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Research report

Food safety knowledge, practices and beliefs of primary food preparers in families with young children. A mixed methods study ☆

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ABSTRACT

Food preparers in families with young children are responsible for safe food preparation and handling to prevent foodborne illness. To explore the food safety perceptions, beliefs, and practices of primary food preparers in families with children 10 years of age and younger, a mixed methods convergent parallel design and constructs of the Health Belief Model were used. A random sampling of 72 primary food handlers (36.2 ± 8.6 years of age, 88% female) within young families in urban and rural areas of two Midwestern states completed a knowledge survey and participated in ten focus groups. Quantitative data were analyzed using SPSS. Transcribed interviews were analyzed for codes and common themes. Forty-four percent scored less than the average knowledge score of 73%. Participants believe children are susceptible to foodborne illness but perceive its severity to be low with gastrointestinal discomfort as the primary outcome. Using safe food handling practices and avoiding inconveniences were benefits of preventing foodborne illness. Childcare duties, time and knowledge were barriers to practicing food safety. Confidence in preventing foodborne illness was high, especially when personal control over food handling is present. The low knowledge scores and reported practices revealed a false sense of confidence despite parental concern to protect their child from harm. Food safety messages that emphasize the susceptibility and severity of foodborne illness in children are needed to reach this audience for adoption of safe food handling practices.

Introduction

Young children have a higher risk than adults for foodborne illness due to their underdeveloped immune system, lower body weight and lack of control over meal preparation. Foodborne illness can result in long term health consequences and even death, especially in young children. Approximately one half of reported foodborne illness occurs in children (Pew Health Group. Children, 2009) and an estimated one-third of all related costs ($2.3 billion dollars per year) are due to illnesses in infants and children under the age of 10 (Buzby, 2001). The increased risk for foodborne illness (Albrecht & Nagy-Nero, 2009; Gerba, Rose, & Haas, 1996) among children is due to their under-developed immune system, lower body weight, and limited control over meal preparation (Buzby, 2001). Children are disproportionately affected by five foodborne microorganisms; *Campylobacter*, *Escherichia coli* O157:H7, *Listeria*, *Salmonella*, and *Shigella* (Pew Health Group, 2009). Infants (under one year of age) have the highest reported cases of salmonellosis and campylobacteriosis (CDC, 2005; Fullerton et al., 2007; Jones, Ingram, Fullerton, et al., 2006).

Numerous surveys have been conducted to determine food safety attitudes, knowledge and practices (Albrecht, 1995; Altekruse, Yang, Timbo, & Angulo, 1999; Angelillo, Vigiani, Rizzo, & Bianco, 2000; Brewer & Prestat, 2002; Brewer & Rojas, 2008; Bruhn & Schutz, 1999; Kennedy et al., 2005; Raab & Woodburn, 1997; Redmond & Griffith, 2004a,b,c; Roseman & Kurzynske, 2006) among general consumers and have found unsafe food handling practices despite acceptable food safety knowledge. The effect of gender, ethnicity, and age on risky food behaviors has

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been studied (Patil, Morales, Cates, Anderson, & Kendall, 2004; Redmond & Griffith, 2003) and food safety knowledge and practices of specific populations have been reported (Anderson, Shuster, Hansen, Levy, & Volk, 2004; Boone et al., 2005; Byrd-Bredbenner, Abbot, & Quick, 2010; Cates, Carter-Young, Conley, & O'Brien, 2004; Daniels, Daniels, Gilmet, & Noonan, 2001; Gettings & Kiernan, 2001; Johnson et al., 1998; Li-Cohen & Bruhn, 2002; Lin, Jensen, & Yen, 2005; Unklesbay, Sneed, & Toma, 1998; Wenrich, Cason, Nan, & Kassab, 2003). Knowledge and practices of mothers of infants and children indicate a need for food safety messages (Kwon, Wilson, Bednar, & Kennon, 2008; Trepka, Newman, Dixon, & Huffman, 2007).

The Health Belief Model (HBM) (Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988) explains the phenomenon of people rejecting screening tests and preventive health care measures for diseases without symptoms and provides a framework for designing strategies for changing behavior. The HBM assesses an individual's perceived threat posed by a health problem, benefits of avoiding the threat, and factors influencing their decision to act (National Cancer Institute, 2005; Rosenstock et al., 1988). The HBM has been used to assess food safety attitudes and behaviors (Hanson & Benedict, 2002). Food safety behavior can be predicted by readiness, self-efficacy, and health motivation (Schafer, Schafer, Bultena, & Hoiberg, 1993).

The primary food preparer, the family member who prepares most of the meals in the household, has a vital role in reducing the number of illness caused by foodborne pathogens for children. Exploring the meaning of foodborne illness among this population using qualitative inquiry and the HBM would identify strategies needed to reduce or prevent foodborne illness in families with young children. The purpose of this mixed methods convergent parallel design (Creswell & Plano Clark, 2011) study (Fig. 1) was to explore the food safety knowledge, perceptions/beliefs and practices of the main food preparer in families with children 10 years and younger using the constructs of the Health Belief Model (Janz & Becker, 1984; Rosenstock et al., 1988).

Methods

A convergent mixed methods design was used where quantitative and qualitative data is collected in parallel, analyzed separately, and then merged in overall analysis and interpretation. This study placed greater priority and emphasis on qualitative inquiry and quantitative research playing a secondary role (Creswell & Plano Clark, 2011). Qualitative data included participant responses to focus group questions; quantitative data included responses from the demographic and knowledge surveys. Approval for this project was obtained from the University Review Board (IRB#2009039800).

Participants and recruitment

Participants were recruited using a random purposeful sample of mailing addresses obtained from InfoUSA, a database of 4300 telephone directories (InfoUSA, 2012). Inclusion criteria were (1)

