

PEER-REVIEWED ARTICLE

Food Protection Trends, Vol 34, No. 6, p.397-408
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Survey of Observed Vendor Food-handling Practices at Farmers' Markets in British Columbia, Canada

ABSTRACT

The purpose of this study was to assess food safety practices and support systems of farmers' markets in British Columbia, Canada. Observations of food vendor stall sites, hand washing, samples offered for tasting, temperature control and preserved items were assessed for compliance with provincial guidelines. Support systems were evaluated by use of a survey tool and through key informant interviews of farmers' market managers. Seven farmers' markets and 21 vendors were observed to have good general site compliance. Six markets had issues with parking and with pets brought by visitors; five had managers on site; and four had a main hand-washing station. No hand washing occurred during more than six hours of direct observation, gloves were not used appropriately, many vendors handled money and food without washing their hands, offered samples for tasting incorrectly or did not have the required hand washing stations at their stall. Although cold storage temperatures were maintained mechanically or with ice packs, four vendors did not have their food under

effective temperature control. Three market managers expressed food safety concerns that included poor food safety practices, poor hand washing and food/money cross-contamination issues. Although most vendors and markets comply with written food safety guideline requirements, direct observation suggests that improvements are required in the areas of hand washing and temperature control.

INTRODUCTION

The increasing popularity of farmers' markets is based on markets offering consumers high quality, local, fresh seasonal foods obtained directly from farmers and producers. These values, "local" and "fresh," along with the perceived value of purchasing high quality products, are cited by consumers shopping at farmers' markets (3, 13), which have been increasing in Canada and North America since the 1970s, as consumers look for alternative choices to industrialized processed supermarket foods (4). In British Columbia (BC), the number of farmers' markets has doubled in the past decade, with over 125

farmers' markets representing more than 3000 vendors reported in 2013 (5, 12). The majority can be defined as temporary food establishments, operating seasonally from spring to fall, although, a subset of winter markets operate year-round in BC. According to the BC Association of Farmers' Markets, a farmers' market must be comprised of a majority of vendors who make, bake, grow or raise the products they sell, and they must have a minimum of six vendors and operate two or more hours per day in a minimum of four markets per year (5). A typical farmers' market in BC would have between 40 to 99 vendors and operate at least once per week between May and October (6). With the increased popularity of farmers' markets, their sales have similarly increased; between 2006 and 2012, revenues from direct sales rose from \$46 million to \$113 million (Canadian) dollars (12). As farmers' markets have proliferated, the foods and products sold in them have also increased in complexity. Fresh fruits, vegetables, and plants are only a few of the commodities

now sold in farmers' markets. Non-food products, categorized under arts and crafts, bath, beauty and pet items, are sold alongside more traditional items such as baked goods, ready-to-eat (RTE) foods, ethnic foods, fresh and frozen meat, fish, dairy products, and a variety of preserved items.

Foods sold at farmers' markets may be grown at the farm, made at home, made in commercial kitchens or manufactured in a processing plant. Food safety issues may arise anywhere along the continuum from growing and preparing the food through to consumption by the consumer. These steps include growing, harvesting, purchasing of ingredients, preparation (home, commercial kitchen, processing plant), transportation to and from the market, storage, display, sales to customers, waste disposal, transport by the consumer to the home, storage at home, and consumption. When consumers were asked to rank various statements about foods from farmers' markets, one survey found the top two beliefs were that

