



## Ensuring Food Safety among Food and Agricultural Nonprofit Organizations: A Review of Literature about Challenges and Opportunities

### ABSTRACT

Food and agricultural nonprofit organizations (FANOs) are a critical part of the food supply chain, requiring evaluation of their food safety assurance within the production, preparation, and distribution of food. This article provides an overview of literature and policy surrounding food safety in nonprofit organizations, particularly FANOs, and proposes opportunities and challenges in FANO research. It addresses the prevalent risks of foodborne illnesses associated with FANOs with poor food safety practices. Three specific problem areas that need to be better addressed in FANO research were revealed. First, poor food safety practices in FANOs can lead to food loss and waste. Second, inadequate food safety behaviors and practices among volunteers are a unique issue that FANOs face due to high volunteer turnover and reduced training time. And third, there is a large disparity between who is regulating and enforcing food safety in FANOs. Potential research questions and methodological limitations of conducting research on each problem area are proposed.

### OVERVIEW

The assurance of food safety is the shared responsibility of all entities along the food supply chain, from producers to consumers (4). This includes nonprofits responsible for addressing hunger, reducing food waste, and educating populations on nutrition and food safety. Food safety policies, regulations, and practices vary from state to state, highlighting the complex challenges and costs associated with food safety compliance (27). With longer and industrialized food supply chains, inadequate food safety practices by producers and distributors may cause pathogens to grow and spread in the community, such as through poor transportation and storage practices during food recovery and distribution (13, 32, 44, 58). With such a heavy reliance on food assistance in the United States, how to safely increase the use of donated or unsaleable foods requires attention (32). It is important for food and agricultural nonprofits (FANOs) to understand the essential concepts of food safety (i.e., pathogens that emerge, why, and in what contexts) to ensure that food is delivered safely and without excess waste. With an understanding of the risks associated with

\*Author(s) for correspondence: Phone: +1 352.273.3536; Fax: +1 352.392.8196; Email: [asim@ufl.edu](mailto:asim@ufl.edu); Kimberly Wiley: Email: [kimberlywiley@ufl.edu](mailto:kimberlywiley@ufl.edu)

foodborne pathogens, how FANOs manage food safety concerns and comply with food safety standards, especially among the vulnerable populations that they often serve, are critical components of public health, safety, and food and nutrition security (3, 58). Complex food safety policy and the scope of FANOs complicate research and practice, resulting in food waste and the risk of foodborne illnesses. This article presents an overview of the subject matter drawn from federal and state policy and the scholarship of nonprofit management, public policy, and food safety.

## FANOS AND FOOD SAFETY

Nonprofits play a critical role in the food supply chain from preproduction to production, distribution, and consumption (37). FANOs engage in the food supply chain through (1) education, training, and advocacy on behalf of producers and consumers; (2) agricultural production; (3) distribution of food through food banks and pantries; and (4) meal programs. At each stage of the food supply chain, nonprofits inevitably encounter the need to implement food safety measures to ensure that safe foods reach consumers (3, 59). Foods, especially foods that reach food and nutrition-insecure consumers, cannot serve their function as a health-sustaining source of life if their consumption causes illness (57). *Figure 1* portrays the typical network of FANOs in any given community, demonstrating the complexity of a system of FANOs and how implementing consistent food safety practices across a community of food sources may prove challenging.

### Food safety risks

Food safety protocols follow a set of standards that describe the proper production, handling, storage, preparation, and distribution of consumable food to manage the risk of foodborne illness (57). It is documented that >200 known diseases are transmitted through foods, and the causative agents include, but are not limited to, viruses, bacteria, parasites, and toxins (35). In the United States, based on comprehensive long-term active and passive surveillance data and other sources, the leading cause of foodborne illness is noroviruses, followed by bacteria (i.e. nontyphoidal *Salmonella* spp., *Clostridium perfringens*, and *Campylobacter* spp.) (6, 39).

