# Assessing the capabilities, opportunities, and motivations to implement Updated Appendix A & B guidelines in Small Meat Processors within the Mid-West

by

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# Abstract

Food safety remains a critical concern within the meat processing industry, particularly for small meat processors who often face unique challenges due to limited resources and workforce constraints. The USDA-FSIS Appendix A & B guidelines, initially introduced in 1999, offer scientific support and procedures to enhance food safety practices, primarily targeting small processors. However, understanding how small meat processors perceive and implement these guidelines through the lens of behavior change can facilitate the development of adoptable food safety interventions. Toward this end, this study applied the COM-B model (Capability, Opportunity, Motivation, and Behavior) to assess small meat processors' behavior toward implementing the updated guidelines across the Midwest.

A previously validated 30-question survey was administered to small meat processors in Kansas, Nebraska, Oklahoma, and South Dakota, along with a one-hour training session over the updated Appendix A & B guidelines. Surveys were distributed pre-training ($n$ = 47 respondents), post-training ($n$ = 25 respondents), and six months post-training ($n$ = 22 respondents). Data was analyzed using the GLIMMIX procedure of SAS with a fixed effect model for survey and state differences.

The study revealed a significant increase ($P < 0.05$) in meat processors' perceived capability to implement updated Appendix A & B guidelines from pre-training (3.63) to post-training (4.37) that maintained at this higher level six months post-training (4.40). However, meat processors' perceived opportunity to implement updated Appendix A & B guidelines remained statistically unchanged across time points ($P > 0.05$), with an average score of 3.98 at pre-training and 3.84 six months post-training. Motivation showed a mixed response, with overall scores increasing from pre-intervention (5.13) to post-intervention (5.18) but declining at

six months (4.39). State-specific analyses highlight Nebraska with the highest perceived capability (4.96) and Kansas with the lowest perceived opportunity (3.83). Motivation was influenced more by automatic rather than reflective factors, emphasizing the need for targeted interventions.

The results indicate that educational interventions effectively improve perceived capability but have a limited impact on perceived opportunity and motivation. Utilizing the Behavior Change Wheel alongside the COM-B model, the study suggests that additional intervention strategies such as enablement, environmental restructuring, and incentivization could enhance behavior change. Specifically, interventions focusing on social opportunities and reflective motivation could support the sustained implementation of Appendix A & B guidelines among small meat processors.

This study provides a foundational understanding of small meat processors' behavior concerning USDA-FSIS Appendix A & B guidelines. The findings emphasize the need for tailored support from extension agents, regulatory agencies, and training programs to enhance small processors' perceived capabilities, opportunities, and motivations. Future research should expand geographic coverage and participant numbers to create a comprehensive strategy for promoting food safety practices across the U.S. meat processing industry.

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# Dedication

I want to dedicate this to my parents, Kevin and Angela Prester; I would not be the person I am today without them.

# Chapter 1 - Literature Review

### *History of Inspection to Support Food Safety*

As the U.S. meat industry evolved, so did the inspection and regulatory inspection systems designed to protect consumers from contaminated products *(7)*. Still, it wasn't until the late 19th and early 20th century that the U.S. government began implementing formal meat inspection laws to reduce risks to public health *(7, 50)*. Today, regulations like the Federal Meat Inspection Act (FMIA) and the Poultry Products Inspection Act (PPIA) ensure that meat and poultry products meet stringent safety standards before reaching consumers *(7, 50)*.

In the late 1800s, the meat industry expanded but continued operating under unsanitary conditions, lack of oversight, and poor hygiene practices, thereby increasing the frequency of consumer exposure to contaminated products *(7, 50)*. At this time, diseases in livestock and adulterated meat were also common and increased health risks to consumers *(50)*. To combat these risks, President Abraham Lincoln established the U.S. Department of Agriculture (USDA) in 1862, which would become the primary regulatory body for meat inspection *(50)*. In 1865, USDA Secretary Isaac Newton worked with Congress to enact a law to quarantine imported animals to prevent the introduction of diseases into U.S. livestock *(50)*. However, the inspection was under the jurisdiction of the Treasury Department instead of the USDA until 1884, when President Chester Arthur established the USDA Bureau of Animal Industry (BAI) and charged it with the inspection and quarantine of imported animals *(50)*.

Despite attempts to decrease the risk to consumers, meatpacking plants remained largely unregulated until Upton Sinclair published *The Jungle*, which exposed the unsanitary conditions of the meat industry *(50)*. This novel showcased graphic descriptions of unsanitary and unsafe working conditions, and inhumane treatment of animals in slaughterhouses *(40)*. Due to the

public reaction and outcry, President Theodore Roosevelt passed the FMIA in 1906, which established mandatory ante-mortem and post-mortem inspection of livestock, sanitary standards for slaughter and processing facilities, and continuous inspection of meat packing plants by USDA inspectors *(1, 7, 50)*. Similarly, consumer demand for poultry products increased in the mid-20$^{th}$ century, leading regulators to recognize the need to extend meat processing safety laws beyond red meats *(50)*. In turn, the PPIA was adopted in 1957, extending federal oversight into poultry processing plants and ensuring that poultry products meet the same standards as meat products *(50)*.

In the 1960s, amendments to the FMIA and PPIA were added to strengthen federal oversight as The Wholesome Meat Act was passed in 1967, and the Wholesome Poultry Act was passed in 1968, which required state inspection programs to be "at least equal to" federal standards *(50)*. However, even after the increase in regulation and inspection, outbreaks still occurred in the meat and poultry industry*(50)*. An *E. coli* outbreak in 1993 caused 400 illnesses and four deaths, prompting the USDA to switch from a visual examination inspection system to a prevention system called Hazard Analysis and Critical Control Points (HACCP) *(39, 50, 59)*. HACCP provided a systematic approach to preventing contamination by requiring processors to identify and control potential contamination hazards during processing and to provide scientific validation for the control methods *(3)* In 1996, the Food Safety and Inspection Service (FSIS) issued the Pathogen Reduction; Hazard Analysis and Critical Control Point Systems; Final Rule and required the implementation of HACCP in all FSIS and state-inspected meat and poultry facilities between by 2000 *(50, 59)*.

Although there has been a century of regulatory improvement, foodborne illnesses associated with meat products remain a significant public health concern. While HACCP

guidelines and inspection regulations have significantly reduced contamination risks, the meat industry continues to work on improving pathogen control, outbreak prevention, and regulatory compliance *(50)*. However, implementing a complex food safety management system can be challenging for very small and small processors, and examining barriers to adopting food safety practices across scales is essential to comprehensively understanding the risks of meat processing entirely.

### *Food Safety in the Meat Industry*

Ensuring the safety of meat and poultry products is essential to protect consumers and prevent illnesses, as meat and poultry products are highly perishable and require proper handling, processing, and storage procedures to minimize contamination *(17)*. Although there have been improvements in food safety regulations, there are still opportunities for contamination, as evidenced by the number of foodborne illness outbreaks associated with meat products *(3)*. Generally, food safety practices focus on preventing biological, chemical, and physical contamination *(3)*. Biological hazards include microorganisms such as bacteria, viruses, or parasites that cause foodborne illness *(3, 41)*. In the United States, it is estimated that each year, a total of 9.4 million foodborne illnesses are caused by microorganisms *(14, 15, 34, 37, 38)*. Of those 9.4 million illnesses, 58% were caused by norovirus, 11% were caused by *Salmonella*, 10% were caused by *Clostridium perfringens* (*C. perfringens*), and 9% were caused by *Campylobacter (24, 38)*. In 2013, 22% of foodborne illness outbreaks were associated with consuming contaminated meat and poultry products *(24, 33, 34)*. Moreover, in 2021, an estimated 77% of *Salmonella* illnesses were caused by seven food categories, which included poultry, pork, and beef; 82% of *E. coli* illnesses were associated with beef and row crops, and 74% of *Campylobacter* illnesses were associated with poultry and dairy *(5)*.

***Biological Hazards of Concern***

USDA-FSIS has identified the following pathogens as significant biological hazards in meat and poultry processing: *Staphylococcus aureus* (*S. aureus*), *Salmonella*, Shiga toxin-producing *Escherichia coli* (STEC *E. coli*), *Campylobacter*, *Listeria monocytogenes* (*Lm*), *Trichinae spiralis* (*T. spiralis*), *Toxoplasma gondii* (*T. gondii*), *Clostridium perfringens* (*C. perfringens*) and *Clostridium botulinum* (*C. botulinum*) *(29, 49, 51, 55)*. To mitigate risks associated with these pathogens, FSIS provides science-based guidance and regulatory oversight to ensure proper control measures are in place throughout meat and poultry processing *(47-49, 51-53, 55, 56)* FSIS emphasizes preventive strategies for controlling pathogens at various stages of production *(47-49, 51-53, 55, 56)* For example, *T. spirals* and *T. gondii* are parasites that can infect swine before they reach the processing facility *(36, 48)*. To address this risk, FSIS encourages sourcing pigs from producers using indoor systems, appropriately labeling Not-Ready-To-Eat (NRTE) pork products, and applying validated lethality treatments to eliminate parasites *(48, 51)*. FSIS highlights *Salmonella*, STEC, and *Campylobacter* as key pathogens due to their prevalence in raw meat and poultry *(51-53, 56)*. *Salmonella* and STEC are primarily associated with beef and poultry products, whereas *Campylobacter* is more common in poultry *(49, 53, 56)*. FSIS recommends applying validated lethality treatments to reduce these pathogens to safe levels *(51)*. Notably, *Salmonella* is an indicator organism for lethality treatments, meaning its reduction signals the effective control of other pathogens *(51)*. *Lm* poses a unique challenge due to its ability to persist in processing environments: 1) grow at low temperatures and 2) form biofilms resistant to antibacterial treatment *(25, 47)*. FSIS also underscores the importance of post-lethality treatments, antimicrobial interventions, and stringent sanitation programs to minimize cross-contamination from equipment and surfaces *(47, 51)*. FSIS also

identifies *S. aureus* as a concern, particularly in products that spend a prolonged time between 50-130°F *(51)*. This pathogen can be introduced through human contact and thrives in dry environments *(22, 51)*. To mitigate risks, FSIS limits the time products remain in this temperature range to prevent bacterial growth *(51)*.

During the cooling and storage phases, *C. perfringens* and *C. botulinum* present significant risks, as the spores can survive lethality treatments and proliferate if products are not cooled rapidly or stored at safe temperatures *(55)*. There are five types of *C. perfringens* food poisoning (Type A, B, C, D, and E) based on their ability to produce α-toxin, β-toxin, ε-toxin, ι-toxin, or Enterotoxin *(8, 21)*. Most cases of *Clostridium perfringens* food poisoning are caused by Type A *Clostridium perfringens*, which produces α-toxin and Enterotoxin *(8, 21)*. Similarly, *C. botulinum* also consists of four bacterial groups (I – IV) based on seven different types of neurotoxins (Types A – G) *(11, 24)*. The most common neurotoxins associated with *Clostridium botulinum* foodborne illness are types A, B, E, and sometimes F *(11, 35)*. FSIS suggests strict cooling and storage protocols to prevent the growth of these spore-forming bacteria, reducing the likelihood of foodborne illness *(55)*.

