



RESEARCH ARTICLE

# Addressing Donated Lead-Contaminated Meats within the Ohio Food Bank System

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## ABSTRACT

**Background:** Lead contamination in game-hunted meat (GHM) remains a health risk due to common use of lead bullets in hunting, affecting meat donated to food banks. This qualitative study examined these risks in Ohio and Minnesota food bank systems, focusing on stakeholders' roles, awareness, and safety measures.

**Methods:** Semistructured telephone interviews were conducted with 26 stakeholders, including meat processors, meat distribution organizations, state meat inspectors, food banks, and food pantries in Ohio and Minnesota. Participants were interviewed about their knowledge and practices related to lead contamination in donated game meat.

**Results:** Significant disparities in awareness and safety measures were found between states. Ohio food banks and pantries exhibited minimal awareness of lead contamination risks (0/18 participants) and relied heavily on meat processors for safety, with few processors employing comprehensive safety measures beyond basic bullet removal. In contrast, Minnesota has a robust system with mandatory x-ray screening of this meat in place, albeit with financial and logistical challenges. Notably, approximately 5-15% of donated meat in Minnesota is discarded annually due to lead contamination. Food banks and pantries in Ohio expressed a strong willingness to learn and implement safety changes when informed about the risks.

**Conclusion:** This study highlights health risk within the Ohio food bank system due to lead-contaminated game meat, necessitating increased awareness and targeted interventions. Willingness of Ohio stakeholders to implement changes underscores the need for educational campaigns and policy discussions to enhance food safety. Collaborative efforts between states could further refine these interventions and promote nationwide food safety standards.

**Keywords:** Lead; Food banks; Bullets; Qualitative

## INTRODUCTION

For more than half a century, concerns have been raised over the use of lead ammunition in US hunting.<sup>1</sup> Beginning with the documentation of waterfowl experiencing lead poisoning from consuming lead shotgun pellets, efforts were made to limit the use of ammunition containing lead, leading to enactment in 1991 of the first nationwide regulation restricting this ammunition's usage.<sup>2,3</sup> Nevertheless, other forms of lead ammunition are still regularly used for hunting in the United States. With roughly 57 000 pounds donated annually to Ohio charity organizations,

lead-contaminated hunted meat poses a potential food safety issue for those with low food security.<sup>4</sup>

Several studies have shown that lead ammunition leaves fragments in meat, often too small/distant from the bullet entrance site to be detected.<sup>5-7</sup> Research has documented elevated lead levels in game meat, with resulting detectable lead concentrations varying widely.<sup>8,9</sup> Thus, meat hunted with lead ammunition can contribute to elevated blood lead levels among at-risk groups such as children and pregnant women.<sup>10-13</sup>





Despite these risks, there has been minimal discussion regarding food bank clients, a common consumer group of GHM. A study in Wisconsin found 15% of donated 1-pound ground venison samples from state food banks had visible lead fragments on x-ray analysis.<sup>14</sup> A recent call to action highlighted the need for primary prevention actions to limit exposure.<sup>15</sup> However, Minnesota and Iowa are currently the only states with regulations specific to this lead exposure risk. Minnesota requires x-ray screening of donated meat and discarding of samples with visible lead contaminants, while Iowa issues warning labels with distributed venison packages.<sup>16</sup>

The purpose of this project was to examine the practice of donated hunted meat in a state with one of the highest rates of donated GHM, Ohio,<sup>15</sup> in order to identify possible areas of intervention that would be effective feasible and acceptable in making this food safer for at-risk populations.

## METHODS

One-time semistructured telephone interviews were conducted with 26 individuals familiar with one or more roles in the donation and distribution of hunted meats (n=19 in Ohio; n=7 in Minnesota, see Table 1), including meat processors, meat distribution organizations, state meat inspectors, food banks, food pantries, and the Ohio Association of Food Banks (OAFB), which oversees most food banks in Ohio.

### Recruitment and Data Collection

Participants were recruited through convenience sampling using various search engines and publicly available food safety net resources to identify suitable candidates (inclusion/exclusion criteria in Table 1).

Initial recruitment information was sent to relevant parties via publicly available emails. If no email was found, a message was sent through the organization's website contact form. In cases where neither method was possible, a phone call was made to

obtain a contact email for sending the recruitment letter. Verbal consent was obtained for the interview with permission for audio recording. Recruitment ceased when thematic saturation (no new emerging themes or ideas) was reached for each role within each state.