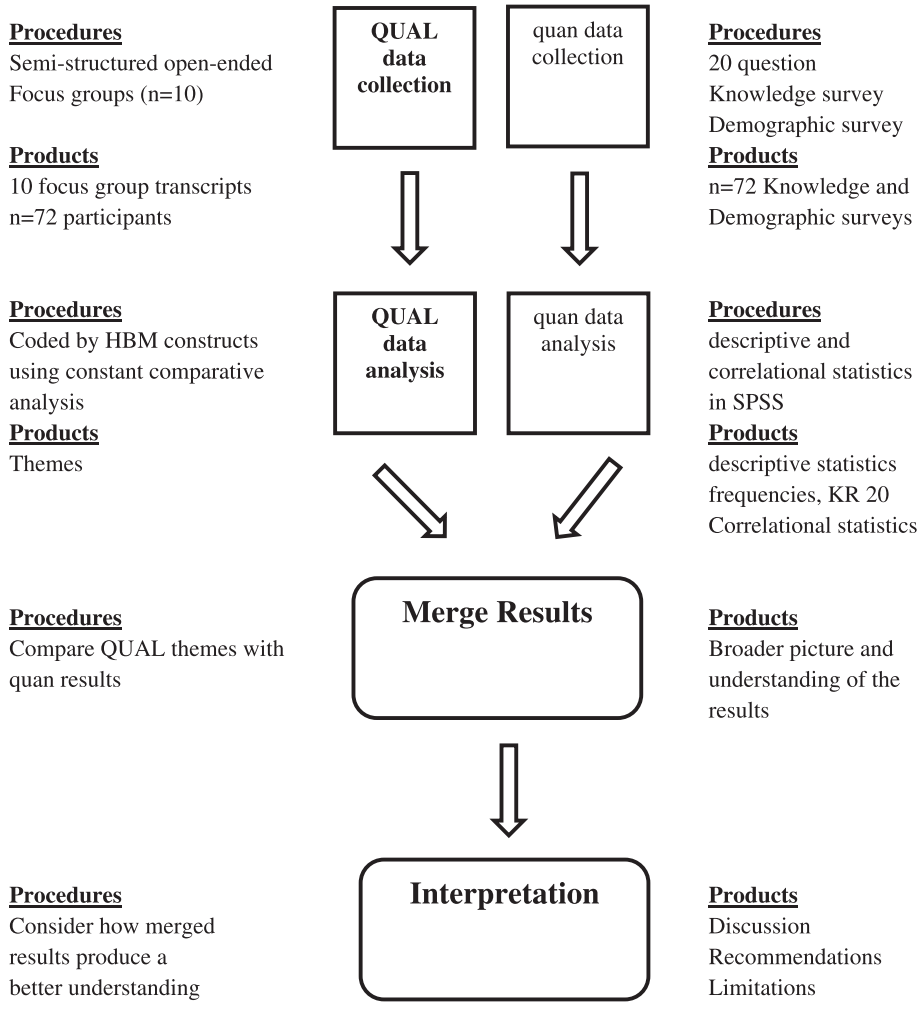

Fig. 1. Convergent mixed methods design (Creswell & Plano Clark, 2011).

main food preparer for a child age ten years or younger and (2) residency within 30 mile radius of designated focus group locations. Random sampling was used to allow generalization of study findings to the larger population within the Midwest. Locations were selected based on micro- and metropolitan areas to obtain urban and rural participants (U.S. Census Bureau, 2007) in two Midwestern states. Letters and stamped, self-addressed reply postcards were mailed to 300 individuals for each of the focus group locations. Food safety kits containing food and refrigerator thermometers, and food safety brochures were offered as incentives. To increase response rate, individuals who had not responded to the initial mailing were sent a repeat mailing, and a second random sample of mailing addresses of 300 individuals provided by InfoUSA was used in recruitment. Individuals who responded were called to verify eligibility, inform of the focus group date, time and location, and confirm interest in participating. Flyers, posted in communities where focus groups were to be conducted, were also used for recruitment.

Qualitative design

The qualitative approach of phenomenology (Creswell, 2007; Harris et al., 2009) was used to explore the meaning of foodborne illness among main food preparers for children 10 years and younger residing in urban and rural areas of the Midwest. Focus groups were used to obtain data in a timely manner, and yield information less accessible without group interaction. For consistency, one interviewer facilitated all the groups.

Focus group interview script

An interview script based on the main constructs of the Health Belief Model (Janz & Becker, 1984; Rosenstock et al., 1988) was developed (Fig. 2). Members of the project team and three external food safety experts independently reviewed the script to establish face validity. Reviewers were instructed to respond to questions as if they were a participant and comment on content, grammar, and understandability of each question. After minor revisions, a pilot focus group was conducted prior to the start of the study to test the instruments and provide experience for the research interviewer who was trained in focus group interviewing. Minor changes were made to the instrument after the pilot test.

Quantitative design

A survey assessing participant's knowledge of safe food handling was developed based on previous food safety related research (Food, 2002; Haapala & Probart, 2004; Medeiros et al., 2004; Unklesbay et al., 1998; Wenrich et al., 2003). Questions were developed based on FightBAC!™ (U.S. Department of Agriculture, 2010) concepts; Clean, Separate, Cook, and Chill (Table 1). Two questions addressing perceived populations at risk of foodborne illness were also included. The knowledge survey contained a limited number of questions as the mixed methods design placed a priority on the qualitative methodology. Demographic questions were included in the survey. The survey was reviewed by the project team, revised and sent to three food safety experts to review content, grammar, and understandability of each question. Guidelines from Simply Put (Centers for Disease Control, 1999) were used to enhance the readability of the survey.

Readability assessments were conducted and scores were within ideal range for readability (Flesch Reading Ease-76.3, Gunning Fog Index 8.6, and Flesch-Kincaid Grade Level sixth grade [ReadabilityFormula.com, 1996]).

Data collection

One researcher, a nutrition graduate student who had completed coursework in qualitative inquiry, conducted all focus groups in community centers, churches, and local extension offices using the interview script and standardized protocol (Creswell, 2007; Krueger, 1990). Participants were arranged in a circle or around tables. A research observer sat near the focus group and penciled observations. Childcare was available in an adjoining room and some infants and small children remained with participants. During the introduction, the purpose of the focus group was explained and participants gave informed consent, completed the demographic and knowledge survey. At the beginning of the discussion, participants were invited to share their name and a favorite meal to assist them in feeling comfortable talking within the group. Participants were directed to hold their questions on food safety until the end to avoid influencing thoughts and opinions of other participants. The focus group interviewer remained flexible in following the sequence of script questions to allow group discussion. The discussions were audio-recorded. Due to the evolving nature of qualitative inquiry, additional topics and questions that arose during focus groups were added to the interview script for subsequent group interviews. Focus groups were conducted until common themes emerged.

Qualitative data analysis

Each focus group discussion was transcribed verbatim. The observations collected during the focus group were added to each transcript. Three members of the project team, including the interviewer, independently analyzed the data using coding guidelines. The focus group transcripts were first read in their entirety to gain familiarity with the data. Segments of text were labeled or assigned codes that described content or meaning (Creswell, 2007; Krueger, 1990). The codes were subsequently collapsed into broad themes or categories. Using intercoder agreement as a reliability strategy (Creswell, 2007), the coders came together and examined the pooled results. The constructs of the HBM were used to organize and sort the themes. Common themes were identified and overlapping areas were eliminated using agreement between three coders. Validation strategies employed were the prolonged engagement of one researcher who spent extensive time in the field close to participants in the course of conducting all focus group discussions and using multiple methods of data collection which included audio-recording and observation of groups during discussions (Creswell, 2007). After themes were identified within each HBM construct, overall themes were identified.