***Overview of HACCP to Control for Biological Hazards***

To proactively prevent foodborne outbreaks rather than merely detecting pathogens, the meat and poultry industry adopted HACCP, a food safety management system designed to control hazards during processing *(3, 18, 58)*. By adopting HACCP, processors can identify potential contamination hazards and establish methods to prevent this contamination through "critical limits." Critical Limits serve as parameters that must be monitored to reduce, eliminate, or prevent contamination from occurring (i.e., cooling a product from 130°F to 80°F in 90 minutes) *(3, 18, 55, 58)*. Critical limits can be a wide range of parameters, such as pH,

temperature, time, moisture level, etc. *(3, 18, 58)*. A unique and essential part of HACCP is that processors must have documentation, such as scientific articles, government documents, or in-plant validation studies, which support their use of a critical limit when controlling pathogens *(3, 18, 58)*.

***Appendix A & B Guidelines***

USDA-FSIS developed the widely used Appendix A & B guidelines to provide science-based support for USD-FSIS classified "small and very small meat processors" in establishing critical limits within their HACCP plans *(51, 55)*. These guidelines serve as a valuable resource for ensuring food safety and regulatory compliance while addressing constraints faced by small processors *(51, 55)*. These guidelines were based on former regulations published in the 1970s and 1980s establishing time and temperature cooking and cooling requirements for meat products *(44, 45, 51, 55)*. The guidelines were created in 1999 as a response to the Pathogen Reduction HACCP Final rule in 1996, as guidelines for processors to follow in their HACCP plans based on the former regulations *(51, 55)*. Additionally, these guidelines are focused on select pathogens, such as *Salmonella, S. aureus*, STEC, *Campylobacter, Lm, T. spiralis, T. gondii, C. perfringens*, and *C. botulinum (51, 55)*. The guidelines were created and published to support small and very small meat processors in the meat and poultry industry *(51, 55)*. Thus, they serve as guidelines rather than mandatory regulations, allowing processors to use them as needed. Since its creation in 1999, there have been updates and changes to the guidelines to add clarification and more critical limits to monitor*(51, 55)*. The following section provides a detailed outline of these changes.

### *Development and Updates*

Appendix A and B were first published in 1999 and have undergone multiple revisions, with the most recent version published in 2021*(51, 55)*. 2017 FSIS proposed revisions due to concerns about the original guidance's vagueness and misapplication to products beyond its intended scope *(51, 55)*. A public comment period gathered feedback from industry stakeholders, generating 52 responses *(54)*. Key concerns included the rescission of older guidance, confusion about whether the guidelines were mandatory, and the financial burden on small and very small meat processors *(54)*. FSIS clarified that while the older guidance lacked sufficient scientific support and was rescinded, the updated guidelines remained recommendations rather than requirements *(54)*. They also acknowledged the financial strain on smaller establishments and committed to supporting studies to examine the efficacy of their existing processing methods *(54)*. Regarding Appendix A guidelines, stakeholders sought clarity on product scope, heating come-up-time limits, relative humidity requirements, and poultry cooking adjustments *(54)*. FSIS refined the guidelines, reinforcing the role of relative humidity in pathogen lethality and adjusting poultry treatments based on new scientific research *(54)*. Comments on Appendix B focused on updated cooling options and removing older recommendations *(54)*. FSIS explained that the revised cooling methods accounted for product variability while maintaining food safety, and older guidelines were removed due to insufficient scientific validation *(54)*. Additional industry concerns included the required 6.5-log reduction in *Salmonella*, post-lethality ingredient safety, and natural casing permeability *(54)*. FSIS reaffirmed that the *Salmonella* reduction standard ensures food safety, required validation for post-lethality ingredients, and clarified that natural casings maintain moisture, negating the need for humidity controls *(54)*. Following the year-long public comment period, FSIS published the updated guidelines in 2021, with plans for

future revisions as needed *(51, 55)*. While these updates provided clearer guidance and stronger pathogen controls, concerns remained about their impact on small and very small meat processors

***Small Meat Processors Definition and Characteristics***

The HACCP Final Rule clearly defines the specifications for meat processing facility size *(46)*. These specifications are based on the number of employees or the amount in annual sales. Utilizing these specifications, USDA defines a large processor as having 500 or more employees, a small processor as having 10 to 499 employees, and a very small processor as having fewer than ten employees or less than $2.5 million in annual sales. *(46)*. Currently, 7,094 facilities are listed in the FSIS inspection directory; 496 facilities are categorized as "large," 2,841 are categorized as "small," 2,917 are categorized as "very Small," and 840 are uncategorized *(57)*. A recent study compiled comprehensive data on small and very small meat processors across the U.S., addressing the lack of a centralized database *(12)*. This study found that most processing establishments in the U.S. are over 25 years old, with 10 to 50 employees *(12)*. A study by Syukron, M. and Y. Su et al.*(43)* however focused on small meat processors in Missouri, providing a more localized perspective. Most small meat processing plant owners were between 35 and 64 years old, followed by those 65 and older *(43)*. The smallest group was aged 18 to 34 *(43)*. Most owners were male, and nearly all were Caucasian, with one Black owner reported *(43)*. These studies provide valuable insight into the demographics and characteristics of small and very small meat processors in the U.S. These studies show that most small meat processing facilities have been around for 25 years, with older ownership and a small employee base, unlike large processing plants, where they have 500 or more employees and can divide employees into

different areas, such as food safety, production, and quality assurance. Inspection status and challenges further exemplify these differences in large and small meat processing facilities.

### *Differences in Small Meat Inspection Approaches*

As exemplified during the COVID-19 pandemic, local meat processing plays a valuable role in local communities by providing an alternative way to purchase products outside of chain stores and restaurants *(6)*. Small meat processors operate under four inspection statuses: federal, state, custom-exempt, and, in some states, Talmadge Aiken *(19)*. Inspection statuses – federal, state, Talmadge-Aiken, and custom-exempt – differ primarily in who provides regulatory oversight, which impacts market access *(19)*. Federally inspected facilities can sell products across state lines, while state-inspected facilities can be intrastate or interstate sales, depending on the state *(19)*. Talmadge-Aiken plants employ state inspectors to conduct federal inspections, allowing those plants to sell products across state lines. As of 2012, only nine states have Talmadge-Aiken plants *(19)*. Custom-exempt processors cater exclusively to individual customers, producing meat not intended for commerce or resale, as products from custom-exempt facilities cannot be resold; there is no requirement for an on-site inspector during the slaughter and processing process *(19)*. Instead, custom-exempt plants must complete an annual inspection of recordkeeping and sanitation requirements *(19)*. A processor's inspection status determines where its products can be sold. As mentioned, if a processor is under federal inspection, its products can be transported and sold across state lines, while state-inspected facilities cannot. In Missouri, processors use three primary sources for end-user sales: in-store retail, call-in orders, and online retail *(43)*. Most customers of Missouri state-inspected facilities are from within the county or in Missouri *(43)*. This shows that not all small meat processors require federal inspection for financial success. A growing niche market for small meat

processors is mobile slaughter, where the processors bring a mobile slaughter unit to conduct the slaughter at the farm or ranch. This approach offers producers convenience and expands processing capacity in rural areas *(19)*. Most mobile slaughter units operate under federal inspection, with only one unit under state inspection. Nearly all units in poultry processing fall under the poultry processing exemption except one state-inspected unit *(19)*. By offering localized solutions, small meat processors and mobile slaughter units provide alternatives for local communities regarding meat production, food accessibility, and strength in the supply chain. Although these processors support their local areas, they also face challenges that can hinder their production processes.

### *Small Meat Processors Challenges*

Although small meat processors provide valuable benefits to products and local markets, they face significant challenges, such as labor shortages, financial costs, and regulatory compliance *(12, 23, 43)*. Several studies have examined these challenges in different regions of the United States. A study in the New England region investigated the slaughter and processing capacity of the area, identifying the challenges for small processors *(23)*. The study found that the biggest challenge for small processors was labor-related, followed by HACCP compliance and environmental regulations *(23)*. Another study conducted in Missouri found that although many processors felt that they were in a better situation since the COVID-19 Pandemic, many still struggled with a labor shortage, regulation compliance, and financial costs associated with food safety, diversified operations, and the difficulty of understanding regulations *(10, 16, 32, 43)*. Another study conducted from 2023 to 2024 established a database of very small and small meat processors across the United States and identified challenges faced by processors of this scale *(12)*. When asked about the USDA-FSIS Appendix A & B guidelines updates, a majority

of processors indicated they had minor changes in cooking and cooling processes, and some processors stated they had significant changes in cooking and cooling processes, and other processors had to utilize alternative scientific support due to the updates in the guidelines *(12)* These studies showcase that although small meat processors are essential to the local area they serve, they must deal with challenges with labor shortages, compliance costs, and, most of all, regulatory adjustments. While regulatory frameworks provide structured guidelines, their successful implementation depends mainly on the ability and willingness of processors to adapt, highlighting the need to examine behavioral influences on food safety compliance.

***Behavior Change Theory***

The implementation of Appendix A and B guidelines can require not only operational adjustments but also significant behavior changes among small meat processors. Adopting new food safety protocols often means modifying existing practices, breaking routine behaviors, and integrating new compliance measures. Finding a behavior change theory applied across various fields would be particularly beneficial, as it could provide a structured approach to fostering compliance within the meat and poultry industry. Recently, Yiannas, F. et al.*(61)* published "*Food Safety Culture*," describing and outlining how behavior directly influences food safety and workplace culture. "*Food Safety Culture*" emphasizes the importance of education, training, and behavioral influence in improving food safety practices *(61)*. Furthermore, "*Food Safety = Behavior*," published in 2015, outlined 30 techniques to enhance employee compliance with food safety practices *(62)*. These two publications helped establish that behavior change theory is critical and underutilized within the food safety industry, and there should be a greater focus *(61, 62)*. Moreover, Davis, R. et al.*(13)* conducted a review to identify behavior change and theories utilized in different scientific areas and their relevance. First, a board of 24 experts and

researchers from social and behavioral sciences (*e.g.*, sociologists, psychologists, epidemiologists, etc.) reviewed the literature to find theories of behavior and behavior change methods *(13)*. From this review, 8,680 articles were found regarding behavior, but only 276 were utilized; from the 276 articles, 82 theories were identified *(13)*. Among the 82 theories identified, the newest theory was the COM-B model developed by Susan Michie *(13)*. The COM-B model is a structured framework for behavior change and provides a systematic approach to predicting behavior adoption *(13)*. This behavior change theory was developed to measure the perceived capabilities, opportunities, and motivations towards a targeted behavior; thus, it can be a suitable model for small meat processors and their adoption of the Appendix A and B guidelines.

