Journal of Food Protection 88 (2025) 100561

Contents lists available at ScienceDirect

Journal of Food Protection

journal homepage: www.elsevier.com/locate/jfp

Research Paper

Conversations With State and Local Inspectors Reveal Ambiguity in the Application of Food Safety Regulations on Small-scale Produce Drying Operations

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ARTICLE INFO

Keywords:
Food safety
Interview
Produce drying
Training

ABSTRACT

Small-scale produce-drying operations face many barriers to complying with food safety regulations. While studies have explored those obstacles from a broader viewpoint, the perspective from niche food processes has not been reported. The purpose of this study was to administer semi-structured interviews with public health inspectors to identify (1) gaps in food safety regulation interpretations and (2) food safety education needs for small-scale produce drying stakeholders. The study revealed discrepancies among inspectors in "what to inspect" and "what to follow," and a lack of uniformity in which regulations or rules were followed. Additionally, inspectors reported complications in inspecting small-scale produce-drying operations. First, they expressed frustration with regulations related to drying because they said the language was vague or outdated. Second, inspectors expressed a lack of confidence in clearly and effectively communicating the importance of certain food safety rules to operations. Third, inspectors complained about the lack of relevant educational resources, which hindered the development of food safety competency. The findings emphasize the importance of technical support to address these gaps, offering specialized training and resources that enhance both inspectors' and operations' understanding of food safety standards, ultimately promoting greater regulatory compliance and safer food production.

Drying produce is an attractive, value-added option for farmers to increase profits, decrease food waste, and meet customer demands (Chen et al., 2021; Torres, 2022). Low-moisture foods, which have low water activities (<0.85), have been associated with foodborne illnesses even though the growth of foodborne pathogens is limited in these products (Acuff et al., 2023; Lieberman et al., 2023; Zhang et al., 2024). Notable outbreaks have been associated with spices, flour, peanut butter, and tree nuts. While pathogens are unable to grow in foods with a water activity at or below 0.85, pathogens can survive in these types of products for extended periods (Acuff et al., 2023). In recent years, dried fruits and vegetables have been implicated in several foodborne recalls and outbreaks. In 2014, a company recalled 59,780 cases of freeze-dried strawberries due to potential contamination with *Salmonella*, spanning 37 U.S. states (FDA, 2014). In 2017, a recall of dried apricots was enacted because of potential contamination with *Listeria,* spanning six U.S. states (FDA, 2018a). In 2018, dried coconut was recalled due to *Salmonella* contamination, which affected eight U.S. states and caused three known hospitalizations (CDC, 2018). In 2020, dried wood ear mushrooms were implicated in a *Salmonella* outbreak with 55 known cases and 12 known hospitalizations (CDC, 2020).

To minimize risk, producers of low-moisture foods must consider implementing a validated kill step into their production processes and also minimize the potential for recontamination of the product with environmental pathogens based on hazard analysis (Acuff et al., 2023). For dried fruit and vegetable producers, especially those oper-

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https://doi.org/10.1016/j.jfp.2025.100561
Received 18 December 2024; Accepted 12 June 2025
Available online 16 June 2025

ating on a small scale, validating a drying process for pathogen control and conducting environmental monitoring can be a major challenge. Small- scale operations often lack resources and/or knowledge needed to adhere to food safety standards (Barone et al., 2020; Chen et al., 2021; Fitzgerald et al., 2024).

