

# A Mixed Methods Approach to Investigating Food Safety Behavior in a Sample of Native American and Hispanic Caregivers of Young Children

Margaret M. Siebert<sup>1</sup>, Christina Perry<sup>1</sup>, Lindsay O'Connell<sup>1</sup>, Julie Albrecht<sup>2</sup>, Kristen Stenger<sup>2</sup> & Kara Vlasin-Marty<sup>2</sup>

<sup>1</sup>Health Education, University of New Mexico, Albuquerque, New Mexico, USA

<sup>2</sup>Nutrition and Health Sciences Department, University of Nebraska-Lincoln, Lincoln, Nebraska, USA

Correspondence: Margaret M. Siebert, Health Education, College of Education, University of New Mexico, 210C Johnson Center-MS04-2610, Albuquerque, NM87131, USA. E-mail: magnify@unm.edu

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## Abstract

Foodborne illness (FBI) disproportionately affects children and minority populations in the U.S. A mixed methods convergence model design was used to explore the food safety knowledge and behavior of Native American (NA) and Hispanic (Hisp) caregivers in New Mexico who prepare food for young children in the home. Quantitative and qualitative research methods (a validated food safety knowledge survey ( $r=.793$ ) and focus group interviews) were implemented in parallel within each ethnic group, the datasets were analyzed separately per group and the results were converged at the point of interpretation. Equal priority was given to each dataset type. The Health Belief Model was used as a theoretical framework to guide qualitative inquiry. An integrative summary of the quantitative and qualitative results was created and meta-inferences identified contradictory and confirmatory elements of the evidence across both groups. A purposeful sample of fifty-five participants in New Mexico (28 NA; 27 Hisp) completed the food safety knowledge survey and participated in focus groups. Quantitative composite mean scores for the Native American (NA) group ( $M=66\%$ ) and Hispanic (His) group ( $M=65\%$ ) indicated low food safety knowledge. A MANOVA conducted to compare the two groups' mean knowledge scores found no significant difference between groups on the food safety subscales [Wilks'  $\Lambda = .852$ ,  $F(6,44) = 1.278$ ,  $p = .287$ ,  $\eta^2 = .162$ ]. The lowest scoring subscale for both groups was 'cook', addressing proper cooking methods (NA=.61, Hisp=.55). Mixed methods analyses revealed that participants overall perceived moderate to high self-efficacy regarding safe food preparation, food purchasing, cooking food, and storing of food, however, the related food safety knowledge item scores were low. Food safety knowledge was often inconsistent with reported food safety practices. Moderate/high self-efficacy may provide a false sense of low risk for FBI.

**Keywords:** health belief model, hispanic, native american, foodborne illness, food safety, mixed methods

## 1. Introduction

Foodborne illness (FBI) is an infectious and/or toxic disease derived and/or transmitted by food handling or consumption (World Health Organization [WHO], 2007). Incidence rates of FBI in Hispanic and Native American populations are much higher than majority ethnic populations (Centers for Disease Control [CDC], 2011b; Khanlian, 2011). In addition, rates of FBI are much larger in child populations than adults (Buzby, 2001; WHO, 2007).

Foodborne illness (FBI) is a preventable health challenge, yet continues to be a persistent threat in the 21<sup>st</sup> century (WHO, 2007). It is estimated that annually foodborne pathogens account for more than 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths each year in the United States (CDC, 2011a; Scallan et al., 2011). The US spends an estimated \$152 billion dollars on medical costs, lost productivity, and premature deaths attributable to FBI (Scharff, 2012). The actual burden of FBI, including total healthcare cost and incidence of disease is much higher than what is on record due to unspecified agents (CDC, 2011a; Scallan, Griffin, Angulo, Tauxe, & Hoekstra, 2011), and the fact that milder cases may not be seen by a physician or reported to the proper surveillance system (Scallan et al., 2011; Mead et al., 1999). Since FBI impacts many people annually, taxes an already overburdened healthcare system, and is completely preventable, food safety and the reduction of FBI have been identified as

priority areas in the Healthy People 2020 initiative (Department of Health and Human Services [DHHS], 2010).

Food safety in the home is consistently misunderstood. A 2002 Benchmark Survey found that 70% of respondents to the Home Food Safety survey did not believe it was common for people to contract a foodborne infection from food prepared in their homes (Cody & Hogue, 2003) although over half of all FBI are acquired in the home (Kennedy et al., 2005). Several other studies (Bruhn & Schutz, 1999; Kennedy et al., 2005; Lin, Jensen, & Yen, 2005; Raab & Woodburn, 1997; Redmond & Griffith, 2004) found that consumer perceptions of food safety are associated with commercial practices and foods most commonly associated with FBI, as opposed to behaviors related to food preparation at home. Increasing risk perceptions of food handlers is certainly an important factor to preventing FBI contracted in the home.