***COM-B Model & Applications***

The COM-B model, developed by Michie, S. et al.*(28)*, posits that an individual's behavior adoption is primarily driven by their perceived targeted behavior: capability, opportunity, and motivation to conduct the behavior *(28)*. Capability refers to the physical and psychological capability (e.g., skills to implement HACCP practices, such as proper cooking and cooling techniques from Appendix A and B, knowledge of regulatory requirements, and ability to interpret and utilize them, etc.) *(26, 28, 60)*. Opportunity refers to the external factors that facilitate or hinder behavior, such as a physical or social opportunity (e.g., equipment and resources to upgrade processing infrastructure, support from regulatory, industry, or peers to encourage compliance, etc.) *(26, 28, 60)*. Motivation consists of the cognitive and emotional drivers – reflective and automatic – that influence behavior (e.g., awareness of long-term benefits from compliance and guidelines, immediate incentives or pressures, such as customer demand for safer products, etc.) *(26, 28, 60)*. Michie, S. et al.*(28)* showcases that capability, opportunity, and motivation influence behavior, and behavior can influence the perceived capability,

motivation, and opportunity, as shown in Figure 1 *(26, 28, 60)*. Furthermore, Michie, S. et al.*(28)* states that capability and opportunity can influence motivation outside influencing behavior.

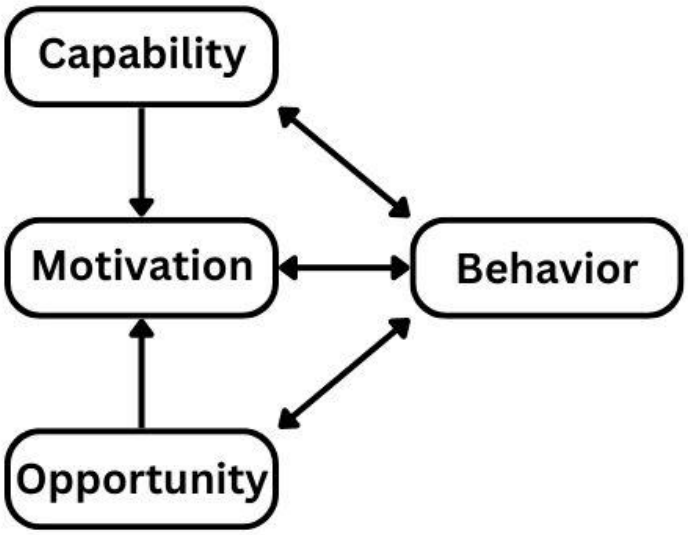


**Figure 1.1: Overview of COM-B model. Adapted from *(28)***

Moreover, The COM-B model is the foundation for another behavior change framework, the "Behavior Change Wheel" *(26, 28)*. The Behavior Change Wheel builds upon the COM-B model, outlining nine intervention methods (education, persuasion, incentivization, coercion, training, enablement, modeling, environmental restructuring, and restrictions) that can increase an individual's capability, opportunity, and motivation to adopt a behavior *(26, 28)*. To support these interventions, the Behavior Change Wheel outlines seven policy categories (guidelines, environmental/social planning, communication/marketing, legislation, service provision, regulation, and fiscal measures) that help implement these strategies effectively *(26, 28)*. By applying the COM-B model and Behavior Change Wheel, these frameworks can be used to assess small meat processors' perceptions of Appendix A and B guidelines and develop

interventions that facilitate compliance. Various studies have highlighted how the COM-B model and Behavior Change Wheel can identify participants' perceived behavior toward a targeted behavior *(4, 20, 31)*. A 2016 study used the COM-B model and Behavior Change Wheel to develop an intervention promoting regular, long-term hearing aid use among hearing loss patients *(4)*. They conducted structured interviews with ten audiologists from five English audiology departments to assess their constructs in assisting patients with auditory rehabilitation *(4)*. The results showed that enhancing the audiologists' psychological capability, physical and social opportunity, and reflective and automatic motivation would encourage behavioral planning, thus improving patient hearing aid usage *(4)*. This approach allowed for the design of an intervention targeting audiologists' behavior to support patients more effectively, utilizing the COM-B model and Behavior Change Wheel. This study highlights that these theories are valuable in designing interventions to target a specific behavior; by using these models, specifically the COM-B model, it is possible to identify which behavioral conditions may be deficient and, thus, an impediment to adopting practices outlined in Appendix A and B guidelines. Moreover, a 2018 study utilized the COM-B model and the Theoretical Domains Framework to measure and analyze members of the pharmacy industry and their antimicrobial stewardship *(20)*. The Theoretical Domains Framework consists of 14 domains with 33 theories of behavior change clustered into those domains for use in behavior change in various industries *(2, 9, 27)*. Within the study, 58 participants from the industry were interviewed and surveyed about their attitudes toward providing self-care advice, antimicrobial stewardship, antimicrobial resistance, and antibiotic compliance *(20)*. The interview and survey results were analyzed using the Behavior Change Wheel to develop targeted intervention methods and policy recommendations *(20)*. The study identified 11 major behavior barriers (*e.g.*, lack of

communication, time issues, limited patient advice, etc.) *(20)*. It utilized seven intervention methods (*e.g.*, training, education, modeling, persuasion, etc.) to address the barriers to enhancing antimicrobial stewardship *(20)*. This study highlights how a structured method, such as the Behavior Change Wheel, can identify barriers to adopting a behavior and intervention methods to reduce those barriers. Similarly, another 2018 study utilized the COM-B model and Behavior Change Wheel to reduce sitting time in the workplace *(31)*. A total of 39 participants took part in focus groups to gather information, attitudes, and challenges towards reducing sitting time at work *(31)*. The findings allowed researchers to develop ten behavior change strategies to address environmental (*e.g.*, height-adjustable desks), organizational (*e.g.*, seminars), and individual (*e.g.*, coaching session) issues *(31)*. This study highlighted that identifying the barriers to targeted behavior is important to develop intervention plans to influence the constructs. These studies showed that the COM-B model could be utilized to develop behavior change techniques with small meat processors and the Appendix A and B guidelines. For example, training sessions focusing on interpreting Appendix A & B and validating alternative methods could improve processors' technical skills, *i.e.*, capability. Similarly, grants for chillers or financial incentives for infrastructure upgrades would reduce barriers to compliance by increasing motivation. Finally, motivational strategies, such as highlighting case studies where compliance led to reduced foodborne illness litigation and enhanced customer trust, could strengthen intrinsic and extrinsic motivations.

### *Examples of COM-B in Food Safety*

While the COM-B model has primarily been used in healthcare, recent research has explored its application in food safety and compliance *(30, 42)*. A recent study utilized the COM-B model to understand producers and food safety practices in informal vegetable markets

in Cambodia *(30)*. The study aimed to understand Cambodian's perceived capabilities, opportunities, and motivations for the daily washing of vegetable contact surfaces in informal markets with soap and water *(30)*. For this study, a questionnaire was developed to gather data based on the COM-B model and the Theoretical Domain Framework *(30)*. After the questionnaire was developed, consisting of 68 questions, it was validated and reviewed to ensure the questions aligned with the COM-B constructs *(30)*. After multiple revisions and a pilot study, the final questionnaire consisted of 30 questions, with respondents being asked about their agreement level over a statement *(30)*. There were five questions regarding capability, seven questions regarding opportunity, and 17 questions regarding motivation in the questionnaire *(30)*. The questionnaire was then sent to 236 vegetable vendors, producers, and distributors from Phnom Penh, Battambang, and Siem Reap*(30)*. The results from the questionnaire highlighted that vegetable vendors and distributors had a lower perceived opportunity to implement the food safety practice compared to their perceived capability and motivation *(30)*. Moreover, the results showed that farmer's perceived capability and opportunity were lower than their perceived motivation. *(30)*. Region-wise, farmers from both regions had lower capability, opportunity, and motivation compared to the vendors in Battambang *(30)*. Moreover, vendors in Siem Reap had lower perceived opportunity and motivation than those in Battambang *(30)*. The differences in the perceived constructs for each region and role could be due to various reasons, such as awareness of food safety practices, proximity to extension services, or the role of the participants (producer vs vendor) *(30)*. These results show that capability, opportunity, and motivation to implement food safety practices may differ based on an individual's role in food production; however, efforts to influence these constructs could lead to improved adoption of food safety practices *(30)*. More recently, a study in Paraguay in 2024 utilized the COM-B model to assess

the perceived capabilities, motivations, and opportunities to implement HACCP as a food safety system *(42)*. This study adapted the questionnaire developed by Mosimann, S. et al.*(30)* to measure the perceived capabilities, opportunities, and motivations of food safety regulators in Paraguay *(42)*. The participants were attendees of HACCP-certified courses and members who actively participated in Paraguay food safety programs *(42)*. A unique aspect of the study was the analysis of the effect of gender and HACCP certification on the likelihood of implementing HACCP *(42)*. The results identified low perceived opportunity across participants *(42)*. Moreover, the results highlighted that perceived opportunity was lower in females than in males. *(42)*. However, having a HACCP certification increased females' perceived motivation and males' perceived capability *(42)*. These results showed that there should be a focus on increasing financial or technical support to increase opportunities for participants, especially females *(42)*.

The evolution of food safety regulations and the implementation of HACCP have significantly improved food safety practices. Yet, small meat processors face challenges in implementing HACCP due to limited financial resources, regulatory complexity, and operational constraints that create barriers to adopting food safety practices. Research on behavior change models, such as the COM-B mode, has demonstrated that it can influence targeted behaviors through intervention methods. However, there is a lack of studies understanding how small meat processors perceive Appendix A and B guidelines, which are beneficial to processors to reach compliance within the meat and poultry industry. This study uses the COM-B model to assess small meat processors' perceived capabilities, opportunities, and motivations to implement Appendix A and B guidelines. This research will help develop interventions that improve compliance and food safety for small meat processors by identifying key barriers and behavior influences.

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# Chapter 2 - Assessing the capabilities, opportunities, and motivations to implement Updated Appendix A & B guidelines in Small Meat Processors within the Mid-West

## Introduction

Ensuring food safety is a top priority in the meat processing industry, and strict adherence to federal regulations is essential to minimizing the risk of foodborne illnesses. To support meat processors in achieving this goal, the United States Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS) introduced the Appendix A & B guidelines in 1999 *(11, 12)*. These guidelines provide scientific support and practical food safety procedures for meat processing, offering critical limits for processes such as temperature control, humidity management, and cooldown times to ensure products are safe for consumption *(11, 12)*. While applicable to all processors, these guidelines are designed for small and very small meat processors, who often face unique challenges in implementation due to limited resources *(11, 12)*.

The USDA categorizes meat processors based on size: large processors have 500 or more employees, small processors have 10 to 499 employees and very small processors have fewer than 10 employees or generate less than $2.5 million in annual sales *(10)*. Unlike large corporations with dedicated food safety teams, small meat processors – often family-owned businesses – operate with constrained financial and workforce resources *(3, 4, 9)*. Owners frequently juggle responsibilities, including financial management, scheduling, and regulatory compliance, with limited support from trained personnel *(3, 4, 9)*. Recent studies highlight these challenges; a survey of Missouri small and very small meat processors identified labor shortages,

regulatory burdens, and supply chain disruptions as top challenges *(9)*. Similarly, a Canadian study found that meat processors listed regulatory compliance, including meat inspection and associated paperwork, as their most significant obstacle, leading to increased staffing and wage costs *(1)*.

Seeing that regulatory compliance is a common challenge with small meat processors, understanding the behavioral factors that influence regulatory compliance is essential. The COM-B model provides a framework for examining behavior change by assessing three key components, or behavioral conditions that must be met on some level for an individual to adopt behavior: capability (*i.e.*, knowledge and skills needed for compliance), opportunity (*i.e.*, available resources and support), and motivation (*i.e.*, willingness to follow regulations) *(5, 6, 13)* . Furthermore, this model has been used in previous food safety studies to assess targeted behaviors and develop guided intervention functions to improve the constructs *(7, 8)*. Applying this model could allow a deeper understanding of small meat processors' barriers to adopting food safety guidelines and can help identify targeted solutions to increase adoption.

