JOURNAL OF THE NACAA

ISSN 2158-9429

VOLUME 18, ISSUE 1 – JUNE, 2025

Editor: Linda Chalker-Scott

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Identifying the Agricultural Health and Safety Training Needs of Urban Agricultural Producers in Oklahoma

Abstract

Most of the United States population resides in urban areas, and interest in urban agricultural production is increasing. The United States Department of Agriculture has recognized a need for investment in urban food systems through increasing food production in and around cities. However, a need exists to better understand the priorities of urban agricultural workers to develop appropriate Extension support programs for this population. The historical roots of Cooperative Extension programs for farm health and safety were examined, and a targeted needs assessment was conducted to improve our understanding of the workplace safety and health training needs of urban farmers in Oklahoma. The work was supported through funding from the Southwest Center for Agricultural Health, Injury Prevention, and Education. Results of this assessment show a need for more education for urban farmers related to workplace safety, with a particular demand for education in pesticide safety practices, as well as occupational and mental health awareness. In addition, this project provides a model for other Extension professionals seeking to study urban agricultural workers' health and safety concerns in other states.

Introduction

Farmers are at much greater risk of workplace injury than the non-agricultural workforce (Elkind, 1993). In fact, farm workers are behind only mining and construction industry workers in the rate of workplace injuries and as much as four times greater rate of injury than the general workforce (DeRoo and Rautiainen, 2000; Elkind, 1993). In addition to physical injury, farm workers also experience an increased risk for stress, anxiety, and mental health issues (Baker et al., 2022; Saane et al., 2004). United States occupational safety laws govern workplace safety practices and have led to safety education programs in industry sectors including agriculture, and Extension professionals have played an important role in these efforts over time (McKnight and Myers, 2009). In addition to traditional farmer education programs, Extension professionals have also had to consider their role in working with urban agricultural producers (Campbell et al., 2023a; Dobbins, et al., 2021; Oberholtzer, et al., 2014). As interest in urban agricultural production has increased, it has illuminated a need to understand the unique perspectives of those working in urban agricultural settings (Campbell et al., 2023b). However, a lack of informational resources to support Urban agricultural education of this kind has been recognized as a major challenge for developing Extension programming to support this clientele (Campbell et al., 2023b).

Extension has not traditionally focused on urban food production in comparison to traditional agricultural communities (Harder et al., 2019). However, the call for Extension professionals to provide programming and support designed to address the unique needs of urban farmers has increased (Campbell et al., 2023b; Clark et al., 2017). Assessing the agricultural health and safety needs of urban farmers and the role Extension professionals may play could be strengthened by first understanding the history of agricultural workplace safety in the United States.

Agricultural workplace safety

The Occupational Safety and Health Act of 1970 (OSHA) was designed to reduce the enormous human and economic toll of workplace hazards, including those which occurred in the agricultural industry (Aherin, 1976; Catz and Guido, 1973). Agricultural

workplace safety regulations and educational initiatives began to emerge from this original legislation, but the legislation was amended in 1976 to exempt farms with 10 or fewer employees (Kelsey, 1991). Thus, the Bureau of Labor Statistics (BLS) only tracks agricultural workplace injuries on farms with fewer than 11 workers (Hayden et al., 2022). In the United States, these smaller operations represent more than 95% of all farms and are exempt from OSHA regulations (DeRoo and Rautiainen, 2000).

