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A Shopper's Eye View of Food Safety at Retail Stores: Lessons from Photographs Taken while Grocery Shopping

ABSTRACT

Food safety-related infrastructure, procedures, and practices at grocery stores play an important role in protecting public health. Thus, as part of a companion study to establish the "true" prevalence of *Listeria monocytogenes* among ready-to-eat (RTE) foods purchased at retail stores, digital photographs were recorded by data collectors trained to identify potential perceived and actual food safety risk situations. Digital photographs taken between 2010 and 2012 at stores across FoodNet sites in California, Maryland, Connecticut, and Georgia were coded by use of qualitative content analysis techniques. Risk factors for foodborne illnesses, including contaminated equipment resulting in cross-contamination, poor personal hygiene, and improper temperature control, were observed. As examples, photographs captured utensils, such as tongs, placed handle-down in containers of uncovered RTE foods, bare-handed contact of deli meat during slicing, and water dripping from the ceiling onto the deli counter. Also seen were practices where good risk management practices were implemented. These digital photographs provide a set of learning materials that the retail food industry can use as examples of what shoppers may see if they are focused on food safety. Such photographs can also be used as a motivation and as a real-world teaching tool to better inform and engage a positive food safety culture among shoppers and employees at grocery stores.

INTRODUCTION

U.S. retail food sales make up an estimated 51.3% of all food sales annually (39). In 2013, annual sales of retail food exceeded $571 billion, with the top 20 retailers accounting

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for 63.8% of total sales *(39)*. Traditional food retailing has shifted over the past three decades to a more consolidated and centralized sales, infrastructure, and delivery system. The food safety culture of a grocery retailer, including infrastructure, standard operating procedures, and how food employees implement systems, can impact the likelihood of food safety risks having adverse effects on shoppers.

Food employees, the front-line foodservice staff charged with preparing meals, are integral to reducing food safety risks. In a multi-part review of foodborne illness outbreaks, some 816 outbreaks were linked to food handler practices, including improper handwashing, cross-contamination, and other risk factors, resulting in 80,682 cases of foodborne illness *(7, 17, 18)*. The U.S. Centers for Disease Control and Prevention (CDC) has identified contributing factors to foodborne illness: (i) food from unsafe sources; (ii) improper holding/time and temperature; (iii) inadequate cooking; (iv) poor personal hygiene; and (v) contaminated equipment/ prevention of contamination; four of these factors are linked directly to food-handler behaviors *(4)*. Outbreaks associated with retailers and similar style food service operations have shown that failure to address risk factors can lead to multiple illnesses *(14)*. The Food Marketing Institute (FMI), the industry trade association for grocery store retailers, promotes grocery store manager and food employee training on identified risk factors and how to mitigate risks *(14)*.

Among foodborne pathogens, *Listeria monocytogenes* is perhaps the most significant threat to public health because of its ubiquity and recalcitrance, as well as the severity of listeriosis *(12, 37)*. In 2006, data from a four-state study by the U.S. National Alliance for Food Safety and Security *(NAFSS; 10)* established that the prevalence (n = 8,015) of *L. monocytogenes* was almost eight times greater on deli meats sliced and packaged at retail (1.2%) than on prepackaged deli meats (0.15%). Subsequent risk assessments confirmed the public health concern related to *L. monocytogenes* at delicatessens *(32)* and suggested that approximately 80% of illnesses and deaths from listeriosis associated with deli-meat consumption are attributable to deli meat sliced at retail facilities *(11)*.

Beyond actual risks for foodborne illness, consumer perception of risk management can also factor into purchasing decisions, store preferences, and other retail choices *(25)*. Likewise, how a consumer perceives risk may be markedly different from how retailers or food safety professionals perceive risks, and the awareness and identification of such differences are critical to developing effective interventions. Also, what consumers see with regard to sanitation as they walk through a retail store can affect their perception and beliefs of how a retailer is managing risks. Familiarity, even in a retail environment, plays a strong role in consumer perception of a risk; a higher rate of familiarity results in a decreased perception of risk *(38)*. Trust also plays a role, in that if retail food employees convey a sense of authority/knowledge about food, consumers may be more likely to trust them, thereby decreasing their perception of the risk *(38)*. In many instances, the retailer may be a local favorite of the consumer, perhaps visited weekly, which implies both familiarity and trust and likely decreases the consumer's perception of risk.