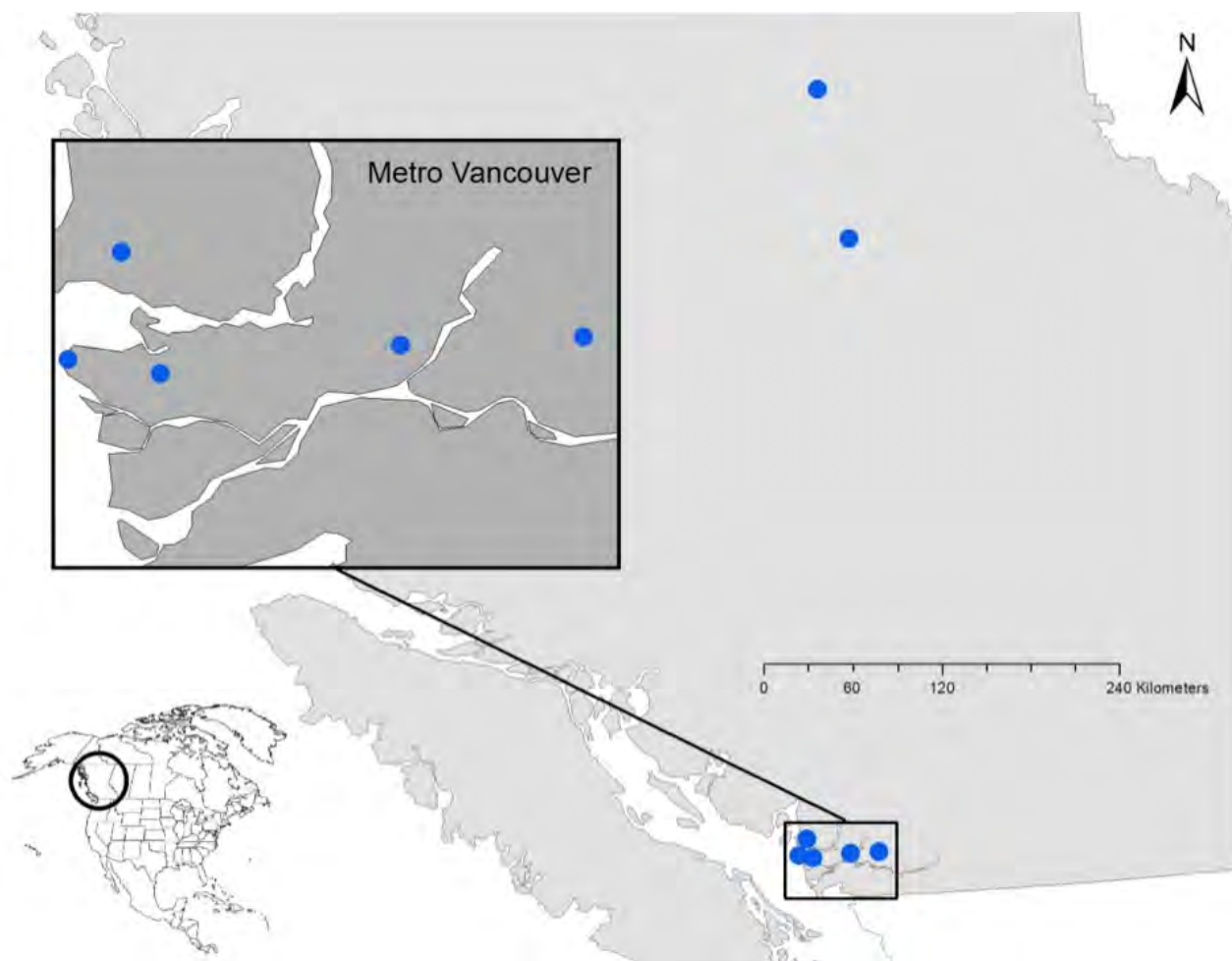


FIGURE 1. Locations of farmers' markets selected for observation study

TABLE 1. List of food safety requirements and observational checklist for five food safety categories in BC farmers' markets

Category examined	Guideline requirement	Additional requirements and detail under MarketSafe course	Farmers' market site checklist (Choice check-boxes for Yes, No, Not observed, Not Applicable and Comments)
General compliance	<ul style="list-style-type: none"> - Sign displayed that states food was prepared in a kitchen not inspected by a regulatory authority - Food products protected from contamination from pets and during storage and display at the market - Surfaces made of easily cleanable materials, maintained and cleaned as necessary 	<ul style="list-style-type: none"> - Adequate stall maintenance and set up - No standing water on the floor - Storage of foods above the ground - Covered stall; protect food from dust, wind, rain and sun - Presence of sneeze guard - Clean attire worn by vendor 	<ul style="list-style-type: none"> • Stall set up and maintenance adequate • Is there any standing water on the floor of the stall? • Are any food products stored on the floor/ground? • Is the stall covered for sunlight and rain? • Are the coolers clean? • Are pets observed in the market? • Is the vendor's attire clean? • Is there a sneeze guard to protect the foods from contaminants while on display?
Hand washing	<ul style="list-style-type: none"> - If sampling for tasting is provided then, cleaning of hands and utensils (by vendor), provided by either <ul style="list-style-type: none"> - running water, soap in a dispenser and paper towels or, - Use of hand wipes for prepackaged food or whole fresh fruits and vegetables satisfactory or, - Side by side vendors may share a hand-washing station 	<ul style="list-style-type: none"> - A source of warm potable water - A free running spot - Liquid soap in a dispenser - Single use paper towels - A container for waste water - Gloves may be used, with appropriate handwashing and changing 	<ul style="list-style-type: none"> • Hand washing is present • Potable running water available • Faucet type • Warm water • Waste water collection container • Liquid Soap • Paper towels • Gloves being used • Gloves in adequate supply • Gloves changed between each task • Only one person handles food and money
Samples for tasting	<ul style="list-style-type: none"> - Samples are portioned and packaged at the home kitchen (except fruits and vegetables) 	<ul style="list-style-type: none"> - Use of squeeze bottles for dispensing sauces - Portions are provided in single use containers (Dixie® cups, toothpicks, spoons) - Cleaned tongs are used to give samples directly to customer - Display samples on clean food tray (wax paper, food grade plastic wrap) - Hand-washing between tasks - Keep samples protected and under control 	<ul style="list-style-type: none"> • Samples are offered • Offered by <ul style="list-style-type: none"> • the vendor (tongs or gloves), • in a paper cup, • with a tooth pick, • in a squeeze bottle • Pre-portioned and pre-packaged • Portioned at the market • Food contact surfaces non-porous and washable • Sanitization frequency • Type and concentration of the sanitizer • Handwashing is being done • Antibacterial wipes are used

