Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Consumer risk perception and trusted sources of food safety information during the COVID-19 pandemic

Merlyn S. Thomas, Yaohua Feng *

Department of Food Science, Purdue University, West Lafayette, IN, 47906, USA

ABSTRACT

Risk perceptions and trusted sources of information may have influenced consumer food handling practices during the COVID-19 pandemic. This study used a mixed-method qualitative-quantitative approach to assess consumer risk perception and trusted sources of food safety information during the pandemic. From April to August of 2020, five waves of online surveys (N = 3,584, with a minimum of 700 per month) were distributed to a U.S. consumer panel, which included only primary food preparers and grocery shoppers. The online focus groups recruited participants (N = 43) from the first wave of survey respondents and were conducted via Webex from May to July 2020. Topics covered in both studies focused on food safety risk perceptions and trusted sources of information during the pandemic. Trusted sources of information included government agencies, healthcare professionals, scientists, and social media. Throughout the longitudinal study, survey respondents and focus group participants perceived a higher risk of getting COVID-19 from people than from food. Survey respondents believed that handwashing could protect them more from COVID-19 than from foodborne illnesses. Many focus group participants practiced handwashing to prevent them from contracting COVID-19 from food items. Both survey respondents and focus group participants trusted the U.S. Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), and healthcare professionals for COVID-19 and food safety information. Focus group participants trusted these entities because they provide information that is "scientifically proven." Survey data for all five months reported social media to be the least-trusted source of both COVID-19 and food safety information. Focus group participants agreed that social media has "misinformation." The findings suggest that increased risk perception may have caused consumers to adopt good hand hygiene. However, consumers may not be connecting such practices to food safety. Food safety educators can use this time of heightened risk perception to connect COVID-19 and food safety practices. Trusted entities of information also need to be aware of their impact on consumer behavior and provide consumers with proper food safety information.

1. Introduction

Government officials and healthcare experts have advised the public to use best practices to reduce the spread of COVID-19. These recommendations include advising people to wash their hands for 20 s, wear face masks over their mouth and nose, disinfect their home, avoid touching their face, avoid close contact with other people, and limit time outside the home (Centers for Disease Control and Prevention, 2020b; World Health Organization, 2020a). Given these changes in daily life, it is not surprising that consumers also have changed the way they think about food and food safety (Fanelli, 2021; Thomas et al., 2021). The International Food Information Council (IFIC) reported in the 2020 Food and Health Survey that COVID-19 was the top food-safety issue for food handling and preparation in the United States (International Food Information Council, 2020). According to the report, almost half of consumers were concerned about food prepared outside the home, and 30% had concerns about at-home meal preparation (International Food Information Council, 2020). Although the virus has not been declared a foodborne pathogen, the public is still concerned about the virus surviving on raw foods of animal origin (Pressman et al., 2020; World Health Organization, 2020b).

Risk perception is a significant determinant of behavior change; behavior models confirm that peoples’ level of risk perception can lead to certain behaviors in health-related situations (Ye et al., 2020). Risk
modeling includes three elements: the attitude of the person, risk sensitivity, and personal fear (Sjöberg, 2000). Depending on the presence of these three elements, a person’s risk perception can drive behavioral change. Many of the behavior changes in response to COVID-19 may be due to changes in consumer risk perception during the pandemic (Loxton et al., 2020; Yuen et al., 2020). In addition to concerns about the virus surviving on food and surfaces, fear of contracting the highly contagious SARS-CoV-2 virus may cause consumers to take extra precautions beyond official recommendations (Centers for Disease Control and Prevention, 2020a).