Therefore, this study assessed perceived capabilities, opportunities, and motivation to implement Appendix A & B guidelines among small meat processors around the United States Midwest after a training session. Moreover, changes were analyzed pre-training, post-training, and six months later regarding implementing Appendix A & B guidelines. Finally, state-specific variations were analyzed regarding implementing Appendix A & B guidelines.

## Materials and Methods

### *Ethical Approval*

All research described here was reviewed by the Institutional Review Board (IRB) at Kansas State University (Manhattan, KS) and deemed exempt (IRB-11918-Various). No

participant received any form of compensation for participation in the study. Participants were notified that their responses were anonymous and would not be traced back to them for any reason.

*Data Collection*

For this study, a survey instrument previously validated by Mosimann, S. et al.*(7),* Sosa, E. A. M. et al.*(8),* Consisting of 33 questions, was used. Questions were adapted to address the likelihood of small meat processors in the Midwest implementing USDA-FSIS Appendix A and B guidelines, thus reducing the total number of questions to 30. The questionnaire (Table 1.1) was digitized using Qualtrics XM (Seattle, WA) and distributed to potential respondents via email and QR code. Participants were asked to select their level of agreement with the statement presented (e.g., I know how much time is required to adopt the updated Appendix A & B guidelines in a processing establishment) using a 7-point Likert scale (1=Strongly disagree, 2=Disagree, 3=Somewhat disagree, 4=Neither agree nor disagree, 5=Somewhat agree, 6=Agree, and 7= Strongly Agree). The survey instrument also collected demographic information, including gender, age, type of meat products produced, previous training on Appendix A and B guidelines, and location (state). Due to a data collection error, data collected at six months post-intervention did not include location (state).

*Participant selection*

Participants were selected by contacting various state meat processors associations in Kansas, Nebraska, Oklahoma, and South Dakota. During their respective state association annual conference or convention, members were presented with a one-hour training session, or educational intervention, over updated Appendix A & B guidelines. A survey was administered to participants pre-intervention, post-intervention, and six months after the intervention.

*Training*

The training, or "educational intervention," given to participants was conducted during the respective state meat processors association conference/convention. The intervention was a one-hour presentation outlining the history and updates to the Appendix A & B guidelines. Furthermore, the intervention also highlighted common issues with the guidelines and presented solutions to challenges. Participants were asked to complete the questionnaire before, immediately after the intervention, and six months after the intervention.

*Data analysis*

Data were analyzed using the GLIMMIX procedure of SAS (SAS Institute Inc., Cary, NC) with $\alpha$ set at 0.05. The fixed effects were survey (i.e., post and pre), state (i.e., Kansas, Nebraska, Oklahoma, or South Dakota), and their interaction (i.e., state*survey) for the pre-and post-intervention data. For the six-month data, only the fixed effect of survey (i.e., pre-, post-, and six-month) was analyzed. Training status (i.e., yes or no) was included as a random effect where applicable. Additionally, the Kenward-Rogers approximation was used for all analyses.

## Results

*Demographic information*

Forty-seven participants completed the pre-questionnaire; respondents were overwhelmingly males (38/47). Six were female, and two additional respondents did not identify their gender. Most respondents (40%) were between the ages of 36–44 years old, followed by 26-35 years old (17%), 45-54 years old (17%), 55-64 years old (15%), and 18-24 years old (9%). Of the 47 respondents, just over half, 53% (25/47), had not received any training on the updated Appendix A & B guidelines before the intervention. Respondents were also asked about the type of inspection that their processing facility held. Most respondents (40%; 19/47 respondents)

worked in federally inspected facilities, 36% (16/47 respondents) worked in state-inspected facilities, and 26% (12/47 respondents) worked in custom-exempt facilities or otherwise did not produce meat for sale.

Twenty-five participants completed the post-questionnaire; respondents were largely male (21/25 respondents). Three respondents were female, and one respondent did not identify their gender. As seen with the pre-intervention survey, most (40%) respondents were between the ages of 36-44 years old, followed by 45-54 years old (24%), 55-64 years old (20%), 18-24 years old (8%), and finally 26-35 years old (4%), with one participant without an indicated age. When participants were asked about receiving training on Appendix A & B guidelines, In contrast to the respondents to the pre-intervention survey, most respondents (68%) to the post-intervention survey indicated that they had received training on Appendix A & B guidelines. A similar percentage of respondents indicated they worked in federally inspected (44%) vs. state-inspected facilities, with the remaining 12% of respondents indicating they worked in custom-exempt facilities or otherwise did not produce meat for sale.

Twenty-two participants completed the 6-month questionnaire. Most respondents were again male (19/22), with the remaining identifying as female. Most respondents (32%) were 36-44 years old, followed by 45-54 years old (27%) and 55-64 years old (27%), and the least was the age range of 26-35 years old (17%). Most participants (55%) indicated they had received training in Appendix A & B guidelines. Similar percentages of respondents indicated they work in federally inspected facilities (45%) vs. state-inspected facilities (41%). The remainder (13%) indicated they work in custom-exempt facilities or otherwise do not produce meat for sale.

*Perceived Capability to implement Appendix A & B guidelines*

Before the intervention, respondents perceived capability to implement the updated Appendix A & B guidelines was low (3.63) but increased significantly (4.37; $P < 0.05$) immediately following the intervention. Furthermore, this increase in perceived capability remained higher (4.40) six months after the intervention. Meat processors in South Dakota had the lowest average perceived capability, with an average score of 3.40, followed by Kansas (3.87), Oklahoma (4.13), and, finally, Nebraska (4.96).

*Perceived Opportunity to implement Appendix A & B guidelines*

Participants perceived opportunity to implement the updated Appendix A & B guidelines numerically increased from 3.98 to 4.18 following the intervention. Six months after the intervention, opportunity decreased to 3.84. Opportunity was lowest among meat processors in Kansas (3.83), followed by South Dakota (4.09), Oklahoma (4.20), and Nebraska (4.43).

*Perceived Motivation to implement Appendix A & B guidelines by survey*

There were no differences in perceived motivation to implement Appendix A & B guidelines over time (pre-intervention: 5.13; post-intervention: 5.18; six months after intervention: 4.39). While no differences were detected, motivation was numerically lowest in meat processors from Nebraska (4.81), followed by Kansas (5.13), South Dakota (5.15), and Oklahoma (5.34).

## Discussion

This study assessed small meat processors' perceived capabilities, opportunities, and motivation in implementing the updated Appendix A & B guidelines using the COM-B model. This study found that the perceived capability among respondents increased immediately following the educational intervention and remained at this higher level six months after the

intervention. There were no changes, however, in perceived opportunity, and perceived motivation decreased over time, albeit only numerically. These results suggest that educational intervention improved knowledge of Appendix A & B guidelines but not other conditions that drive adoption of behaviors. Thus, small meat processors may require continued support, incentives, and further research on external barriers regarding Appendix A & B guidelines.

Michie, S. et al.*(5)* explain various intervention functions in their book "The Behavior Change Wheel" and what COM-B conditions they link to. Capability is broken into physical and psychological interventions like training and enablement work for physical and psychological capability, and education interventions work for psychological capability. For opportunities, broken into physical and social opportunity, interventions like restriction, environmental restructuring, and enablement work for both types of opportunity; moreover, training interventions work for physical opportunity, and modeling interventions work for social opportunity. Lastly, automatic and reflective motivation and interventions such as persuasion, incentivization, and coercion work for both types of motivation. Education intervention works for reflective motivation, whereas training, environmental restructuring, modeling, and enablement interventions work for automatic motivation. Along with intervention types, Michie, S. et al.*(5)* provide policies supporting these intervention methods; policies such as guidelines, regulations, and legislation can work for all kinds of interventions except for modeling; communication/marketing work for education, persuasion, incentivization, and modeling; fiscal measures work for incentivization, coercion, training, environmental restricting, and enablement; service provision works for all intervention functions except restriction and environmental restructuring. Lastly, environmental/social planning policies work only with environmental

restructuring and enablement. Understanding how policies can be used as interventions makes recommending future methods for improving these conditions for small meat processors easier.

The capability in the COM-B model refers to physical capabilities, such as physical skills a person may possess, and psychological capabilities, such as a person's knowledge, cognitive, and interpersonal skills *(5, 6, 13)*. In this study, participants' overall perceived capabilities increased post-intervention and remained increased six months later, as highlighted in Table 2.2. Furthermore, specific questions "I am very familiar with the updated Appendix A & B guidelines" and "I know how much it costs to adopt the updated Appendix A & B guidelines in a processing establishment" showed an increase post-intervention and remained increased six months after. Moreover, the same questions showed a difference between states, with Nebraska processors having the highest score while South Dakota had the lowest, along with Oklahoma regarding "I know how much it costs to adopt the updated Appendix A & B guidelines in a processing establishment".

This increase in perceived capability post-intervention and six months post-intervention highlights how the training, or "educational intervention," enhanced the processors' knowledge and confidence in implementing the updated Appendix A & B guidelines, with long-term retention. Thus, these intervention methods should be used further when targeting certain behaviors with small meat processors if the goal is to increase perceived capability. However, it should be noted that the score is on a scale of 1 to 7; thus, these scores would also be around neutral. Regarding states, although there was not a statistical difference on average between the states, Nebraska processors did show that regarding familiarity and cost, they had a higher response. This could be due to Nebraska processors only having federal inspection; thus, their support and training regarding the Appendix A & B guidelines was more prominent than states

with federal and state inspection. This could be further explained by the fact that Oklahoma and South Dakota have federal and state inspections and have had lower responses regarding familiarity with and the cost of implementing the guidelines.

To further increase the perceived capability of implementing the Appendix A & B guidelines, future interventions could be further education, training, or modeling interventions supported by marketing, service provision, or guidelines, regulations, or legislation for education and training. Specifically, having a quarterly or semi-annual workshop hosted by USDA-FSIS addressing the guidelines and how to utilize them in facilities. USDA-FSIS could market this workshop to processors by state or even by region. This would allow processors to gain further knowledge of the guidelines, thus increasing their perceived capability regarding implementing the updated Appendix A & B guidelines.

In the COM-B model, opportunity refers to the physical (*i.e.*, time, location, resources, and infrastructure) and social opportunities (*i.e.*, social cues, interpersonal influences, and cultural norms) that may influence whether a person adopts a behavior *(5, 6, 13)*. Unlike capability, this study showed no differences among participants' overall perceived opportunity pre-, post-, and six-month post-intervention and no differences between meat processors from different states. This could indicate that educational intervention did not address the barriers that limited participants' perceived opportunity. However, the question "I have enough workforce to process products according to the updated Appendix A & B guidelines," representing physical opportunity, showed a decrease from the pre-and post-intervention to the six-month post-intervention. This decrease in perceived opportunity six months post-intervention could be due to various reasons, such as processors losing workforce or workforce knowledge regarding the guidelines decreasing. Alternatively, capability and motivation can influence opportunity; thus,

six months post-intervention, processors had a higher capability regarding implementing the guidelines but a lower motivation; their perceived capability and motivation could influence their response regarding their perceived opportunity.