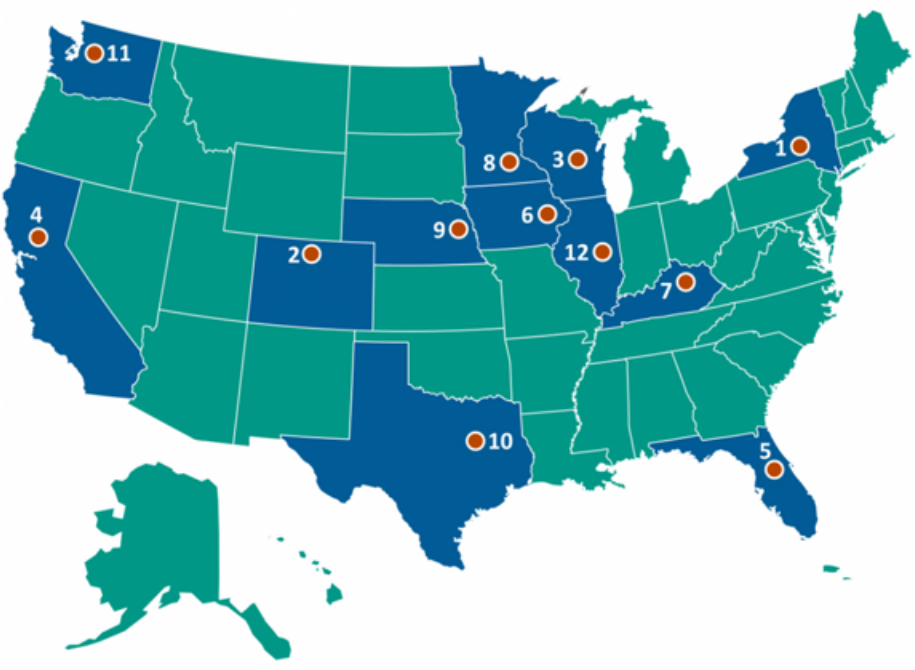
Extension and agricultural safety

In 1976, the U.S. Congress provided funding to the Cooperative Extension Service in each state for $20,000 formula grants under the Smith-Lever Act to support agricultural safety Extension programs in all 50 states and Puerto Rico (McKnight and Myers, 2009). As a result of this initial funding, nearly all states developed agricultural safety education programs. However, the federal investment in agricultural occupational safety never increased, and by 1990 the number of states with full or part-time Extension farm safety specialists dropped considerably (McKnight and Myers, 2009). As support waned for full-time Extension farm safety programs, emphasis shifted toward initiatives led by professionals in the public health sector under the direction of the National Institute for Occupational Safety and Health (NIOSH), which became the leading organization for agricultural occupational safety and health (McKnight and Myers, 2009).

Centers for agricultural safety

In 1991, NIOSH funded four regional centers for applied research, education, and injury prevention education in agriculture and in 1996, several more agricultural health and safety centers were established (McKnight and Myers, 2009), and today there are 12 regional NIOSH centers in operation (Figure 1). In 1996, NIOSH also developed the first National Occupational Research Agenda (NORA) which includes agendas for various industrial sectors including Agriculture, Forestry, and Fishing (AgFF), which focuses on the actions most needed to identify and prevent avoidable adverse health outcomes among agricultural workers (McKnight and Myers, 2009). The regional NIOSH agricultural centers have served as leaders in identifying regional agricultural safety issues (McKnight and Myers, 2009). NIOSH centers have also contributed to successes

such as decreasing the rate of acute pesticide poisoning in production agriculture through pesticide education programs which identified emerging pesticide problems, and assisted in developing targeted prevention efforts (McKnight and Myers, 2009). These centers also provide funding in the form of small grants to regional Extension professionals for short-term educational initiatives that address regional priorities.



1. Northeast Center for Occupational Health and Safety (Bassett Healthcare Network)
2. High Plains Intermountain Center for Agricultural Health and Safety (Colorado State University)
3. National Children's Center for Rural and Agricultural Health and Safety (National Farm Medicine Center)
4. Western Center for Agricultural Health and Safety (University of California, Davis)
5. Southeastern Coastal Center for Agricultural Health and Safety (University of Florida)
6. Great Plains Center for Agricultural Health (University of Iowa)
7. Southeast Center for Agricultural Health and Injury Prevention (University of Kentucky)
8. Upper Midwest Agricultural Safety and Health Center (University of Minnesota)
9. Central States Center for Agricultural Safety and Health (University of Nebraska Medical Center)
10. Southwest Center for Agricultural Health and Injury Prevention and Education (University of Texas Health Sciences Center at Tyler)
11. Pacific Northwest Agricultural Safety and Health Center (University of Washington)
12. Great Lakes Center for Farmworker Health and Well-being (University of Illinois Chicago)