To prioritize prevention efforts, epidemiologists attribute foodborne illness to specific commodities. For example, from 1998 to 2008, 46% of foodborne illness was attributed to produce and more deaths were caused by poultry than by other commodities (37). In 2021, the Centers for Disease Control and Prevention compiled multistate outbreaks and identified 74 foodborne outbreaks of contaminated foods; they were primarily linked to *Salmonella* spp., Shiga toxin-producing *Escherichia coli* and pathogenic serotypes, and *Listeria monocytogenes* found in cooked chicken and leafy greens (7). Overall, these outbreaks caused 3,615 illnesses, 1,011 hospitalizations, and 26 deaths. Notably, more than

one third were due to *Salmonella* from backyard poultry and contact with chickens, ducks, geese, and turkeys. Other *Salmonella* outbreaks have been linked to undercooked ground beef and raw cookie dough (5). These various outbreaks of foodborne illness demonstrate their prevalence as a health issue while also posing the question of what role FANOs play in such outbreaks. For example, multiple cases of *Salmonella* infections were determined to be a result of a frozen chicken product distributed in Ruby's Pantry, a food pantry with locations in Minnesota and Wisconsin (1). In 2022, 534 orders of Jif peanut butter distributed across food banks in northeastern Ohio were linked to multistate *Salmonella* outbreak (2). Ultimately, these two examples illuminate the need to define the role that FANOs play in ensuring food safety in the food supply chain as well as the importance of assessing the adequacy of the current safety practices for food handling, preparation, and distribution.

### Risk of foodborne illness in nonprofits

Food safety standards are implemented to ensure that food systems practices prevent the risk factors associated with foodborne illness (28). Noncompliance with retail food safety standards is higher among organizations that require food storage or provide emergency food delivery (9). Food banks and food pantries face challenges in storing significant amounts of food options for longer periods of time and are limited by low budgets and decentralized systems (3). Unlike in the commercial food industry, food inflow and outflow can be unpredictable in nonprofit food banks and food pantries. These FANOs depend upon the availability of food donations. External factors such as emergencies or welfare programming changes affect demand. Unstable supply and demand destabilizes such nonprofits and can pull resources away from compliance oversight.

## OPPORTUNITIES AND CHALLENGES OF FOOD SAFETY RESEARCH AND FANOS

Some FANOs are driven by missions or incorporate program components to educate consumers, food handlers, and producers on the importance of food safety to reduce foodborne illness (42). Although education efforts are an important component of reducing foodborne illness among food handlers (33), other systems-based interventions have also been recommended, such as improving transportation efficiency (13). In this investigation, we identify three challenges in food safety-related issues and nonprofit organizations. These challenges elucidate areas of opportunity for improvement through changes in practice, policy, and research. First, poor food safety practices in FANOs can lead to food waste. Second, such practices are driven by inadequate knowledge of safe food handling by FANO staff, volunteers, and clientele. Third, complex and unclear food safety policy implementation perpetuates these problems.



FIGURE 1. Food and agriculture nonprofits in communities.

Next, we define these three problem areas and offer recommendations for research inquiries. We also address the methodological limitations in FANOs and food safety research.

### 1. Food waste

**Problem.** Reducing food waste is the aim of many FANOs, but poorly regulated food recovery processes pose potential food safety risks that may exacerbate food waste.

Food waste refers to the edible food that is thrown away by consumers, whereas food loss occurs at the production and distribution levels (30, 41). Food waste results from improper food storage from production to consumption and can be operationalized at a single stage in the supply chain or across the entire process (38). According to the U.S. Department of Agriculture (USDA), approximately 30–40% of the retail- and consumer-level food supply is wasted, resulting in environmental and economic costs (40, 50). Lack of knowledge of food preservation, storage, and hygiene practices can result in food waste due to spoilage (45). The average American, for example, spends approximately \$1,300 annually on food that ends up being wasted (11). The

problem of food waste appears oxymoronic when considering that many people struggle to provide food for themselves and their families: 17 million U.S. households were food insecure in 2022 (51). Inadequate attention to time/temperature control can lead to food spoilage and food waste, as per the common recommendation “when in doubt, throw it out.” Attention to food safety, specifically time/temperature control and expiration dates, helps to reduce the occurrence of foodborne illness and may also support a reduction in food waste at the retail and consumer levels (32, 36).