To address the barrier of workforce regarding perceived opportunity to implement the guidelines, enablement interventions through the policy of fiscal measures could be utilized. More specifically, implementing a grant for small and very small meat processors actively utilizing the Appendix A & B guidelines that provide funds for hiring new or existing employees. An intervention regarding this barrier assists processors with the workforce regarding implementing the guidelines and the challenges of finding and retaining labor for processors. Small and very small meat processors have consistently shown that labor is a challenge for them; recently, a survey found that 66% of processors have had up to a 25% turnover rate in the past year *(2, 4, 9)*. Addressing workforce barriers through a grant system may increase the small and very small meat processors' perceived opportunity to implement the updated Appendix A & B guidelines and address workforce challenges that have plagued the industry.

Furthermore, the study found no differences regarding perceived opportunity from meat processors from different states. Appendix A & B guidelines apply to meat processors regardless of geography *(11, 12)*. Overall, The Appendix A & B guidelines provide free and open access by USDA-FSIS to all meat processors from very small to large; thus, every meat processor has the same opportunity to utilize the guidelines *(11, 12)*. Moreover, Appendix A & B guidelines are not required to be used by meat processors but rather to be provided as support documents that can assist processors with ensuring safe procedures are being followed when processing products for consumers *(11, 12)*. Appendix A & B guidelines are based on scientific studies and research that has been conducted to ensure that the procedures and guidelines listed in the document are

safe for processors to follow and use as support documentation for their HACCP plans *(11, 12)*. Based on the availability of the guidelines, this would perhaps explain the lack of differences regarding states and their perceived opportunity to implement the updated Appendix A & B guidelines

In the COM-B model, motivation can be reflective, which includes planned processes and beliefs, or automatic, which includes desires, impulses, and inhibitions *(5, 6, 13)*. Unlike capability, participants' average perceived motivation decreased from the pre- and post-intervention to six months post-intervention. These results show that participants were motivated after the educational intervention, but motivation may have decreased due to the lack of continued engagement or tangible benefits. Specific questions: “Processing according to the updated Appendix A & B guidelines would improve the quality of my product”, “It would be beneficial for my processing establishment if I adopted the updated Appendix A & B guidelines”, “Adopting the updated Appendix A & B guidelines would enhance my processing establishment’s reputation” and “I would process according to the updated Appendix A & B guidelines if this would enhance the quality of my products” all showed a decrease in perceived motivation from pre-and post-intervention to six months post-intervention.

Furthermore, regarding perceived motivation between states, there were no average differences. However, specific questions: “I could sell my products to more consumers if I adopted the updated Appendix A & B guidelines” and “My processing establishment would make money if it had adopted the updated Appendix A & B guidelines,” showed a difference with Nebraska having the lowest response, while Oklahoma had the highest response. Moreover, “My processing establishment would make more money if it had adopted the updated Appendix

A & B guidelines" had a difference regarding the state of Nebraska pre-intervention and post-intervention.

These differences showed that six months after the training session, processors had a lower perceived motivation, along with differences between Nebraska processors and Oklahoma processors. The decrease in perceived motivation six months after the training session could be due to the lack of benefits, such as quality improvement and reputation enhancement, processors felt they would have from implementing the guidelines. Unlike pre- and post-training sessions, processors may not have observed benefits from implementing the guidelines in their facilities; additionally, a lack of follow-up or continued support could lead to decreased motivation. Furthermore, the difference between Nebraska and Oklahoma in terms of selling more products and making more money could be due to Nebraska processors' already established customer base. In contrast, Oklahoma processors felt implementing the guidelines would expand their customer base. Moreover, Nebraska processors had a lower perceived motivation post-training session regarding making more money if implementing the guidelines. Finally, post-training session, Nebraska processors had a lower perceived motivation compared to pre-training session, possibly due to not seeing any financial benefits highlighted in the training session.

To address the barriers regarding perceived motivation to implement the updated Appendix A & B guidelines, incentivization through fiscal measures, service provision, or legislation. Specifically, implementing a tax credit program for processors who implement Appendix A & B guidelines could increase perceived motivation. Moreover, utilizing legislation to implement state-level benefits, such as reduced fees for inspection or state tax breaks, for processors who implement the Appendix A & B guidelines could increase perceived motivation. Finally, working with USDA-FSIS to provide a guideline consultation program that assists

processors with consulting on proper implementation of the guidelines, challenges with guidelines, or hands-on assistance could increase perceived motivation.

Although there is no requirement or regulation to force small meat processors to utilize the Appendix A & B guidelines, the guidelines aim to support small meat processors with the safety of their products *(11, 12)*. By using these guidelines, small meat processors have a straightforward guide and foundation of scientific knowledge to support their processes and HACCP plans instead of finding scientific support on their own. This study showed that participating small meat processors had an increased perceived capability to implement the guidelines after a training session, no changes on average regarding perceived motivation, and a decrease in perceived motivation six months post-training session.To address the barriers to implementing the guidelines, interventions such as education, enablement, and incentivization through the means of marketing, fiscal measure, or service provision should be utilized to increase processors perceived capability, opportunity, and motivation

Utilizing the COM-B model to determine how small meat processors perceive their capability, opportunities, and motivations to implement Appendix A & B guidelines, there is now a baseline for other agencies to improve their intervention methods. Extension agents, inspection personnel, and policymakers can now understand how small meat processors perceive the guidelines supporting them and can develop more effective methods to train, distribute, and educate them about these guidelines. By understanding where behavioral conditions are deficient, these support groups can now focus on developing intervention methods that will focus on that construct to increase and improve one's behavior towards these guidelines and, most importantly, how to improve support to small meat processors in the future.

It should be noted that there were limitations to the current study. First, the sample size of participants was small, with the pre-intervention survey having only 47 participants and the post-intervention survey having only 25 participants. Another limitation was the focus on the Mid-west region, which limits small meat processors' challenges and behaviors around the rest of the United States and other parts of the world. Although these limitations did exist in this study, future research should focus on incorporating small meat processors across the United States and increasing the number of participants within the study. By increasing the area and participants, there would be a better baseline and understanding of what small meat processors' behavior across the United States may look like and can compare issues and challenges affecting all small meat processors.

This study looked at small meat processors' perceived capability, opportunity, and motivation toward implementing the updated Appendix A & B guidelines. On average, perceived capability to implement Appendix A & B guidelines increased over time among small meat processors, while perceived opportunity remained unchanged, and perceived motivation decreased. Further interventions (*i.e.,* education, training, and enablement) should be utilized to address barriers to implementing the guidelines. Utilizing the COM-B model allows supporting agencies to develop further better resources and support for small meat processors regarding food safety guidelines.

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**Table 2.1 Questionnaire used to assess perceived capabilities, opportunities, and motivations to implement updated Appendix A & B guidelines for Small Meat Processors in the Mid-West**

| Question | COM-B construct |
|---|---|
| CAPABILITIES | |
| 1. I am very familiar with the updated Appendix A & B guidelines | Capability – Psychological |
| 2. I know the reasons why Appendix A & B guidelines were updated | Capability – Psychological |
| 3. I know how much time is required to adopt the updated Appendix A & B guidelines in a processing establishment | Capability – Psychological |
| 4. I know how much it costs to adopt the updated Appendix A & B guidelines in a processing establishment | Capability – Psychological |
| OPPORTUNITIES | |
| 5. Most processors in my area have obtained training on the updated Appendix A & B guidelines | Opportunity – Social |
| 6. Most processors in my area believe that it is important to obtain training on the updated Appendix A & B guidelines | Opportunity – Social |
| 7. Other processors in my area frequently talk about the benefits of the updated Appendix A & B guideline | Opportunity – Social |
| 8. Government officers encouraged me to learn about the updated Appendix A & B guidelines for my processing establishment | Opportunity – Social |
| 9. I have enough money to adopt the updated Appendix A & B guidelines in my processing establishment | Opportunity – Physical |
| 10. I have enough time to adopt the updated Appendix A & B guidelines in my processing establishment | Opportunity – Physical |
| 11. I have enough workforce to process products according to the updated Appendix A & B guidelines | Opportunity – Physical |
| 12. I know where I can learn more about the updated Appendix A & B guidelines | Opportunity – Physical |

| | |
|---|---|
| 13. I know where assistance would be found for adopting the updated Appendix A & B Guidelines | Opportunity – Physical |
| MOTIVATION | |
| 14. Other processors similar to me think that I should adopt the updated Appendix A & B guideline | Motivation – Reflective |
| 15. Consumers who buy products from my processing establishment expect me to follow the updated Appendix A & B guidelines | Motivation – Reflective |
| 16. It would be difficult for me to process products according to the updated Appendix A & B guidelines | Motivation – Reflective |
| 17. Processing according to the updated Appendix A & B guidelines would improve the quality of my products | Motivation – Reflective |
| 18. I plan to update my HACCP plans to reflect the updated Appendix A & B guidelines | Motivation – Reflective |
| 19. It would be beneficial for my processing establishment if I adopted the updated Appendix A & B guidelines | Motivation – Reflective |
| 20. Adopting the updated Appendix A & B guidelines would enhance my processing establishment's reputation | Motivation – Automatic |
| 21. I would process according to the updated Appendix A & B guidelines if this would enhance the quality of my products | Motivation – Automatic |
| 22. I would adopt the updated Appendix A & B guidelines if this would make my products more popular among consumers | Motivation – Automatic |
| 23. The safety of my products affects my reputation as a processor | Motivation – Automatic |

| | |
|---|---|
| 24. I would adopt the updated Appendix A & B guidelines if it would increase my profits | Motivation – Automatic |
| 25. I could prevent people from getting sick if I processed my food products according to the updated Appendix A & B guidelines | Motivation – Reflective |
| 26. I could sell my products to more consumers if I adopted the updated Appendix A & B guidelines | Motivation – Reflective |
| 27. I would process my products according to Appendix A & B guidelines if this made my products safer | Motivation – Automatic |
| 28. The safety of my products makes me proud | Motivation – Automatic |
| 29. My processing establishment would make more money if it had adopted the updated Appendix A & B guidelines | Motivation – Reflective |
| 30. The quality of my products makes me proud | Motivation – Automatic |

**Table 2.2** Least square means for perceived capability for States pre- and post-intervention, state, and survey.

| | KS | | OK | | SD | | NE | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** | **SEM[1]** | **P-Value** | **KS** | **OK** | **SD** | **NE** | **SEM[1]** | **P-Value** | **Pre** | **Post** | **SixMo** | **SEM[1]** | **P-Value** |
| Capability #1 | 3.07 | 4.13 | 3.95 | 5.01 | 2.99 | 3.22 | 4.35 | 6.50 | 1.46 | 0.66 | 3.60$^{bc}$ | 4.48$^{ab}$ | 3.10$^{c}$ | 5.43$^{a}$ | 1.14 | 0.01 | 3.56 | 4.41 | 4.58 | 0.90 | 0.05 |
| Capability #2 | 3.23 | 4.15 | 3.89 | 5.05 | 3.80 | 4.58 | 4.35 | 4.00 | 1.29 | 0.78 | 3.69 | 4.47 | 4.19 | 4.17 | 0.92 | 0.42 | 3.71 | 4.53 | 3.58 | 0.71 | 0.08 |
| Capability #3 | 3.97 | 4.21 | 4.16 | 3.90 | 2.68 | 3.84 | 4.02 | 6.00 | 1.39 | 0.41 | 4.09 | 4.03 | 3.26 | 5.01 | 1.01 | 0.19 | 3.85 | 4.21 | 4.70 | 0.83 | 0.29 |
| Capability #4 | 3.92 | 4.34 | 3.06 | 4.05 | 2.24 | 3.89 | 4.37 | 6.00 | 1.30 | 0.66 | 4.13$^{ab}$ | 3.55$^{b}$ | 3.07$^{b}$ | 5.19$^{a}$ | 0.94 | 0.04 | 3.41$^{b}$ | 4.35$^{a}$ | 4.76$^{a}$ | 0.71 | 0.02 |
| Capability Average | 3.55 | 4.20 | 3.76 | 4.50 | 2.93 | 3.87 | 4.29 | 5.63 | 1.19 | 0.94 | 3.87 | 4.13 | 3.40 | 4.96 | 0.93 | 0.11 | 3.64 | 4.37 | 4.40 | 0.74 | 0.05 |

[abc]Least Square means in the same row in the same section lacking a common superscript differ ($p < 0.05$).
[1]SEM (Largest) of the least squares means.