Table 1 continued on next page

TABLE 1. List of food safety requirements and observational checklist for five food safety categories in BC farmers' markets (cont.)

Category examined	Guideline requirement	Additional requirements and detail under MarketSafe course	Farmers' market site checklist (Choice check-boxes for Yes, No, Not observed, Not Applicable and Comments)
Temperature control	<ul style="list-style-type: none"> - Eggs are stored at 4°C during transportation and storage/display at the market - All higher risk foods must be maintained at 4°C or colder from the point of packaging through to sale to the consumer - Meat, poultry and fish products must be kept frozen 	<ul style="list-style-type: none"> - Refrigerated foods kept below 4°C - Frozen foods kept frozen - Foods kept out of the danger zone temperature (4°C to 60°C) - Use of food grade ice packs and/or ice made of potable water when coolers used (during transportation) - Coolers are kept closed and out of direct sunlight - Temperatures monitored 	<ul style="list-style-type: none"> • Mechanical cooling system in use • Cooler box in use • Mechanical freezer available for frozen products • Coolers used for frozen products • Thermometer available and in place • Thermometer cleaned/sanitized after each use • Ice made of potable water • Food-grade ice packs
Preserved items	<ul style="list-style-type: none"> - If foods are packed in jars: only proper sealing jars (e.g. Mason-type) should be used - vendor responsible to provide evidence that a food is lower risk - for each food item, indicate location of processing/packaging (e.g. commercial establishment including address) 	<ul style="list-style-type: none"> - Complete labeling (producer's name and contact information, a "packed on" date, storage information, the list of ingredients) - Available documentation if PHF 	<ul style="list-style-type: none"> • Products have appropriate labeling: name, contact info, ingredients, allergens, storage info • Made in approved premises • If PHF, documentation available on site (A_w, pH)

foods were of higher quality and that there was less chance of foodborne disease from foods purchased from farmers' markets (13). Foodborne illnesses arising from foods purchased at farmers' markets, although rare, do occur. In Canada, raw milk cheese purchased at farmers' markets in Edmonton, Alberta and manufactured at a licensed dairy processing plant was responsible for at least 12 *Escherichia coli* O157:H7 illnesses in 2002 and 2003 (15). In the U.S., at least three documented outbreaks have been linked to farmers' market foods. Guacamole, salsa and uncooked tamales prepared in restaurants and sold in farmers' markets in Iowa caused 44 illnesses, including five hospitalizations, in 2010 (22). It was concluded that poor preparation and poor food temperature control at the farmers' markets had contributed to the outbreak (22). Cantaloupe samples offered for tasting in Colorado (2000) and strawberries sold at farmers' markets in Oregon (2011) caused 29 illnesses, nine hospitalizations and one death (11).

Foodborne illnesses are known to be caused by improper safe food handling practices such as poor personal hygiene and hand washing, inappropriate temperature control of potentially hazardous foods (PHFs), and cross-contamination that leads to RTE foods becoming contaminated with foodborne pathogens (25, 26). Each year in BC over 550,000 people, or one in eight individuals, become ill with domestically acquired foodborne illness (8).