Food recovery organizations are an important sector of FANOs that specifically focus on reducing food waste. Food recovery nonprofits collect surplus foods from retailers, restaurants, or food manufacturers to redistribute foods to those in need (58). Nonprofits specializing in food waste recovery consult their appropriate state regulation agency for the proper practices when determining how to manage the safe handling and redistribution of recovered foods (28, 43, 58). State-level agencies have the authority to incorporate different versions and sections of the U.S. Food and Drug Administration (FDA) Model Food Code to use in food

recovery and distribution to account for differing levels of risk relevant to different types of food (i.e., produce versus restaurant leftovers). Inconsistencies can make the food recovery programs either dangerous to implement or at risk of noncompliance with food safety standards (58). People working in fruit and vegetable recovery nonprofits and emergency food operations in California have highlighted a lack of infrastructure, logistical support, and ambiguous food safety regulations with high compliance costs as prominent issues that contribute to food loss (10). Food waste is a prevalent issue that nonprofits are seeking to combat, but further guidance is needed to ensure that food safety standards are being met in efforts to reduce food waste (32). The USDA addresses how nonprofits can benefit from collaborating with gardeners to decrease food waste. For example, The People's Gardens, which are USDA-supported gardens, donate all food that is grown to nonprofits such as food banks, pantries, and kitchens (49). Community gardens may play a role in combating food waste by donating excess produce grown in the gardens to FANOs. However, like the concerns about minimizing cross-contamination and preventing foodborne pathogens in food bank and pantry supplies, the foods that travel from community gardens are similarly at risk and require education, training, and infrastructure to ensure that donated foods reach their destination safely. Thus, community-level food safety practices need to be implemented when considering the role that gardens play in decreasing food waste. Food safety practices for garden-grown fruits and vegetables may differ from food production on other parts of the food supply chain due to adhering to different food safety regulations, or exemption from the regulation because of low production volume. For example, under the Food Safety Modernization Act of 2011, produce farms are regulated by the Produce Safety Rule, whereas other food manufacturing or processing facilities for human food are regulated by the Preventive Control for Human Food (10).

Food safety training for workers and volunteers can be a practical way to not only reduce the spread of foodborne illness in nonprofits but also reduce the amount of food that is thrown away due to poor handling practices (42). Other possible solutions to increase food safety and reduce food waste include clearer expiration date labels, use of advanced technology to evaluate food safety, and communication along each step of the food supply chain (44). During distribution, food services need to prioritize time/temperature control and sanitization practices to efficiently transport their food. Proper food storage practices need to be observed by vendors and markets before cooking the food so that it is not thrown away by consumers (29, 30, 33).

**Potential research questions.** The potential research questions on food waste in nonprofits are as follows.

- Are FANOs distributing or serving spoiled food, leading to foodborne illnesses?

- Do inadequate food safety practices result in food waste in FANOs?
- Do food safety practices result in overzealously disposing of food in FANOs?
- What controls are in place to keep foods safe during transportation to and from FANOs?
- How do nonprofits interact with commercial entities to reduce food waste while complying with food safety regulations in their state?

**Methodological limitations.** The methodological limitations in research on food waste in nonprofits involve quantifying the holistic causes and economic and environmental impacts of food waste to propose reasonable behavior or policy change (10). Researchers must define the stage or stages in the food supply chain that they are assessing for food waste and consider both the precedents and antecedents to the stage in question (30). For example, they must specify whether they are concerned with household- or production-level food waste to clarify what behaviors are observable and the extent to which they affect the problem. Food recovery efforts by nonprofits are a major means of combating food waste (14). Thus, researchers should consider how food safety influences food recovery and how to ensure that safe and consumable foods remain safe and are not ultimately thrown away through existing successful programs.

## 2. Inadequate knowledge of safe food handling

**Problem.** Food safety knowledge of nonprofit staff, volunteers, and FANO clientele about regulations and practices is often inadequate.

This inadequacy may result in outbreaks of foodborne illnesses and diseases. Unsafe food handling practices, such as inadequate handwashing and lack of food thermometer and refrigeration thermometer use, are more likely when minimal or no food safety training exists (9, 17, 25). A small sample study suggested volunteers at food banks and pantries receive less training on proper food safety practices than the organization's supervisors and managers (8), even though volunteers are more likely to handle the food.

An area contributing to inadequate food safety knowledge and practices among FANOs is the large number of volunteers involved. For example, Second Harvest Food Bank of Central Florida serves the Orlando metropolitan area through 625 "feeding partners," including emergency food pantries, soup kitchens, shelters, and senior centers. Second Harvest depended on 39,138 volunteers contributing to 119,765 work hours in 2022, averaging 3 work hours per volunteer. This nonprofit calculated its 2021 food value to be >\$154 million across its seven facilities (52), and the Florida Department of Health (DOH) reported 23 food hygiene violations at one of their facilities in the same year (19). Ensuring that each volunteer has adequate knowledge of food safety risks and oversight of food handling behaviors is a costly endeavor.