Kennedy (2005) found that there is a positive correlation between food safety knowledge and safe food handling practices. Studies indicate a knowledge gap between the Hispanic population's knowledge of food safety and safe food handling practices (Palmeri, Auld, Taylor, Kendall, & Anderson, 1998; Taylor, Serrano, Anderson, & Kendall, 2000; Yang et al., 1998) but little to no research has been done for Native American populations. Patil et al. (2005) and Racz et al. (2009) have suggested that cultural food preferences and practices may be predisposing factors that increase the likelihood of contracting FBI. To date, there has been very little research investigating the food safety knowledge, practices, and cultural beliefs of Native American and Hispanic populations. Food safety knowledge and practices of Native American and Hispanic families must be better understood so that community initiatives and educational interventions can be culturally tailored for these populations.

### *1.1 Populations Most at Risk*

Certain populations experience higher rates of FBI including ethnic minority populations, children, the elderly, and persons with weakened immune systems (Buzby, 2001). Of these populations most at risk, children under the age of 15 are of particular importance because they amount to approximately 50% of all cases of FBI (CDC, 2007a) and almost 33% of the annual cost accrued to treat FBI, which has been estimated at \$2.3 billion (Buzby, 2001).

When segmented by age and pathogen, children have much higher rates of FBI than adult populations. Infants under one year of age have the highest reported rates of campylobacteriosis (Buzby, 2001) and children under the age of four are almost three times as likely to contract campylobacteriosis than any other age group below 50 years (Pew Health Group, 2009). Although FBI is typically acute and short in duration, the United States Food and Drug Administration (FDA) estimates that 2-3% of cases will develop subsequent problems, or secondary complications, some of which are chronic (Buzby, 2001). Some secondary complications relating to the campylobacteriosis pathogen are reactive arthritis and Guillain-Barre Syndrome, an autoimmune nervous disorder with potentially debilitating consequences (Buzby, 2001).

Most experts argue that children are more susceptible to contracting FBI because their immune systems are not fully developed, they have a lower bodyweight, reduced stomach acid production, and limited control over food preparation (Buzby, 2001; Haffejee, 1995). Because children typically have limited ability to purchase and prepare foods, they are reliant on an adult or family member to do so (Buzby, 2001). The implication is that primary food handlers (those who primarily prepare food for the children in their home) must be aware of correct food safety practices in order to protect their families and children from contracting FBI (Buzby, 2001; Pew Health Group, 2009).

Ethnic minority populations are also disproportionately affected by FBI. New Mexico represents a unique cultural milieu with high percentages of minority populations. According to the 2010 United States Census, when compared with the average demographic composition of the United States, New Mexico has a significantly higher Hispanic population (46.3% in NM to 16.3% nationally) and American Indian/Alaskan Native (henceforth referred to as Native American) population (9.4% in NM to 0.9% nationally). In 2004, the CDC's Foodborne Diseases Active Surveillance Network, FoodNet, began surveillance of New Mexico. The rates of FBI in New Mexico are significant (CDC, 2011b) and are much higher in Hispanic and Native American populations when compared to white populations (Khanlian, 2011).

Nationally, rates of FBI differ between ethnic groups. According to the CDC Hispanic populations are at an increased risk of contracting FBI due to certain cultural food preferences such as the consumption of unpasteurized milk products and soft cheeses (CDC, 2007b). For instance, Hispanic infants have 12 times greater incidence of listeriosis and Hispanic women ages 30-34 are 13 times more likely to contract listeriosis (Lay et al., 2002). Listeriosis, a foodborne pathogen found in unpasteurized milk and soft cheeses, has been linked to miscarriages and birth complications (Silk et al., 2012; Pouillot, Hoelzer, Jackson, Henao, & Silk, 2012). Further, incidence rates of salmonella were highest among Hispanic populations from 1997-2001 (Voetsh, Angulo, & Jones, 2007). Several studies suggest that in Hispanic populations, there are significant inconsistencies between food safety

knowledge and proper food handling practices when compared to other groups (Palmeri et al., 1998; Taylor et al., 2000; Yang et al., 1998).

There are insufficient data at present to fully understand the food safety knowledge and practices of Native American populations. The New Mexico Department of Health, Epidemiology and Response Division reported that Native American populations are at a significantly higher risk of contracting campylobacteriosis (41.7/100,000)—a rate more than three times greater than white New Mexican residents (13.1/100,000) (Racz, Selvage, Adams-Cameron, Mansmann, Scherzinger, & Smelser, 2009). Animal husbandry practices of Native Americans (including slaughter and milk production) incorporate sheep, cattle, and other farm animals known to be vectors of campylobacteriosis (Racz et al., 2009). If understood, the specific cultural practices surrounding food and water preparation and acquisition may explain the heightened rates of campylobacteriosis and other foodborne illnesses in New Mexican Native American populations.