Another potential factor driving consumer changes in food handling practices is information sources, whether they be government agencies, healthcare professionals, scientists, or social media. The level of trust can play a role in whether a consumer follows the advice of certain sources or entities (Balog-Way & McComas, 2020). The IFIC’s 2018 food and health survey reported that consumers considered healthcare professionals, such as registered dietitians, to be the most trusted source of food information (76% for older adults ages 65+, and 65% for younger adults), and some (38%) trusted government agencies, including the U. S. Department of Agriculture (USDA), U.S. Environmental Protection Agency (EPA), Centers for Disease Control (CDC), and the U.S. Food and Drug Administration (FDA), for nutritional information (International Food Information Council Foundation, 2018). A past study (Rolison & Hanoch, 2015) on the knowledge and risk perception of the Ebola virus in the United States reported that most respondents had the greatest trust in the Internet as a source of information, followed by the government, and then the media. Consumers’ level of trust during a health crisis may influence whether they adopt certain recommended food safety behaviors.

Some researchers have used a qualitative-quantitative mixed-methods approach to assess consumer food safety knowledge and risk perceptions by combining survey data and data from interviews or focus groups (Meyenburg et al., 2014; Parra et al., 2014). A mixed-method approach can increase the confidence in the results, and address some of the shortcomings of using either quantitative or qualitative methods (Hurmerinta-Peltohämälä & Nummela, 2006; McKim, 2017). This present study utilizes both focus group discussion and survey data to obtain a more in-depth analysis of consumer food safety perceptions during the COVID-19 pandemic.

The objective of this study was to explore factors influencing change in food handling practices during a pandemic. These factors include risk perceptions and trusted sources of food safety information during the COVID-19 pandemic.

2. Materials and methods

Before data collection began, the Institutional Review Board at Purdue University (IRB # 2020–558) approved a research protocol. The study contains two parts: a survey study and a focus group study. The survey was pilot-tested among 26 consumers for face validity. A Cronbach alpha test was conducted on the pilot test to assess internal consistency of the different scales within the survey; the alpha ranged from 0.65 to 0.91 (Pallant, 2010). The focus group script was also pilot-tested to obtain feedback and make minor revisions to questions. The pilot test consisted of six sessions with an average of four participants per session. The pilot tests allowed researchers to create probing questions on certain topics, designed to evoke further thoughts from participants (Krueger, 2014).

2.1. Study participants

For the survey study, respondents were recruited each month (April to August) through an online consumer panel of Qualtrics XM, an external online survey company. For each month, Qualtrics provided the researchers with at least 700 completed surveys (de Zwart et al., 2010). Although the respondents may not have been the same month to month, Qualtrics guaranteed that they were from the same pool of consumers. The survey was sent to participants in the United States through the respondents’ panel portal or via email invitation. Qualtrics and researchers worked together to ensure that those who completed the survey received an incentive of $5 (U.S).

Focus group participants were recruited from the survey respondents during the first wave of the survey in April 2020. Volunteers for the focus groups initially were split into three groups based on the number of COVID-19 cases (by April 27, 2020) in their resident state: low, medium, or high (Supplemental Table 1; Johns Hopkins Coronavirus Resource Center, 2020). After categorizing participants based on the number of cases in their state (low, medium, or high), a convenience sample recruited up to 12 participants for each group. However, a low participation rate from low- and medium-incidence states caused researchers to combine these groups to create low–medium groups (Thomas & Feng, 2021). This paper refers to high groups as “H” and low-medium groups as “LM.” All survey respondents and focus group participants had to pass the inclusion criteria: Primary grocery shopper and meal preparer of the household, and adults who were 18 years and older.

2.2. Study procedures

In order to assess changes in food safety behaviors and risk perceptions, the survey was distributed for a total of five waves. Surveys were distributed to the same pool of consumers once a month from April 2020 to August 2020. Previous studies related to past pandemics or food safety provided the basis for designing the current study’s survey questions (Bangarter et al., 2012; Barrett & Feng, 2021; de Zwart et al., 2010). The first survey in April 2020 had 47 questions in total; three of these questions were used to recruit participants for the focus group study. The remaining four surveys contained only 44 questions because the researchers were no longer recruiting for the focus group study.