Interviews addressed the use of lead ammunition in hunting game meat, food safety practices for donated meat, risks associated with consuming GHM and the organization-specific safety measures in place. Interviews also explored participants' willingness to learn more about food safety issues, share knowledge of safety practices used by other organizations, and advocate for changes within their own organizations. Participants were asked 2 structured questions, "On a scale of 0-10, how interested would you be in learning about some of the safety methods other organizations have put in place?" and "On a scale of 0-10, how interested would you be in advocating for your organization to try and promote some of the practices in improving donated hunted meat safety?" The responses were then interpreted as either promoters (ratings 9-10), passives (ratings 7-8), or detractors (ratings 0-6), following conventions of the net promoter score (NPS), a validated measure of intent to act.<sup>17</sup> No questions, prompts, or guides were provided to participants prior to the interview. For the full interview guide, see Appendix.

Interviews were conducted by a research assistant who held a master of health science (MSH) degree with experience conducting semistructured interviews. The interviewer was not previously known to study participants. No one else was present during the interviews besides the participants and researcher. All data including original MP3 audio files were stored using unique study identifiers in an encrypted electronic database, REDCap (Research Electronic Data Capture). To help maintain confidentiality, written transcriptions were deidentified by replacing personal identifiers with generic signifiers, for example "Mr. Smith" replaced with "Foodbank Administrator." Only the deidentified written transcriptions were retained for analysis.

**Table 1. Inclusion/Exclusion Criteria for Study Enrollment**

Inclusion	
1.	Age range: 18 years or older.
2.	Must be employed or actively volunteering at 1 of the following in Ohio or Minnesota: <ul style="list-style-type: none"> <li>• food bank, food pantry, or related organization</li> <li>• meat distribution facility involved with processing of game-hunted meat</li> <li>• game-hunted meat donation organization</li> <li>• meat inspection organization or associated entities</li> </ul>
3.	Knowledgeable regarding at least 1 of the following: <ul style="list-style-type: none"> <li>• demographics that their organization serves</li> <li>• food that their organization donates</li> <li>• meat inspection practices of their respective organization</li> </ul>
4.	Comfortable conversing in English.
Exclusion	
1.	Does not meet the inclusion criteria as stated above.



This protocol for this project was reviewed by the University Hospitals institutional review board (IRB) and was determined to meet criteria for exemption from IRB review.

## Analysis

The study applied content analysis, a methodological orientation that allows for the systematic categorization and analysis of qualitative data.<sup>18</sup> This approach was chosen because it facilitates the identification of patterns and themes within narrative responses and open-ended data.

One data coder was involved in data analysis. The coding tree for data analysis was developed to systematically categorize and analyze the qualitative data collected from the interviews, allowing for a comprehensive and nuanced analysis and providing a deeper understanding of the issues related to lead contamination in donated GHM. Transcripts were manually coded and tracked. Participants did not provide feedback on the findings, and transcripts were not returned to participants for comment or correction.

## RESULTS

Of 94 individuals invited to participate in the study, 4 declined to participate, 26 agreed, and the remainder did not respond to investigator outreach. Participants represented 8 food banks, 5 meat processors, 3 meat inspectors, 1 GHM donation organization, and 5 food pantries. Of these 26 participants, 25 reported their role within the organization. All that responded were employed within their organization, with 21 of these respondents having a leadership role (eg, director, owner, CEO). Nineteen interviewees were located in Ohio, while the remaining 7 were located in Minnesota. Interviews averaged 25 minutes in length.

### Overview of Process—Ohio

An understanding of the GHM distribution process in Ohio was formulated entirely from interviews with study participants, as no official resources showing this entire process exist. To aid in con-

ceptualization, a diagram illustrating the process was created based on interview findings (Figure 1).