Limited research has been conducted among ethnic minority populations to determine if cultural practices contributes to heightened rates of FBI among these populations. A meta-analysis of food handling behaviors that segmented respondents by ethnicity proposed that the heightened rates between ethnicities could be derivative of a variance in socio-economics and cultural practices (Patil, Cates, & Morales, 2005). Another study conducted focus groups with African American, Hispanic, and Asian participants (Henley, Stein, & Quinlan, 2012). Their conclusion suggests that food preference (such as preferred cuts of meat, or live poultry purchasing, slaughtering, and cooking) may be attributable to culture, but all participants regardless of culture shared similar risk behaviors surrounding food safety (Henley et al., 2012). Another study investigated Latino perceptions of FBI risk after a FightBac health campaign intervention. Findings suggest that a social marketing campaign approach using culturally relevant media channels is an effective way to positively change Latino/Hispanic knowledge, attitudes, and behaviors about food safety (Dharod, Perez-Escamilla, Bermudez-Millan, Segura-Perez, & Damio, 2004).

More research targeting the cultural practices surrounding food preparation and acquisition in Native American and Hispanic populations could reveal important information relevant to knowledge, behaviors, and attitudes regarding food safety within these populations. This research would contribute to the literature by providing health educators, extension educators, and health communication specialists with culturally specific information regarding food safety to develop more appropriate and culturally tailored educational interventions and health campaign materials for Native American and Hispanic groups.

### *1.2 Purpose of the Study*

The purpose of this study was to use a convergent parallel mixed methods design to explore the similarities and differences in food safety knowledge, beliefs, and practices of Native American (NA) and Hispanic (Hisp) caregivers who prepare food for young children in a home environment. This approach yielded a more complete understanding of the factors associated with food safety behavior among diverse caregivers of young children.

## **2. Method**

### *2.1 Study Design*

A convergent parallel mixed methods design was used (Creswell & Plano Clark, 2011). This type of design collects quantitative and qualitative data in parallel, analyzes them separately, and then merges the two data sets at the point of interpretation. The integration of quantitative and qualitative data maximizes the strengths and minimizes the weaknesses of each type of research design (Creswell & Plano Clark, 2011). Meta-inferences identified contradictory and confirmatory elements of the evidence across both groups. The quantitative data, collected by a validated *food safety knowledge survey* ( $r=.793$ ), were used to find knowledge gaps in food safety information and was structured using the four food safety educational constructs of the USDA FightBac campaign (Partnership for Food Safety Education, 2010). The previously validated knowledge survey was developed and tested using members of each cultural group. Statistical tests were applied to test the validity and reliability of the instrument. The qualitative data, collected in focus group interviews was used to explore the food safety practices, perceptions and cultural preferences of Native American and Hispanic participants in New Mexico. Information gathered in this study was used to develop a culturally appropriate food safety educational intervention salient to Native American and Hispanic populations in New Mexico.

Approval for this research was received from the University of New Mexico Institutional Review Board (HRPO #11-386 and HRPO #11-219).

### *2.2 Sample*

Stratified purposeful sampling was used to select study participants. Inclusion criteria included Native American or Hispanic ethnicity, English proficiency, and primary food handler (parent, relative, or caregiver) in a home

environment for at least one child under the age of 10.

### 2.3 Procedures

Participants were recruited in central and southern New Mexico over a three-week period using recruitment flyers strategically placed in local community centers, community medical and dental clinics, grocery stores, and pharmacies. An advertisement of the study was also posted on craigslist.org. Participants were screened for eligibility and were provided the details of the study and logistics of the focus groups when they telephoned the primary researcher in response to the ad.

Focus group interviews ranged in length from 60 to 90 minutes. A trained facilitator matched the participant's ethnicity in the majority of focus groups (7 out of 9). Focus group discussions were audio-recorded on an Apple MacBook Pro laptop using a Yeti Microphone and the recording program GarageBand.

Once informed consent was obtained, and before the focus groups began, participants completed a food safety knowledge survey and a demographic form. So as to not impact the thoughts and opinions of the other participants, everyone was asked to hold any question about the survey until the end of the focus group interview. Following the completion of the knowledge survey and focus group interview, participants were given a \$25 gift card for their participation.

### 3. Results

A total of 55 primary food handlers matching the demographic criteria for inclusion participated in this study (28 Native American; 27 Hispanic). Participant demographics are detailed in Table 1. A total of nine focus groups were conducted; five Native American groups and four Hispanic groups.

Table 1. Participant demographic characteristics

Characteristic	Native American 28 (50.9%)	Hispanic 27 (49.1%)
Gender		
Male	8 (28.6%)	6 (22.2%)
Female	19 (67.9%)	20 (74.1%)
Unreported*	1 (3.6%)	1 (3.7%)
Education		
Some High School	1 (3.6%)	0 (0%)
Diploma/GED	7 (25%)	9 (33.3%)
Some College	15 (53.6%)	3 (14.8%)
College Graduate	4 (14.3%)	14 (51.8%)
Unknown	1 (3.6%)	0 (0%)
Employment		
Unemployed	15 (53.6%)	8 (29.6%)
Part-time	9 (32.1%)	5 (18.5%)
Full-time	3 (10.6%)	12 (44.4%)
Unreported*	1 (3.6%)	2 (7.4%)

\*Did not report on the confidential demographic form.