Two questions contained an option, “If you are paying attention, please do not select this option,” to detect respondents’ level of disengagement. These instructional manipulation checks (IMCs) can be useful, because previous studies show that some respondents did not pay attention when filling out questions for online surveys (Feng & Archila, 2020; Oppenheimer et al., 2009; Thomas & Feng, 2020). IMCs can improve study quality by providing additional screening mechanisms to ensure participant attention.

Survey questions focused on topics about food safety and the COVID-19 pandemic. Questions about food safety included respondents’ risk perceptions of food safety, their general concerns about food safety, and their level of confidence in their food safety measures. Further questions about food safety were asked regarding COVID-19. These questions included respondents’ risk perceptions of getting COVID-19 from other people versus from food. Respondents who reported that they ordered takeout food from restaurants were asked about their risk perception of getting COVID-19 from takeout food and packaging. Respondents also were asked to rate (on a scale of 1–100) how much they believed handwashing could protect them from COVID-19, and to what degree does handwashing afford protection from foodborne illnesses. Additional survey questions related to food safety and COVID-19 information inquired about respondents’ sources of trusted information during the pandemic. These sources were the U.S. Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), social media influencers; TV show hosts, family and friends, and health professionals. All the questions can be found in Appendix A of the supplemental material.

Similar to the survey study, the online longitudinal focus group method was used to assess changes in perception, attitudes, and practices of people in the United States concerning food safety and the COVID-19 pandemic. Due to COVID-19 pandemic restrictions and participants’ locations, this study used the Webex video-calling service, 2020 version 40.2.14.19 from Cisco, San Jose, California, USA.
The focus group script contained 11 questions related to COVID-19 and was separated into three sections: preventive measures, food safety concerns, and food safety information. The first section assessed current safety measures that participants were taking to protect themselves from COVID-19. Participants also were asked if these preventive measures were effective in protecting them from COVID-19. The second section focused on food safety concerns, food safety practices, food purchasing habits, and participants’ plans for continuing those preventive practices once the pandemic was over. The third section addressed the quantity and quality of food safety information that participants received during the pandemic, trusted sources of food safety information, and preferred delivery formats to communicate food safety information during the pandemic. When asked about trusted sources of information, participants chose from the following list: government agencies, websites, TV news, social media, family and friends, and healthcare professionals. In order to assess changes during the three-month study, similar questions were asked with some minor changes to assess differences between the months. During the third month of focus group discussions, an additional question was whether participants had been cautious or aware of foodborne illness before the COVID-19 pandemic. This allowed researchers to acquire a baseline of pre-pandemic attitudes toward foodborne illnesses.

2.3. Data analysis

Survey data were analyzed using SPSS Statistics version 26 (Armonk, NY: IBM Corp) for descriptive data, data within each month, and longitudinal data between each month. A McNemar test was used to analyze differences in categorical data. This test assessed the significance of trusting sources for food safety information versus trusting the same sources for COVID-19 information (Adedokun & Burgess, 2012; Laerd Statistics, 2015a). A paired sample t-test was conducted to analyze any significant differences between the perception of food safety and COVID-19 for each month (Laerd Statistics, 2015b; Xu et al., 2017). One-way ANOVA (analysis of variance) was used to determine whether a significant difference emerged between food safety and COVID-19 risk perceptions of respondents across all five months (Laerd Statistics, 2017). One-way ANOVA was also used to inquire whether social determinants, including gender, income, ethnicity, age, education, and health condition affected risk perceptions (Centers for Disease Control and Prevention, 2019). Statistical significance was determined at a p-value < 0.05.