Figure 1. Map of the 12 NIOSH Centers for Agricultural Safety and Health. Courtesy of the Center for Disease Control (CDC) and NIOSH. https://www.cdc.gov/niosh/extramural-programs/php/about/ag-centers.html#cdc_program_profile_program_impact-centers

Urban farmers

Today, more than 80% of the U.S. population is concentrated in urban areas, with more than one half of the nation living in urban areas of 500,000 people or more (Isserman, 2005). With this has come an interest in urban agricultural production and local food systems (Campbell et al., 2023a). As such, the United States Department of Agriculture (USDA) has recognized the need for investment in urban food systems (Campbell et al., 2023b; USDA, 2022). The USDA is supporting urban agriculture through new Research and Extension initiatives (USDA, 2022). Although no standard definition of urban farming or urban agriculture exists, it is generally defined as food production within urban or peri-urban areas (Hodgson et al., 2011). Urban agriculture includes commercial or nonprofit urban farms, and market gardens, as well as associated food processing and distribution enterprises (Campbell et al., 2023a).

A lack of standard definition has caused confusion about what activities are included under the umbrella of the term *urban agriculture* and may be a barrier to developing Extension programming in this area (Campbell et al., 2023a). There persists a need to better understand the concerns of agricultural workers in urban areas to develop appropriate Extension support programs (Campbell et al., 2023b; Ruemenapp, 2017). Understanding the attitudes, perceptions, and needs of clientele is central to the Extension educator role, and growing interest in urban food production has led to the need for Extension professionals to better understand the perspectives of individuals working in such portions of our food systems (Clark et al., 2017). More emphasis is being placed on Extension programming regarding urban agriculture, including greater attention on urban food-systems in research endeavors and by Extension programs (Campbell et al., 2023a; Dobbins et al., 2021).

Conceptual frameworks

Extension professionals seeking to develop educational programs for urban agricultural producers should first be informed of what their audience lacks to develop training programs most aligned with their needs, and this generally requires some form of a needs assessment (Etling and Maloney, 1995). Conducting a needs assessment is a

priority in the *program development process*, a model widely used in Extension (Benge and Warner, 2019). The model is comprised of three primary processes: (1) program planning; (2) program design and implementation, and (3) program evaluation (Benge and Warner, 2019). This model is widely used to conceptualize the foundation for successful Extension programming (Benge and Warner, 2019). *Program Planning* is the first step in the program development model process, creating a road map for the program to follow (Benge and Warner, 2019). Extension professionals should begin with the end in mind by setting program goals after conducting a needs assessment (Benge and Warner, 2019). Extension professionals cannot deliver an appropriate program and achieve the desired broader outcomes without first understanding what is needed by the target audience (Benge and Warner, 2019).

This study was conducted by Extension professionals in Oklahoma and funded by the Southwest Center for Agricultural Health, Injury Prevention and Education (SW Ag Center) in Tyler, Texas to better understand the workplace health and safety education needs of urban agricultural producers. The mission of the SW Ag Center is to improve the safety and health of agricultural workers through research, intervention and education projects that build and leverage a network of strategic partners who represent the diversity of the workforce and range of agricultural production in its region (SW Ag. Center, 2023). This project addressed three of the goals of the SW Ag Center, including 1) outreach efforts that target regional emerging issues in vulnerable populations, 2) education that is relevant and useful to agricultural stakeholders, and 3) the Center's outreach is broadened. As such, the project provided a better understanding of the health and safety concerns of urban agricultural workers in Oklahoma and informed the development of Extension health and safety educational programming to address the unique needs of urban agricultural workers.