The U.S. Food and Drug Administration (FDA) has established regulations that dictate the approach food operations must use to minimize food safety risks (FDA, 2024a). The Food Code was developed as a food safety model for retail food establishments, establishing a uniform approach to food safety inspections. The document is updated every two to five years, the most recent full edition being from 2022. Each state in the United States can choose to adopt all or portions of the FDA Food Code as their own state regulations for retail food establishments (FDA, 2022). The Food Safety Modernization Act (FSMA) Preventive Controls for Human Food (PCHF) rule (21 CFR Part 117) is a federal regulation that dictates minimum food safety standards for wholesale food manufacturing (FDA, 2018b). The FSMA PCHF rule is a risk-based approach to identify potential food safety hazards and implement appropriate controls to minimize food safety risks (FDA, 2024b). In 2015, the FSMA PCFH was updated, requiring food safety plans (FDA, 2018b). The FSMA Produce Safety Rule (PSR) (21 CFR Part 112) is a science-based federal regulation that sets a minimum standard for safe farming practices on-farm growing, harvesting, packing, and minimal processing of raw agricultural commodities (RAC) that are commonly consumed raw (FDA, 2024c). A farm operation that also conducts food processing is considered a mixed-type facility and may have to comply with 21 CFR Part 112 and Part 117. While these regulations cover some specific guidance on how to manage pathogens in various commodities, there are no specifics on how to reduce risks when drying fruits and vegetables. Therefore, the application and interpretation of these regulations for dried fruit and vegetable operations are challenging for both inspectors and operations (Azansa & Zamora-Luna, 2025; Chen et al., 2021; Fitzgerald et al., 2024; Yapp & Fairman, 2006; Xu et al., 2022).

The federal government oversees food safety inspections, partnering with state and local agencies to tackle regulatory oversight under contracts and cooperative agreements (FDA, 2024d). Regulatory requirements vary depending on the type, size, and food product of an operation, making regulatory oversight of produce drying particularly complex as shown in Figure 1 and Table 1. The figure demonstrates that in general, produce that is harvested and dehydrated whole is regulated by the FSMA PSR (21 CFR Part 112). However, if the farm's three-year sales average is $25,000 or less (adjusted for inflation), they are exempt from complying with FSMA PSR. In contrast, farms operating as mixed-type facilities, those that cut and then dry produce, are typically regulated under the FSMA PCHF (21 CFR

