, regulation of these foodservice vendors tends to fall in a grey area; some vendors do not fall under formal health department supervision, and others may sell food prepared in uninspected home facilities. This study focused on the development of an instrument to assess key temporary foodservice establishment food safety practices, specifically, behaviors related to food handling, hand washing, or glove usage. In order to minimize the Hawthorne Effect, this study chose a novel technology-oriented approach. Employee behaviors were observed and coded in accordance with Indiana Health Department criteria. Preliminary results suggest that the examination of food handling behaviors in temporary foodservice establishment employees is warranted, and that the use of observational techniques combined with smart phone technology did seem to capture the sequence of employee actions, while simultaneously minimizing the Hawthorne Effect.

Keywords: *Food safety, Hand washing, Temporary foodservice establishments, Farmers' market, Smartphone*

INTRODUCTION

In the United States, farmers' markets grew from a reported 1,755 markets in 1994 to 5,274 by 2009. Most recently, there were 81 farmers' markets reported in Indiana (USDA, 2009). According to the National Farmers Market Manager Survey, by 2005, total sales across the United States were estimated to exceed \$1 billion. The survey also found that markets averaged 959 weekly customers and had average annual sales of \$242,581 (USDA, 2009).

Farmers' markets provide food to many people, however, regulations governing them often fall into a grey area. For example, some retailers are categorized as "Home-based Vendors," and under Indiana Code are exempt from many food establishment regulations (Linton & Gilliam, 2009). Additionally, Indiana Code 16-42-5-29 provides exemption from food establishment requirements for individual vendors at farmers' markets. The code does permit inspection by the state health department if products are misbranded, adulterated, or if a consumer complaint has been received (Indiana, 2009); however, due to the short-term nature of temporary foodservice operations, investigation of complaints may occur well after the conclusion of retail sales, negating any regulatory benefit.

Temporary foodservice establishments face unique issues. Typically, vendors sell their products outdoors, exposed to environmental contaminants such as dirt, insects, and pollution. Often, farmers' markets are found in locations with limited access to potable water for hand or product washing, or electricity for refrigeration (Worsfold, Worsfold, & Griffith, 2004). Also, most farmers' markets are seasonal, usually from spring through early fall, with their products exposed to unsafe holding temperatures. Given these circumstances, there is significant potential for foodborne illness due to cross-contamination, improper food holding, or environmental exposure.

The increasing popularity of farmers' markets coupled with inadequate oversight can contribute to incidences of foodborne illnesses. The Center for Disease Control and Prevention (CDC) identified 95 foodborne illness outbreaks potentially associated with fairs, festivals, and temporary mobile services from 1988-2007, which resulted in almost 4,000 ill with 144 hospitalizations (CDC, 2008). The majority of these outbreaks were linked, either suspected or confirmed, with bacteria or viruses, such as Norovirus, Salmonella, and Staphylococcus, which are generally controllable with proper hand washing (CDC, 2008). A recent study of 321 restaurants found that workers used soap only 28% of the time during required hand washing activities and only washed their hands appropriately after handling raw animal products 23% of the time (Green, Selman, Radke, Ripley, Mack, Reimann, Stigger, Motsinger, & Bushnell, 2006). The authors concluded that workers either did not know when to wash their hands or occasionally choose not to wash their hands, both actions that placed the dining public at risk.

Guzewich and Ross's (1999) review of the literature on the topic of foodborne illnesses found that 82% (n=66) of the reported outbreaks implicated food workers as the source of infection, and that "the majority of the outbreaks associated with food workers involved transmission of the pathogen by the food worker's hands" (Guzewich & Ross, 1999, p. 4). Identifying problematic food handling behaviors is the first step in developing appropriate educational interventions. Thus, this study focused on the development of an instrument to assess key temporary foodservice establishment food safety practices, specifically, behaviors related to food handling, such as hand washing and glove usage.

LITERATURE REVIEW

Over the decades, foodborne illness outbreaks have cost the U.S. society between \$2.9 and \$6.7 billion annually (Buzby, Roberts, Jordan-Lin, & MacDonald, 1996). In 2007, the CDC reported that a total of 1,097 foodborne illnesses outbreaks occurred resulting in 21,244 illnesses and 18 deaths (CDC, 2010). For 297 of these outbreaks, most were diseases that are, for the most part, preventable with appropriate food handling behaviors, such as hand washing.