**Table 2.3** Least square means for perceived opportunity for States pre- and post-intervention, state, and survey

| | KS | | OK | | SD | | NE | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** | **SEM[1]** | **P-Value** | **KS** | **OK** | **SD** | **NE** | **SEM[1]** | **P-Value** | **Pre** | **Post** | **SixMo** | **SEM[1]** | **P-Value** |
| Opportunity #1 | 3.30 | 3.16 | 3.63 | 3.99 | 3.30 | 4.10 | 3.53 | 2.50 | 1.00 | 0.54 | 3.23 | 3.81 | 3.70 | 3.02 | 0.60 | 0.42 | 3.46 | 3.52 | 3.60 | 0.47 | 0.95 |
| Opportunity #2 | 3.47 | 3.71 | 4.37 | 4.40 | 3.61 | 4.84 | 4.24 | 5.00 | 1.11 | 0.72 | 3.59 | 4.38 | 4.22 | 4.62 | 0.69 | 0.26 | 3.93 | 4.27 | 4.08 | 0.53 | 0.69 |
| Opportunity #3 | 2.63 | 3.40 | 3.35 | 3.43 | 2.71 | 3.50 | 3.29 | 4.00 | 1.05 | 0.86 | 3.01 | 3.39 | 3.11 | 3.64 | 0.59 | 0.72 | 3.00 | 3.48 | 2.83 | 0.42 | 0.32 |
| Opportunity #4 | 3.83 | 4.35 | 4.05 | 3.80 | 3.34 | 3.91 | 3.38 | 3.00 | 1.50 | 0.89 | 4.09 | 3.93 | 3.63 | 3.19 | 0.94 | 0.77 | 3.78 | 3.93 | 5.16 | 0.80 | 0.09 |
| Opportunity #5 | 3.92 | 3.55 | 3.48 | 4.20 | 4.95 | 4.08 | 4.48 | 4.00 | 1.24 | 0.47 | 3.74 | 3.84 | 4.51 | 4.24 | 0.89 | 0.44 | 3.98 | 3.97 | 2.94 | 0.64 | 0.12 |
| Opportunity #6 | 3.80 | 3.78 | 3.61 | 4.49 | 4.37 | 3.79 | 4.28 | 4.50 | 1.22 | 0.58 | 3.79 | 4.05 | 4.08 | 4.39 | 0.85 | 0.82 | 3.88 | 4.10 | 3.54 | 0.62 | 0.59 |
| Opportunity #7 | 4.69 | 4.11 | 3.92 | 3.79 | 4.21 | 4.02 | 5.32 | 4.00 | 1.07 | 0.77 | 4.40 | 3.85 | 4.12 | 4.66 | 0.74 | 0.45 | 4.43[a] | 4.03[ab] | 3.29[b] | 0.57 | 0.04 |
| Opportunity #8 | 4.07 | 4.51 | 4.77 | 5.58 | 4.85 | 4.36 | 5.25 | 6.50 | 1.49 | 0.62 | 4.29 | 5.17 | 4.60 | 5.88 | 1.18 | 0.10 | 4.60 | 5.01 | 4.58 | 0.90 | 0.58 |
| Opportunity #9 | 3.97 | 5.10 | 5.10 | 5.89 | 5.11 | 4.83 | 5.33 | 6.50 | 1.37 | 0.62 | 4.53 | 5.50 | 4.97 | 5.91 | 1.02 | 0.13 | 4.74 | 5.43 | 4.64 | 0.77 | 0.20 |
| Opportunity Average | 3.73 | 3.94 | 4.02 | 4.39 | 4.06 | 4.12 | 4.41 | 4.44 | 0.82 | 0.96 | 3.83 | 4.20 | 4.09 | 4.43 | 0.64 | 0.39 | 3.98 | 4.18 | 3.84 | 0.52 | 0.53 |

[abc]Least Square means in the same row in the same section lacking a common superscript differ ($p < 0.05$).

[1]SEM (Largest) of the least squares means.

**Table 2.4** Least square means for perceived motivation for States pre- and post-intervention, state, and survey

| | KS | | OK | | SD | | NE | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** | **SEM[1]** | **P-Value** | **KS** | **OK** | **SD** | **NE** | **SEM[1]** | **P-Value** | **Pre** | **Post** | **SixMo** | **SEM[1]** | **P-Value** |
| Motivation #1 | 3.77 | 3.66 | 4.35 | 4.66 | 4.48 | 4.10 | 4.63 | 5.00 | 0.94 | 0.85 | 3.72 | 4.51 | 4.29 | 4.82 | 0.62 | 0.10 | 4.21 | 4.20 | 3.76 | 0.44 | 0.52 |
| Motivation #2 | 3.56 | 4.20 | 4.00 | 5.43 | 5.14 | 4.17 | 3.71 | 3.50 | 1.21 | 0.25 | 3.88 | 4.71 | 4.65 | 3.61 | 0.69 | 0.25 | 3.98 | 4.48 | 3.25 | 0.50 | 0.13 |
| Motivation #3 | 4.13 | 3.80 | 4.41 | 4.00 | 4.29 | 4.17 | 4.14 | 3.50 | 1.09 | 0.99 | 3.96 | 4.21 | 4.23 | 3.82 | 0.62 | 0.90 | 4.26 | 3.92 | 4.75 | 0.45 | 0.31 |
| Motivation #4 | 3.50 | 4.00 | 4.35 | 5.14 | 4.14 | 4.00 | 4.71 | 3.00 | 1.14 | 0.37 | 3.75 | 4.75 | 4.07 | 3.86 | 0.65 | 0.23 | 4.09[a] | 4.24[a] | 2.50[b] | 0.46 | 0.01 |
| Motivation #5 | 5.61 | 4.56 | 5.13 | 5.34 | 5.37 | 4.60 | 5.60 | 7.00 | 1.13 | 0.15 | 5.09 | 5.24 | 4.99 | 6.30 | 0.83 | 0.23 | 5.40 | 5.00 | 4.81 | 0.70 | 0.31 |
| Motivation #6 | 4.91 | 5.01 | 5.37 | 5.11 | 4.03 | 4.86 | 4.79 | 5.00 | 0.96 | 0.73 | 4.96 | 5.24 | 4.44 | 4.89 | 0.59 | 0.40 | 4.94[a] | 4.96[a] | 2.89[b] | 0.54 | 0.00 |
| Motivation #7 | 4.50 | 5.00 | 4.65 | 5.43 | 4.43 | 3.83 | 3.57 | 3.50 | 1.11 | 0.64 | 4.75 | 5.04 | 4.13 | 3.54 | 0.63 | 0.14 | 4.41[a] | 4.69[a] | 2.22[b] | 0.48 | 0.00 |
| Motivation #8 | 5.54 | 5.61 | 5.31 | 5.54 | 5.75 | 5.19 | 5.08 | 5.00 | 0.98 | 0.87 | 5.57 | 5.43 | 5.47 | 5.04 | 0.61 | 0.86 | 5.42 | 5.46 | 4.52 | 0.46 | 0.11 |
| Motivation #9 | 5.48 | 5.53 | 5.50 | 5.55 | 5.31 | 6.22 | 4.74 | 6.50 | 0.86 | 0.35 | 5.51 | 5.52 | 5.77 | 5.62 | 0.53 | 0.93 | 5.35[ab] | 5.76[a] | 4.68[b] | 0.44 | 0.05 |
| Motivation #10 | 6.42 | 5.85 | 6.27 | 6.27 | 6.73 | 6.76 | 5.69 | 7.00 | 0.80 | 0.31 | 6.14 | 6.27 | 6.74 | 6.34 | 0.48 | 0.46 | 6.31 | 6.26 | 6.37 | 0.36 | 0.96 |
| Motivation #11 | 5.63 | 5.80 | 5.76 | 5.86 | 5.86 | 6.67 | 5.29 | 7.00 | 0.89 | 0.47 | 5.71 | 5.81 | 6.26 | 6.14 | 0.50 | 0.58 | 5.66 | 6.09 | 5.64 | 0.38 | 0.36 |
| Motivation #12 | 5.00 | 5.40 | 4.88 | 5.57 | 4.71 | 4.83 | 4.86 | 2.50 | 1.16 | 0.24 | 5.20 | 5.23 | 4.77 | 3.68 | 0.66 | 0.18 | 4.89 | 5.08 | 3.83 | 0.49 | 0.10 |
| Motivation #13 | 4.54[a] | 5.13[a] | 4.62[a] | 5.26[a] | 4.60[a] | 3.72[a] | 4.17[a] | 1.00[b] | 1.13 | 0.04 | 4.84[a] | 4.94[a] | 4.16[ab] | 2.58[b] | 0.68 | 0.01 | 4.53 | 4.45 | 3.40 | 0.59 | 0.11 |
| Motivation #14 | 5.87 | 5.77 | 5.40 | 5.70 | 5.87 | 6.45 | 5.50 | 4.50 | 0.89 | 0.59 | 5.82 | 5.55 | 6.16 | 5.00 | 0.54 | 0.30 | 5.65 | 5.78 | 5.11 | 0.41 | 0.29 |
| Motivation #15 | 6.79 | 6.22 | 6.38 | 6.26 | 6.46 | 6.53 | 5.92 | 7.00 | 0.67 | 0.23 | 6.50 | 6.32 | 6.49 | 6.46 | 0.43 | 0.91 | 6.46 | 6.36 | 6.34 | 0.35 | 0.87 |
| Motivation #16 | 4.06 | 4.20 | 4.71 | 4.86 | 4.00 | 3.67 | 4.00 | 2.50 | 0.95 | 0.54 | 4.13[ab] | 4.78[a] | 3.83[ab] | 3.25[b] | 0.54 | 0.05 | 4.28 | 4.12 | 3.42 | 0.41 | 0.18 |
| Motivation #17 | 6.60 | 6.23 | 6.62 | 6.26 | 6.17 | 6.71 | 5.89 | 7.00 | 0.67 | 0.18 | 6.42 | 6.44 | 6.44 | 6.45 | 0.42 | 1.00 | 6.44 | 6.40 | 6.67 | 0.35 | 0.64 |
| Motivation Average | 5.13 | 5.13 | 5.20 | 5.47 | 5.18 | 5.12 | 4.89 | 4.72 | 0.55 | 0.89 | 5.13 | 5.34 | 5.15 | 4.81 | 0.35 | 0.47 | 5.13[a] | 5.18[a] | 4.39[b] | 0.29 | 0.00 |

[abc]Least Square means in the same row in the same section lacking a common superscript differ ($p < 0.05$).