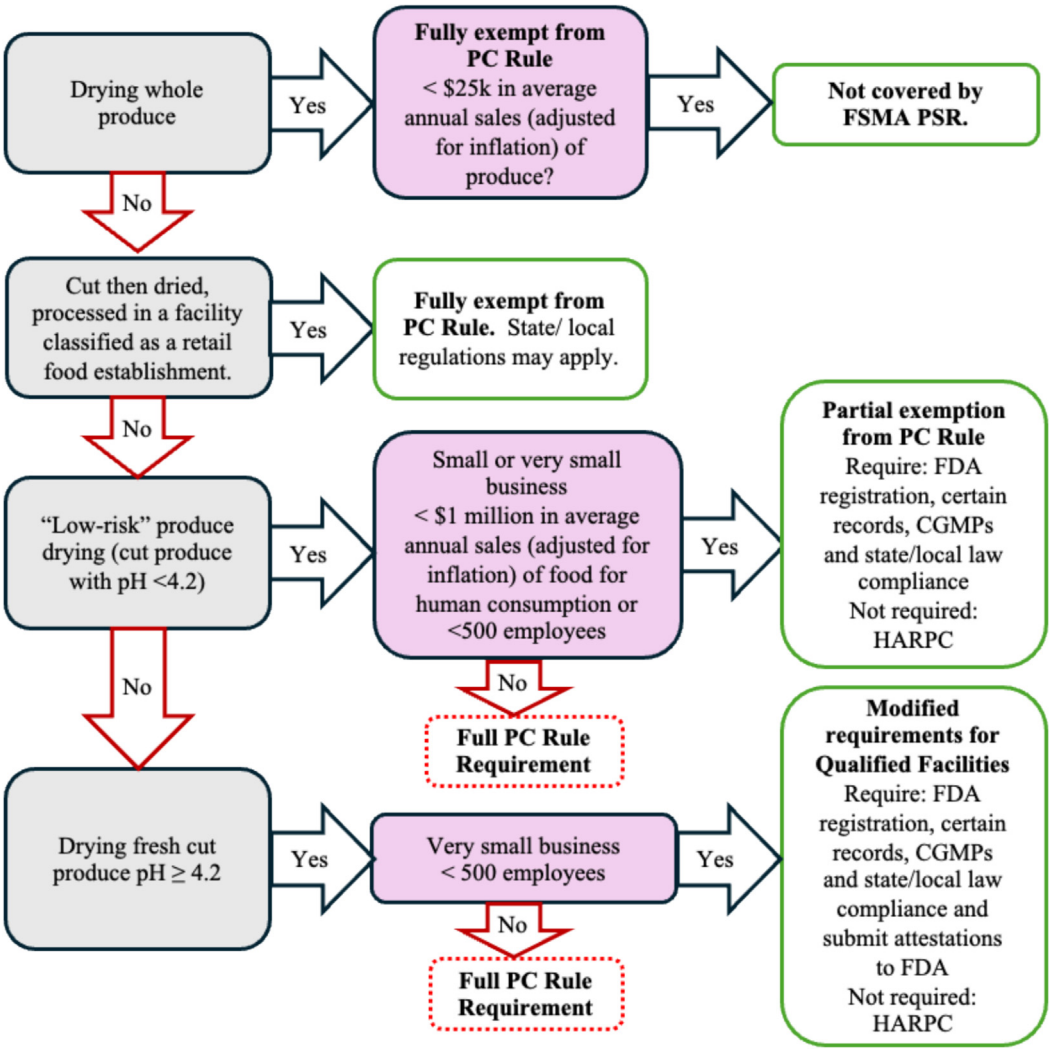

Figure 1. Farm mixed-type facility produce-drying food safety regulation flowchart adapted from DiCaprio, E. & Feiereisel, K. (UC Davis Food Safety, 2018). Note: FSMA PSR may still apply.

Table 1
Food safety regulation scope

Federal Regulations		
21 CFR 112	Standards for growing, harvesting, packing, and holding of produce for human consumption	Food Safety Modernization Act (FSMA) Produce Safety Rule. Sets food safety regulatory standards for produce production and harvesting practices
21 CFR 117	Current good manufacturing practices, hazard analysis, and risk-based preventive controls for human foods	Food Safety Modernization Act (FSMA) Preventive Controls for Human Food Rule. Sets food safety regulatory standards for food manufactures
FDA Food Code	Retail food safety guidance	The FDA Food Code is a model set of regulations for food safety in retail and foodservice establishments, developed by the FDA to help states and local jurisdictions establish food safety standards, and is updated every four years

Part 117). With partial exemption or modified requirements based on the operations' size and level of risk (Community Alliance with Family Farmers, 2021). To reduce the regulatory burden on small-scale operations, many states have allowed home-based businesses, which permit certain low-risk food products to be produced in a residential kitchen and sold with minimal regulatory oversight (FDA, 2024a; The National Agriculture Law Center, 2025).

Inspectors play a crucial role in ensuring adherence to food safety standards among small-scale operations (Buckley, 2015; Hagqvist et al., 2021; Shabaneh et al., 2022), which often encounter compliance difficulties due to their lack of awareness and knowledge of food safety regulatory requirements (Fay et al., 2023; Harrison et al., 2016; Yapp & Fairman, 2006). This finding emphasizes the importance of inspectors in ensuring the safety of our food supply. However, many studies have shown that, in general, inspectors lack adequate and up-to-date training (Hagqvist et al., 2021; King et al., 2020; Pham et al., 2012), and differing interpretations of food safety standards have been identified among inspectors (Xu et al., 2022; Zagorski et al., 2021).

There remains ambiguity in which food safety regulations apply to small-scale fruit and vegetable drying operations and how regulations are enforced for these types of businesses. This study aimed to explore food safety regulation perception and interpretation, and food safety education needs for small-scale produce-drying operations and food safety inspectors. We identified recommendations for technical support providers to create resources to help producers and inspectors comply with safety regulations.

Materials and methods

This study used qualitative research (interviews) for data collection. Before the study began, the University Institutional Review Board approved the protocol (IRB-2021-1436).