Quantitative data analysis

The quantitative data were entered into Statistical Package for Social Sciences (SPSS Version 17.0, 2008) and analyzed for frequency distribution, descriptive statistics, *t*-test for equality of means, Pearson's correlation, and ANOVA and Tukey's Honestly Significant Difference post hoc test where differences occurred. Statistical significance was determined at a p value $\leqslant 0.05$. Kuder-Richardson Formula 20 (KR20) was used to test the survey for reliability.

Mixed method analysis

A side by side comparison of the qualitative and quantitative data was employed (Creswell & Plano Clark, 2011) to identify convergent and divergent findings.

Perceived Susceptibility	Do you think that some people are more likely to get sick from food than others? Do you think there are some populations who are more at risk of getting sick than others? Some people get sick from eating food more often than others. What do you think accounts for these differences? Do you think you're at risk of getting sick from food? Do you think anyone in your household can get sick from food? Do you think your family can get sick from food eaten in restaurants? Do you think you or your family could get sick because of how food is made in your home? What foods do you think might make people sick and how do they make one sick?
Perceived Severity	What are the typical symptoms you think of when a person is sick from food? Do you think there are more serious symptoms? Have you or anyone living with you been sick from food? -What led you to believe the sickness was caused by food? -How bad was it? *(Probe for specific symptoms)* -What specific foods/drinks do you think caused this sickness? -What did you/they do differently that day? *(Depends on who was sick)* *(Probe for missed work/school, went to the doctor, etc)* -How did their illness affect you? *(If they weren't the sick person)* If your kids got sick from food, what do you think could happen to them? -Are there more serious symptoms? *(If they say stomach ache, vomiting, etc)*
Perceived Benefits	To what extent do you think you can prevent your family from getting sick from food? What steps can you take to prevent your family from getting sick from food? Are there things that you could be or should be doing to prevent getting sick from food? What about steps that others in your household can take to prevent getting sick from food?
Perceived Barriers	What gets in the way of you taking these steps (or doing these things) to prevent your family from getting sick from food? What is challenging or difficult about some of the steps you can take to prevent your family from getting sick from food? Of those problems you have mentioned, which is most difficult to overcome?
Self-efficacy	To what extent do you feel confident in your ability to safely prepare food in your home for your family so they don't get sick from food? To what extent do you feel confident in your ability to safely store food in your home? To what extent do you feel confident in your ability to safely purchase food for you and your family? How confident are you that the supply of food (from grocery store, restaurant, Farmer's market) you and your family consume is safe?
Cues to action	Think about the last time you were given information that you were able to use right away. -What was unique about that information or how it was provided? -What made it useful to you? Think about the last time you were given information that was not useful to you. -What was unique about the information or how it was provided that made it not useful?

Fig. 2. Interview script using Health Belief Model administered to focus groups of primary food preparers (n = 72) for children ⩽10 years living in urban and rural areas of the Midwest.

Results

Participants

Ten focus groups (n = 72) were conducted, averaging seven participants per group and 50 min duration. Participants were primarily female (n = 62), 36 ± 8.6 (mean ± standard deviation) years of age, and the highest level of education reported by 43% was a college/postgraduate degree. The majority reported current or previous work (11% and 61% respectively) in a food/nutrition related job although two-thirds had not received training or education related to nutrition, food preparation, or food safety. Over three-fourths of the participants indicated that they prepare the meals in their home all or nearly all of the time and over half were employed outside of the home (Table 2).

Qualitative results

Themes emerged within all constructs of the HBM and are shown in Table 3. Individuals perceived as being susceptible to foodborne illness are children and older adults, individuals other than self, and all populations. Perceived severity of foodborne illness is gastrointestinal discomfort and medical treatment. Implementing safe practices and avoiding inconveniences were perceived benefits to preventing foodborne illness. Perceived barriers to practicing safe food handling include childcare duties, time, and knowledge. Self-efficacy themes were confidence, food handling control, leftover food safety concerns, and false sense of confidence. Cues to action were quick easy to read material, eye catching message, and shocking message. Two broad themes were observed; desire to avoid harm to their child, and high

Table 1
Food safety knowledge survey responses among Midwestern primary food preparers ($n = 72$) in families with young children.

Question	Frequency[a] ($n = 72$)	Percentage of sample (%)
1. What is the best way to handle leftover chili, soup, or stew?[a]		
Let cool on the countertop to room temperature	26	36.6
[b]Put in the refrigerator within 2 h of cooking it	43	60.6
Put in the refrigerator within 4 h of cooking it	1	1.4
I don't know	1	1.4
2. *E. coli* (bacteria) in undercooked meat could kill you or your children.		
[b]True	62	86.1
False	7	9.7
I don't know	3	4.2
3. A cutting board should be washed with soap and hot water or placed in a dishwasher after using it to cut raw meat.		
[b]True	70	97.2
False	1	1.4
I don't know	1	1.4
4. If a leftover food looks and/or smells good, it is still safe to eat.		
True	15	20.8
[b]False	52	72.2
I don't know	5	6.9
5. Placing raw meat or poultry in a plastic bag before putting it in your grocery cart/basket:[a]		
Increases your chance of foodborne illness	3	4.3
[b]Decreases your chance of foodborne illness	53	75.7
Makes no difference regarding foodborne illness	14	20.0
6. A child is more likely than an adult to become ill from eating raw or undercooked hamburger.		
[b]True	55	76.4
False	10	13.9
I don't know	7	9.7
7. Where is the best place to store raw hamburger in the refrigerator?		
On the top shelf	8	11.1
[b]On the bottom shelf	33	45.8
[b]Below ready-to-eat foods	24	33.3
It makes no difference	7	9.7
8. Washing hands after changing a diaper:		
Increases your chance of foodborne illness	3	4.2
[b]Decreases your chance of foodborne illness	64	88.9
Makes no difference regarding foodborne illness	5	6.9
9. Which is an acceptable way to clean a cutting board after it is used for raw meat?[a]		
Wiping it off with a dishrag	0	0.0
[b]Washing it with soapy water	43	63.2
Rinsing it well with water	0	0.0
Washing with bleach and water	24	35.3
I don't know	1	1.5
10. What is the best way to tell when chicken has cooked long enough?[a]		
The juices run clear	8	11.3
It falls off the bone	6	8.4
[b]Test with meat thermometer	55	77.5
I don't know	2	2.8
11. It is safe to use raw eggs in recipes that will not be cooked.[a]		
True	5	7.0
[b]False	55	77.5
I don't know	11	15.5
12. What is the best way to thaw frozen hamburger?[a]		
[b]In the refrigerator	57	79.2
[b]In the microwave	11	15.3
On the countertop	1	1.4
[b]Under running water	3	4.2
13. Washing your hands with soap and water after cracking open raw eggs will decrease your chance of getting a foodborne illness.		
[b]True	66	91.7
False	2	2.8
I don't know	4	5.5
14. After meat has been cooked thoroughly, it is safe to leave it at room temperature for longer than two hours.		
True	7	9.7
[b]False	62	86.1
I don't know	3	4.2
15. What is the best way to tell when hamburger has cooked long enough?[a]		
The juices run clear	4	6.2
It is brown in the middle (no pink)	23	35.4
[b]Test with meat thermometer	37	56.9
I don't know	1	1.5
16. It is safe/okay to give an infant a bottle of baby formula or breast milk that has been out of the refrigerator for longer than 2 h.		
True	6	8.3
[b]False	63	87.5
I don't know	3	4.2