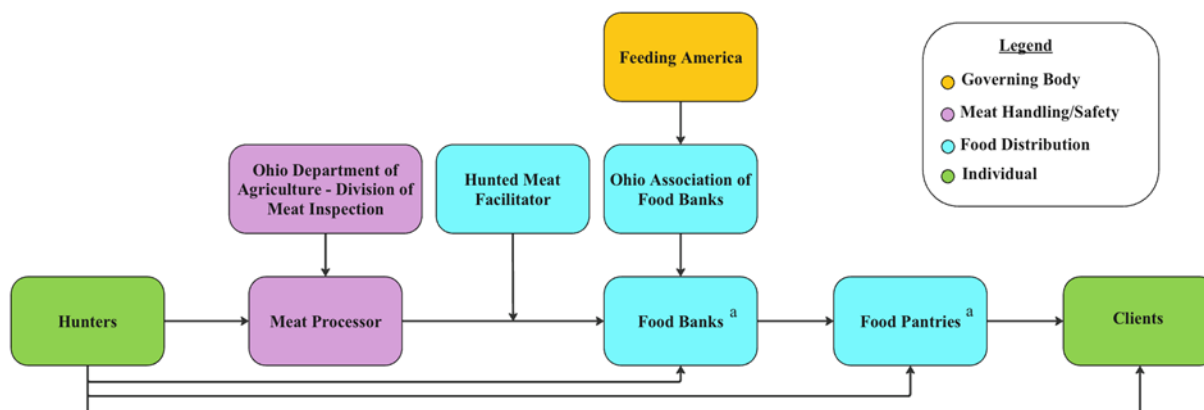
Within Ohio, venison is donated to families through food pantries with no restrictions or warning labels regarding the danger of lead, indication the meat was hunted, etc. Food banks and food pantries that are governed by the OAFB and hunted meat facilitators rely on US Department of Agriculture approved meat processors to handle safety measures. However, these processors follow different guidelines for donated meat compared to grocery store-intended meat, with the only reported lead safety measures being the removal of bullet entrance areas and, in one case, newer meat processing technology. The GHM that is donated will sometimes have labels that read “Not for Sale” and the type of meat (eg, ground venison), but do not describe the manner in which the meat was harvested. These safety measures are not required of those food banks and pantries that are not governed by the OAFB.

### Overview of Process—Minnesota

The GHM distribution process in Minnesota, confirmed by prior work,<sup>15</sup> is similar to Ohio’s but incorporates complex measures to limit lead contamination. These extra measures are coordinated by the Department of Natural Resources (DNR) and the Minnesota Department of Agriculture (MDA).

Hunters obtain licenses with a surcharge that funds the venison donation program. Deer carcasses are donated to licensed processors under the MDA, which inspects these facilities for safety. The meat undergoes x-ray scanning for lead contamination, with contaminated batches discarded and safe meat distributed to regional food banks. The MDA tracks and reports on the donated meat, providing feedback to processors.

The DNR funds the program through hunting license surcharges and collaborates with the MDA. Additional efforts include training processors on safe practices, with food banks providing warning labels to families about the risks of consuming game meat.



**Figure 1. The Game-Hunted Meat Distribution Process in the Ohio Food Bank System**



Annually, 5-15% of firearm-related venison meat is discarded due to lead contamination, with no decrease in donated venison quantity due to these regulations.

Three main themes emerged from interviews. First, awareness and knowledge of lead contamination of GHM differs between Ohio and Minnesota. Second, the overall buy-in of stakeholders to addressing the topic of lead-contaminated meats is role-specific. Finally, Minnesota has a robust system in place to address lead-contaminated meats, but drawbacks exist. Quotes from interviews are noted in Table 2.

### Theme 1: Awareness and Knowledge of Lead Contamination in Donated Game-Hunted Meat Differs Between Ohio and Minnesota

Interviews revealed significant disparities in awareness and knowledge about lead contamination in donated GHM between stakeholders in Ohio and Minnesota. In Ohio, there was a prevalent lack of awareness among food banks and pantries regarding the risks associated with lead contamination in GHM. When queried about this issue, one food bank acknowledged, "This is the first time that I've heard of it being contaminated with lead due to bullets...I've heard of lead in water, but not through hunted meat for example." Additionally, the existing safety measures in Ohio were minimal with assumptions that other parties were responsible for maintaining appropriate safety measures. One food bank

noted "...[We're] pretty much banking on them [meat processors] that it's good to go."

In contrast, stakeholders in Minnesota demonstrated a higher level of awareness about lead contamination issues with multiple parties citing the concern of consumption with this product. However, there was an overall ambiguity regarding the distribution flow of donated meat. One processor even suggested this uncertainty was leading to a decrease in willingness to donate meat, saying, "I know before the DNR were coming to pick everything up I think there was a lot more places willing to do it and now that there's more regulation on it and it's tighter and it's not going to your local food shop." Of note, this contradicts the meat inspector from Minnesota who noted that amount of donated game meat "ebbs and flows [year over year]" with no notable trend.