Interview development and pilot test. An interview approach is a common methodology used to gain a range of thoughts and in-depth perceptions on a food safety topic of interest through one-on-one discussion with the researcher and individuals of similar backgrounds (Buckley, 2015; Hagqvist et al., 2021; Liu et al., 2022; Zagorski et al., 2021). In the current study, researchers developed the script, which three university food safety specialists reviewed. Previous studies have employed this protocol (Chen et al., 2024a, 2024b; Feng et al., 1984). Researchers pilot-tested the script with three industry professionals to assess interview clarity and flow. The interview included six sections: (1) background, (2) expected food safety controls for produce-drying operations, (3) regulations used during the inspection, (4) perceived produce dryers' knowledge, (5) interaction with produce dryers, and (6) future University Extension needs. Researchers developed a hypothetical scenario interview version for inspectors who had not yet inspected small-scale produce-drying operations. For this study, small-scale produce drying operations were defined as businesses with fewer than 500 full-time employees or an average of less than $1,000,000 per year in the past 3 years.

Data collection. Researchers sought to identify and recruit participants on a multistate level through public email lists, point-of-contact interactions, and word of mouth; however, they faced many obstacles, including: (1) statements by inspectors that small-scale dried produce was not allowed in their jurisdiction; (2) assertions by inspectors that dried produce was not under their jurisdiction; and (3) failure of inspectors to respond to researchers inquiries. They concluded interview collection at $n = 32$ once saturation of information was reached (Hennink & Kaiser, 2022; Liu & Eaton, 2023). Interviews were held via Zoom and lasted for approximately 45 min. The interview participants were government employees who may be identifiable based on their voice and fear repercussions based on their interview responses. To protect their confidentiality and encourage honesty, interviews were not recorded, a common approach in sensitive research contexts (Boucher et al., 2023; Gustavson et al., 2024; Lisk et al., 2023; Rutakumwa et al., 2020). To mitigate bias, three trained researchers, including the interviewer, took detailed notes during each live interview. After the interview, the researchers combined their notes into one comprehensive transcript (Rutakumwa et al., 2020). To further reduce bias and ensure accuracy, participants reviewed the final transcript. Participants were offered $50 each to thank them for their time and contribution.

Data analysis. Interview analysis was completed using NVivo 14 software to conduct qualitative coding. Throughout the coding process, the codebook was checked by an additional research assistant. The primary project investigator then reviewed the final codebook. Descriptive, process, and emotional codes were initially developed during the first code cycle. During the second code cycle, categories were constructed from the codes using the pattern coding method (Saldaña, 2016). Finally, categories were combined into common themes (Table 2).

Results and discussion

Participants in the interviews consisted of a total of 32 inspectors from 15 different states (Table 3). The inspectors revealed insight into food safety regulations used, and food safety education needs for small-scale produce-drying operations and food safety inspectors.

Regional variability in regulations used. Inspectors across all U. S. regions—Northeast, South, West, and Midwest—demonstrated variability in their reliance on key regulatory frameworks during inspections. The Northeast reported the highest use of the Food Code but did not reference 21 CFR Part 112. In contrast, inspectors in the West frequently cited both the Food Code and 21 CFR Part 112. Inspectors in the South relied primarily on 21 CFR Parts 117 and 101, while those in the Midwest uniquely incorporated a state-level wholesale food code into their practices. It was also common across regions for inspectors to reference multiple regulations during inspections.

These regional inconsistencies are consistent with prior research on inspection practices, which highlighted how economic and social factors can influence regulatory interpretation (Lundén et al., 2021). Furthermore, although the federal government oversees food safety, regulatory authority is often contracted to state and local agencies (FDA, 2024d). Because requirements vary based on operation type, size, and product, and enforcement structures differ by jurisdiction,

opportunities for regulatory interpretation and variability in enforcement are inevitable.

Inconsistent use of Food Code versions. Although the Food Code was the most commonly referenced regulation among inspectors, the version of the Food Code used varied both across and within states. This variability was expected, given that states may adopt different versions of the Food Code at different times. However, notable inconsistencies were observed even within a single Northeast state: among 12 inspectors, seven used the federal version, two used the state-adopted version, and five referenced both versions during inspections. Similar findings have been reported by Zagorski et al. (2021), who observed that inspectors within the same state often relied on a mixture of regulatory documents, including state and federal food codes and other inspection materials. The variation in Food Code versions may partly be explained by the adoption timelines of local agencies. Because the FDA releases an updated Food Code approximately every three to five years, and adoption by state and local agencies can lag behind federal updates, inspectors within the same jurisdiction may rely on different versions depending on agency policies and training updates.