FANO volunteers often give their time as groups, such as from fraternities and corporate volunteer days. For example, Florida Blue offers its workers 8 paid hours per year to donate to the worker's preferred cause. The Greater Chicago Food Depository, which distributed 77.3 million meals in 2022, invites corporate groups of up to 29 volunteers for tasks such as repackaging fresh produce for distribution on shifts lasting 2–3 h (24). Such volunteering often occurs in single visits rather than as a weekly or regular volunteer commitment. As a result, FANOs host exponentially more volunteers than other types of organizations.

This problem can be defined as high volunteer turnover and is prevalent in nonprofits (31, 55). A high turnover rate in volunteer workers means that a greater portion of volunteers may be new and inexperienced and thus more likely to struggle with retention of food safety knowledge, practices, and regulations (15, 31, 55). Providing preservice and in-service training programs, recognizing and rewarding volunteers' contributions to the nonprofit's mission, and implementing more challenging tasks may all lower the turnover rate of volunteers in FANOs and increase the probability of sufficient food safety knowledge and experience (31, 55).

Resources such as Foodsafety.gov, the Association of Food and Drug Officials, and the Conference for Food Protection offer printable charts, up-to-date research, and training opportunities accessible to FANO leaders. To combat the issue of inadequate food safety knowledge and practices, researchers have analyzed the effectiveness of education modules and trainings on food safety and handling for nonprofit workers (17, 42). Pretests and posttests revealed that education modules and trainings can be effective in improving understanding and knowledge of food safety regulations and practices for both volunteers and paid workers (17). One study proposed that better management and leadership, which encourages and emphasizes the importance of proper food safety practices, is necessary (16). As such, FANOs' risk management protocols for foodborne illness should mirror the proactive financial control activities and disaster preparedness plans that are required of them by their public funders and accepted nonprofit best practices.

The clientele of FANOs should also be considered to a greater extent in future research surrounding food safety and nonprofits, which is an issue that was noted in research surrounding the Woman, Infants, and Children nutrition program in Miami, Florida, in the late 2000s (12). For example, multiple studies revealed that the clients' knowledge about safe food practices was limited, especially regarding cooking and chilling parameters, inadequate handwashing, and lack of refrigeration for perishable items (46, 47). In addition, research has shown that clients can be apathetic to unsafe food practices and foodborne illnesses and disregard the possible threats that they pose to their and their children's health (46, 47). Ultimately, this elucidates a need to assess how adequately

food safety is taught and what level of importance it holds in nutrition nonprofit programs. When workers at FANOs providing nutrition education become more familiar with proper food safety practices themselves, it can be inferred that the clients will, in turn, receive better training.

**Potential research questions.** The potential research questions on knowledge of safe food handling in nonprofits are as follows:

- How does volunteer food safety knowledge affect service delivery in FANOs?
- What are the learning costs associated with accessing food safety information?
- What is the relationship between the number of annually reported volunteers and food safety violations or foodborne illness outbreaks?
- What is the economic cost of FANO volunteer turnover and food safety training implementation?
- What volunteer retention strategies are uniquely effective for FANOs when delivering food safety training?
- What FANO food safety risk management strategies are most effective at preventing foodborne illnesses?

**Methodological limitations.** Volunteer and staff knowledge, attitudes, and behaviors largely drive food safety practices (17, 42). Thus, researchers must define metrics for knowledge and attitudes toward food safety practices separate from metrics for their behaviors. Operationalizing each separately is essential for developing instructional materials. Mixed methods can be effective in analyzing the food safety knowledge of workers in FANOs. However, studies on instructional materials tend to be exploratory, include small samples, and are often point-in-time analyses. One study gathered qualitative data through open-ended interviews with 105 pantry managers and coded for common themes to offer researchers nuanced information that may not have been revealed in close-ended questionnaires (8). Through this method, valuable information was revealed from the pantry managers about common, widespread food safety issues in North Carolina food pantries, such as workers' lack of knowledge about food recalls and irregular use of refrigerator thermometers. The tedious process of mixed-methods studies that pair qualitative and quantitative methods makes it difficult for researchers to analyze larger sample sizes. This limitation is particularly true when FANO volunteers often volunteer one time for a short shift.

Structured surveys can be used to assess changes in knowledge through pre- and post-interventions and to measure the adequacy of workers' knowledge (16, 17, 42). Pre- and post-survey data have helped to inform the effectiveness of training and education programs to understand how workers' knowledge about food safety practices and regulations can improve after undergoing training (17, 42).