Farmers' market operations are characterized by a lack of facilities and infrastructure compared to retail grocery stores, creating opportunities for preventable hygiene and food contamination issues. Farmers' market managers are responsible for coordinating and approving vendors. This task includes ensuring that the site and vendor stalls meet basic requirements and reviewing vendor food applications. Food safety guidance for managers and vendors selling food products at farmers' markets are outlined in two documents. One is the Temporary

TABLE 2. Key informant interview questions and survey questions of farmers' market managers

Farmers' market managers' key informant interview questions	How do you communicate with your vendors?
	What is your biggest challenge when managing the market?
	Do you have enough time to do your job, and how many hours per week do you spend managing your market?
	Suggest one thing that would give you more support or make your job easier?
	What is the most important food safety issue at your market?
	Have you ever had difficulty distinguishing between a PHF and non-PHF food?
Farmers' market managers' survey questions (5-point likert scale)	When you have a question about how to manage the market, who do you ask for help? Chose from most likely to least likely (or does not apply) from the following choices: BC Association of Farmers' Markets, Environmental Health Officer, operations manager, vendor and friend.
	Rate your satisfaction with different types of information provided to you. Choose from excellent to poor (or does not apply) from the following choices: meetings with regional health authorities, meetings with your local farmers' markets, meetings with the BC Centre for Disease Control, guidelines specific for your farmers' markets, brochures for food safety, provincial temporary food market guidelines or workshops

Food Market (TFM) guidelines managed by government health agencies (7). The second is an instructor taught MarketSafe course and workbook designed for farmers and producers (9, 14). Most farmers' market managers have received food safety education from provincially offered food safety courses such as FOODSAFE or MarketSafe, although this is not a requirement. This is in contrast to provincial BC requirements for food safety training of owners and operators of food service premises, where at least one person on shift must have approved food safety training (2). Thus, farmers' market managers may have diverse backgrounds and abilities to recognize food safety hazards, such as those related to requirements that foods be protected from contamination and be temperature controlled and that vendors practice basic hygiene such as hand washing. The purpose of our study was to observe the food safety behaviors of food vendors by assessing their compliance with food safety guidance and to assess existing support structures in BC farmers' markets through a combination of direct observation, survey and interview of market managers.

MATERIALS AND METHODS

Farmers' market site and vendor selection

Seven farmers' market sites were selected from two geographically distinct areas in BC, Metro Vancouver and northern BC (Fig. 1). Three vendors from each farmers' market were observed. Vendors were selected if they offered foods for sale, if they were handling RTE foods (e.g., baked goods), PHFs requiring temperature control (cheese, meats, fish, and eggs), foods requiring labelling (jams/jellies and pickled products) and/or foods that were being offered for tasting.

Observational study of farmers' market vendors compliance with food safety guidelines

An observational checklist was developed based on the food safety requirements for vendors described in the TFM guideline and MarketSafe educational course (Table 1). The checklist was reviewed with local Environmental Health Officers to target five food safety areas: (1) general vendor site compliance; (2) handwashing; (3) samples offered for tasting; (4) temperature control, and (5) preserved

TABLE 3. Compliance of vendors with requirements for five food safety categories in BC farmers' markets

Category examined	No. markets	No. vendors	Requirements	Compliant or % correct	Not used or Not applicable
General compliance	7	21	Stall set-up adequate, stall covered, no standing water on floor	90.4	
			Food products are stored appropriately off the ground	47.6 ^a	
			Vendors attire clean	100	
			Coolers clean	61.9	38.1
			Sneeze guard is used to protect displayed foods	28.6 ^b	33.3
Hand washing	5	11	Presence of hand-washing station	63.6	
			Complete hand-washing supplies	45.5	
			Appropriate use of gloves	0	63.6
			One person handling money and food	90.0	
Samples for tasting	5	11	Portioning at the market	54.5	
			Portioning before the market	45.5	
			Serving methods to customers	36.3	
			Hand-washing between tasks	0	
			Appropriate food contact surfaces	100	
Temperature control	7	10	Mechanical cooling	60	
			Cooler	30	
			No cooling system	10	
			Food temperature under control	60	
Preserved items	3	3	Appropriate labeling	100	
			No PHF are offered for sale	100	
			Made at home	100	
			Made at commercial premise	0	
			Documentation available	66	

^avalue includes three vendors with coolers stored on ground

^bvalue includes two vendors who did not use sneeze guards but sold pre-packaged foods

items. This study was approved by the University of British Columbia Behavioral Research Ethics Board.

Permission from market managers was sought in advance to talk to vendors and to take photos at the market before the site visit. Each vendor was observed for approximately 15 to 20 minutes to witness several food safety tasks as customers were being served. Vendors were not aware they were being observed, and results were recorded away from the vendor sites to minimize the Hawthorne effect (1).