Perceptions about food-related risks are influenced by both cultural and social factors. Risk communicators who do not consider factors that affect the way the general public perceives risks are unlikely to foster the appropriate level of risk perception *(23)*. People tend to categorize risks as tolerable or intolerable according to subjective attributes, including familiarity and perceived catastrophic potential *(27, 35)*. Risks are more tolerable or accepted if they are perceived as being familiar, voluntary, natural, or under an individual's control, whereas risks perceived as unfamiliar, involuntary, or exotic are less likely to be tolerated *(13)*.

In this increasing age of sharing experiences in real-time, what a shopper sees in a retail store, whether an actual risk or not, can lead to a social amplification of risk. The goal of this project was to collect, analyze, and share (photographic) examples of what shoppers may see when visiting retail stores. These photographs provide a qualitative analysis of real-life risk factors versus perceived risk factors that can be used by the grocery and food service industries to modify employee behaviors and make improvements to store infrastructure so as to mitigate any potential public health risks, perceived or actual, that may currently exist.

APPROACH

Genesis of photographic survey of behaviors that may compromise food safety at grocery stores

To assess the impact of measures taken throughout the 2000s by both regulatory authorities and the food industry to better manage the potential threat of *L. monocytogenes*, a large-scale and scientifically-sound survey was undertaken to quantify the prevalence, levels, and types of this pathogen in several categories of some 27,000 total RTE food samples purchased at retail establishments across the U.S. *(28)*. Samples were collected at both supermarket chains and independent grocery stores within FoodNet sites in California, Maryland, Connecticut, and Georgia over a 24-month period between 2010 and 2012. While shopping for these foods, data collectors also captured, via digital photographs, numerous practices deemed potentially unsafe and/or highly favorable to support the presence, persistence, and/or proliferation of *L. monocytogenes* in/on the targeted foods and/or within the retail environments. These actual photographs taken by shoppers comprise the framework for this article.

Selection of locations within the FoodNet sites

Sampling within a FoodNet site was weighted by the populations in the counties covered by FoodNet surveillance,

using Census data (July 1, 2008 estimate from www.census.gov). The order in which the counties were sampled was determined using a random number table *(19)*. Lists of large and small retail markets were created by using current telephone directories accessed at the Library of Congress. For each county, retail stores were divided into List A (major supermarkets) and List B (other grocers). The stores on the lists were numbered, and a random number table *(19)* was used to select stores for each collection week (5 major supermarkets and up to 10 other grocers). It was assumed that 75% of shopping is done at major supermarket chains, and the number of samples from List A and B stores were weighted accordingly *(15)*. Collectors purchased samples from at least two stores on List A and two stores on List B, until the specified number of samples was collected. Not included in the sample were retail markets such as convenience stores, gas stations, or farmers markets.

Elaboration of coding schedule for photographs

Photographs of food handling, food safety practices, and store operating procedures were taken at retail stores by shoppers trained to recognize risky practices if such situations arose. Retail stores were chosen based on targeted criteria including size, types of departments, and geographical location. Note that the photographs taken for this study represent point-in-time observations taken by shoppers specifically qualified to capture risky practices and/or behaviors and to comprehend their likely affects. The observations made and photographs taken may be somewhat different from what a typical consumer may observe or react to. Digital photographs were taken using camera-equipped smart phones. A literature review was conducted to determine potential food safety behaviors to inform the coding schedule used to analyze the selected digital photographs. Previous content analyses of food safety behaviors have focused on more traditional media, such as televised cooking programs *(5, 20, 29)*. A coding schedule was designed to record risk factors present and to group "like" photographs together. Content analyses are aimed at producing reliable and replicable data *(24)* via a deductive or inductive approach *(3)*. We used a deductive approach, recording only those practices and procedures that are shown or explicitly stated, not likely behaviors. To this end, digital photographs were taken by shoppers at grocery stores to develop a visual representation of employee behaviors and poor standard practices, as well as infrastructure shortcomings and/or store hazards, for use as a tool to inform and engage employees, managers, and consumers in dialogue, awareness, and actions that collectively may lead to lowering their potential risk to public health. These photographs were grouped into themes based on CDC's (Centers for Disease Control and Prevention) contributing factors: (i) food from unsafe sources; (ii) improper holding/time and temperature; (iii) inadequate cooking; (iv) poor personal hygiene; and (v) contaminated equipment/ prevention of contamination. *(Fig. 1–14)*.