Jurisdictional complexity in oversight. Variability in jurisdictional oversight emerged as a significant source of complexity and frustration for inspectors, particularly when oversight depended on how the produce was processed. For example, one inspector described focusing exclusively on whole produce that was dried, applying 21 CFR Part 112 as the guiding regulation. However, once produce was sliced before drying, it was reclassified under manufactured foods. As one inspector explained, “Mushroom growers growing, harvesting, and packaging whole falls under produce safety, but the slicing and packaging of that produce are under manufactured foods” (West, A; R6).

Regulatory gray areas and operational confusion. Jurisdictional boundaries often shifted based on seemingly small changes in product handling, leading to confusion and operational challenges. This was echoed by another inspector who noted, “The only difficulty I see is the jurisdictional boundaries” (West, A; R7). Such regulatory gray areas are not unique to produce drying; prior research has similarly documented confusion when food operations “crossover” into food manufacturing, leading both inspectors and businesses to seek clearer regulatory guidance (Xu et al., 2022). Given that operators often view inspectors as trusted experts who can facilitate business growth (Hagqvist et al., 2021), unresolved jurisdictional ambiguities may disproportionately burden small-scale producers striving to expand their operations.

Differing expectations for written documentation. Inspectors’ expectations for written plans varied depending on the regulatory frameworks they followed. Inspectors who utilized the Food Code were more likely to require written documentation, such as Hazard Analysis and Critical Control Points (HACCP) plans and Standard Operating Procedures (SOPs), during inspections. In contrast, inspectors who primarily relied on specific sections of 21 CFR were less likely to request written plans, instead conducting inspections based largely on visual observations and verbal communications. About half of the inspectors, regardless of whether they used the Food Code or 21 CFR, requested operational records related to water activity monitoring and/or Time/Temperature Control for Safety (TCS) logs.

These differences likely reflect the underlying regulatory requirements. The Food Code, which governs retail food establishments, generally mandates written HACCP plans and related documentation without exemptions based on facility size, although some state and local adaptations may allow size-based exemptions. In contrast, 21 CFR Part 117 provides partial or modified exemptions for small- and very small-scale operations, which alleviates the requirement for a formal Hazard Analysis and Risk-Based Preventive Controls (HARPC) plan. As a result, inspectors working under 21 CFR Part 117 often rely more heavily on visual assessments and operator interviews, particularly for small-scale produce drying operations not required to maintain formal written plans.

Inconsistencies in critical safety parameters. Although certain trends emerged based on the regulations inspectors cited, significant variability remained even among inspectors using the same regulatory frameworks. In particular, inconsistencies were evident in the assessment of water activity and the application of time and temperature controls for safety (TCS) in produce dehydration operations.

The first notable inconsistency was the wide range of acceptable water activity levels reported by inspectors, spanning from $\leq$0.6 to 0.86. This variation suggests a lack of standardized benchmarks or shared understanding regarding safe water activity targets. Additionally, inspectors more often relied on documentation and visual observations rather than direct measurements of water activity, highlighting a potential gap in available tools or measurement practices.

In terms of TCS, inspectors frequently referenced it as an important consideration but demonstrated vague or inconsistent application. Some inspectors mentioned specific requirements, such as storing cut vegetables below 41 ˚F, while others dismissed TCS entirely in the context of dried produce.

Inconsistencies in facility eligibility for produce drying. Discrepancies also emerged regarding facility types permitted to dry and package whole produce. Notably, even within a single Midwestern state, four inspectors operating under the same state jurisdiction provided differing responses, citing facilities such as “residential kitchens” (Midwest, C1; R10), “all facilities” (Midwest, C4; R10), “on farm” (Midwest, C2; R10), and “commercial kitchen” (Midwest, C3; R10) as acceptable.