The focus group sessions were analyzed using the transcripts from each recorded session. One person transcribed the recordings word for word, while a different person checked the transcripts for accuracy. Researchers used NVivo version 12 (QSR International, Burlington, Massachusetts, USA) to code and analyze the transcripts. One researcher developed an initial codebook by reviewing and coding all the transcripts from the first-month sessions (May 2020). Both inductive and deductive approaches with different types of coding methods were used to develop the codebook (Braun & Clarke, 2006; Saldana, 2015; Thomas, 2006). A deductive approach coded participants’ responses to the questions asked during focus group sessions. Meanwhile, an inductive approach coded notable responses and allowed themes to emerge directly from the data (Fereday & Muir-Cochrane, 2006). The coding methods included attribute, descriptive, emotion, and process coding (Saldana, 2015). In order to minimize bias in codebook development, a separate researcher evaluated the codebook and used it to independently code two transcripts from the first month. The same two researchers discussed any disagreements in coded data and made changes to the codebook. The researchers anticipated creating additional codes after the first-month codes due to the longitudinal nature of the study. They developed additional codes after focus group sessions when the moderator and co-moderator discussed the highlights and interesting points of each discussion. To allow for these additional codes to be added to the book, researchers continued codebook development throughout the three months. They added six codes in total after the initial codebook was developed. With the consensus of the two researchers, they developed the final codebook (Supplemental Table 2), containing the codes, the definitions of each code, the coding method, and an example directly from the transcriptions. The first researcher used this final codebook to code the remainder of the sessions, while the second researcher checked the coded data for accuracy. Similar to the initial coding process, researchers developed categories and themes using inductive and deductive approaches, which allowed for the discovery of new themes and for addressing the focus group questions (Supplemental Table 3; Yang et al., 2019).

3. Results

3.1. Demographics of survey respondents and focus group participants

More than 700 respondents completed the survey each month (April to August 2020), amounting to a total of 3584 respondents (Table 1). The demographic results (gender, age, ethnicity, income, and education) were consistent throughout the five months because the survey was designed to match the U.S. population (United States Census Bureau, 2010). Most respondents reported having over five years of experience in meal preparation (Table 1). Across all five months, respondents took an average of 12 min to finish the survey.

Table 2 displays the demographic details of focus group participants (Thomas & Feng, 2021). A little over half (56%) were female, and 26% were 45–54 years of age. Most (81%) identified as White (non-Hispanic). The demographics for the survey were similar to these findings. After analysis, no notable difference in responses were found between high-incidence states and low-incidence states (COVID-19 cases). The lack of difference may be due to the varied number of cases within regions of the same state and the characteristics of the participants who volunteered for the focus group discussions. All focus group sessions lasted a maximum of 1.5 h.

3.2. Perceptions of the most likely source of contracting COVID-19

Throughout all five months, survey respondents perceived a significantly higher risk of contracting COVID-19 from people rather than from food (Supplemental Table 4). Respondents perceived a medium risk (51.11–54.68) of contracting COVID-19 from people, and a less-than-medium risk (27.56–31.38) of contracting it from food. Throughout the focus group sessions, some people expressed similar views: they felt that they were more likely to contract the virus from other people than from food. This was especially apparent in July, when they had not heard of anyone becoming infected with COVID-19 from food: “I haven’t heard much about people getting it from food, so as long as I’m taking care of it the way that I have been, you know washing and making sure I’m cooking things as thoroughly as I usually do … I don’t really feel like I’m too worried about that” (female, 25–34, H3).

This study also assessed consumers’ perceived risk of takeout foods from restaurants. The survey study reported less-than-medium perceived risk (mean < 50) for takeout food (Supplemental Table 5). For takeout food overall and hot takeout foods, the survey reported a significant decrease in risk perceptions from April to May, but an increase from May to June. For food packaging, the survey reported a significant decrease from April to May, and then a significantly lower
Table 1
Survey demographics from April to August.