WHAT WAS SEEN

Qualitative digital photo examples

What data collectors captured through digital photographs demonstrates that shoppers could also easily identify food safety concerns if they had an aptitude for and interest in doing so. Cross-contamination is, in many respects, the easiest risk factor to mitigate *(Fig. 1, 2, 3, 4 and 5)*. Examples of this infraction included utensil handles in direct contact with RTE foods, co-mingling of raw and RTE foods, and poorly cleaned/maintained food contact surfaces and cleaning materials. Corrective measures would include review of SOPs and better attention to detail by employees with regard to problem areas, coupled with frequent monitoring and reminders from managers to employees. Similar to cross-contamination is poor hygiene by employees, as represented by bare-hand contact with deli meats while slicing *(Fig. 6)*; this can be rectified by providing employees with a refresher course on wearing gloves, hairnets, and beard cozies, and by strategically posting reminders about the ban/policy on bare-hand contact. A somewhat related contributing factor is poor sanitation, such as debris on food contact surfaces and residual food on the outside of packaged/sealed foods *(Fig. 7 and 8)*. Mitigation steps would include more frequent and rigorous cleaning regimens. Next to be addressed is inadequate temperature control *(Fig. 9)*, as illustrated by store-packaged deli meats and cheese that have been over-stacked and improperly positioned in an open-air deli case. Communication by management to employees of the importance and procedures for correct temperature control will go a long way toward preventing this risk factor. With regard to examples of a perceived rather than an actual risk factor, we captured photographs of water leaking from the ceiling directly onto the deli case and water ponding on the floor next to the deli case, as well as the placement of dog bones on the top of the deli counter in close proximity to RTE foods and food packaging materials *(Fig. 2, 4, and 10)*. Again, attention to detail by store associates and timely action to remediate the problem would directly and effectively address risks related water-related pathogen transfer or harborage which, upon closer inspection of *(Fig. 2 and 4)*, is seen to be, on many levels, both avoidable and unacceptable. Lastly, we have included a few photographs of behaviors and scenarios that we determined to be good practices *(Fig. 11, 12, 13, and 14)*. Such practices included the use of accurate and visible temperature recorders in the deli case, a clean and well-maintained salad bar, proper separation of raw and RTE seafood, and proper storage of clean/sealed containers of packaged seafood.

Figure 1. Utensil handles in RTE food (staff and public access).