Vendors were approached after the observation period, when no customers were present, to assess general site compliance, temperature control, and records. Information was collected by interviewing the vendor and observing temperatures on vendor thermometers, if present. Permission was acquired from vendors to collect this information and to take photos. Site assessments of all vendors were tallied, and proportions who correctly followed the guidelines were determined. Issues noted during initial observation were also recorded.



- a. Good practice for offering samples for tasting by a cheese vendor. Toothpicks and cups are used for providing samples. Samples have been cut and pre-portioned before the market.
- b. Poor practice for offering samples for tasting by a cheese vendor. Toothpicks are jammed together in containers. Cross-contamination between gloved and ungloved hand in upper left of photo frame. Samples are being portioned at the market on a single cutting board with potential for cross-contamination between cheese samples.
- c. Good practice for reducing cross-contamination in baked goods. Goods are separately packaged.
- d. Partially poor practice to prevent cross-contamination in baked goods. A sneeze guard prevents cross-contamination of goods (right); however, goods placed in wicker bins are exposed to consumer handling (left), and uncovered goods in tray exposed to other sources of contamination, such as pests (back)
- e. Poor practice for temperature control of baked goods. The pastries depicted have a dairy (milk) topping and are displayed without refrigeration. (Ambient temperature recorded as 24°C (76°F)).
- f. Partially poor practice for temperature control of eggs. The vendor has a refrigerator for storage of eggs (right back); however, several cartons of eggs are left on the display table without refrigeration.

FIGURE 2. Observed good and poor practices at farmers' markets

Determining support structures and concerns of farmers' markets managers

A general site survey was conducted at each farmers' market to assess whether a main hand-washing station was provided for vendors and consumers, to observe whether pets were found in the market, and to assess the availability of parking. Key informant interviews of farmers' market managers, arranged prior to the site visit, were also conducted. Interviews with managers were conducted during market operations but timed to be after market set-up to minimize interview stress. Additional information about market facilities and supports was collected by an E-mail survey of farmers' market managers and vendors on market facilities and supports described elsewhere (*Table 2*) (17).

RESULTS

Observational assessments of vendors

The most common vendors chosen for inclusion in this study were those selling PHFs requiring temperature control (42.9%). These included four vendors selling eggs, three selling cheese, and one each selling frozen fish or meat products. Vendors selling pre-prepared baked goods (38%) and preserves (14.3%), as well as one vendor selling fresh vegetables, were also assessed.

All BC farmers' market vendors in this study were assessed for their compliance with provincial guidelines for general site safety ($n = 21$) and for one or more food safety areas (*Table 3*). We found most vendor stalls were generally tidy and covered for protection from rain and sun; vendors' coolers and attire were observed to be clean, and all vendors appeared to have appropriate washable and non-porous food contact surfaces at their stalls. However, 11 (52.5%) vendors stored food pallets and boxes directly on the ground, nine (42.9%) vendors either did not use a sneeze guard to protect uncovered foods or did not sell pre-packaged foods, and four of 11 (36.4%) vendors providing samples for tasting did not have the required hand-washing station at their stall. Two of seven (28.6%) vendors with a hand-washing station had incomplete hand-washing supplies. One vendor who did not have a hand-washing station had two people working at the stall, one handling food and the other handling money. The majority of vendors (90.9%) were observed to handle both food and money, and although four vendors used gloves, none were using them correctly (i.e., gloves were not changed between tasks; bare hand for handling money and gloved hand for handling food were touching and/or used for the same task). When vendors offering samples for tasting to the public were observed, no hand washing was observed between tasks during the entire observation period. Slightly more vendors portioned samples at the market ($n = 6$, 54.5%) than at home ($n = 5$, 45.5%); however, only four were observed to correctly serve samples for tasting to the public. Compliance with temperature control was assessed in ten vendors. One vendor selling baked goods

with whipped cream topping did not use a cooler on site, all goods were on display, and ambient temperature recorded on that day was 24°C. Two egg vendors had more than five boxes of eggs sitting outside, and a frozen fish vendor had left the cooler open, with visible thawing of frozen product observed. One of ten vendors had a thermometer on site to assess equipment temperature. Two of three vendors selling non-PHF preserves were able to provide documentation demonstrating that their products were low risk (i.e., acidic pH values), and all vendors selling preserves had complete and appropriate labelling on products they had prepared at home. Vendor stalls depicting good and poor compliance with guidelines are illustrated in *Fig. 2*.