[1]SEM (Largest) of the least squares means.

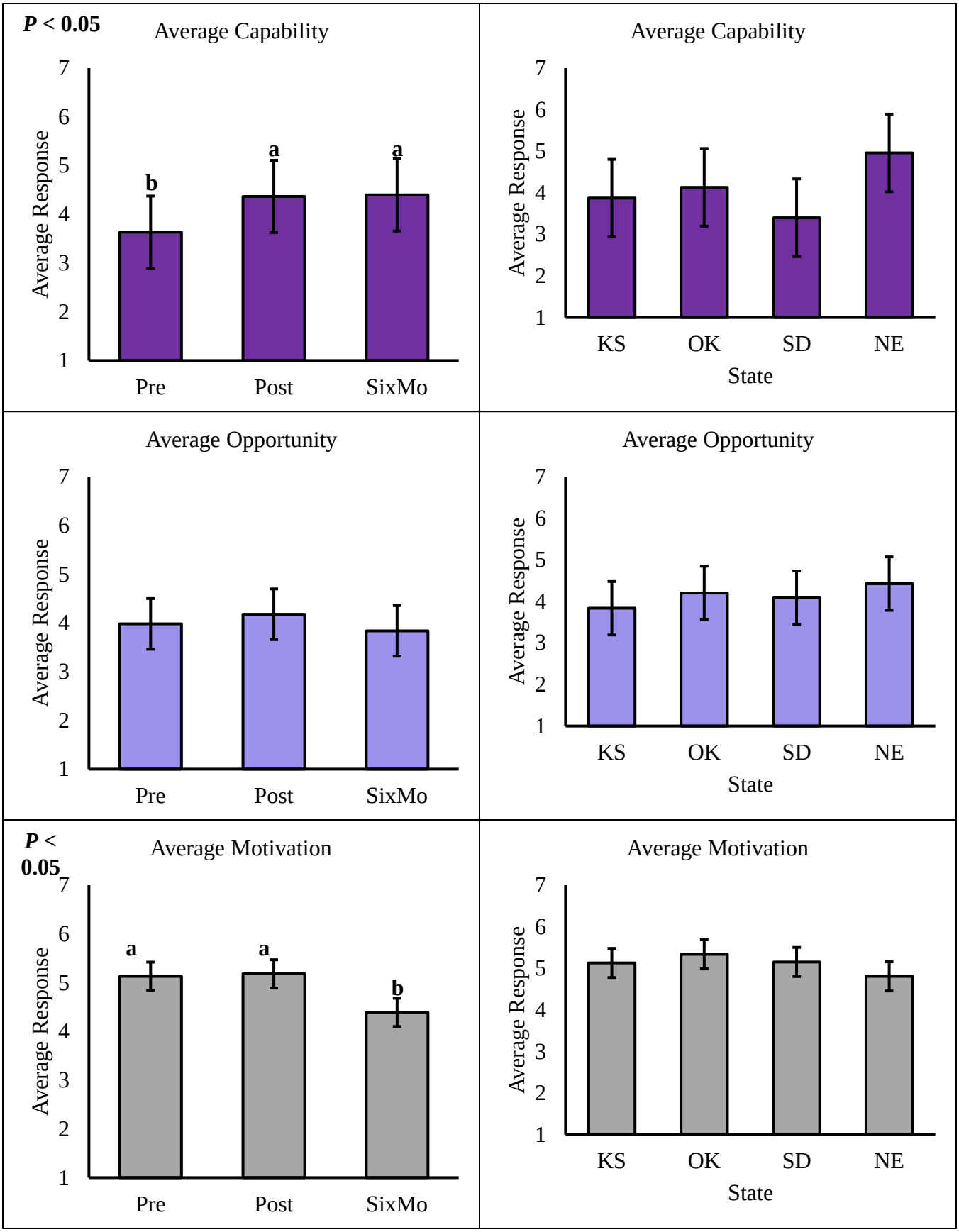


**Figure 2.1** Estimated mean responses (1=Strongly Disagree to 7=Strongly Agree) with corresponding SE to the questions comprising the constructs of capability
Significant differences ($p < 0.05$) are indicated by different letters

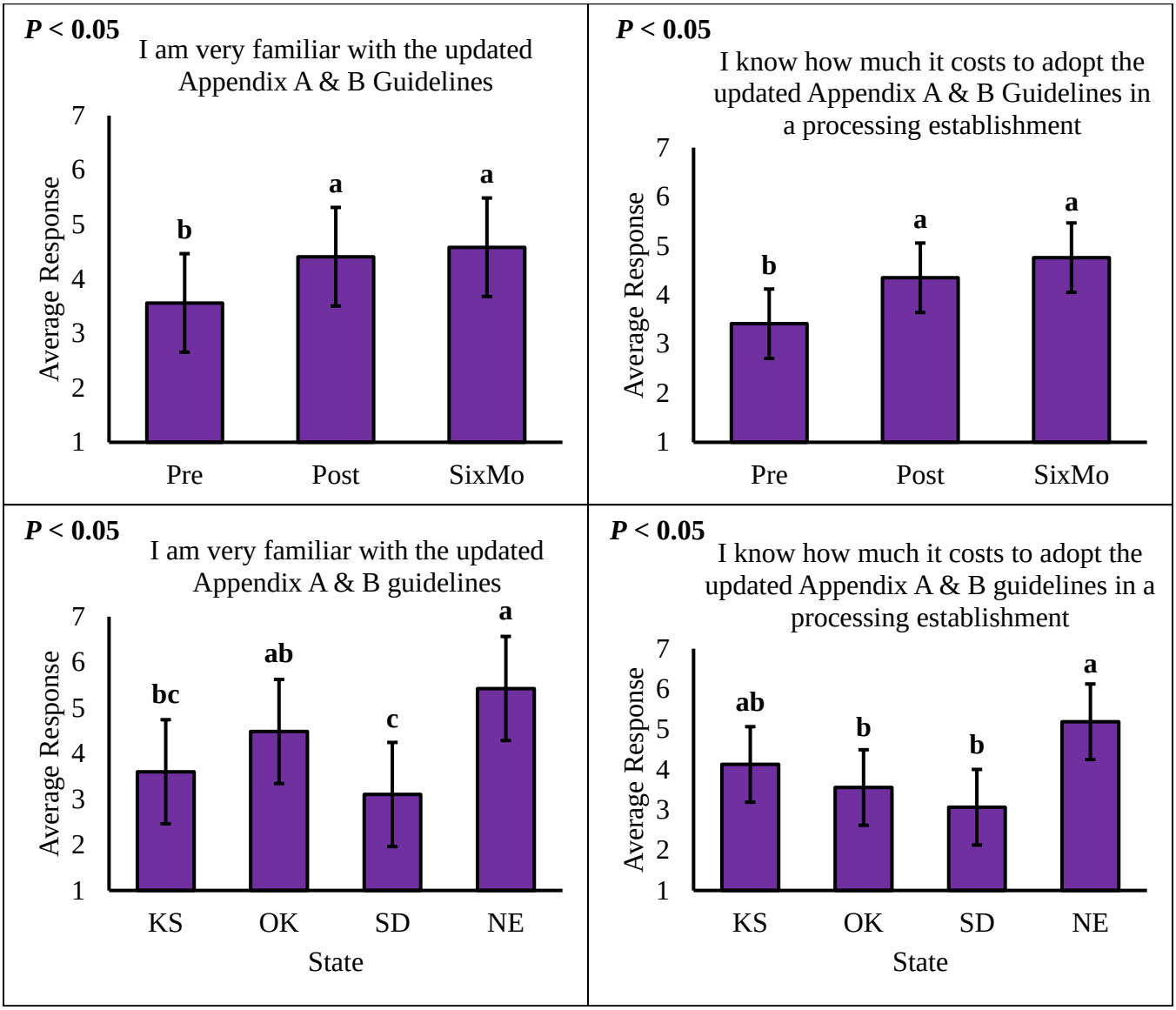


**Figure 2.2** Estimated mean responses (1=Strongly Disagree to 7=Strongly Agree) with corresponding SE to the questions comprising the capability construct.
Significant differences ($p < 0.05$) are indicated by different letters

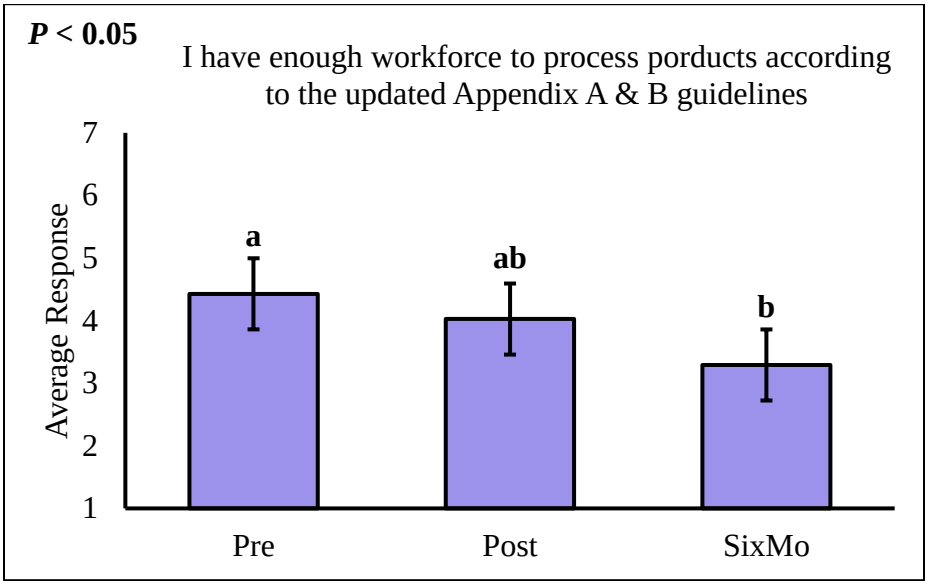


**Figure 2.3** Estimated mean responses (1=Strongly Disagree to 7=Strongly Agree) with corresponding SE to the questions comprising the opportunity construct.
Significant differences ($p < 0.05$) are indicated by different letters