#### 3.1 Survey Results (Quantitative)

The *Food Safety Knowledge Survey* was developed based on the relevant research literature (Byrd-Bredbenner et al., 2007; Haapala & Probart, 2004; Medeiros et al., 2004; Meysenburg et al., 2009; Unklesbay, Sneed, & Ramses, 1998; Wenrich, Cason, Lv, & Kassab, 2003); was structured around the USDA FightBac constructs of Cook, Clean, Separate, and Chill (Partnership for Food Safety Education, 2010); and was validated ( $r=.793$ ) in a previous study (Siebert, 2012). The knowledge survey was validated for content by subject-matter experts (registered dietitians)

and members of each cultural group (NA and Hisp). Additional statistical measures including item difficulty, item discrimination, and internal consistency, were calculated to ensure the instrument was valid and reliable (Siebert, 2012). All quantitative data were entered onto excel spreadsheets and imported into SPSS for analyses (version 19.0, SPSS Inc., Chicago, IL, 2010). The data from the food safety knowledge surveys were analyzed for composite mean knowledge scores per ethnic group, in each knowledge content domain (Cook, Clean, Chill, Separate, Foods that Increase Risk, and Groups most at Risk), and for each individual item. Group mean knowledge scores were compared using a MANOVA to assess whether ethnic groups differed significantly across the knowledge content domains. Lowest and highest scoring content domains and individual items were compared to qualitative data and then used to identify areas of knowledge deficit to guide the development of an educational intervention. A total of 55 participants completed the food safety knowledge survey.

### 3.1.1 Native American Results

The composite knowledge mean score of 66% (SD=.1) indicated a low level overall of food safety knowledge. The knowledge items were coded such that higher scores reflect favorable answers. Knowledge was considered high at >80%, average between 70%-80%, and low <70%. Native American participants (N=28) scored lowest in the FightBac 'cook' and 'separate' categories. The lowest scoring item was related to the proper method to cool soup; 61% of the participants thought that cooling the soup to room temperature on the counter and then refrigerating it was the correct answer. Other low scoring items were related to how long to store hamburger and chicken, (most thought it was not safe beyond 1-2 days rather than 3-4 days); and reheating soup (43% of participants thought it was correct to heat soup "just until it is hot, but not too hot to be eaten right away"). Highest scoring items were knowing that chicken and eggs may contain Salmonella, how to properly clean a cutting board, that foods kept beyond the expiration date are not safe, and that it was not safe to add a raw egg to infant formula.

### 3.1.2 Hispanic Results

The composite knowledge mean score of 65% (SD=.09), indicated a low level of food safety knowledge. Hispanic participants (N=27) scored lowest in the 'cook' and 'clean' categories. Similarly to the Native American groups, the lowest scoring item was how to cool a large pot of soup; 82% of participants thought that cooling soup to room temperature and then refrigerating it was correct, only 7% correctly answered the question ("put the soup in a clean shallow pan and refrigerate right away"). Hispanic participants had low knowledge scores pertaining to the concept area of how to properly clean kitchen countertops (the group was split evenly between using a strong bleach solution, hot soapy water with a bleach solution, or just hot soapy water), and the best way to determine if chicken was done (41% thought chicken was done when it was no longer pink in the center). High correct percentages were scored on items that asked about which foods may carry Salmonella (eggs and chicken), which foods (from a list) should be refrigerated, and whether it is safe to add a raw egg to infant formula. Table 2 presents the results of the food safety knowledge survey for each ethnic group and their combined mean knowledge scores.

Table 2. Mean scores for the food safety knowledge survey

Group	Knowledge	Cook	Chill	Separate	Clean
Native American	66% (SD=.1)	61% (SD=.22)	64% (SD=.19)	61% (SD=.18)	66% (SD=.13)
Hispanic	65% (SD=.09)	55% (SD=.21)	65% (SD=.15)	67% (SD=.16)	62% (SD=.15)
Combined	65% (SD=.1)	58% (SD=.22)	65% (SD=.17)	64% (SD=.16)	65% (SD=.13)

### 3.2 Focus Group Results (Qualitative)

The focus group script was structured using the Health Belief Model, a theoretical model often used to assess culturally specific behaviors and readiness to change (Rosenstock, 1988; Janz & Becker, 1984). This theoretical basis allowed the researchers to gain a deeper understanding of the perceived barriers and benefits to food safety, perceived severity of risk and susceptibility of contracting a FBI, cues to action that would prompt behavior initiation, and perceived self-efficacy.