| Characteristics | April, N = 703 | May, N = 732 | June, N = 707 | July, N = 716 | August, N = 726 |
|-----------------|---------------|--------------|--------------|--------------|---------------|
| Gender          |               |              |              |              |               |
| Male            | 51 (76)       | 49 (73)      | 53 (75)      | 52 (74)      | 50 (73)       |
| Female          | 49 (73)       | 51 (76)      | 53 (75)      | 52 (74)      | 50 (73)       |
| Age             |               |              |              |              |               |
| 18–24           | 12 (16)       | 13 (18)      | 13 (18)      | 13 (18)      | 13 (19)       |
| 25–34           | 18 (25)       | 19 (26)      | 18 (25)      | 18 (25)      | 18 (25)       |
| 35–44           | 15 (21)       | 17 (23)      | 17 (23)      | 17 (23)      | 17 (23)       |
| 45–54           | 19 (27)       | 15 (21)      | 15 (21)      | 17 (22)      | 17 (22)       |
| 55–64           | 17 (24)       | 16 (22)      | 16 (22)      | 17 (23)      | 17 (23)       |
| 65 and above    | 19 (27)       | 20 (27)      | 20 (27)      | 19 (27)      | 19 (27)       |
| Ethnicity       |               |              |              |              |               |
| White (non-Hispanic) | 81 (79)  | 76 (79)  | 76 (79)  | 81 (79)  | 78 (79)  |
| Hispanic        | 6 (7)        | 8 (7)       | 6 (7)       | 5 (5)       | 5 (5)       |
| Black or African American | 8 (3)  | 8 (3)  | 6 (3)  | 5 (3)  | 5 (3)  |
| Asian or Pacific Islander | 5 (7) | 5 (7) | 5 (7) | 5 (7) | 5 (7) |
| Other           | 1 (1)        | 1 (1)       | 1 (1)       | 1 (1)       | 1 (1)       |
| Native American | 0 (1)        | 0 (1)       | 0 (1)       | 1 (1)       | 1 (1)       |
| Income          |               |              |              |              |               |
| Less than $10,000 | 6 (9)   | 6 (9)   | 6 (9)   | 5 (5)   | 6 (6)   |
| $10,000–$29,999 | 21 (30)  | 22 (30)  | 22 (30)  | 21 (30)  | 21 (30)  |
| $30,000–$49,999 | 19 (27)  | 19 (27)  | 19 (27)  | 18 (27)  | 18 (27)  |
| $50,000–$79,999 | 23 (33)  | 24 (34)  | 24 (34)  | 23 (33)  | 23 (33)  |
| $80,000 and above| 28 (40) | 28 (40) | 27 (39) | 27 (39) | 27 (39) |
| Prefer not to answer | 3 (5)  | 3 (5)  | 2 (3)  | 2 (3)  | 2 (3)  |
| Education       |               |              |              |              |               |
| Not High School Graduate | 2 (4) | 2 (4) | 1 (1) | 3 (4) | 4 (6) |
| High School or GED Degree | 38 (55) | 41 (55) | 40 (55) | 41 (55) | 42 (55) |
| Bachelor’s Degree | 39 (59) | 39 (59) | 39 (59) | 39 (59) | 39 (59) |
| Graduate Degree | 19 (27) | 17 (24) | 18 (24) | 19 (27) | 20 (27) |
| Experience in preparing meals |        |              |              |              |               |
| Less than 1 year | 1 (2)   | 1 (2)   | 1 (2)   | 1 (2)   | 1 (2)   |
| 1–3 years       | 8 (13)      | 7 (12)     | 9 (15)     | 9 (16)     | 9 (16)     |
| 3–5 years       | 9 (16)      | 8 (16)     | 8 (16)     | 7 (13)     | 8 (15)     |
| Over 5 years    | 82 (120)    | 82 (120)   | 82 (120)   | 82 (120)   | 82 (120)   |
| Total people in the household | 280 | 280 | 280 | 280 | 280 |

Table 2
Overview of demographics for all focus group members, N = 43.