(*continued on next page*)

Table 1 (*continued*)

Question	Frequency[a] (n = 72)	Percentage of sample (%)
17. It is safe to store raw eggs at room temperature.		
True	4	5.6
[b]False	62	86.1
I don't know	6	8.3
18. Using a thermometer when testing the doneness of hamburger:		
Increases your chance of foodborne illness	2	2.8
[b]Decreases your chance of foodborne illness	65	90.3
Makes no difference regarding foodborne illness	5	6.9
19. Washing your hands with soap and water before preparing meals makes foodborne illness less likely to occur.		
[b]True	69	95.8
False	1	1.4
I don't know	2	2.8
20. Who is more at risk of getting a foodborne illness? Choose all that apply.		
[b]Infants	30	41.7
[b]Children	28	38.9
Adults	0	0.0
[b]Pregnant women	19	26.4
[b]Elderly	26	36.1
All are at the same risk of getting a foodborne illness	41	56.9

[a] Missing data.
[b] Coded as correct.

self-efficacy in the ability to prevent foodborne illness among family members.

Quantitative results

Knowledge survey responses are listed Table 1. The mean score for the knowledge survey was 18.2 on a scale from 0 to 25 (73% correct). Less than half of the participants (44%) received an acceptable score of 75% or greater on the knowledge survey; while 8% scored 50% or less. Those with a college degree had a significantly higher score (p = 0.015) than those with a high school degree. Seventy-two percent had experience in a food or nutrition related job and scored significantly higher (p = 0.018) than those with no experience. Almost 14% did not know that *E. coli* from undercooked meat can be deadly. While the differences in scores was not significant (p = 0.148), those having a child one year or younger had lower scores when responding to a question on proper storing of infant formula or breast milk. Reliability testing resulted in a KR20 of 0.772.

Mail was ranked as the most preferred method of receiving food safety material, followed by email, a brochure from a grocery store, and broadcast and print media (television, magazine, radio, and newspaper). None of the participants chose "I would not be interested in receiving information on food safety".

Mixed methods results

Using the Health Belief Model constructs, a comparison of the qualitative and quantitative data is provided in Table 4 and illustrates areas of agreement plus discrepant findings.

Discussion

The purpose of this study was to explore the food safety knowledge, practices and beliefs of primary food preparers for young children by collecting qualitative and quantitative data simultaneously in a concurrent mixed method design. The use of a mixed methods research provided a richer understanding of the participants' knowledge, practices and beliefs about food safety and revealed consistent but also discrepant findings.

The focus group discussions revealed that some participants perceived children and older adults to be at higher risk for foodborne illness than the general public due to weaker immune systems. Similarly, less than half (39% and 42% of the participants) identified children and infants, respectively, at greater risk for foodborne illness on the knowledge survey. Comments of "personally I don't really ever think about it" and "just luck of the draw" illustrate the low perceived susceptibility that they or their children will contract foodborne illness. However 76% knew that a child is more likely than an adult to become ill from eating raw or undercooked hamburger and signifies that one cause of foodborne illness is known. Main food preparers' low perceived susceptibility of foodborne illness might be explained by a study that reported the perceived risk for foodborne illness among consumers has declined (Fein, Lando, Levy, Teisl, & Noblet, 2011). Targeting food safety messages to main food preparers on the increased susceptibility of young children to foodborne illness is indicated. Main food preparers in families with children may be receptive to this message due to their desire to avoid harming children under their care.

Main food preparers verbalized their perception of the severity of foodborne illness as low. The gastrointestinal discomfort, "horrendous cramps" and "I will *never* get sick like that again" were familiar to many. Discussion of serious complications of dehydration and intestinal bleeding requiring hospitalization were shared by a minority who had personal or family experience with foodborne illness. In contrast, more than three fourths (86%) of the participants knew that *Escherichia coli* (*E. coli*) in undercooked meat could kill them or their child. In another study of adults with low income, more (94%) knew this fact (Wenrich et al., 2003). Lack of experience with foodborne illness and its serious health consequences may contribute to the low perceived severity among these main food preparers despite accurate food safety knowledge in specific areas.

The survey revealed that 57% of the participants (Table 4) identified the best way to test the doneness of hamburger is with the use of a meat thermometer, but most participants shared that they cut into meat to check color for doneness; "I just look at it, you know, and you can tell it's done. But I don't even know what the real temperature should be". Three fourths of women with low incomes reported the same practice of using color to verify doneness of ground beef patties ((Kwon et al., 2008). The U.S. Department of Agriculture reports that one out of every four hamburgers turns

Table 2
Characteristics of Midwestern primary food preparers (n = 72) in families with young children participating in mixed methods research on food safety.

Characteristic	Frequency[a] (n = 72)	Percent of sample (%)
Gender		
Female	63	87.5
Male	9	12.5
Ethnicity/Race		
Caucasian/White	58	80.6
African American/Black	1	1.4
Hispanic/Spanish origin	10	13.9
Other[b]	3	4.2
Age (years)		
19–29	13	18.8
30–39	36	52.2
40–49	14	20.3
⩾50	6	8.7
Last grade completed		
Some high school	4	5.6
High school graduate	37	51.4
College graduate	31	43.0
Experience in food/nutrition related job		
Current	8	11.1
Past	44	61.1
None	20	27.8
Education/training		
Food safety	29	40.3
Food preparation	28	38.9
Nutrition	29	40.3
None	48	66.7
Food safety certification		
⩽4 h training	11	15.9
8 h training	5	7.2
⩾1 day training	3	4.3
None	50	72.4
Child age 1 year or younger		
Yes	22	30.6
No	50	69.4
Pregnant		
Yes	8	11.1
No	64	88.9
Prepare meal in household		
All of the time	27	37.5
Nearly all of the time	28	38.9
Some of the time	17	23.6
Never	0	0.0
Meals/week at school/daycare		
0–1	6	9.1
2–3	6	9.1
4–5	32	48.5
6–7	4	6.1
>7	8	12.1
Child does not attend	10	15.1
Meals/week from restaurant		
0–1	37	56.1
2–3	24	36.4
4–5	3	4.5
6–7	0	0.0
>7	0	0.0
Child does not eat at restaurant	2	3.0
Employment		
Full-time outside of home	35	50.7
Part-time outside of home	11	15.9
Full-time from home	2	2.9
Part-time from home	3	4.3
Not employed/retired	18	26.1