Description of farmers' markets observed and farmers' market manager concern

The number of markets visited in each geographic area, northern and metro-Vancouver, represent between 14 to 15% of the total number of markets in those areas. The number of vendors present in the seven farmers' markets in this study varied from nine to 125 (median 35) vendors. General site observational assessments revealed that approximately half (57%) had main hand washing stations available to consumers and vendors, pets were observed in all markets except the one that displayed signs saying pets were not allowed, and parking availability was an issue for the majority of markets (85.7%). In the E-mail survey of BC farmers' markets managers and vendors, 60% reported they had access to electricity and 70% had public washrooms. Hand-washing facilities were available at less than half of the markets (42%), with even fewer (22%) equipped with warm water.

Five of seven farmers' market managers were available on-site for interview during market visits. A manager assistant and board member were present at the remaining two markets. During key informant interviews, a variety of issues, challenges, and supports were identified (*Fig. 3*). Common concerns included wanting more support from their local municipality and increasing public attendance. Most market managers had no specific food safety issues to report, although three expressed concerns about temperature control of foods, poor food handling and poor hand washing by some vendors. Market managers communicate with their vendors most often via E-mail, and at meetings and annual general meetings, although direct contact by phone and face-to-face is also required in some areas. When market managers were surveyed as to whom they most often contacted for assistance, they ranked their operations manager as the most likely person to contact, followed by their association, and other vendors; environmental health officers were the least likely to be contacted. Survey information found guidelines and information provided by their own farmers' market was the most useful for managers and vendors (57%, $n = 132$), followed by meetings held at farmers' markets (32%) and the temporary food market guidelines (25%).