### Theme 2: Overall Buy-In of Stakeholders to Addressing the Topic of Lead-Contaminated Meats is Role-Specific

The buy-in from stakeholders to address lead-contaminated meats varied significantly across different parties. In Ohio, the willingness to change was notably high among food banks and pantries once they were informed about the issue. Among these 2 groups, there was an overall interest in learning more and advocating for their organization to improve policies surrounding this issue, NPS = 8.3 and 36.4, respectively (Table 3).

**Table 2. Emerging Themes Through Discussions Regarding Lead-Contaminated Meats From Food Bank System Participants in Ohio and Minnesota**

Theme 1: Disparities in Awareness and Knowledge of Lead Contamination in Donated Game-Hunted Meat Between Ohio and Minnesota	
Ohio	Minnesota
"...it's a solid, one-piece bullet... anything it hits gets destroyed ...I can't imagine that would affect anything of the integrity of the meat of anything."	"I know before the DNR were coming to pick everything up I think there was a lot more places willing to do it and now that there's more regulation on it and it's tighter and it's not going to your local food shop."
"...[We're] pretty much banking on them [meat processors] that it's good to go. Unless there's something that's glaring...we're pretty much trusting that person."	
"We've been working with Ohio Department of Natural Resources for so many years, and they've pretty much approved us, so I don't think we have any real issues at all on that."	
"I think we're about as safe as we can be with the deer meat at this point."	
Theme 2: Overall Buy-In of Stakeholders to Addressing the Topic of Lead-Contaminated Meats is Role-Specific	
Food Bank/Pantries	Meat Processors
"Just because people are in need doesn't mean that they have to get the worst of the worst...I totally would advocate [for change]..."	"I would say I'm not really that interested because I really don't have time to learn about it and I don't think that's really...a danger."
"You just put me on game and opened my eyes to something that we've been missing that we should really be more cognitive of."	"...I really don't have the time to learn about it, and I don't think there's really that big of a danger."
	I mean on the deer end, it's kind of like we're just doing it as a favor [anyways]..."
Theme 3: Minnesota Has a Robust System in Place to Address Lead-Contaminated Meats but Drawbacks Exist	
Food Bank/Pantries	Meat Processors
"I would say it's a good program. It might be too much controlled. I suppose they're afraid of little kids eating the venison and getting lead poisoning."	"People should know about it [lead contamination], but...you don't need to have all these little [surveillance] steps...we don't even know where it [donated meat] is going."
	"I don't think it's bad...[but] I think it might be a waste of money."



On the other hand, meat processors in Ohio showed mixed responses with some expressing concerns about the financial burden of implementing new safety measures or a reluctance to acknowledging this issue. Time constraints were also highlighted by this party, especially during busy times such as hunting season (eg, “I would say I’m not really that interested because I really don’t have to time to learn about it and I don’t think that’s really... a danger”). Responses regarding an interest in learning more or advocating for their organization to improve policies surrounding this issue were much more negative compared to food banks/pantries, NPS = -50 and -50, respectively (Table 3).

### Theme 3: Minnesota Has a Robust System in Place to Address Lead-Contaminated Meats but Drawbacks Exist

Minnesota's system to address lead-contaminated meats is comprehensive and involves multiple steps to ensure safety as described above. This system significantly reduces the risk of lead contamination reaching consumers, particularly those relying on food banks and pantries.

However, this robust system is not without its drawbacks. The increased costs associated with these safety measures, including the transportation of meat to x-ray facilities and the subsequent storage and handling, pose financial challenges that are not fully offset by funding generated by the DNR through the hunting license program. For instance, the cost of storing meat at processors while awaiting x-ray results can strain smaller operations. Challenges with understanding meat flow distribution, as mentioned in Theme 1, also have led to hesitancy in participating in the donation program. Additionally, some meat processors and food pantries reported concerns regarding the loss of donated meat due to discarding and its downstream effects on food security, with one pantry expressing they were “bothered with [the] amount of meat that is wasted from this process.”

## DISCUSSION

This study reveals a significant health risk within the Ohio food bank system and identifies multiple factors contributing to inadequate safety measures for GHM. While implementing a proper safety model presents various challenges, it is evident that the system as a whole is largely unaware of this issue. The strong willingness of interviewed food banks and pantries to learn more and

advocate for change suggests that the absence of specific safety measures is due to a statewide lack of awareness. This contrasts with Minnesota, where many stakeholders are aware of the risks associated with lead exposure through GHM and have implemented safety measures to mitigate these risks.