Quantitative survey methodology generally allows for larger sample sizes, because the data collection is simpler than conducting qualitative, open-ended interviews. For example, the use of survey tools to measure the food safety knowledge of onsite, not-for-profit, healthcare, and school food services. The survey methodologies provide findings with application-based knowledge and greater generalizability than mixed-methods studies with smaller sample sizes. However, generalizing findings from a sample of full-time food workers or supervisors to one-time volunteers may not be appropriate given the variation in a person's commitment to the FANO or food safety.

Data collection via tests, surveys, and interviews during a small window of a volunteer shift could distract the worker and cost the organization their valuable donated time. Unobtrusive behavioral observations would be less costly for the FANO because such data collection approaches would not disrupt workflow, although human error in data collection risks reliability in the data (56). Workspace testing for bacteria following a shift would also separate the researcher from the workflow, but would limit reliability if it were unclear which volunteer caused the bacterial spread. Capturing the effects of an intervention would require a large research team, increasing the research cost and decreasing feasibility.

### 3. Implementation of food safety policy

**Problem.** It is cumbersome for nonprofit leaders, volunteers, and consumers to determine who is implementing, regulating, and enforcing food safety policies for their organizations.

The Food Code is developed by the FDA and "... assists food control jurisdictions at all levels of government by providing them with a scientifically sound technical and legal basis for regulating the retail and food service segment of the industry" (54). These regulations are updated on a regular basis: every 2 years before 2001 and every 4 years thereafter, with supplemental changes in between (28, 54). Different agencies, which regulate various states and territories, determine when to incorporate a version of the Food Code into their rules and oversee compliance with these rules (54).

In Florida, three major food safety agencies incorporate the Food Code into their administrative rule. The Department of Business and Professional Regulation (DBPR) currently uses the 2017 Food Code to regulate hotels, restaurants, mobile food vehicles, caterers, and public food service events (21). The Florida Department of Agriculture and Consumer Services (FDACS) currently uses the 2017 Food Code to regulate the commercial food supply, including retail and wholesale food businesses (18, 22). Finally, the Florida DOH currently uses the 2013 Food Code to regulate food safety at the institutional level (20).

Given the variation of regulations among these agencies, the question of whether and how nonprofit organizations are being regulated for food safety becomes prominent. A nationwide survey was conducted by the Harvard Law

School Food Law and Policy Clinic to assess the regulations and guidance surrounding food safety in retail and restaurant food donations (34). The survey revealed that the DBPR and the FDACS had no regulation or guidance documents for food donations; the Florida DOH was not included in the survey (34). Thus, when considering the food donation aspect of nonprofit organizations, it is evident that food safety is not being overtly regulated or guided.

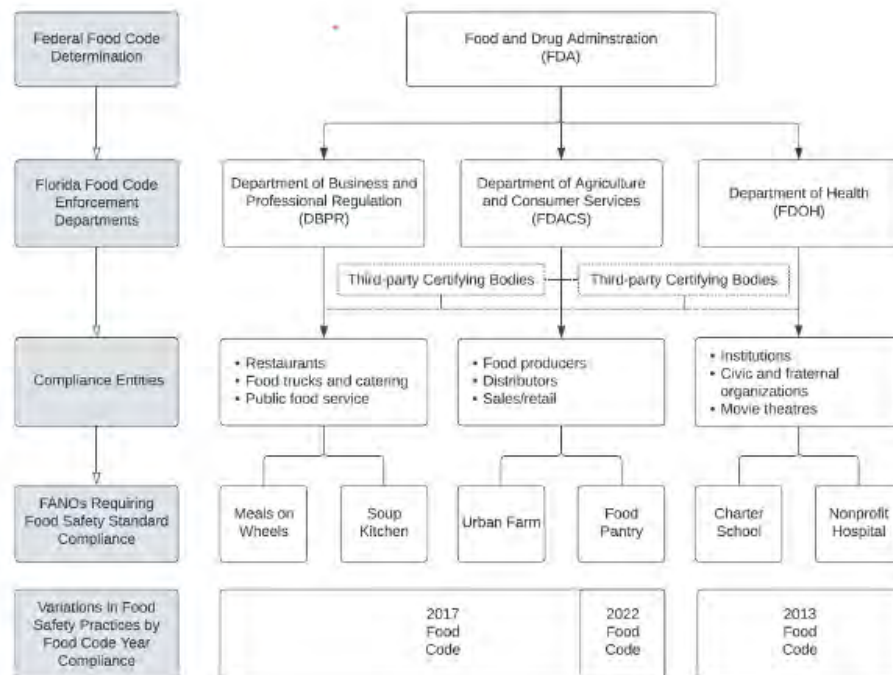
The Florida DOH does regulate food safety standards of certain nonprofit organizations, but which organizations they regulate is often difficult to ascertain. For example, civic organizations that offer food service to the public with the goal of furthering the common good or general welfare, including not-for-profit organizations, are regulated by Florida DOH (20). In addition, food banks or pantries that are subsidiary to larger institutions may be regulated. For example, the Hitchcock Field & Fork Pantry at the University of Florida is regulated by Florida DOH, given that all food service on the University of Florida must comply with DOH standards (48).