Regarding the implication of food safety practices associated with food away from home, one study reported that improper food handling accounted for 97 percent of foodborne illness outbreaks in foodservice establishments (Howes, McEwen, Griffiths, & Harris, 1996). Collins (1997) noted that 80 percent of foodborne illness outbreaks were associated with food away from home. More recently, 45 percent of foodborne illness outbreaks in the U.S. and 54 percent of outbreaks in the U.K. were associated with restaurants, hotels, and pubs (Olsen, MacKinnon, Goulding, Bean, & Slutsker, 2000).

Since half of every dollar is spent on food consumption at restaurants in the U.S. (Blisard, Lin, Cromartie, & Ballenger, 2002), the examination of food safety issues in foodservice establishments is justified. The FDA (2004) recommends that food employees should use barriers when working with ready-to-eat (RTE) foods, defined as food that is safe to eat without further cooking. Therefore, RTE foods which are prepared or produced on premise in temporary foodservice establishments for immediate sale and consumption should be handled with some forms of barriers such as gloves, paper, and utensils. Given the results of an observational study conducted by FDA (2004) that 57% of restaurants failed to prevent bare-hand contact with RTE foods, it is essential to examine the food safety practices of vendors who produce RTE foods onsite in temporary foodservice establishment venues. Additionally, given the unique circumstances associated with farmers' markets and the importance of proper hand washing in the prevention of foodborne illnesses, hand washing behavior was identified as a key food safety practice for this study.

Clayton and Griffith (2004) utilized a notational analysis approach to assess food safety practices. They found that notational analysis had several advantages over traditional checklists, for example by reducing the amount of observer interpretation. Previously used methods such as self-reporting, risk assessment, traditional checklists, and inspections may have provided limited information in regards to operational food safety practices (Oteri & Ekanem, 1989; Harrison, Griffith, & Tennant, 2001; Kassa, Harrington, Bisesi, & Khuder, 2000; Gillespie, Little, & Mitchell, 2000; Morrison, Caffin, & Wallace, 1998). The use of notational codes provided for a detailed recording of employees' actions and tracked the specific sequence of actions, which allowed researchers to identify and isolate specific points in the process of food preparation where hand washing activities should have occurred. In order to properly identify when hand washing should occur, researchers referenced the hand washing criteria provided by the Indiana State Department of Health (see Table 1).

Table 1

Indiana State Department of Health Code 410 IAC 7-24-129: When to Wash Hands

(a) Food employees shall clean their hands and exposed portions of their arms as specified under section 128 of this rule immediately before engaging in food preparation, including working with exposed food, clean equipment and utensils, and unwrapped single-service and single-use articles and the following:

- 1) After touching bare human body parts other than clean hands and clean, exposed portions of arms.
- 2) After using the toilet room.
- 3) After caring for or handling service animals or aquatic animals as specified in section 435(b) of this rule.
- 4) After coughing, sneezing, or using a handkerchief or disposable tissue.
- 5) After drinking, other than as specified in section 136(b) of this rule, using tobacco, or eating.
- 6) After handling soiled surfaces, equipment, or utensils.
- 7) During food preparation, as often as necessary to remove soil and contamination and to prevent cross-contamination when changing tasks.
- 8) When switching between working with raw food and working with ready-to-eat food.
- 9) Before touching food or food-contact surfaces.
- 10) Before placing gloves on hands.
- 11) After engaging in other activities that contaminate the hands.

Note.

Indiana State Department of Health (ISDH), 2004

The Consensus Measurement in Hand Hygiene (2009) project identified the direct observation of hand washing behavior as the “gold standard” of measurement methods. The report noted that observation enables researchers to examine the type of hand hygiene products used, the thoroughness of cleaning, and the use of gloves. Even though the project aims to enhance the hand hygiene practices of health care workers, the method used offers useful evidence as to how to go about effectively assessing hand hygiene practices in general.