Purpose and Research Questions

Although literature related to conducting educational needs assessment is abundant (Waters, and Haskell, 1989), specific literature related to the needs of urban agricultural workers is considerably less abundant (Campbell et al., 2023b). A needs assessment is an appropriate place to begin planning educational programming (Benge and Warner,

2019). Therefore, to better understand the needs of urban agricultural producers in Oklahoma, a needs assessment of the target audience was conducted.

We sought to understand the workplace health and safety educational needs of urban agricultural producers. The primary research questions were:

- What do urban agricultural producers believe are their most important workplace health and safety training needs?
- What knowledge gaps in urban agricultural safety education would be important areas to focus Extension programming?

Methods

The Borich needs assessment model (Borich, 1980) was used for this study. This model allows researchers to determine potential gaps in knowledge among a program's participants across key knowledge areas to aid in a training program's development and implementation. The Borich approach involves five steps:

1) Determine the competencies to assess.
2) Participant self-assessment regarding attainment of the selected competencies.
3) Ranking the responses by calculating mean weighted discrepancy scores (MWDS) to determine the competencies that need training.
4) Evaluate the existing programming.
5) Revise programs as needed to address findings.

This study focused primarily on the first four steps of the model to identify urban farmer needs and inform future Extension program emphasis.

Participants

The research procedures for this study were approved by the Oklahoma State University Institutional Review Board in December 2022. The study participants (n = 21) were identified using existing Extension email lists and email address provided by a local farmer's market and a local food hub organization. Approximately 85 individuals were identified as potential participants for the study which represented a 24% response rate. Qualtrics was utilized to distribute the instrument and an optional demographic

questionnaire. Seventeen participants identified *as non-Hispanic or Latino*, one identified as *Hispanic or Latino*, and three selected the *prefer not to say* option when asked to indicate their ethnicities. Two participants selected *Native American*, one *Asian*, seven *Black*, 11 *White or Caucasian*, and one preferred not to say when asked to indicate their race. Thirteen participants selected *male*, seven selected *female,* and one selected *prefer not to say* when asked to identify their genders. Participants were also asked to select the age range that best described them. As such, the mean age of the twenty respondents was 32.

Instrument development and data analysis

For this study, participants were asked to rate their perceived *importance* (RQ1) of agricultural safety practices using a five-point Likert-type scale, with 1 being *not important* and 5 being *very important*. Next, participants were asked to rate their *knowledge* (RQ2) of the agricultural safety practices using a five-point Likert-type scale with 1 representing *no knowledge* and 5 representing a *high knowledge* level. The instrument items included 14 agricultural health and safety practices identified by researchers based on the SW Ag Center (2023) safety priorities which supported the instrument's content validity (Almanaresh et al., 2019). Participants were asked to rank these items by rating the *importance* of the agricultural safety topic, and their personal *knowledge* of the topic, which generated two sets of scores, one for each identified safety practice. After this, a MWDS (Borich, 1980) was calculated for each item based on the discrepancy between the participants' rating of the *importance* of the agricultural safety topic, and their personal *knowledge* of the topic. This resulting score was then used to rank and prioritize agricultural safety topics for future Extension program delivery (Borich, 1980).

Results

Participants rated their perceived importance of the selected agricultural safety practices as well as their personal knowledge of the identified safety practices. The scores for importance were helpful for understanding the safety practices considered

important by participants but were not as meaningful for identifying the most important areas on which to focus education (Barrick, et al., 1983). This is because a participant may consider a practice important but also may have a strong knowledge of that practice resulting in a topic not being a priority need for training. Likewise, a participant may report a low knowledge of the topic but also report a low importance for the same. For this reason, MWDS were determined. The MWDS was calculated by subtracting the *knowledge* score (see Table 1) from the *importance* score (see Table 2) for each item and then multiplying it by the *importance* score (Barrick et al., 1983) to produce MWDS (see Table 3).

Table 1. The mean score of participants perceived importance of the safety practice.