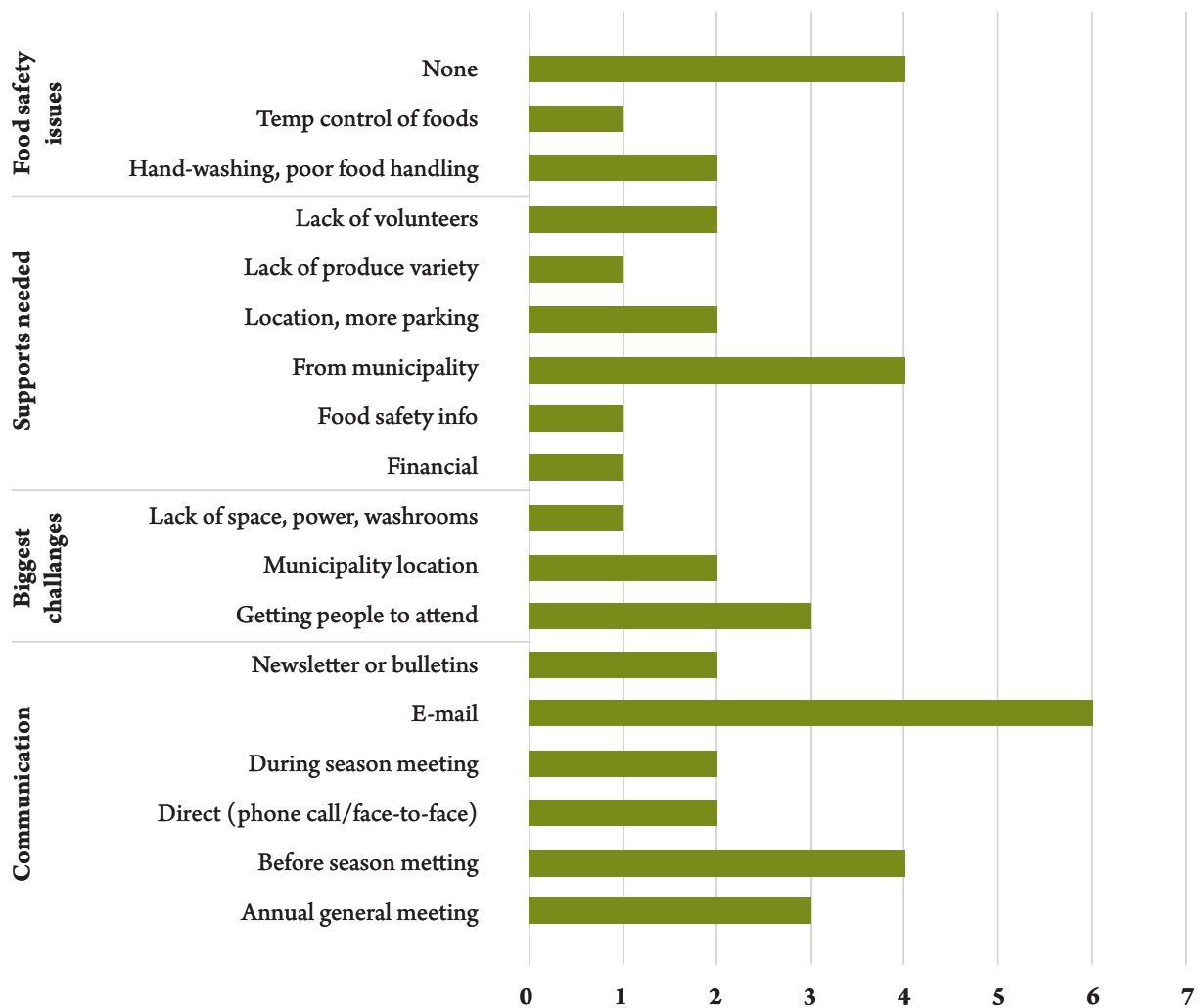


FIGURE 3. Concerns and issues of farmers' market managers

DISCUSSION

Although good knowledge and understanding of food safety principles were demonstrated in survey results of farmers' market managers and vendors when they were queried about hand washing, temperature control, providing samples for tasting, and preventing cross-contamination (reported elsewhere), the behaviors witnessed during this observation study were not in compliance with accepted standards outlined in the temporary food market guidelines or MarketSafe course (16, 17). Examples of observations not in compliance with accepted practices included cutting of cookie samples with a pocket knife and with bare hands, with no cleaning of knife or hand washing; food on the floor of a bread vendor next to another vendor with a dog; carrot cake with cream-cheese icing in direct sun on a hot day; inadequate use of ice packs

for eggs offered for sale and eggs left outside of cooling units; food products in top layer of coolers open for display, with visible thawing; and vendors using their hands to assess warmth and doneness of concession foods. Observations in compliance with guidelines included a hand-washing station set up in the centre of the market, appropriate use of sneeze guards, separate containers or utensils (e.g., paper cups or toothpicks) to offer samples for tasting and correct labelling and documentation for preserved items. One vendor in compliance with requirements for frozen meats used mechanical cooling; however, the recorded temperature was -2°C, not suitable for long-term frozen storage.

Farmers' market managers and environmental health officers have no inspection oversight of the processing and manufacture of products prepared in the home and then sold at farmers' markets. Home prepared foods sold

in farmers' markets are generally considered as lower risk; however, these products still require proper consideration during transportation, storage and on-site display such that food safety risks are minimized. For example, foods must be protected from the sun, kept under correct temperature control, and protected from potential cross-contamination, such as from dirty utensils, dirty surfaces or animals (dogs), and pests. Of the seven farmers' markets visited, six allowed pets. The TFM guidelines do not recommend excluding pets from farmers' markets. Rather, this decision is left to the market manager. Processing or further manufacturing of higher risk foods (i.e., meat, fish, and dairy products) at home is not allowed in BC, such foods must be prepared in a licensed commercial or community kitchen. Inspection oversight by health authorities (i.e., environmental health officers) does exist during processing of these foods, but they are still vulnerable to temperature control issues during transportation, storage, and sale at farmers' markets. Scheinberg et al. (2013) reported on transportation practices of raw and frozen poultry to farmers' markets in Pennsylvania. While most vendors transported products on ice, 38% reported transporting in a cooler or pre-cooled chest, with no ice or further cooling means (20). Higher risk foods must be pre-packaged and properly labelled to protect them from contamination to facilitate recall should a hazard be identified. Based on observations from this study, poor practices were evident in some vendors, as demonstrated by failures to protect foods adequately from contamination or to provide sufficiently cool temperatures for baked goods, eggs, and previously frozen products. However, as data was collected from a small number of vendors in the seven markets visited, these observations may not reflect industry wide practices.

Hand washing was not practiced at any of the seven farmers' markets observed during this study. Although hand washing stations were available in 64% of vendor stalls requiring this equipment, not all stations were adequately supplied, and hand washing was not observed even once during over six hours of observed operation. Simply having the equipment necessary to comply with a recommendation is insufficient; behaviors must also be in compliance. These results suggest that farmers' market vendors need education about the role of hand washing in limiting the spread of infectious agents. Hand washing is critically important for vendors offering food samples for tasting. Farmers' market vendors are challenged with tight spaces in their stalls, few have access to centralized hand washing stations, and vendors lack access to hot water for cleaning and sanitizing. Vendors engage in multiple activities such as selling foods, unloading trucks, preparing samples, managing waste, and handling money; seldom are vendors sufficiently staffed to separate these duties, although such tasks create opportunities for the transfer of infectious agents from money, foods, food

handlers, and consumers via multiple pathways. Money, for example, may harbor pathogens for extended periods and be transferred to hands (24).