The authors concluded that the biggest limitation of direct observation is the “Hawthorne Effect” (Consensus Measurement in Hand Hygiene, 2009), i.e. when people notice that they are being observed, they might change or modify their behaviors. In the case of Clayton and Griffith’s study (2004), the “Hawthorne Effect” was identified as a limitation of the notational observation approach. Even though Clayton and Griffith (2004) excluded actions recorded in the first thirty minutes of observation from the analysis to allow the workers to become accustomed to the researcher’s presence, the Hawthorne Effect was still considered a limitation. Another observational study on food worker’s hand washing practices attempted to reduce the Hawthorne Effect by not revealing exactly which behaviors were being recorded and then discarding the first fifteen minutes of observations to allow workers to become acclimated to the presence of the

researcher (Green et al., 2006); however, their efforts were not enough to minimize the influence of the researcher's presence. Therefore, with observational studies, efforts to minimize the Hawthorne Effect must be considered.

METHODOLOGY

Two prior studies were foundational for the development of this observational instrument (Clayton & Griffith, 2004; Green et al., 2006). Clayton and Griffith's (2004) instrument used handwritten notational coding to track food safety actions in restaurants and catering operations, and was the basis for the instrument later used in Green et al's (2006) study. Since both of their studies shared the limitation of the Hawthorne Effect, the goal of this study was to collect data via observation with minimal detection by the subjects. This study's preliminary focus was safe food handling, specifically the hand washing behaviors of vendors at local farmers' markets in Tippecanoe County, Indiana. The study was approved for Institutional Review Board research exemption due to the public nature of the venue and the fact that there would be no intentional direct contact with the subjects. Prior to developing and introducing the instrument, each market was visited to assess the demographics of the food vendors. After initial assessment, it was decided to refine the sample to exclude vendors who sold items that represented minimal food safety risk; for example, vendors who sold non-food products, such as soap; vendors who sold goods prepared and wrapped off-premise, such as cookies and breads; and vendors who sold only raw produce. Vendors who sold ready-to-eat hot or on-site prepared foods appeared to have the greatest potential for food safety violations and, therefore, became the sample population for this study.

Clayton and Griffith's (2004) instrument was developed specifically for the operational requirements of professional catering kitchens. With permission, their instrument was modified to fit the unique operational environment associated with farmers' market operations. Unnecessary terms were eliminated and specific information relevant to this venue was added. This preliminary instrument was paper and pencil, and formatted with sections for recording the general market details in addition to the basic actions of vendors as they handled food. This version was tested at one of the markets, where observers attempted to record employee actions in order of sequence, and to validate the identified actions and details. The observers were positioned approximately thirty feet from the vendor, and began recording their observations simultaneously. Over a period of about sixty minutes, the employee performed multiple food handling activities as well as other activities that required subsequent sanitation actions. Hand recording these actions proved to be time consuming and inadequate for capturing all sequential actions. It was also difficult to conceal the instrument, which increased the risk of altering employee behaviors in accordance with the Hawthorne Effect. After this preliminary test, the researchers were debriefed and modifications for improvement were determined.

The second instrument incorporated a flow chart approach with more fields for recording additional sequential actions. A second pilot test produced similar limitations as the first. Additional revisions were reviewed and incorporated. The focus of the third modification became speed of use. The notational checklist format previously used in the Clayton and Green studies was condensed (Clayton & Griffith, 2004; Green et al., 2006). The size was reduced from a full sheet of paper to a half sheet which was easier to conceal during observations. This

instrument was evaluated in the same manner as the prior versions. While the new form represented an improvement, similar limitations were encountered. Debriefing resulted in the addition of more details, which proved to be adequate for collecting content; however, this increase affected adversely the ease of recording and the length of time required to complete an observation.

Throughout the piloting process, content experts, including a local county health inspector and a professor with significant food safety experience were consulted in order to validate the content of the survey and identify any additional points of inclusion. After analysis of the first three pilot tests, researchers addressed the transformation of the instrument from a paper-and-pencil instrument to a technology-based tool. Qualtrics Survey Software was selected as the data collection tool. This survey incorporated the content from the preliminary tests and emulated the branching method of prior instruments to capture actions sequentially. The instrument was formatted for use with an iPhone, and hosted on an internet-accessible server.