Safety Practices Importance Score	
Safe lifting and moving of heavy items	4.68
Know how to identify signs of stress in others	4.47
Wearing appropriate protective equipment (PPE) when applying pesticides	4.42
Taking regular breaks to reduce stress	4.42
Taking time for mental wellness activities	4.42
Proper storage and maintenance of farm equipment	4.36
Proper disposal of chemicals and fertilizers	4.31
Applying pesticides according to label directions	4.31
Sleeping at least 8 hours each night	4.31
Using protective measures to guard against ticks and other biting insects	4.21
Wearing earplugs or other ear protection while operating loud equipment	3.89
Proper use of sunscreen and other sun protection	3.84
Wearing a mask or respirator while performing tasks such as mixing soil	3.78
Drink water every 15 minutes, even when not thirsty	3.63

Mean scores were calculated by averaging the participants' rating for each item.

Table 2. The mean score of participants' self-reported knowledge of the safety practice.

Safety Practices Knowledge Score	
Sleeping at least 8 hours each night	4.05
Taking time for mental wellness activities	3.95
Safe lifting and moving of heavy items	3.89
Taking regular breaks to reduce stress	3.84
Proper storage and maintenance of farm equipment	3.53
Proper use of sunscreen and other sun protection	3.47
Know how to identify signs of stress in others	3.37
Wearing earplugs or other ear protection while operating loud equipment	3.21
Drink water every 15 minutes, even when not thirsty	3.16
Wearing appropriate protective equipment (PPE) when applying pesticides	3.11
Proper disposal of chemicals and fertilizers	3.00
Wearing a mask or respirator while performing tasks such as mixing soil	3.00
Using protective measures to guard against ticks and other biting insects	2.95
Applying pesticides according to label directions	2.79

Mean score was calculated using mean of five-point Likert-type rating for each participant.

Each weighted score had a possible score of -5 to 10. Higher numbers indicate a stronger discrepancy score or a greater gap between the participants' perceived importance and their knowledge of a topic (Table 3). The highest discrepancy scores indicate the greatest need for training in that area (Barrick, et al., 1983). A topic with a negative score would be considered inappropriate for emphasis in programs since it resulted from a combination of either a very low importance score or a very high knowledge score (Barrick, et al., 1983). Likewise, a topic with a score that is relatively close to zero also would not be considered appropriate since existing knowledge of the topic is equal to the respondents' perceived importance of the topic (Barrick, et al., 1983). Topics with positive scores were rank-ordered and safety topics having the

highest values are considered the greatest priority for educational programming (Barrick, et al., 1983).

Table 3. Weighted discrepancy of participants perceived Importance, and knowledge of safety practices.

Safety Practice	MWDS Importance/Knowledge
Applying pesticides according to label directions	**6.428**
Know how to identify signs of stress in others	**6.095**
Wearing appropriate protective equipment (PPE) when applying pesticides	**5.761**
Proper disposal of chemicals and fertilizers	**5.619**
Using protective measures to guard against ticks and other biting insects	**5.142**
Proper storage and maintenance of farm equipment	4.666
Wearing earplugs or other ear protection while operating loud equipment	4.142
Safe lifting and moving of heavy items	3.904
Wearing a mask or respirator while performing tasks such as mixing soil	3.476
Taking regular breaks to reduce stress	2.476
Taking time for mental wellness activities	2.380
Proper use of sunscreen and other sun protection	2.142
Drink water every 15 minutes, even when not thirsty	1.761
Sleeping at least 8 hours each night	1.428

Note. Bolded indicates the five highest MWDS and highest priority for educational programming.