A transcript based analysis approach was used to analyze the qualitative data (Krueger & Casey, 2009). Focus group interviews were transcribed verbatim and independently coded by two coders using the Krueger method

(Krueger & Casey, 2009). The coding structure was guided by the research questions of the study, the theoretical constructs of the Health Belief Model, and by reviewing participant responses. Coders used an iterative process to narrow the number of discrete codes and finalize the coding structure. The coded data was analyzed for themes using an intra - case analysis, first examining each case individually, and then using a cross-case analysis, summarizing intra - case themes for differences, similarities, and/or unexpected results (Ryan & Bernard, 2003). ‘Cases’ refer to each individual focus group. Themes were discussed across researchers and finalized once consensus was reached. Table 3 illustrates the final themes and summaries of each groups’ beliefs and practices regarding, perceived susceptibility and severity, perceived barriers, cues to action, self-efficacy, the USDA FightBac food safety categories (Cook, Clean, Chill, and Separate), and food safety topics of interest.

### 3.2.1 Native American Participants’ Summaries

*Health Belief Model Constructs.* Native American participants were generally aware of FBI, it’s symptoms and terms used to describe FBI. ‘Food poisoning’ was a common phrase used across all Native American focus groups to refer to getting sick from food. Participants believed that getting sick from food is contingent on poor hygiene, preparation, and storage practices. When asked about what symptoms are associated with food poisoning participants mentioned upset stomach, diarrhea, vomiting, dehydration, and “flu-like” symptoms. When asked about foods they have heard about that caused food poisoning participants mentioned cantaloupe, peanut butter, eggs, and spinach. They indicated that most of their information came from FBI outbreaks announced in the media.

Participants identified several different groups of individuals that may be more at risk for FBI, including children, the elderly, pregnant women and those with compromised immune systems. Several participants believed that children were less susceptible to FBI when compared to adults. Perceived risk was strongest when eating outside the home, in restaurants, or at public events. This lack of control was the most resonant concern of participants.

The most frequently mentioned barrier to food safety practices in the home was time. Being in a hurry causes one to take “short cuts” such as not sanitizing as thoroughly or washing hands as frequently. Dating foods was perceived as inconvenient but believed to be effective. Several participants mentioned that as time goes by, food gets pushed around in the refrigerator and the timeframe that foods are safe to consume becomes more difficult to estimate. Multiple person households were also seen as barriers to food safety. The more people in the home the more unaware of who is putting what into the refrigerator or accessing food that may be outdated or spoiled. Most participants felt confident in their ability to safely prepare, cook, store and purchase food. Reasons given for their high confidence were never to seldom getting sick from their own food and being the preparer of the food in their home.

*USDA FightBac Concepts.* Specific practices related to the FightBac constructs reveal that participants do not use meat thermometers regularly and may be unsure of how to properly defrost meat. Most participants use subjective ideas of doneness. One participant said, ‘*Doneness is checked by cooking until there is no red*’. This was consistent throughout all Native American focus groups. When discussing defrosting methods, a few participants mentioned putting meat in a bowl of water in the sink or several mentioned placing the meat on the counter until it is thawed. The most notable practice that could increase risk of foodborne illness is the handling of soups and stews. Some refrigerate and cool down everything “*right away*,” though, some participants also mentioned leaving soup on the stove to eat or store later.

Native American participants wanted more information pertaining to defrosting meat and food storage and preferred that the information be delivered by educators or tribal members, in a workshop or classroom format. It is interesting to note that although these preferred methods are more traditional, less traditional methods were reported to seek out information. The media seems to be a key factor in creating initial awareness surrounding foodborne illness. Many participants use radio and “googling” to seek information about FBI. In future studies, these methods could be tested for receiving information as well.

### 3.2.2 Hispanic Participants’ Summaries

*Health Belief Model Constructs.* There was general awareness of FBI, especially when related to an outbreak. Participants used the term “food poisoning” to refer to FBI but “stomach bug” and “runny butt” are others. The usual symptoms (vomiting, diarrhea, and stomach cramps) were mentioned but participants thought fever might indicate something else. Personal and vicarious experiences of FBI influenced behaviors and reminded participants of food safety. Confusion existed in discerning between FBI and a food allergy, FBI and bacteria, and FBI and a virus.

Participants’ sense of susceptibility was influenced by their personal experiences. Perceived risk increased when not in control of cooking, or when others were assisting in the kitchen. When asked who is most likely to be at risk

of contracting a FBI participants agreed that the elderly, pregnant women, people with chronic diseases, and people with diabetes were the most at risk populations. Most women also listed children as being more at risk to contract an FBI, but the men did not agree that children were more susceptible to FBI. Foods participants believed were more likely to carry an FBI were chicken, deli meats, soft cheeses, eggs, and food from a restaurant.

Most participants agreed that contracting an FBI was “horrible” but did not perceive it to be “life threatening”. Few participants mentioned the severity of FBI in child populations, and again male primary food handlers felt that FBI was not severe in children and “will pass”. Severity of FBI was usually determined by the “watch and wait” system; if symptoms persisted or worsened medical care was sought out.