These findings align with previous studies indicating that inspectors often struggle with consistent interpretation and application of regulations (Ma et al., 2017; Xu et al., 2022; Zagorski et al., 2021). The inconsistencies observed in the present study may be explained, in part, by the variation in regulatory frameworks utilized by inspectors and differences in agency training and adoption of specific regulatory guidance.

Frustrations with regulatory clarity and usability. Inspectors' frustrations with regulatory documents also contributed to the inconsistencies observed in inspections. Many inspectors found the regulations overly vague, excessively lengthy, or outdated, which complicated both interpretation and enforcement. As one inspector noted, “The food code is very cumbersome even as a regulator to go through. It’s an 80-page document and you really have to know what to search for. You wouldn’t even know what keywords to look for. Like TCS… vocabulary that is challenging for the lay person” (Northeast, F11; R7). Other inspectors pointed to specific areas of confusion, such as expectations for environmental monitoring, with one commenting, “There is some confusion as far as the expectation of environmental monitoring” (Northeast, L; R7).

A need for clearer regulatory language and training. Across interviews, inspectors consistently emphasized the need for clearer regulatory language, particularly regarding which requirements apply to specific operations and which exemptions are available. These findings are supported by research in related fields; for example, a study with pharmaceutical inspectors found that targeted regulatory training significantly improved inspectors' understanding and inspection consistency (Shiihi et al., 2021). When inspectors struggle with cumbersome or unclear regulations, it may undermine both the consistency and adequacy of inspections, posing challenges for enforcement and compliance across the food sector.

Lack of resources and training undermines consistency. In addition to regulatory challenges, a lack of adequate resources and training emerged as a major factor contributing to inspection inconsistencies. Inspectors frequently expressed frustration with underfunded public health departments, workforce shortages, and limited access to specialized training. One inspector explained, “(There is) quite a bit of turnover for produce safety (inspectors).… We are a state

Table 2
Interview code book

Theme	Code	Description	Example quote
Discrepancies in what to inspect			
	Water activity	Inspectors mentioned water activity as a part of their inspection parameters or not	Don't get into levels of water in the health department
	Time temp control	Inspector mentioned time temp control as a part of their inspection parameters or not	Dried produce is not considered TTCS
	Documentation	Inspector said they either looked for records/documentation or not	They (operations) do not have to know SOPs, documentations in paper because they are small, but I encourage them to do that
Discrepancies in what to follow			
	Food code	Inspector said they used a version of the food code for their inspection	Food Code incorporates the federal food code from FDA, the 2013 version
	FSMA	Inspector said they used FSMA for their inspection	Most typically, we follow FSMA preventative controls
	PSR	Inspector said they used PSR for their inspection	Dehydration is not considered as a kill step, so that's under PSR
	CFR 101 labeling	Inspector said they used CFR 101 labeling for their inspection	Off the top of my head, 21 CFR 101 labeling regulation would apply
	CFR 117 GMP	Inspector said they used CFR 117 GMP for their inspection	GMPs under 117
	Sanitation Code	Inspector said they used sanitation code for their inspection	follow CMR 590 mass sanitation code.
	Doesn't know	Inspector said they don't know what regulation they would use	I don't know.
Challenges in inspecting			
	Frustration with rules/regulations	Inspectors expressed frustration with the rules and regulations (too vague, confusing, too long…)	… the only difficulty I see is the jurisdictional boundaries
	Frustration with lack of resources	Inspector expressed frustration in the lack of resources needed to do their job	quite a bit of turnover for produce safety. It's because you can't easily promote people. We are a state agency, but we are paid below the industry. We have a chem lab that is highly trained, they just cannot get paid as they would in the industry. Inspector turnover required to constantly retrain people, which is time-consuming. The retention of skilled people is hard.
	Difficulties in educating		
	Operations confused	Inspector mentioned the operations being confused or frustrated about what they should be doing due to a lack of experience	"If I was a small operation what would be confusing: smaller business is more likely to be confused because they haven't had experience in food production. More prohibited in participating, disadvantage to small produce dryers. Smaller operations are more likely to get confused because they might be a farmer or a nonindustry member"
	Operation confusing with regulations	Inspector mentions the operation being frustrated by the regulations	"They (operations) struggle to understand what the regulation means and what applies to them. There was some similar discussion at Land Grant University on how you can make training specifically for preventative control a little simpler understandable for smaller operators who don't have a food background. As you can imagine, the difficulty answering questions and trying to explain HACCP."
	Culture and language barriers	Inspector mentioned language or cultural barriers when it came to inspecting	"There are language barriers also. [Example about having an issue with someone who owned several gas stations– she spent 3 h with him to explain everything that needs to be done]"
Requested educational support			
	Clarity of rules and regulations	Inspectors were asked whether they wanted resources on clarity of the rules and regulations. Yes or no questions	"[Guidance on best food safety practices specific to product type] often deals with specific regulations and inspects all or nothing, lose sight of specific processing parameters."
	Dried produce specific information	Inspectors were asked if they wanted resources on dried produce-specific processes. yes or no question	"[Clarity on different regulations] because I don't have clarity so that would be nice to have."
	"One pager" resources	Inspectors mentioned they wanted resources that came on a sheet of paper or a page	"Fact sheets would be helpful. Something that inspectors could hand out or share on websites. Like check out this website from Purdue…"