Food safety regulatory problems in FANOs also arise when considering whether updates to the Food Code are adopted by state-level agencies. The most recent food code at the time of writing this article is the 2022 Food Code. It can take years for a state agency to adopt and implement a new food code, as evidenced by the Florida DOH enforcement of a 10-year-old code. An update in the food code is costly for institutions, which may lead to advocacy against such a change by their trade associations (23).

Nonprofit third-party certifying bodies. Third-party certifying bodies play a commercial role in food safety and compete with one another for client engagement with their set of standards (59). These organizations, such as SGS North American Inc. and NSF Certification, LLC, are FDA-accredited bodies that "can conduct food safety audits and issue certifications of foreign food facilities" (53). Third-party certifying bodies compete for the business of entities such as nonprofits, so this competition may increase pressure to produce grades favorable to the institutions (26).

Third-party certifying bodies may adapt to new food safety practices faster than their state governmental counterparts (28). This makes their services more preferable to avoid foodborne illness among higher resourced nonprofits, such as Feed America (28). Lower resourced nonprofits specializing in food services may avoid the additional scrutiny from third-party certifying bodies, given their reduced capacity and lack of prior certifications (3, 59).

For example, a national association of meal delivery programs for seniors may use a third-party certifying body to oversee their local programs because the regulator adopted the 2022 Food Code that addresses proper steel storage containers to reduce *Salmonella* that directly affects their clientele. The 2022 Food Code requires using those new steel containers that a small nonprofit may not be able to afford.



**FIGURE 2. Major regulation entities and compliance in Florida.**

As a result, a smaller meal delivery for nonprofit may avoid this third-party oversight provider.

**Potential research questions:** The potential research questions on food safety policy implementation are as follows:

- How does FANOs' size affect compliance with the Food Code?
- Do FANOs have the pecuniary and human resources and capital to adhere to the Food Code?
- How do the administrative burdens associated with compliance affect FANO programmatic outcomes?
- How do advocacy organizations influence the complex food policy issue arena?

**Methodological limitations.** The mosaic of governmental and third-party food safety regulations adds a layer of administrative tasks that can be time-consuming to navigate. *Figure 2* demonstrates how the variation in regulatory bodies could mean that the same salad provided in five FANOs on a single street could be regulated by three different Food Code versions. This difference matters because of the change in a *Salmonella* protocol updated in the 2022 Food Code. To assess a breakdown in policy implementation related to a *Salmonella* outbreak would require the inclusion of one federal authority, three state authorities (in Florida alone), third-party certifying bodies, dozens of categories of FANOs, distributors, and producers. The costs and feasibility of data collection and analysis make such studies impractical.

## CONCLUSION

FANOs have a responsibility to serve their clients and communities while complying with food safety policy to protect their health. FANOs are uniquely positioned to benefit from food safety policies, especially to decrease food waste produced by their operations and to promote safe food recovery. Unfortunately, FANOs face a complex and at times contradictory regulatory landscape that imposes heavy administrative burdens, which may be especially burdensome in light of the unique challenges faced by FANOs. Implementation can only be as accurate as the worker's knowledge, which may be undermined by factors such as volunteer turnover, brief instructional opportunities, and inconsistent inflow and outflow of food products. This implementation may be overseen by various private and public regulatory agencies with differing requirements and associated costs, which increases complexity and may strain already underresourced nonprofits. Future researchers should examine current compliance practices and barriers faced by FANOs. Professionals in the field, such as policy-makers or regulatory bodies, could address the challenges highlighted by advocating for more cohesive policies that are less resource intensive or by translating these policies into practical recommendations for FANOs that address their unique opportunities and challenges.

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