Interviews revealed multiple potential barriers to implementing safety measures. A significant issue is the lack of appropriate funding for intervention targets in Ohio, whereas Minnesota has a surcharge system in place to account for these increased costs. If a system is eventually put in place by Ohio, they are likely to be met with similar sentiments of many interviewed Minnesota stakeholders who felt the entire process of donating meat was convoluted and may be leading to a decrease in overall willingness to participate in this program. Nevertheless, 7 replicable strategies identified by interviewees follow.

**Educational Campaigns.** Educational campaigns can increase awareness about the risks of lead contamination in game meat among all stakeholders. By raising awareness, these campaigns can lead to better safety practices and greater buy-in for other interventions. Ohio food banks and pantries showed a high willingness to learn and implement changes once informed about the issue, suggesting a significant impact of targeted information on this topic. These campaigns can also involve training for meat processors and collaboration with health care providers to disseminate information on safe consumption practices. Of note, one of the initial studies revealing elevated lead content in donated GHM was noted as a source of motivation for change both in our interview with the MDA, and in Iowa.<sup>16</sup>

**Labels for Food Pantries and Food Banks.** Another approach would be to implement warning labels on donated game meat for both food pantries and food banks. This low-cost intervention could raise awareness among clients and organizations without directly reducing contamination rates, though it would require consistent implementation across various locations for maximum effectiveness. These warning labels could serve as an initial step to inform and protect clients, and increase awareness among Ohio’s food banks and pantries regarding the risks of lead contamination. Given that interviewees expressed a willingness to learn and advocate for safer practices, warning labels are likely to be both acceptable and feasible. Some meat processors already provide

**Table 3. Ohio Stakeholder Net Promoter Scores on Topic of Lead-Contaminated Meats**

	Question	Promoters	Passives	Detractors	Net promoter score (NPS) <sup>a</sup>
Food Banks/Pantries	Learning More <sup>b</sup>	6	1	5	8.3
	Advocating <sup>c</sup>	6	3	2	36.4
Meat Processors	Learning More <sup>b</sup>	1	0	3	-50
	Advocating <sup>c</sup>	1	0	3	-50

<sup>a</sup> Net promoter score (NPS) = (number of promoters - number of detractors) / total respondents) × 100. Promoters: scores 9-10, passives: scores 7-8, detractors: scores 0-6

<sup>b</sup> Learning more=“On a scale of 0-10, how interested would you be in learning about some of the safety methods other organizations have put in place?”

<sup>c</sup> Advocating=“On a scale of 0-10, how interested would you be in advocating for your organization to try and promote some of the practices in improving donated hunted meat safety?”





labels indicating the type of meat given to food banks and pantries, so adding or revising a label would not be especially burdensome.

**Upgrading Meat Processing Equipment.** Upgrading meat processing equipment, such as meat grinders, could significantly reduce lead contamination rates, ensuring safer donated game meat. However, this poses a financial burden on meat processors, potentially limiting their willingness to adopt these changes, particularly as meat processors were less willing to learn about this topic overall compared to other players in the system. A potential solution to this barrier could be implementing funding models similar to Minnesota's hunting license surcharge to help alleviate the financial burden on processors.

**Engaging Health Care Providers.** Engaging health care providers by alerting them to the exposure risk from lead-contaminated game meat can also help spread awareness. Providers can screen at-risk populations based on their dietary habits, and counsel families regarding strategies to mitigate adverse impact, such as directing donated game meats to nonpregnant adults and older children.

**Restricting Game Meat Donations.** Restricting game meat donations to pregnant women and children, who are the most at-risk populations, can significantly reduce health risks. However, full enforcement is challenging, requiring staff education, member buy-in, and alternative food resources for affected clients.

**X-Ray Screening.** A more comprehensive solution involves mandatory x-ray screening to detect and discard contaminated meat. Effective, x-ray screening incurs high costs for transportation, screening, and additional personnel and facilities. Minnesota's robust system, which includes x-ray screening funded by a surcharge on hunting licenses, serves as a model that Ohio could consider. This intervention ensures that contaminated meat is identified and removed before reaching consumers, significantly reducing the risk of lead exposure. The success of Minnesota's system, despite its financial and logistical challenges, underscores the potential effectiveness of this intervention.