The use of smart phones in observation studies was initiated by Columbia University Mechanical Engineering Department in New York City (Jeffrey-Coker, Basinger, & Modi, 2010). In January 2010, researchers collected data using HTC G1 smart phones running Google's Android operating system to survey 300 farmers in rural Mali. The authors asserted that this method had advantages of allowing remote monitoring of data collection, facilitating the data collection procedure, and reducing survey times. The use of smart phone in data collection was expected to provide another advantage to this current study; reducing the Hawthorne Effect. Hagen, Robertson, Kan, & Sadler (2005) discussed the difficulty of direct observations noting the growing need for new research methodology to assess consumer use of mobile devices. The authors asserted that many of challenges to collecting observation data stem from the fact that the presence of observer affected the behavior of subjects. Thus, for the purposes of this study, the use of smart phones in data collection permitted researchers to discretely observe vendors thus minimizing the Hawthorne Effect.

The instrument was designed to capture 50 separate observations via smart phone technology, and designed for frequent data uploads throughout the process. The expectation was that an electronic survey with pre-determined multiple options in each category, coupled with the use of a smart phone to record the data, would reduce the risk of encountering the Hawthorne Effect, while standardizing data collection. By using the touch screen capabilities of the phone, researchers were able to create the illusion of texting without alluding to the fact that observations were being recorded.

Each observation consisted of a series of sequential actions that were considered a "transaction". For example, the first observation was indicative of an action, such as "handle", "touch", and "eat/drink". Following that, observers would identify the object of the prior action, such as "RTE Food", "Waste Container", and "Cooking Utensil," as well as specific qualifying details, such as "Wrapped" or "Exposed". Lastly, the instrument provided an opportunity to record specific hand sanitation practices, such as "Washing Hands under Water with Soap", "With Gloves, Prior Attempted Hand Wash", or "No Hand washing Behavior Observed". Eventually, a total of 55 actions, objects, and sanitation practices were listed on the instrument with text options available for items not provided.

Prior to entering the field, researchers familiarized themselves with the technology-based instrument by conducting trial runs of the software in simulated situations. This process was repeated throughout the development of the instrument each time a revision was implemented, after which the instrument was again field tested. Researchers synchronized the start of observations, simultaneously observing and documenting the actions of the same subject. It was noted that the ease of recording actions was improved and that the detail was more comprehensive; however, the frequent data uploads were time consuming and often interrupted the recording of observations. In order to increase recording speed, the instrument was refined to reduce the number of required uploads. Additionally, slight modifications to the content were incorporated in order to further streamline the data collection process. The tool was tested again at a local outdoor festival where it was substantially quicker and more efficient. However, significant detail was lost by this streamlining which resulted in inconclusive results and analytical limitations. Therefore, the instrument was revised and once again pilot tested with the appropriate vendors at all of the local county farmers' markets (see Figure 1).