Being rushed or in a hurry was the most prominent barrier to implementing proper food safety in the home. When rushed, participants skipped steps or took “shortcuts” such as not washing fruits and vegetables, not washing a knife after cutting meat, not cooking foods completely, not doing dishes right away, and leaving foods out on the counter after the meal. Family members such as husbands and children were also seen as a barrier to implementing food safety procedures because they may not wash their hands, clean properly, and continuously open the refrigerator. Self-efficacy was moderate to high for participants’ perception of their ability to cook, store, prepare, and purchase foods safely. However, participants mentioned several areas of confusion pertaining to their self-efficacy such as when to use bleach and when to use hot soapy water, plastic cutting boards versus wood, how long foods can be refrigerated, cooking temperatures for meat and seafood, and proper microwave cooking.

*USDA FightBac Constructs.* Participating Hispanic primary food handlers regularly keep foods hot, but did not know the correct temperature. Meat thermometers were only used on the holidays. Confusion surrounds meat preparation. Participants were unsure of the proper methods to defrost meat, the cooking temperatures for meat, and whether meat can be eaten raw. Participants were also unsure of how long leftovers can be stored safely listing anywhere from two days to two weeks. Participants mentioned appropriate separate practices such as switching knives, keeping meat and produce separate in the refrigerator, and immediately washing utensils used for meat preparation. Cleaning practices such as hand washing and sanitizing surfaces were common but the proper ways to sanitize surfaces and use bleach were misunderstood.

Hispanic participants wanted more information about egg safety, cooking meat, proper leftover storage, washing produce, and microwave cooking. When asked where Hispanic primary food handlers had received their food safety information it was primarily from mothers and grandmothers but pediatricians, WIC offices, cookbooks, the Internet, and TV (in the case of current outbreaks) were also common sources. Participants preferred to receive food safety information from the Internet and email but wanted the messages concise, personal, and without links to follow to other webpages. Simple print brochures or something picked up at the point of purchase, such as the grocery store, trinkets like a refrigerator magnet, using Spanish TV, or commercials were also mentioned as possible preferred information channels.

Although both groups did perceive themselves as being at risk to contract a FBI, they did not perceive it as severe. Both perceived this risk to be higher when not “in control” of cooking or when eating out, and did not perceive risk when cooking at home. When preparing food at home some barriers exist that prevent primary food handlers from both groups from following proper food safety guidelines such as being rushed or others accessing the refrigerator. Self-efficacy to cook, store, prepare, and purchase food was high among both groups. Specific practices related to the FightBac constructs revealed that Native Americans and Hispanics do not use meat thermometers regularly and may be unsure of how to safely defrost meat. Native Americans wanted more information pertaining to defrosting meat and food storage and preferred that the information was salient to the community and come from an interpersonal source such as a tribal member, food safety educator, or in a classroom setting. Hispanic groups desired more information on food preparation, cooking foods properly, and proper storage methods and appealed more to media channels such as internet/email or Spanish TV. Summary results are presented in Table 3.

Table 3. Focus group themes and summaries

Theme	Native American	Hispanic
Susceptibility	<ol style="list-style-type: none"> <li>1. Influenced by personal experience</li> <li>2. Higher when not in control of food preparation (in home or eating out)</li> </ol>	<ol style="list-style-type: none"> <li>1. Perceptions of FBI risk were greater when not in control of cooking at home</li> </ol>
Severity	<ol style="list-style-type: none"> <li>1. Most do not see FBI as severe</li> <li>2. Most underestimated severity to children in their home</li> </ol>	<ol style="list-style-type: none"> <li>1. Most do not see FBI as severe</li> <li>2. Severity determined by “watching and waiting”</li> </ol>
Barriers	<ol style="list-style-type: none"> <li>1. Being in a hurry</li> <li>2. Children accessing the refrigerator at home</li> <li>3. Other people in the home preparing food</li> <li>4. No electricity in the home on certain reservations</li> </ol>	<ol style="list-style-type: none"> <li>1. Being in a hurry</li> <li>2. Husbands and children accessing refrigerator at home</li> <li>3. Other family members in the kitchen during food preparation</li> </ol>
Self-Efficacy	<ol style="list-style-type: none"> <li>1. High perceived confidence in cooking, storing, preparing, and buying certain foods</li> </ol>	<ol style="list-style-type: none"> <li>1. Medium to high for cooking, storing, preparing, and buying foods</li> </ol>
Cues to Action	<ol style="list-style-type: none"> <li>1. People: educators, tribal members</li> <li>2. Workshops and classes</li> </ol>	<ol style="list-style-type: none"> <li>1. Email/Internet</li> <li>2. Print brochures</li> <li>3. Spanish TV/commercials</li> </ol>
FightBac Concepts	<ol style="list-style-type: none"> <li>1. Cook: No use of meat thermometers, use color as an indicator of doneness</li> <li>2. Chill: Confusion about safe ways to cool soup, how/when to store leftovers, dating food is inconvenient, and safe ways to defrost meat (soaking in water to store leftovers was preferred)</li> <li>3. Separate: strong awareness of this concept, however, many do not bag raw meats in grocery stores</li> </ol>	<ol style="list-style-type: none"> <li>1. Cook: Use of food thermometer only on holidays, confusion over defrosting meat, cooking temperatures for meat</li> <li>2. Chill: Confusion over how long to store leftovers</li> <li>3. Clean: Proper bleach use is misunderstood</li> </ol>
Food Safety Topics of Interest	<ol style="list-style-type: none"> <li>1. Defrosting meat, food storage, eggs (when to refrigerate, and their safety for kids)</li> <li>2. Focus on positive health and not sickness because it is culturally inappropriate to associate illness with food</li> </ol>	<ol style="list-style-type: none"> <li>1. Storage, washing produce, meat, cooking temperatures, egg safety, and microwave safety</li> </ol>