[a] Missing data.
[b] Caucasian/Hispanic, Caucasian/Native American, Caucasian/African American.

brown before reaching a safe internal temperature; some brown at internal temperatures as low as 135°F (U.S. Department of Agriculture, 2006). O157:H7 is most commonly associated with foodborne illness from consuming undercooked hamburger. While most *E. coli* related illnesses among young children cause abdominal cramping, vomiting, and diarrhea lasting from a few days to a week, more severe life-threatening cases of hemolytic uremic syndrome or permanent kidney failure, requiring lifelong dialysis or a kidney transplant (Buzby, 2001) has been reported.

According to the Health Belief Model, when perceived susceptibility is heightened, the perceived benefits of taking action (safe food handling practices) are greater. Main food preparers have a low perception of the severity of foodborne illness as described by one participant, "you know the rules are out there but do you necessarily follow them? You might not, you know. . ..But I've never been sick, so to me, it's (susceptibility) not a big issue". This perception may explain why the benefits of avoiding inconveniences in altering family schedules, "I'd be home, it would be a curse, definitely" and extra cleaning and laundry were not sufficient to engage participants in the safe actions they identified. Hand washing was most common reported practice for prevention of food borne illness among main food preparers, and 96% correctly identified that washing hands with soap and water prior to food preparation decreases the chance of foodborne illness. Altekruse, Street, Fein, and Levy (1995) found 86% of consumers had similar knowledge. Despite verbalizing other safe practices (benefits) such as using food thermometers, properly thawing food, observing expiration dates, maintaining clean surfaces, cutting boards, and utensils, putting leftovers away immediately, and buying from local and known sources, violations were acknowledged. Barriers to practicing food safety included childcare duties, knowledge deficits, and time limits; "we get lazy, we slack, we're rushing and we don't take the precautions". Violations of food safety are similar to those reported among US consumers (Dietary Guidelines Advisory Committee, 2010).

Studies suggest that young adults may lack food safety knowledge due to recent reduction or elimination of home economic courses that teach food safety in secondary schools (Byrd-Bredbenner et al., 2007; Altekruse et al., 1995). Those with a college degree had a significantly higher score (p = 0.015) than individuals with a high school degree, which mirrors the results from a meta-analysis (Patil et al., 2005). The same study also revealed those with a college education had less safe food practices compared to those without the higher education. Seventy-two percent of main food preparers reported either currently or having worked in a food or nutrition related job. This group scored significantly higher (p = 0.018) than those who have never worked in a food or nutrition related job which may be due to food safety training classes required for employment. Many participants learned about food safety from a parent, grandparent, or foodservice employment; "I know from working in restaurants and stuff. You wash your hands, wipe your counter, clean, you know. If you got time to lean, you got time to clean." Other studies also identified family as a source of food safety knowledge and an influence on food safety behaviors (Kwon et al., 2008; Trepka, Murunga, Cherry, Huffman, & Dixon, 2006).

High self-efficacy in preventing foodborne illness was prevalent in the discussion especially when handling of food was in their personal control. Self-efficacy refers to one's ability to successfully perform the action to prevent the health threat (Janz & Becker, 1984; Rosenstock et al., 1988). The amount of experience in food preparation may explain their confidence as many have been cooking since grade school. A more plausible explanation is that their family knowingly had not become ill from food prepared in their own kitchens as one participant stated, "I haven't gotten anybody sick yet from my cooking". Foodborne illness, originating from home-cooked meals, is under-reported, dismissed as minor, and perceived to occur sporadically and affect only a small group of people (Redmond & Griffith, 2004a,b,c). Consumers do not believe that foodborne outbreaks occur in their home kitchens (Levy, Choiniere, & Fein, 2008; Miles & Scaife, 2003).

Main food preparers were less confident in preventing foodborne illness when consuming food prepared outside the home

Table 3
Themes by Health Belief Model construct and selected individual responses related to food safety from 10 focus groups conducted with primary food preparers (n = 72) in families with young children in the Midwest United States.

Common themes by Health Belief Model construct	Quotes
Perceived susceptibility	
Children/Older Adults	"They just eat what's in front of them. If someone's not looking out for them, they'd probably get sick."
	"I have to make sure that their (children) meat is fully cooked, not like mine."
	"If you're going to eat it, you're the only one. You're not going to feed it to the kids."
	"Now that we have two young kids, we just pretty much eat at home."
Happens To Others	"I've never been sick so to me it's not a big issue."
	"I just haven't experienced it."
	"Personally I don't really ever think about it."
	"You really never know if it's truly food or if it's something else going on with the GI."
Anybody	"If you're not taking the right precautions, anybody can get sick."
	"But,. . ..I think if your healthy you're still going to get sick."
	"Just luck of the draw."
Perceived severity	
Gastrointestinal Discomfort	"Horrendous cramps."
	"You feel like you want to die."
	"It's not like a cold. You can kinda go on with a cold. . .if you get struck with that, you're in the bathroom."
	"I will *never* get sick like that again."
Medical Treatment	"I know some people went to the hospital for that, got sick."
	"He ended up going to the emergency room because of how severe, he got diarrhea, dehydrated."
Perceived benefits	
Safe Practices	"Handwashing."
	"Making sure things are well cooked."
	"Keep things hot or cool."
	"I'm not going to let them (kids) get sick because I didn't want to do it for them."
Avoid Inconvenience	"I'd be home; it would be a curse, definitely."
	"When mom's sick, the house stops."
	"Laundry, just pure laundry of blankets and sheets and changing again and again and then again, it's just work to try to keep on top of it."
Perceived barriers	
Child Care Duties	"I know what I need to do, but when you're exhausted with little ones and you're trying to work, cleanliness is the first thing that goes by the wayside."
	"With the kids and somebody under foot we take short cuts that we shouldn't take."
Time	"We get lazy, we slack, we're rushing, and we don't take the precautions."
Knowledge	"I don't even know what the real temperature should be."
	"We don't really know the rules as far as cooking. When it's done are you supposed to put in the fridge *right* away?"
Self-efficacy	
Confident	"I haven't gotten anybody sick yet from my cooking"
	"I picked up some of that (food safety) when I worked at a hospital in food service."
Food Handling Control	"The only thing you can control is what you have in your own house."
	"You can do everything right, and if it wasn't prepared properly before you got it from the store, you can still get sick."
Leftover Food Safety Concerns	"I've heard on the radio and they've had commercials saying that tips to save energy, to let it (leftovers) cool on the counter. . .not what they were saying before."
	"Like the leftovers in the fridge, how long can you keep those?"
	"How long can they (leftovers) be out after I cook them?"
False Sense of Perceived Confidence	"I just sometimes go by smell or how it looks. . .."
	"I just kinda keep an eye on things. If it doesn't look right, I get rid of it."
	"We don't boil them (eggs) all the way, they are kinda liquid and we put salt on it and we eat it and we have never been sick. . ..we believe that it makes us stronger. . ."
Cues to action	
Quick Easy to Read material	". . .if it's a lot of heavy reading, it's going to be put aside."
Eye Catching Message	"It has to be catching and interesting, not monotone. . .bright colors. . .things that stand out and make you think 'Oh yeah, I've seen that', so you're telling people about it too."
Shocking Message	".. but something sort of gory or sort of scary that maybe shocks"