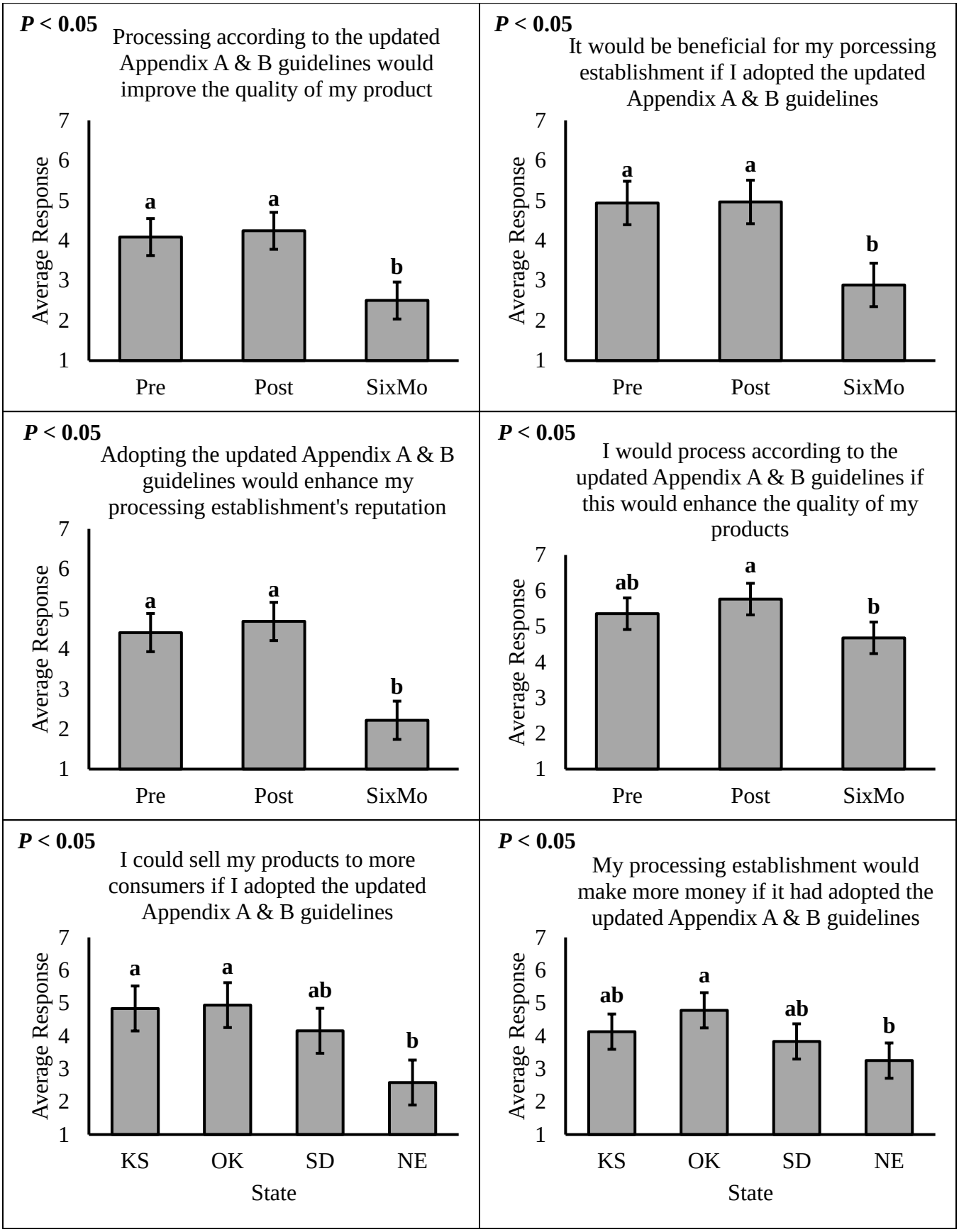


**Figure 2.4** Estimated mean responses (1=Strongly Disagree to 7=Strongly Agree) with corresponding SE to the questions comprising the motivation construct.
Significant differences ($p < 0.05$) are indicated by different letters

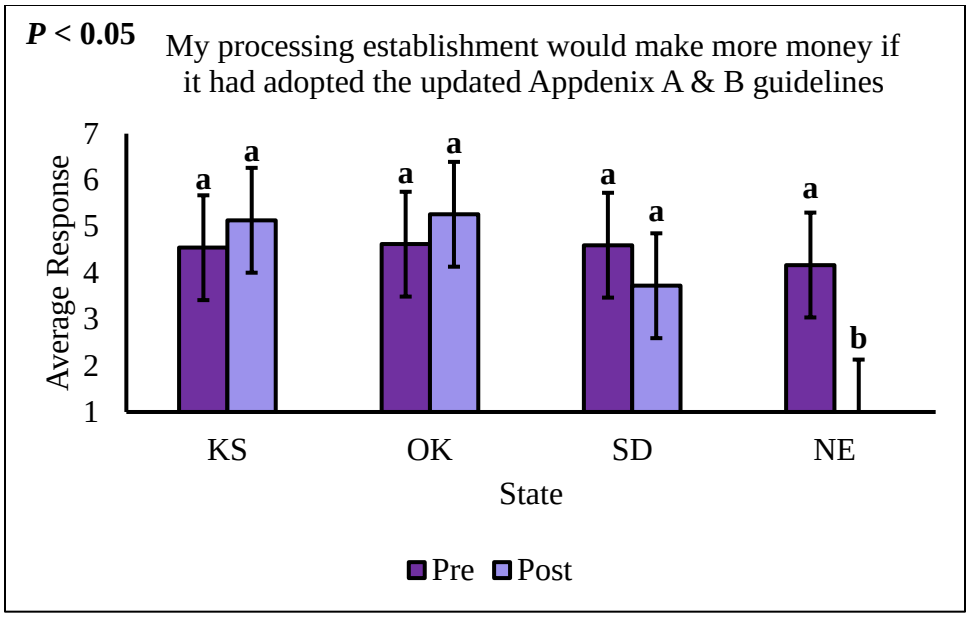


**Figure 2.5** Estimated mean responses (1=Strongly Disagree to 7=Strongly Agree) with corresponding SE to the questions comprising the motivation construct.
Significant differences ($p < 0.05$) are indicated by different letters

# Appendix A - Participant Evaluation Survey

KANSAS STATE UNIVERSITY

**CONSENT STATEMENT/AGREEMENT:**

*The success of the program depends on feedback from stakeholders like you. You are invited to participate in this survey because your input, experience, and advice are critical to ensuring our programs are as effective as possible.*

*This survey can be completed in about 10 minutes.*

*While appreciated, your participation in this survey is **voluntary**. You may elect not to participate, you are not required to answer any questions you do not wish to answer, and you may discontinue the survey at any time without penalty. Your results are kept confidential, and we do not collect any information, such as names, emails, or addresses, that could personally identify you. Additionally, all responses are kept in electronic form and password protected. The results are used only for academic purposes and will not be shared with third parties. The protocol has been approved by the Institutional Review Board (IRB) of Kansas State University (KSU).*

*This is part of a research project designed to evaluate differences in individual perceptions pre- and post-educational interventions, as such you will be asked to complete the **same** survey at three different time points. These may feel repetitive, but it is necessary for measuring change.*

*We thank you for your participation and if you have any questions, please feel free to contact Dr. Jessie Vipham at jessiev@ksu.edu or Dr. Lisa Rubin at rubin@ksu.edu*

*By checking the "Agree" box, you indicate that you:*
- *Have read the material above*
- *Are 18 years of age or older*
- *Are participating in the survey voluntarily*

○ Agree

○ Disagree

**INSTRUCTIONS:**

In this survey, we are interested in what you do as a processor. So, when you are answering questions, please think about what you do as a processor, and not what you may do at home or in another job. When we talk about "processing establishment" we are referring to any processing facility for both animal and plant origin that could take place on a field, on a farm, or a processing facility and any other related activity.

Please note that some of the questions may sound similar to other questions in the survey. Consider each question separately and new as you hear them. Please also take as much time as you need to answer each question.

Today we will focus on the updated USDA-FSIS Appendix A & B guidelines, which occurred December 2021. The Appendix A & B guidelines are an important part of food safety and another aspect of HACCP.

For all the questions, we will read you a statement. We will then ask you how much you agree or disagree with the statement. For example, we will read a statement like "It will rain today". We will then ask you how much you agree with that statement using the scale below. You can use an X to mark the answer that best represents your opinion in relation to the statement:

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree or disagree
- Somewhat agree
- Agree
- Strongly agree

Have you received training on the updated Appendix A & B guidelines?

- ○ No
- ○ Yes

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If so, how did you receive the training?

If so, when did you receive the training?

Instructions: Read the following statements and think about to what extend do you agree. Mark with an X in the circle that best describes your opinion.

| | Strongly disagree | Disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| I am very familiar with the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I know the reasons why Appendix A & B guidelines were updated | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I know how much time is required to adopt the updated Appendix A & B guidelines in a processing establishment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I know how much it costs to adopt the updated Appendix A & B guidelines in a processing establishment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Most processors in my area have obtained training on the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Most processors in my area believe that it is important to obtain training on the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other processors in my area frequently talk about the benefits of the updated Appendix A & B guideline | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Government officers encouraged me to learn about the updated Appendix A & B guidelines for my processing establishment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I have enough money to adopt the updated Appendix A & B guidelines in my processing establishment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I have enough time to adopt the updated Appendix A & B guidelines in my processing establishment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I have enough workforce to process products according to the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I know where I can learn more about the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I know where assistance would be found for adopting the updated Appendix A & B Guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Other processors similar to me think that I should adopt the updated Appendix A & B guideline changes | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Consumers who buy products from my processing establishment expect me to follow the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| It would be difficult for me to process products according to the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Processing according to the updated Appendix A & B guidelines would improve the quality of my products | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I plan to update my HACCP plans to reflect the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| It would be beneficial for my processing establishment if I adopted the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Adopting the updated Appendix A & B guidelines would enhance my processing establishment's reputation | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I would process according to the updated Appendix A & B guidelines if this would enhance the quality of my products | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I would adopt the updated Appendix A & B guidelines if this would make my products more popular among consumers | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The safety of my products affects my reputation as a processor | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| I would adopt the updated Appendix A & B guidelines if it would increase my profits | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I could prevent people from getting sick if I processed my food products according to the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I could sell my products to more consumers if I adopted the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| I would process my products according to Appendix A & B guidelines if this made my products safer | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The safety of my products makes me proud | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| My processing establishment would make more money if it had adopted the updated Appendix A & B guidelines | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| The quality of my products makes me proud | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

Please select the inspection status covering your processed products (I.E. Hams, Bacon, Jerky, etc)

- ○ Federal Inspection
- ○ State Inspection
- ○ Custom / Not for Sale

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Please list the products that you process:

Gender?

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to say

Age?

- ○ 18-24 years
- ○ 26-35 years
- ○ 36-44 years
- ○ 45-54 years
- ○ 55-64 years
- ○ >65 years

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We thank you for your time spent taking this survey.
Your response has been recorded.

# Appendix B - IRB Approval Form

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Jessie Vipham
Animal Sciences & Industry
Manhattan, KS 66506

Proposal Number: IRB-11918

FROM: Lisa Rubin, Chair
Committee on Research Involving Human Subjects

DATE: 11/02/2023

RE: Proposal Entitled, "Assessing the capabilities, opportunities, and motivations to implement Updated Appendix A & B guidelines in Small Meat Processers within the Mid-West."

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §104(d), category:Exempt Category 2 Subsection ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

Electronically signed by Lisa Rubin on 11/03/2023 11:48 AM ET

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