### 3.3 Mixed Methods

After analyzing the qualitative and quantitative datasets, the results from each were compared at the point of interpretation to identify areas of convergence (similarity) and divergence (difference). Equal priority was given to each type of dataset. To determine if mean knowledge scores from the food safety knowledge survey differed significantly for each ethnic group a MANOVA was conducted. After merging results and identifying areas of convergence and divergence recommendations for educational interventions were identified for each ethnic group and collectively.

MANOVA results indicate no significant group difference on dependent variables (mean subscale knowledge scores) [Wilks'  $\lambda = .852$ ,  $F(6,44) = 1.278$ ,  $p = .287$ ,  $\eta^2 = .162$ ]. Since mean food safety knowledge was not found to differ significantly by ethnic group, quantitative food safety knowledge scores can be combined for interpretation.

### 3.4 Convergence

Quantitative and qualitative data converged when the results of each data set were similar. Convergent data analysis reveals that food safety practices mentioned by focus group participants as areas of confusion were also reflected as low scoring knowledge items such as: cleaning surfaces and countertops/proper bleaching methods, leftover storage, reheating leftovers, and meat cooking and preparation practices (such as meat thermometer use). The preferred channel to receive food safety information differed between groups, but this preference was similarly reflected in both data sets. Native American participants preferred small group educational settings, focused on health. Hispanic participants preferred alternative media channels (email/internet, pamphlets/brochures, and commercials and programming on Spanish TV). Survey results corroborate that Hispanic populations are more inclined to prefer alternative (media or electronic) to traditional channels (print, person/expert, or classroom) for food safety education than Native American participants. Both Native American and Hispanic groups were aware of FBI but did not perceive it to be severe. Susceptibility for both groups increased when the primary food handler did not feel "in control" of cooking, such as when another family member was in the kitchen, when being assisted while cooking, or when eating out.

### 3.5 Divergence

Quantitative and qualitative data diverged when the data sets were dissimilar. Focus group participants' reported personal efficacy to cook, store, prepare, and purchase food was high but the mean knowledge scores extrapolated from the food safety knowledge survey were low across all subscales (Cook and Separate being the lowest). This high efficacy may provide a false sense of low risk of FBI for primary food handlers, but the actual risk may be much higher since knowledge scores are low. Cultural food preferences also differed across groups. Native American participants appeared to consume less 'traditional foods' compared to Hispanics who often spoke of 'traditional foods' such as tripe, menudo, and tamales. The food safety knowledge survey reiterated that food preferences might differ per group. Native American participants expressed frequent consumption of soup but their knowledge scores were low on questions pertaining to soup cooling and reheating. Hispanic participants scored low on a knowledge item pertaining to the proper way to cook chicken. These findings will be used to inform and culturally tailor an educational intervention for both ethnic groups. Mixed methods findings presented in Table 4.

Table 4. Similarities and differences between Native American (NA) and Hispanic (Hisp) Groups on food safety knowledge and practices

	Similarities	Differences
Quantitative	<ol style="list-style-type: none"> <li>1. Exhibited low food safety knowledge</li> <li>2. Scored lowest in the 'cook' construct area</li> <li>3. Least understood the proper method Hisp group to cool soup</li> <li>4. Understood that chicken and eggs included hamburger/chicken storage, &amp; carry Salmonella</li> </ol>	<ol style="list-style-type: none"> <li>1. 'Separate' concepts were the second lowest scoring items for the NA group; 'Clean' concepts were second lowest for Hisp group</li> <li>2. Low scoring items for the NA group included hamburger/chicken storage, &amp; reheating soup; for the Hisp group cleaning counters, &amp; cooking chicken until done were low</li> <li>3. The NA groups scored higher on cutting board cleaning items; Hisp scored higher on refrigerated items</li> </ol>
Qualitative	<ol style="list-style-type: none"> <li>1. Aware of FBI (symptoms, common causes, etc.) especially when associated with an outbreak</li> <li>2. Perceived greater susceptibility when not "in control" of cooking or when eating out</li> <li>3. Did not see FBI as severe and underestimated incidence caused in homes</li> <li>4. Severity determined by "watching and waiting" to see if symptoms worsened</li> <li>5. Identified similar barrier (other family members accessing the refrigerator) or Internet</li> <li>6. Self-efficacy was high for both groups on cooking, storing, preparing, and purchasing foods safely</li> </ol>	<ol style="list-style-type: none"> <li>1. NA and Hisp groups differed on some barriers to food safety (NA-driving long distances for food, may not have electricity; Hisp-being rushed, others in kitchen)</li> <li>2. NA groups reported cooking soup frequently and may not properly cool it</li> <li>3. Hisp groups report eating more cultural foods like tamales and menudo</li> <li>4. NA groups preferred traditional classroom educational settings</li> <li>5. Hisp groups are open to learning about FS on alternative channels like TV</li> </ol>