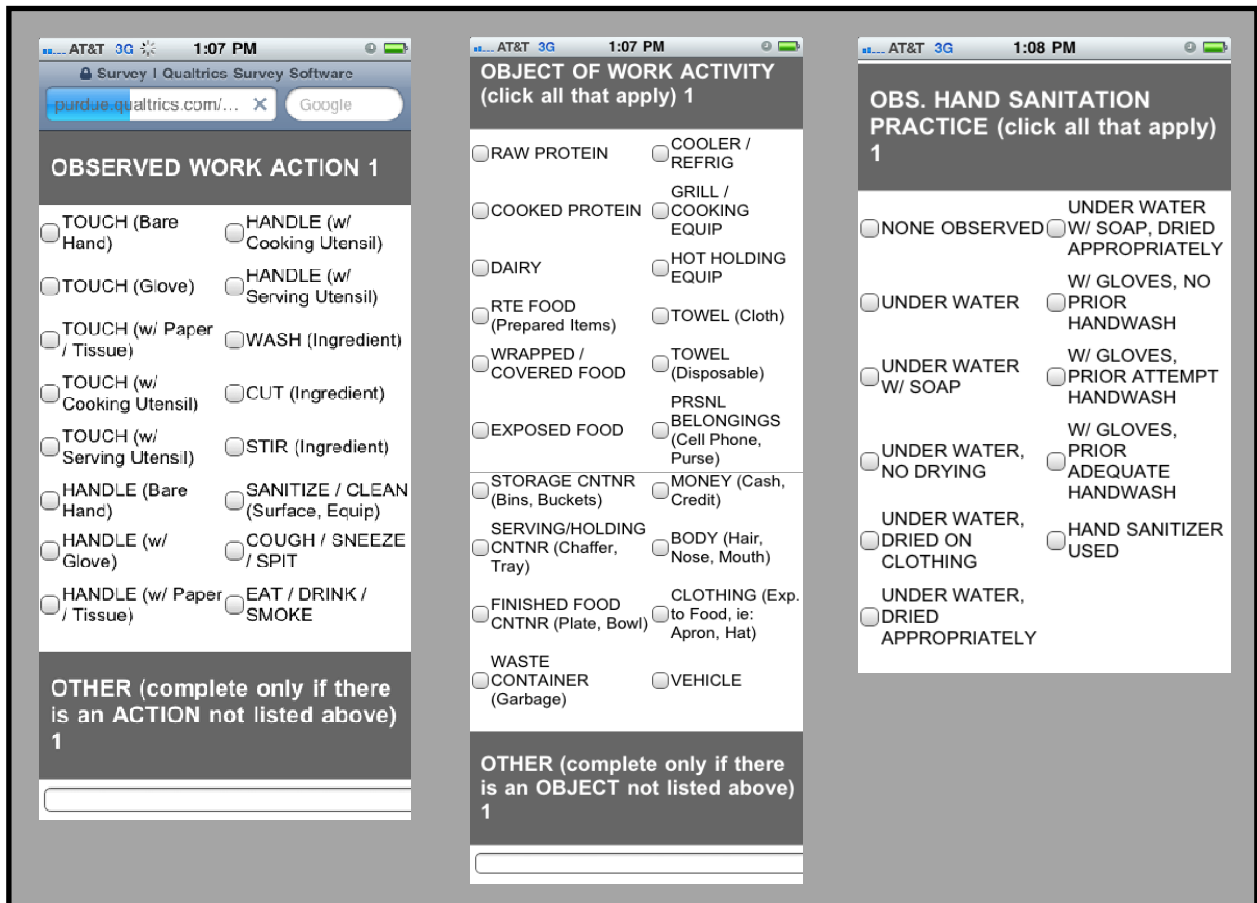


Figure 1. Observational Instrument Screenshot

RESULTS

In all there were three vendors with five employees who fit the criteria of offering ready-to-eat food products prepared on site for immediate service. During the observations, one of the researchers encountered a new technological challenge in that going backwards through the survey resulted in a loss of previously collected data, forcing that observation to be discarded. Therefore, the final sample included four observed employees; 3 server/cashiers and 1 cook. Each employee was observed for 50 specific transactions, resulting in 200 total sequences of observed behaviors. The data was coded in accordance with Indiana State Department of Health criteria to identify points where hand washing should have occurred ([ISDH], 2004). Occurrences were then compared with observed behaviors to determine frequency of violations.

Due to the observational nature of this study, it was necessary to consider inter-rater reliability and inter-observer reliability between the researchers and the subsequent coding of observations. All the observations were recorded by two researchers in parallel and coding of observation data were conducted by two researchers separately. Therefore, both inter-observer reliability and inter-rater reliability of the recorded transactions were measured using Cohen's Kappa via SPSS software. After coding all observations independently, researchers again utilized Cohen's Kappa to measure inter-rater reliability. Results indicated Kappa values ranging from .678 to 1.00, indicating that there was a substantial level of agreement between observers and the subsequent coding (Landis & Koch, 1977).

Results indicated that the frequency and type of violations varied depending on the employee's position as a cashier/server or a cook. The most frequently violation of the first two observations, both female servers, involved touching one's body (observation 1, n=9, 90%) and touching personal belongings (observation 2, n=10, 50%). During observation 3, the male cook was observed most frequently touching a vehicle without subsequently washing his hands (n=6, 55%), and lastly, for observation 4, a female server/cashier repeatedly handled ready-to-eat food with her bare hands (n=6, 40%). Although suggestive, these results must be considered very limited given the small number of observed employees.

CONCLUSION, LIMITATIONS, AND FUTURE STUDIES

While refinement of the instrument continues, preliminary results suggest that examination of temporary foodservice establishment employees' food handling behaviors is warranted. Additionally, the use of an observational approach in conjunction with smart phone technology did seem to capture the sequence of employee actions, while minimizing any Hawthorne Effect, as the observers were never questioned regarding their actions. Future research should expand to test the instrument in multiple outdoor venues with other observers. For consistency purposes, observers will need to be trained, preferably by the use of videotaped scenarios. Increasing the variety and frequency of observations will help to refine the instrument, and yield more generalizable results.

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