by others, restaurants, including fast food establishments. "The only thing you can control is what you have in your own house", mirrors findings from other studies that report personal responsibility for food safety is significantly correlated with perception of personal control over food handling (Byrd-Bredbenner et al., 2007; Redmond & Griffith, 2004a,b,c). Additional studies indicate that perceived susceptibility of foodborne illness is higher when food is prepared by others because of the lack of control over the food handling and preparation (Trepka et al., 2006; U.S. Department of Agriculture, 2000). In parallel fashion, a low confidence in preparing food safely was voiced by participants who had personally experienced an illness, or caused a family member to become ill due to their improper handling of food.

A false sense of confidence emerged from the discussions and reflected in incorrect responses on the food safety knowledge survey. Many reported practices and habits that indicated unsafe food handling, including limited hand washing, not using food thermometers and eating cookie dough containing raw eggs. Low self efficacy was found in the proper handling of food leftovers comparable with the report of Wenrich et al. (2003) that only 35% of surveyed adults with low incomes were aware that leftovers should not remain at room temperature to cool before being refrigerated. Seventy percent of the participants correctly answered that even though a food looks and/or smells good, it may still contain unseen bacteria that can cause illness but a few revealed that they determine a food is safe by its appearance or smell" I just sometimes

Table 4
Mixed methods analysis: Side-by-side comparison of qualitative and quantitative results among primary food preparers ($n = 72$) for young children.

Health Belief Model constructs	Focus group results	Knowledge survey results
Perceived susceptibility	42% knew infants were at risk	Wide range of responses
	Lack of personal experience lead to belief they were not susceptible	39% knew children were at risk 76% knew that a child would more likely to become ill from eating undercooked hamburger
Perceived severity	Low severity, gastrointestinal discomfort	86% correctly answered that *E. coli* in undercooked meat could kill you or your child but only 57% correctly identified using a thermometer for testing doneness of hamburger
	If family member experienced foodborne illness and required medical attention, more severe symptoms reported	
Perceived benefits	Identified practices that would avoid foodborne illness (handwashing, use of thermometer)	Correct identification of these practices that avoid foodborne illness; washing hands before food preparation 96%, after changing diaper 89%, after cracking raw eggs 92%. 78% knew that a thermometer was the best way to tell when chicken was done
Perceived barriers	Listed childcare responsibilities at home, time and knowledge	72% knew that look and smell were not an indicator for safe leftovers
	Lack of knowledge for cooking temp/time and leftovers; Barriers outweighed perceived benefits of using safe practices (example: use of thermometer)	61% knew that chili should be refrigerated within 2 h
Self-efficacy	Participants were very confident in ability to prepare food safely for family	Mean score of 73% on knowledge survey; 44% receive a passing score of 75% or higher
	Stated unsafe practices due to barriers Not as confident when preparation was out of their control	
Cues to action	Quick, easy to read Eye catching Shocking message Important messages via word of mouth and family (parent/grandparent) Working in a food-related job as info source	Highest rank was mail; with email as the 2nd choice

go by smell or how it looks", both of which are unreliable indicators of food safety. While the differences in scores was not significant ($p = 0.148$), those having a child one year or younger had lower scores on proper storing of infant formula or breast milk. A survey of women with low incomes found that over 20% leave prepared baby formula or bottled breast milk at room temperature for more than two hours (Trepka et al., 2007). Fein and Falci (1999) reported similar percentages for those who left baby formula at room temperature and those that believed that chicken and meat left out at room temperature is safe to eat. They concluded that the lack of knowledge regarding proper food handling encompasses all foods including infant formula.

The numerous cues identified by the survey and focus group discussions can be addressed with social marketing communication which accommodates this target group's interest in readily accessible information (Fox, 2011). While most participants reported a preference of receiving information via email or television, others reported these media outlets as their least desired choice, similar to other findings (Wenrich et al., 2003). A preference for "something sort of gory or sort of scary that maybe shocks" might increase the audience's interest or reveal the severity of foodborne illness among infants and young children.

Previous research indicates that parents of young children are more likely to change behavior when the change would benefit their children (U. S. Department of Agriculture, 2005) Food safety messages should promote food safety practices as benefiting the health of young children and preventing catastrophic illness or death. Roberts et al. (2008) reported little change in behavior among food service employees even after food safety training suggesting that knowledge is insufficient to change behavior. To promote behavior change, they suggest rational be given to support the need to change. Food safety programs should be designed not only to increase knowledge about food safety, including food leftover handling, but also to emphasize the importance of adopting safe food handling practices. Education for primary food preparers using the Health Belief Model, should increase their perceived susceptibility and severity of foodborne illness, increase the perceived benefits of and reduce barriers to following safe food handling practices, and provide helpful strategies to remain successful at sustaining safe food handling practices.

These findings are limited to the Midwest and qualitative analysis may reflect personal biases of the research team. Administration of the food safety knowledge survey prior to the focus groups may have affected the contents of the discussions. The majority of participants reported experience in food/nutrition which is expected to have a positive impact on knowledge scores. A Spanish translator was not required for the focus group discussion among Hispanic participants but it is unknown if language barriers existed with the written survey.