Abbreviations: NA=Native American; Hisp=Hispanic; FBI=Foodborne Illness; & FS=Food Safety

#### 4. Discussion & Implications

Results from this study confirm that areas of knowledge deficit do exist and some food safety practices are poorly understood within Native American and Hispanic primary food handlers of children under the age of 10 in New Mexico. Because young children have little control of food choices or preparation it is a cause of concern that most primary food handlers with children under the age of 10 do not feel susceptible to FBI in their homes, do not perceive FBI as severe, and rate themselves high in their self-efficacy to cook, prepare, purchase, and store food. Many studies affirm our finding that food handlers do not perceive themselves as at risk of FBI when "in control" of food preparation in the home (Cody & Hogue, 2003; Bruhn & Schutz, 1999; Kennedy et al., 2005; Lin et al., 2005; Raab & Woodburn, 1997; Redmond & Griffith, 2004). Future food safety educational interventions should not only focus on the areas identified in this study as knowledge gaps or misunderstood food safety practices but also on increasing Hispanic and Native American primary food handler's perceptions of susceptibility and severity of FBI.

Further research should consider the cultural preferences of both Native American and Hispanic groups pertaining to food choice. This study demonstrates that Native American and Hispanics' preferred foods are different from each other and other cultural groups and that this might underlie heightened rates of FBI in each respective population. For instance the Hispanic populations' preference for soft or Mexican-style cheeses may contribute to heightened rates of Listeriosis (CDC, 2007b; Silk et al., 2012; Pouillot et al., 2012).

This study shows that the preferred channel for dissemination of food safety materials may also differ between groups with Native Americans preferring a small group educational settings and Hispanic groups preferring alternatives to traditional educational settings such as Internet/email, print materials, and Spanish TV

programming/commercials. As Dharod et al. (2004) demonstrated, food safety and educational materials in these alternate channels are effective and should be considered for the Hispanic population.

A consideration for health educators and health promoters interested in creating tailored food safety educational materials for Native Americans is place of residence. Many study participants discussed that living on a reservation versus off a reservation (sometimes referred to by focus group participants as 'rural' versus 'urban') could impact food choice, availability/freshness, purchasing, preparation, storage, and even slaughtering. Further research could investigate whether the rates of FBI and the food safety behaviors differ for Native American reservation residents versus those living off reservations, as well as the differences between those living in rural versus urban areas.

This study contributes to the paucity of FBI literature that attempts to explore the existent health inequity found in Native American and Hispanic populations. The unique approach of mixed methods parallel convergent design (Creswell & Plano, 2011) allowed researchers to compare and contrast, or triangulate, quantitative and qualitative data to provide a more complete picture of food safety knowledge, beliefs, and practices in Native American and Hispanic populations.

#### 4.1 Limitations

A limitation of this study is that a purposeful sample of Native American and Hispanic food handlers were recruited from the central and southern regions of New Mexico and therefore do not represent all Native American or Hispanic individuals residing globally. However, a stratified purposeful sampling approach was used and can lend credibility to a research study because the pre-identified sample characteristics were confirmed from the research literature to be associated with the phenomenon of study and therefore may be more representative of the sub-population compared to convenient or haphazard sampling (Patton, 2001). The possibility of social desirability bias is likely with the use of focus groups and that self-reported practices of participants may not reflect actual behaviors (Redmond & Griffith, 2004). In addition, MANOVA statistical significance of between-group differences may have emerged with a larger sample size. The small sample size reduces the statistical power of the quantitative data but if the sample size became too large it would reduce and limit the ability to find experiential differences in the qualitative data (Creswell & Plano, 2011). The premise being that the use of both quantitative and qualitative approaches combined provides a better understanding of the research data than either approach alone, even with a small sample size (Creswell & Plano, 2011).

#### 4.2 Conclusion

This study, to the best of the authors' knowledge, is the first of its kind to use a mixed methods convergence model design to investigate the food safety knowledge, beliefs, and practices of both Native American and Hispanic populations living in New Mexico. The mixed methods process allowed researchers to crosscheck participants' self-reported perceptions and practices with their actual knowledge scores in these areas. Food safety knowledge was often inconsistent with reported food safety practices. These findings can now be applied in food safety educational interventions, and health campaign efforts by health educators and promoters to lessen the heightened rates of FBI found in these populations.

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