agency, but we are paid below the industry.… Inspector turnover requires us to constantly retrain people, which is time-consuming" (West, K; R15).

Desire for targeted and ongoing education. Many inspectors highlighted the need for continuing education programs to stay updated on evolving regulations, food safety hazards, and inspection best practices. In particular, they emphasized a desire for more commodity-specific guidance, especially for emerging sectors such as dried produce, as well as training programs tailored to both facility managers and frontline workers. These findings corroborate previous studies identifying the need for targeted training materials and enhanced education for inspectors overseeing specialty processes and small-scale operations (Chen et al., 2021; Hagqvist et al., 2021; Harrison et al., 2016; King et al., 2020; Ma et al., 2017; Xu et al., 2022).

Request for accessible food safety resources. Furthermore, several inspectors in the current study expressed a desire for periodic retraining courses to reinforce critical concepts, a need echoed in other sectors where refresher programs have been shown to improve regulatory compliance and inspection outcomes (Atif, 2019; Pham et al., 2012). Despite efforts to streamline regulatory oversight, inconsistencies persist, further highlighting the importance of standardized food safety resources to supplement existing regulations (Borraz et al., 2022; Lomando & Dennings, 2024). Without sustained investment in training, resources, and workforce support, inconsistencies in inspection practices are likely to continue.

Balance between convenience and comprehensive resources. Inspectors consistently emphasized the need for more accessible resources, not only for themselves but also for small-scale operations. In particular, they highlighted a preference for single-page materials such as flow charts and FAQs that simplify key food safety requirements. This preference for concise, user-friendly resources is supported by prior research; for example, Pham et al. (2012) found that inspectors favored online tools such as newsletters and centralized websites compiling essential information. Similarly, small-scale operations often report limited resources for training and tend to prefer online

Table 3
Demographic variables for inspectors (n = 32)

Variable	n
Inspected small-scale produce-drying operations before	
Yes	14
No	18
Years of experience	
<1 year	3
1–4	10
5–8	7
9–12	5
13+	5
Not specified	2
Education	
Associate	1
Undergraduate degree	19
Graduate degree	9
PhD	1
Not specified	2

over in-person learning formats (Barone et al., 2020; Harrison et al., 2016).

However, although one-page and online resources are favored for their convenience and lower time demands, several studies caution that overly simplified materials may not sufficiently improve food safety outcomes. For instance, Clayton et al. (2002), Fielding et al. (2011), and Mancini et al. (2012) advocate for a more holistic, comprehensive approach to food safety education. In one study, a brief two-hour, hands-on class for food service workers failed to significantly improve knowledge retention (Mancini et al., 2012).