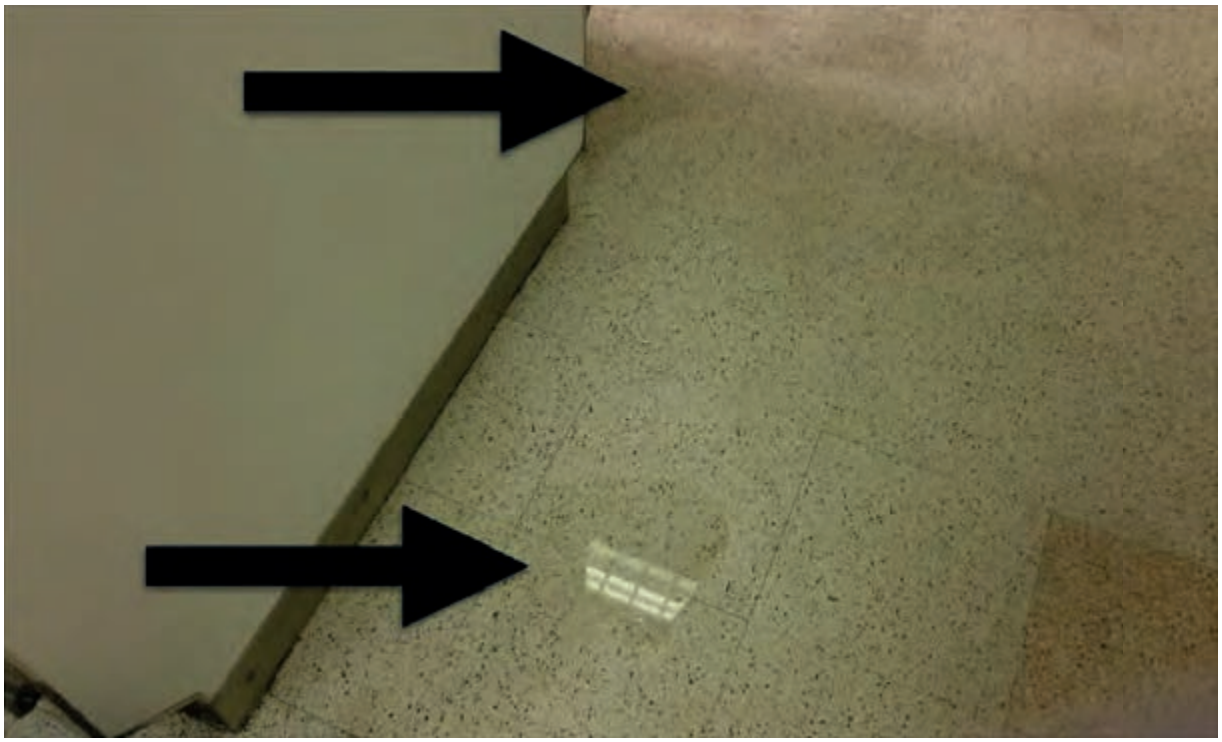

Figure 2. Standing water on floor due to building infrastructure deficiencies.

Figure 3. Contamination potential from raw to RTE seafood via spray mister. Water sprayed over raw seafood into RTE.

Figure 4. Water dripping from the ceiling onto deli display case (products still for sale).

Figure 5. Deli meat resting on a cloth rag with visible stains and debris on slicer.

Figure 6. Bare hand contact of deli meat.

Figure 7. Food debris on the outside of a container.

Figure 8. Food debris left in display; wet area.

Figure 9. Deli ends in cooler above fill line, blocking cooling air flow.

Figure 10. Dog bones for sale, above RTE food display case.

Figure 11. Proper storage of packaged seafood, no food debris on lids.

Figure 12. Separation of raw and ready-to-eat seafood.

Figure 13. Clean and sanitized salad display.

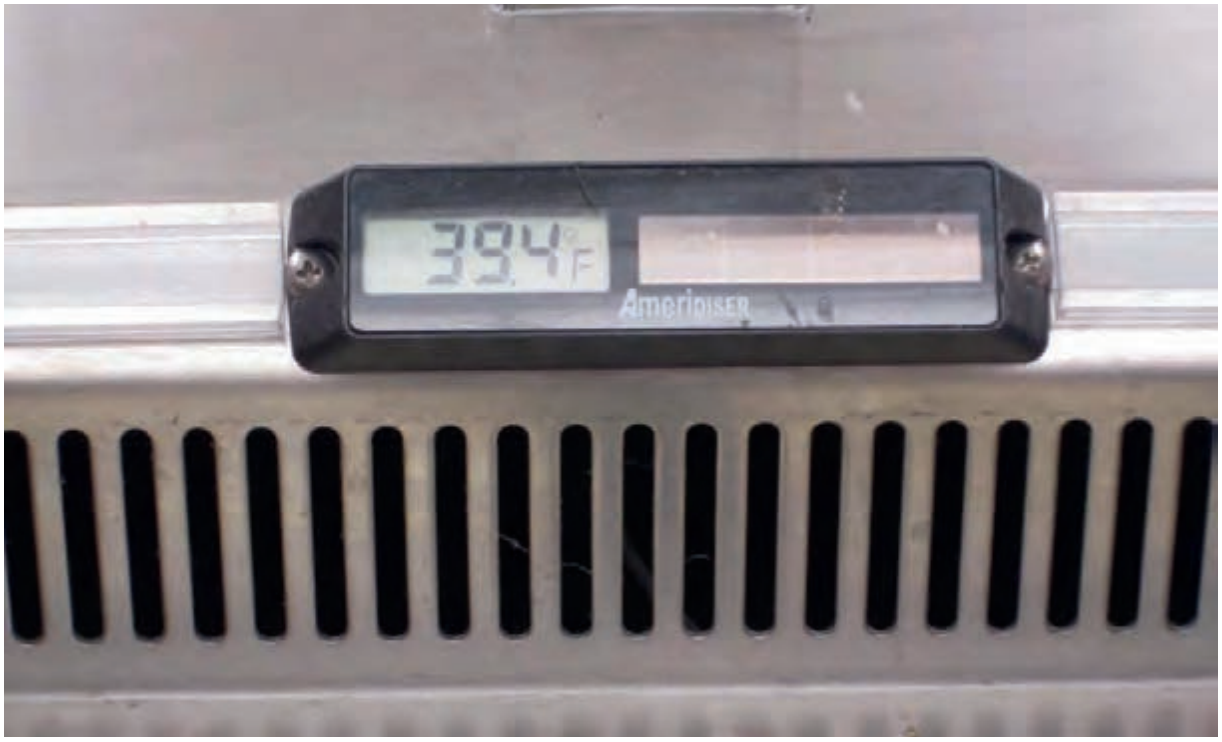

Figure 14. Visible temperature monitor. Good practice: reducing temperature abuse.