**Limiting Lead Ammunition.** Promoting the use of non-lead ammunition among hunters is another intervention with significant potential impact. Reducing lead ammunition use can decrease lead contamination in donated game meat. However, previous attempts to limit lead ammunition have met with minimal success due to long-standing hunting traditions, pushback from organizations like the National Rifle Association, and the higher costs of alternative ammunition materials.<sup>19</sup>

## Limitations

This study acknowledges several limitations. First, the use of convenience sampling may introduce selection bias, limiting the generalizability of the findings. Participants who were more accessible or willing to participate might have different perspectives

than those not included. Additionally, the study relied on self-reported data from stakeholders, which could be influenced by social desirability bias or recall bias, potentially affecting response accuracy.

The qualitative nature of the study also presents limitations. While semistructured interviews provided in-depth exploration of stakeholders' views and practices, the findings are not generalizable to all food bank systems or meat processors. The study focused on stakeholders within Ohio and Minnesota, which may not fully represent the diversity of practices and perspectives in other states. Furthermore, differences in themes between states, such as awareness of lead-contaminated meats as a health risk, may be attributed to the implementation of systems in Minnesota compared to Ohio.

Efforts were made to achieve saturation in the interviews; however, additional insights might have been gained with a larger sample size or the inclusion of other relevant stakeholders not part of the study. Despite these limitations, the study provides valuable insights into the practices and perceptions regarding lead contamination in donated GHM within the Ohio food bank system, highlighting areas for potential intervention and improvement.

## PUBLIC HEALTH IMPLICATIONS

The findings from this study highlight the urgent need to address lead contamination in donated GHM, particularly within Ohio's food bank system. This issue poses serious health risks for at-risk populations such as children and pregnant women, for whom even low-level lead exposure can have long-term health consequences. Incorporating additional safety measures—ranging from warning labels and enhanced screening to educational campaigns—would likely benefit not only clients of food pantries and food banks but also the broader public. Given the willingness of many Ohio stakeholders to learn more about this topic and advocate for safer practices, there is a strong foundation for implementing strategies that have been successfully used elsewhere, as demonstrated by Minnesota's robust system.

These results can be used by state-level policymakers, public health officials, food assistance organizations, and health care providers in Ohio to develop or strengthen programs that minimize the risks associated with GHM. Stakeholders throughout the donation and distribution chain could benefit from clear guidance and consistent regulations, including funding models to offset any financial burden. Ultimately, these interventions would contribute to the reduction of lead exposure among food-insecure populations, safeguarding the well-being of individuals who rely on donated GHM for protein while promoting a healthier, more informed community.

## CONFLICTS OF INTEREST

On behalf of all authors, the corresponding author states that there is no conflict of interest.



## AUTHOR CONTRIBUTION

Jared Lebron: conceptualization, methodology, formal analysis, investigation, data curation, writing—original draft, writing—review and editing, visualization. Marie Masotya: conceptualization, methodology, writing—review and editing, supervision. Sarah Ronis: conceptualization, methodology, formal analysis, writing—review and editing, resources, supervision, project administration.

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## Appendix—Interview Guide

### Addressing Donated Lead-Contaminated Meats within the Ohio Food Bank System

1. Tell me about your organization.
2. Do you have data for how many children and women are served through your services?
3. If not, do you have any rough estimates of these measures?
4. Tell me about your organization's role in helping the process of donated game-hunted meat eventually reaching those in need.
5. I'm curious about the types of donated meats that you receive, could you tell me more about that?
6. Does this change depending on the time of year? How so?
7. What methods do the donators use to hunt?
8. What types of materials are used in the ammunitions?
9. Has this always been the case, or have there been any changes in methods of hunting in recent years? If yes, could you tell me about some of the reasons for this?
10. Are there any risks to these donations, such as bullet fragments?
11. Certain organizations proposed/utilized modes of intervention to try and limit distribution of potentially lead-contaminated meats. Which if any the following applies to your organization?
  - a. Limiting of meat donation that have been hunted with lead ammunition
  - b. Screening meat after it had been donated, but before brought to food banks
  - c. Limiting donation of game-hunted meat to children and pregnant women
12. If yes to any of the above, how does your organization make this happen?
13. In addition to any of the methods just described, what else does your organization do to help make sure the meat being donated is safe to eat?
14. What motivated the policies you have in place for food safety in your organization?
15. Are there any areas of limiting contaminated-meats that you think your organization could improve in? If yes, what are they?
16. On a scale of 0-10, how interested would you be in learning about some of the safety methods other organizations have put in place?
17. On a scale of 0-10, how interested would you be in advocating for your organization to try and promote some of the practices in improving donated hunted meat safety?