While inspectors and operators may prefer online courses and concise handouts due to perceived time savings, effective food safety training may ultimately require a balance between convenience and comprehensive education to ensure meaningful behavioral change.

Inspectors' role as educators and communication challenges. Many inspectors view themselves as educators, yet they often struggle to convey food safety standards effectively, particularly to small-scale operations unfamiliar with industry practices. As one inspector explained, "Smaller businesses are more likely to be confused because they haven't had experience in food production … because they might be a farmer or a non-industry member" (Northeast, F13; R12). Several inspectors noted that regulatory language can overwhelm these operations, making it difficult to explain complex concepts such as HACCP in an accessible manner. One inspector shared, "They (operations) struggle to understand what the regulation means and what applies to them. As you can imagine, it's difficult answering questions and trying to explain HACCP … to them" (Midwest, D; R8).

These challenges are consistent with previous research demonstrating that small-scale operations often lack foundational food safety knowledge and regulatory familiarity (Chen et al., 2021a, 2021b; Fitzgerald et al., 2024; Harrison et al., 2016; Yapp & Fairman, 2006). For example, Fitzgerald et al. (2024) found that inspectors frequently observed gaps in operators' understanding of Good Manufacturing Practices (GMPs), sanitation protocols, and hazard analysis requirements. Similarly, Low et al. (2022) reported that many home-based apple dryers relied on subjective visual cues rather than objective measures such as drying time or water activity, underscoring the need for targeted food safety education tailored to small-scale and home-based producers.

Taken together, findings from both the current study and previous literature highlight an urgent need for clear, accessible regulatory guidance and targeted food safety training materials specifically designed for small-scale produce drying operations.

Limitations. While the results from the interviews provide valuable insights into the complexities of regulatory inspection and small-scale food operations, several limitations must be considered when interpreting the findings. Due to the qualitative nature of the interview methodology, the results are not generalizable to all inspectors or regions. Future research could incorporate surveys or other quantitative methods to further investigate factors influencing inspectors' decision-making processes on a broader scale. Additionally, the barriers and educational needs identified for operations were described from the inspectors' perspective. Although these insights are informative, future studies should directly engage small-scale operators to validate and expand upon these findings. Another limitation is that many participating inspectors had limited experience specifically with produce drying operations, which may be attributed to high turnover rates and the small pool of inspectors willing to participate in the study. Finally, due to confidentiality requirements, interview transcripts were developed from detailed notes taken during the sessions rather than from audio recordings. Although two note-takers and one interviewer captured observations in each session, some nuances and subtleties may have been missed during live notetaking. These factors should be taken into account when considering the scope and applicability of the study's conclusions.

Conclusion

This study is the first to investigate food safety educational needs and gaps between regulations and applying regulations in small-scale produce-drying processes from the perspective of inspectors. The findings reveal discrepancies in the regulations applied and inspection practices, as well as a lack of resources tailored to small-scale operations. The results highlight the critical need for technical assistance educators to provide clearer guidance and specialized training for both inspectors and operations, promoting a better understanding of food safety standards and improving regulatory compliance.

CRediT authorship contribution statement

Autumn Stoll: Writing – original draft, Project administration, Investigation, Formal analysis. **Megan Low:** Writing – review & editing, Methodology, Investigation. **Amanda J. Kinchla:** Writing – review & editing, Funding acquisition, Conceptualization. **Nicole Richard:** Writing – review & editing, Investigation, Funding acquisition. **Erin DiCaprio:** Writing – review & editing, Investigation, Funding acquisition. **Yaohua Feng:** Writing – review & editing, Methodology, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The researchers would like to thank all participants for their time and contribution, as well as Alejandra Marcela Prado Jaramillo, Keyshla M. Narváez-Dávila, Elma Kontor-Manu, Han Chen, and Maeve Swinehart for their research support. This work was supported by the USDA Hatch project 1016049, USDA NIFA 2021-70020-35663, and USDA NIFA 2020-68012-31822.

Appendix A. Supplementary material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.jfp.2025.100561.

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