DISCUSSION

Both qualitative and quantitative research methods have been utilized by researchers to assess food risk infrastructure and employee handling practices. Studies using qualitative data derived from focus groups, surveys, or inspection reports established that food handlers do not always employ safe practices or proper hygiene, nor do they use risk reduction tools such as thermometers or hand washing tools *(7, 16, 31, 35)*. Researchers must gather data on actual practices from inside the system to successfully change behavior *(30)*. Actual practices of food handlers and attendant outcomes provide a better indicator of outbreak predictability and intervention evaluation than inspection reports or other indicators. One method to accomplish this is through both ethnography (i.e., a scientific description of the customs of people) and observations using photographs. Studies that utilized direct observation of food handling have reported that many individuals commit errors during preparation, but self-report different actions *(2, 6, 9, 21, 22, 34)*.

Petran and colleagues *(31)* showed that a bare-hand contact violation is twice as more likely to occur at a norovirus outbreak-linked restaurant than in a non-outbreak restaurant. Other food-handler factors that contributed to norovirus outbreaks include single use and single service articles (relative risk of 8.82 when comparing outbreak with non-outbreak restaurants), proper eating/tobacco use by staff (risk of 5.88), and cross-contamination (risk of 2.21). We also captured employees using their bare hands in contact with foods *(Fig. 6)*.

Sandman *(36)* pointed out that pairing the potential threat of the risk (hazard level) with the audience's risk perception response (i.e., level of outrage), some low-hazard risks can become the focus of high public concern, whereas other ongoing and perhaps more serious hazards may receive less attention. Examples are pests seen by shoppers or missing hair restraints, which have little public health impact compared with a poor/non-existent handwashing requirement or cross-contamination. Also, individuals often categorize risks as tolerable or intolerable according to subjective attributes rather than data *(27)*. Socially-promoted, subjective indicators, such as the perception that dirty restrooms result in a higher likelihood of becoming ill from a food establishment, are commonplace outside the food safety world (the concept of 'check the restroom before you eat there'). In contrast, other studies connecting outbreaks with factors that are not socially promoted are more likely to demonstrate that ill staff, handwashing, and temperature control are better indicators of risk *(18, 31)*.

The most effective training program for food employees would include case studies and real-life examples, which are more impactful and which inspire a greater likelihood of discussing risks. Creating a sense of personal responsibility is another factor in driving food safety behaviors to improve *(33)*. An individual must demonstrate the intention to make

a change and feel that it fits with a societal norm to do so *(1)*. For example, a culture of food safety within a grocery store setting could be created through supportive management practices, including on-going training, empowering all employees to encourage their colleagues to reduce CDC's contributing factors and incentivizing them to do so with positive consequences such as prizes or recognition. Simply increasing knowledge, however, is not the only component to imparting change in behavior; solely evaluating a training program based on whether there was a change in knowledge is not sufficient *(40)*. Providing food handlers/servers with the knowledge and desire to communicate risk is only part of the risk communication process. Risk messages can be truly effective only if they contain information that food handlers/servers, as well as consumers, understand and are likely to remember *(8)*. Kuttschreuter *(26)* surveyed people (n = 288) to determine perception of risk and whether people are likely to avoid a risk; 60% reported that they would attempt to learn more about a risk if presented with one. Risky behaviors and scenarios are abundantly clear in the figures included in the present study and provide the framework for additional research and meaningful dialogue to make measureable progress towards behavioral changes by employees that reduce risk.

Further research is warranted to assess perceptions, food safety attitudes, and self-reported behaviors related to observed food safety hazards by consumers who shop at grocery stores and is under way via a national online survey of some 1,000 consumers. The results of this survey will be communicated to food safety professionals associated with both large and small grocery stores for facile and practical communication to employees to foster positive changes. The photographs depicted in the present study provide the justification and framework for these further studies that are planned or in progress.

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