Conclusions

The increased risk and disproportionate prevalence of foodborne illness among young children requires safe food handling by main food preparers to reduce serious health consequences and associated costs. The use of mixed methods research to measure food safety knowledge and explore perceptions/beliefs of those responsible for food preparation provides a richer in-depth understanding beneficial for targeting food safety education to prevent foodborne illness. Main food preparers for children 10 years and under are concerned for the safety and health of their children but less than half of the participants (44%) received an acceptable score of 75% or greater on the food safety knowledge survey. Their perceived severity of foodborne illness is low and they report a

high level of self efficacy and confidence in their current food handling practices with exception of leftover food handling. However, the numerous unsafe practices reported and knowledge deficits indicate a false sense of confidence. Addressing the concern that primary food preparers have for their child's health, food safety messages that detail the incidence and severity of foodborne illness among children are indicated. Education programs that focus on changing main food preparers' behavior and improving food safety knowledge may use the Health Belief Model for increasing perceived susceptibility and severity of foodborne illness; increasing benefits of safe food handling and reducing barriers to safe food handling practices.

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References

Albrecht, J. (1995). Food safety knowledge and practices of consumers in the USA. *Journal of Consumer Studies in Home Economics, 19*(2), 119–134.

Albrecht, J. A., & Nagy-Nero, D. (2009). Position of the American Dietetic Association. Food and water safety. *Journal of the American Dietetic Association, 109*(8), 1449–1460.

Altekruse, S. F., Street, D. A., Fein, S. B., & Levy, A. S. (1995). Consumer knowledge of foodborne microbial hazards and food-handling practices. *Journal of Food Protection, 59*(3), 287–294.

Altekruse, S. F., Yang, S., Timbo, B. B., & Angulo, F. J. (1999). A multi-state survey of consumer food-handling and food-consumption practices. *American Journal of Preventative Medicine, 16*(3), 216–221.

Anderson, J. B., Shuster, T. A., Hansen, K. E., Levy, A. S., & Volk, A. (2004). A camera's view of consumer food-handling behaviors. *Journal of the American Dietetic Association, 104*(2), 186–191.

Angelillo, I. F., Vigiani, N. M. A., Rizzo, L., & Bianco, A. (2000). Food handlers and foodborne diseases. Knowledge, attitudes, and reported behavior in Italy. *Journal of Food Protection, 63*(3), 381–385.

Boone, K., Penner, K., Gordon, J. C., Remig, V., Harvey, L., & Clark, T. (2005). Common themes of safe food-handling behavior among mature adults. *Food Protection Trends, 35*(10), 706–711.

Brewer, M. S., & Prestat, C. J. (2002). Consumer attitudes toward food safety issues. *Journal of Food Safety, 22*(2), 67–83.

Brewer, M. S., & Rojas, M. (2008). Consumer attitudes toward issues in food safety. *Journal of Food Safety, 28*, 1–22.

Bruhn, C. M., & Schutz, H. G. (1999). Consumer food safety knowledge and practices. *Journal of Food Safety, 19*(1), 73–87.

Buzby, J. C. (2001). Children and microbial foodborne illness. *Food Review, 24*(2), 32–37.

Byrd-Bredbenner, C., Abbot, J. M., & Quick, V. (2010). Food safety knowledge and beliefs of middle school children. Implication for food safety educators. *Journal of Food Science Education, 9*(1), 19–30.

Byrd-Bredbenner, C., Maurer, J., Wheatley, V., Schaffner, D., Bruhn, C., & Blalock, L. (2007). Food safety self-reported behaviors and cognitions of young adults. Results of a national study. *Journal of Food Protection, 70*(8), 1917–1926.

Cates, S. C., Carter-Young, H. L., Conley, S., & O'Brien, B. (2004). Pregnant women and listeriosis. Preferred educational messages and delivery mechanisms. *Journal of Nutrition Education and Behavior, 36*(3), 121–127.

Centers for Disease Control and Prevention (1999). *Scientific and technical information. Simply put*. http://www.cdc.gov/healthcommunication/ToolsTemplates/Simply_Put_082010.pdf. Retrieved 27.01.09.

Creswell, J. W. (2007). *Qualitative inquiry and research design. Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Daniels, R. W., Daniels, B. L., Gilmet, P., & Noonan, D. (2001). Audits international 2000 home food safety study report. *Food Safety Magazine, 7*(1), 37–40.

Dietary Guidelines Advisory Committee (2010). *The Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans*. Washington, DC: Department of Health and Human Services. http://www.cnpp.usda.gov/dgas2010-dgacreport.htm. Retrieved 21.06.12.

Fein, S. B., & Falci, C. D. (1999). Infant formula preparation, handling, and related practices in the United States. *Journal of the American Dietetic Association, 99*, 1234–1240.

Fein, S. B., Lando, A. M., Levy, A. S., Teisl, M. F., & Noblet, C. (2011). Trends in U.S. consumers' safe handling and consumption of food and their risk perceptions, 1988–2010. *Journal of Food Protection, 74*(9), 1513–1523.

Food and Drug Administration (FDA). 2002. Food safety survey: Summary of major trends in food handling practices and consumption of potentially risky foods. http://smas.chemeng.ntua.gr/miram/files/publ_304_11_2_2005.htm. Retrieved. 20.07.09.

Fox, S. (2011). *Accessing Health Topics on the Internet*. http://pewresearch.org/pubs/1875/internet-health-topics-accessing-updated-data. Retrieved 20.03.12.

Fullerton, K. E., Ingram, L. A., Jones, T. F., Anderson, B. J., McCarthy, P. V., Hurd, S., et al. (2007). Sporadic *Campylobacter* infection in infants. A population-based surveillance case-control study. *Pediatric Infectious Disease Journal, 26*(1), 19–24.

Gerba, C. P., Rose, J. B., & Haas, C. N. (1996). Sensitive populations. Who is at the greatest risk? *International Journal of Food Microbiology, 30*(1), 113–123.

Gettings, M. A., & Kiernan, N. E. (2001). Practices and perceptions of food safety among seniors who prepare meals at home. *Journal of Nutrition Education, 33*(3), 148–154.

Haapala, I., & Probart, C. (2004). Food safety knowledge, perceptions, and behaviors among middle school students. *Journal of Nutrition Edcucation and Behavior, 36*, 71–76.

Hanson, J. A., & Benedict, J. A. (2002). Use of the health belief model to examine older adults' food-handling behaviors. *Journal of Nutrition Education and Behavior, 34*(Suppl. 1), S25–S30.

Harris, J. E., Gleason, P. M., Sheean, P. M., Boushey, C., Beto, J. A., & Bruemmer, B. (2009). An introduction to qualitative research for food and nutrition professionals. *Journal American Dietetic Association, 109*(1), 80–90.

InfoUSA, 2012. U.S. consumer lists. http://lp.infousa.com/msn_generic?key=Infousa.Com&bas_offer=01A12&bas_ven dor=078783&utm_source=MSN&utm_medium=PPC&utm_term=inf ousa.com&bas_division=028. Retrieved 20.03.12.

Janz, N. K., & Becker, M. H. (1984). The health belief model. A decade later. *Health Education Quarterly, 11*(1), 1–47.