The safety practices such as, *safe lifting and moving of heavy items,* and *sleeping at least 8 hours each night* had high importance scores, but also had a relatively high knowledge score, making them lower in their MWD score and thus not a priority for training. Likewise, safety practices like *wearing a mask or respirator while performing tasks such as mixing soil*, and *drinking water every 15 minutes, even when not thirsty* had relatively low knowledge scores but also had low importance scores. After calculating the MWD for each safety practice, the top five identified safety practices included, *applying pesticides according to label directions*, *knowing how to identify signs of stress in others*, *wearing appropriate protective equipment (PPE) when applying*

pesticides, *proper disposal of chemicals and fertilizers*, and *using protective measures to guard against ticks and other biting insects*. These top five priorities for training address both research questions by factoring together what urban farmers believe are important safety training needs and what they perceive as their knowledge gaps.

Limitations

This study has several limitations. First, the fourteen agricultural safety and health practices included in the instrument were based on the priority areas identified by the Southwest Ag Center and may not fully reflect the concerns of urban producers outside this region. Second, the lack of a standardized definition of “urban agriculture” created ambiguity, and participants were asked to self-identify as urban producers, which may have resulted in inconsistent interpretations of the term. Third, the study used a small, non-random sample (n = 21) drawn from Extension lists, a farmers market, and a food hub. This approach may have introduced sampling bias, as participants could be more engaged, better informed, or more safety-conscious than the broader population of urban agricultural producers. Additionally, all data were self-reported, which may be influenced by social desirability or recall bias. Finally, while the use of a quantitative needs assessment model helped identify priority areas, the absence of qualitative data limits the depth of understanding regarding the specific challenges faced by urban producers in implementing safety practices.

Conclusions

Each topic was ranked according to its MWD score and those with the highest rankings were selected as priority areas for focus in future Extension programming targeting urban agricultural producers. The top five areas for focusing Extension programming included (a) *Applying pesticides according to label directions*, (b) *Knowing how to identify signs of stress in others*, (c) *Wearing appropriate protective equipment (PPE) when applying pesticides*, (d) *Proper disposal of chemicals and fertilizers, and (e) Using protective measures to guard against ticks and other biting insects.* These findings are supported by literature.

Pesticide safety

Pesticide safety practices identified as a priority in this study include *Applying pesticides according to label directions*, *wearing appropriate protective equipment (PPE) when applying pesticides,* and *proper disposal of chemicals and fertilizers*. These findings are supported by research indicating improper pesticide handling, not following pesticide labels, failure to use protective equipment, unsafe pesticide disposal, insufficient knowledge of pesticides, and lack of training as major issues in agricultural workplace safety (Afshari et al., 2021; Damalas, et al., 2018; Sapbamrer and Thammachai, 2020).

Mental health

The need for mental health education identified in practices like *knowing how to identify signs of stress in others* confirms the importance of mental health education for farmers, supported by findings Saane et al. (2004) which found that levels of anxiety and depression were equally high between both full-time and part-time farm workers which is important to this study because many urban producers identify as part-time farmers (Hendrickson and Porth, 2012). Additionally, Baker et al. (2022) found that farm workers experience an increased risk for stress, anxiety, and mental health issues. However, while the urban producers in this study ranked *taking time for mental wellness activities* as important, they also ranked a high knowledge of this practice. Fuller et al., (2007) suggested that there is less access to mental health care and resources in rural communities than in urban areas and potential cultural implications related to help-seeking that may account for differences between urban and rural producers perceived importance of mental health practices.

Implications for Extension

Extension professionals have a history of providing educational programming in agricultural health and safety but emphasis in this area has ebbed over the years since the initial legislative emphasis and funding appropriation in the 1970’s (McKnight and Myers, 2009). In addition, most emphasis on agricultural safety has focused on larger farming settings (McKnight and Myers, 2009). Increased growth in urban food systems has increased the need for Extension professionals to understand the needs of urban

farmers and ways Extension can support urban agriculture issues (Clark et al., 2017). We know unique urban needs exist (Ruemenapp, 2017) but based on the structure of urban programs we need to have further conversations on who should provide the programming and base this programming on the identified needs of the urban clientele we are trying to engage (Campbell et al., 2023a). There is an opportunity for Extension professionals to reinvest in agricultural health and safety education in ways that are uniquely targeted to urban agriculture.

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