Poor hand washing practices in farmers' markets have been reported elsewhere (10, 23). Behke et al. (2012) observed and recorded hand washing activities on a smart phone for 18 employees at an Indiana farmers' market (10). In that study, observers witnessed hand washing in two out of an observed 417 transactions that required hand washing. Issues with staff performing multiple duties, such as vendors handling RTE foods and money without subsequent hand washing were also observed (10). A survey of cheese vendors at farmers' markets also found a lack of hand washing and issues with refrigeration (23). Hand washing concerns are not unique to farmers' markets. Poor hand washing compliance rates, based on the 2005 FDA food code, were observed in food handlers in restaurants (5%) and assisted living facilities (22%) (21). Overall compliance rates were 5 to 33% in restaurants and assisted living facilities, respectively (21). In agreement with our observations, no hand washing was observed after handling of money, or in a survey of Indiana farmers' market vendors (10, 21). Failure to wash hands adequately is not limited to food handlers. In hospitals, average rates of hand washing compliance following patient contact or when moving from clean and dirty sites have been reported to be below 50% (18, 19).

Non-food items offered as samples by vendors at markets have also been linked to illness. In one BC market in 2013, a sample of hand cream became implicated in a medically diagnosed chemical burn. The affected individual was offered a sample of hemp hand cream that was subsequently applied to an existing sun burn, leading to an allergic dermatitis reaction. Although the date and location of the market was known, the individual could not recollect the product name or vendor name. Inspectors were hampered in the investigation as product trace back led to one vendor who did not carry the product implicated in the case. Further, the implicated vendor recalled other vendors were also selling and offering samples of skin care products. Our conclusion was that the list of market vendors and products sold appeared to be incomplete; no further follow-up was possible. The TFM guidelines do state that market managers are responsible for maintaining a written record of all vendors and products sold. This incident highlighted the limited ability to trace back vendor names at larger farmers' markets, particularly when samples are offered and no products purchased. It is uncertain whether any farmers' market manager has undergone a mock recall or investigation of this nature.

In BC, a focus on classroom style food safety education has been in place since July 1, 2000, when a requirement for food safety training for food service establishments was included in the Food Premises Regulation (2). There is no regulated requirement for managers or vendors at

farmers' markets to take food safety training, although most do. Choices available include FOODSAFE, established in 1985, and another classroom-based food safety training program created for farmers' market personnel called MarketSafe, first offered in 2010. MarketSafe provides more detail on the best practices for preparing foods at home, transporting foods to market, offering samples to consumers for tasting, general food handling, and cleaning and sanitation expectations (9). However, while food safety training may improve general food safety knowledge, this does not impact food safety behaviors, as evidenced by the results of this study. Subjects missing from FOODSAFE, MarketSafe or the TFM guidelines include recall practices for food and non-food products; handling of consumer complaints; dealing with reports of illness; and guidance on how to provide information to health authorities on these issues.

Farmers' market managers receive most of their information through meetings with their association or from their operations managers. Although they do consult the online TFM guidelines, they are less likely to contact an environmental health officer directly for assistance with a food issue. To deliver food safety information effectively to managers and vendors of farmers' markets, food safety information should be shared by operations managers and/or association members at their own meetings. We recommend that health authorities liaise with farmers' market associations, managers, and

operations manager to discuss food safety concerns and deliver food safety training. More emphasis should be placed on supporting behavioral changes in vendors handling RTE foods, specifically on the importance of handwashing; appropriate practices for sampling and tasting; temperature control; and product display to prevent cross-contamination. In the event a vendor selling food is linked to human disease, farmers' market administrators and managers also need to be aware of the role of product traceability in food safety. In conclusion, although most vendors and markets comply with written food safety guideline requirements, and general vendor site observations indicated good compliance, direct observation of vendor behavior and practices suggest that improvements are required in the areas of hand washing and temperature control. Communications between health and regulatory agencies and the farmers' markets and their associations also require improvement.

ACKNOWLEDGMENTS

The support of Jon Bell and Elizabeth Quinn (BC Association of Farmers' Markets), Roberta LaQuaglia (Vancouver Farmers' Markets), Brian Johnston and Jasmina Egeler (Vancouver Coastal Health), Jim Green and Greg Thibault (Northern Health) are appreciated. Financial support was gratefully received from the BC FoodSafe Secretariat.

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