Johnson, A. E., Donkin, A. J., Morgan, K., Lilley, J. M., Neale, R. J., Page, R. M., et al. (1998). Food safety knowledge and practice among elderly people living at home. *Journal of Epidemiology and Community Health, 52*(11), 745–748.

Jones, T. F., Ingram, L. A., Fullerton, K. E., et al. (2006). A case-control study of the epidemiology of sporadic *Salmonella* infection in infants. *Pediatrics, 118*(6), 2380–2387.

Kennedy, J., Jackson, V., Cowan, C., Blair, I., McDowell, D., & Bolton, D. (2005). Consumer food safety knowledge. Segmentation of Irish home food preparers based on food safety knowledge and practice. *British Food Journal, 107*(7), 441–452.

Krueger, R. A. (1990). *Focus groups. A practical guide for applied research*. Thousand Oaks, CA: Sage Publications Inc.

Kwon, J., Wilson, A. N., Bednar, C., & Kennon, L. (2008). Food safety knowledge and behaviors of women, infant, and children (WIC) program participants in the United States. *Journal of Food Protection, 71*(8), 1651–1658.

Levy, A. S., Choiniere, C. J., & Fein, S. B. (2008). Practice-specific risk perceptions and self-reported food safety practices. *Risk Analysis, 28*(3), 749–761.

Li-Cohen, A. E., & Bruhn, C. M. (2002). Safety of consumer handling of fresh produce from the time of purchase to the plate. A comprehensive consumer survey. *Journal of Food Protection, 65*(8), 1287–1296.

Lin, C.-T. J., Jensen, K. L., & Yen, S. T. (2005). Awareness of foodborne pathogens among US consumers. *Food Quality and Preference, 16*(5), 401–412.

Medeiros, L. C., Hillers, V. N., Chen, G., Bergmann, V., Kendall, P., & Schroeder, M. (2004). Design and development of food safety knowledge and attitude scales for consumer food safety education. *Journal of the American Dietetic Association, 104*, 1671–1677.

Miles, S., & Scaife, V. (2003). Optimistic bias and food. *Nutrition Research Review, 16*(1), 3–19.

National Cancer Institute (2005). *Theory at a Glance. A guide for health promotion practice* (2nd ed.). http://www.cancer.gov/cancertopics/cancerlibrary/theory.pdf. Retrieved 20.03.12.

Patil, S. R., Morales, R., Cates, S., Anderson, D., & Kendall, D. (2004). An application of meta-analysis in food safety consumer research to evaluate consumer behaviors and practices. *Journal of Food Protection, 67*(11), 2587–2595.

Pew Health Group. Children and Foodborne Illness. (2009). http://www.pewtrusts.org/news_room_detail.aspx?id=56074. Retrieved 20.03.12.

Raab, C. A., & Woodburn, M. J. (1997). Changing risk perceptions and food-handling practices of Oregon household food preparers. *Journal of Consumer Studies and Home Economics, 21*(2), 117–130.

Readability Formulas (1996). http://www.readabilityformulas.com/free-readability-formula-tests.php. Retrieved 27.01.09.

Redmond, E. C., & Griffith, C. J. (2003). Consumer food handling in the home. A review of food safety studies. *Journal of Food Protection, 66*(1), 130–161.

Redmond, E. C., & Griffith, C. J. (2004a). Consumer attitudes and perceptions towards microbial food safety in the domestic kitchen. *Journal of Food Safety, 24*(3), 169–194.

Redmond, E. C., & Griffith, C. J. (2004b). Consumer perceptions of food safety risk, control and responsibility. *Appetite, 43*(3), 309–313.

Redmond, E. C., & Griffith, C. J. (2004c). Microbiological and observational analysis of cross contamination risks during domestic food preparation. *British Food Journal, 106*(8), 581–597.

Roberts, K. R., Barrett, B. B., Howells, A. D., Shanklin, C. W., Pilling, V. K., & Brannon, L. A. (2008). Food safety training and foodservice employees' knowledge and behavior. *Food Protection Trends, 28*(4), 252–260.

Roseman, M., & Kurzynske, J. (2006). Food safety perceptions and behaviors of Kentucky consumers. *Journal of Food Protection, 69*(6), 1412–1421.

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief Model. *Health Education Quarterly, 15*(2), 175–183.

Schafer, R. B., Schafer, E., Bultena, G. L., & Hoiberg, E. O. (1993). Food safety. An application of the health belief model. *Journal of Nutrition Education, 25*(1), 17–24.
Statistical Package for Social Sciences, SPSS Version 17.0 (2008).
Trepka, M. J., Murunga, V., Cherry, S., Huffman, F. G., & Dixon, Z. (2006). Food safgety beliefs and barriers to safe food handling among WIC program clients, Miami, Florida. *Journal of Nutrition Education and Behavior, 38*, 371–377.
Trepka, M. J., Newman, F. L., Dixon, Z., & Huffman, F. G. (2007). Food safety practices among pregnant women and mothers in the women, infants, and children program, Miami, Florida. *Journal of Food Protection, 70*(5), 1230–1237.
U.S. Census Bureau (2007). *Metropolitan and micropolitan statistical areas wall maps*. http://www.census.gov/geo/www/maps/msa_maps2007/us_wall_1107.html. Retrieved 20.03.12.
U.S. Department of Agriculture (2000). *PR/HACCP rule evaluation report. Focus group study on food safety messages and delivery mechanisms*. http://www.fsis.usda.gov/OA/research/fsmessages.pdf. Retrieved 20.03.12.
U.S. Department of Agriculture Food Safety and Inspection Service (2005). *A report of the "Is It Done Yet?" social marketing campaign to promote the use of food thermometers*. http://www.fsis.usda.gov/PDF/IsItDoneYet_Campaign_Report_120105.pdf. Retrieved 10.06.12.
U.S. Department of Agriculture website for the Partnership for Food Safety Education (PFSE) (2010). http://www.fightbac.org and http://www.foodsafety.gov. Accessed 2.12.11.
Unklesbay, N., Sneed, J., & Toma, R. (1998). College students' attitudes, practices, and knowledge of food safety. *Journal of Food Protection, 61*(9), 1175–1180.
Wenrich, T., Cason, K. L., Nan, L. V., & Kassab, C. (2003). Food safety knowledge and practices of low income adults in Pennsylvania. *Food Protection Trends, 23*(4), 326–335.

Further reading

Centers for Disease Control and Prevention. *Foodborne illness. Frequently asked questions*. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/files/foodborne_illness_FAQ.pdf. Retrieved 20.03.12 .
Partnership for Food Safety Education. FightBAC!™. http://www.fightbac.org/. Retrieved 25.03.12.