| LM^3 (n = 10) | H1^1 (n = 8) | H2^2 (n = 10) | H3^3 (n = 9) | H4^4 (n = 6) | Total |
|---------------|-------------|--------------|--------------|--------------|-------|
| Age           |             |              |              |              |       |
| 18–24         | 2 (3)       | 0 (0)        | 0 (0)        | 1 (0)        | 6     |
| 25–34         | 2 (3)       | 0 (0)        | 0 (0)        | 0 (0)        | 7     |
| 35–44         | 2 (3)       | 1 (0)        | 0 (0)        | 0 (0)        | 3     |
| 45–54         | 1 (2)       | 4 (1)        | 2 (3)        | 3 (1)        | 11    |
| 55–64         | 2 (3)       | 1 (0)        | 3 (1)        | 1 (0)        | 8     |
| 65+           | 1 (2)       | 2 (0)        | 3 (0)        | 2 (0)        | 8     |
| Ethnicity     |             |              |              |              |       |
| White/non-Hispanic | 9 (21) | 7 (17) | 8 (20) | 8 (20) | 35    |
| Black or African American | 0 (1) | 1 (0) | 0 (0) | 0 (0) | 2     |
| Asian or Pacific Islander | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1     |
| Gender        |             |              |              |              |       |
| Male          | 5 (12)      | 4 (10)       | 5 (12)       | 5 (12)       | 19    |
| Female        | 5 (12)      | 4 (10)       | 8 (20)       | 4 (10)       | 24    |

a LM Represents the focus group with participants from low-medium states for COVID-19 cases in April 27, 2020 (under 10,000).

b H Represents the focus groups (1–4) with participants from the high states for COVID-19 cases in April 27, 2020 (over 10,000 cases).

The effect of social determinants on risk perceptions was analyzed only for the survey study (Supplemental Tables 6A–E). When analyzing the social determinants of risk perceptions of getting COVID-19 from food, ethnicity and age had a significant impact in each of the five months. Those who were not White (non-Hispanic) and younger adults (<55 years old) had a significantly higher perception of risk for contracting COVID-19 through food. Furthermore, gender, education, household health conditions, and income had a significant impact in three or fewer of the months. For the significant values, males, respondents with higher education levels (bachelor’s degree), those who did not have any at-risk individuals in the household, and those who made a lower income (<$50,000 annually) perceived a higher risk of disease.
contracting COVID-19 through food.

When analyzing the social determinants of risk perceptions of getting COVID-19 from people, income, age, and household health conditions had an impact in one of the months. Gender did not have a significant impact in any of the five months (Supplemental Tables 6A–E). Respondents who had a higher income (> $50,000 annually), higher education levels (≥ bachelor’s degree), were not White (non-Hispanic), younger adults (< 55 years old), and those who had at least one at-risk individual in the household, perceived a significantly higher risk of contracting COVID-19 from other people than from food.

3.3. Handwashing and risk perceptions

Survey respondents had a significantly higher perception that handwashing protects them from COVID-19, compared to protecting them against foodborne illness (Supplemental Table 7). In high and low-medium (H and LM) groups throughout the three months, many focus group participants included handwashing as a practice to avoid getting COVID-19 from other people and from food. In May, one participant noted: “[I] wash my hands at least five times a day so. I feel like I’m doing my part; it’s up to everybody else to do theirs” (male, 25–35, H3).

The COVID-19 pandemic caused most participants to become more aware of handwashing, as one respondent expressed: “We don’t really wipe things down when they come into the house or anything, but we have been pretty hyper-aware about washing our hands, doing hand sanitizer … before doing anything with food and everything” (female, 18–24, LM, July).

However, one focus group participant in July did not directly connect handwashing with food safety, even though he engaged in the practice: “I don’t know if it’s related to food or what, [but] when I come from the supermarket or having packages, I’ll wash my hands before I do anything else. I put the food away and then I wash my hands” (male, 65+, H2).

The social determinants of beliefs of handwashing effectiveness on COVID-19 and foodborne illness were analyzed using the survey data (Supplemental Tables 6A–E). For handwashing effectiveness on COVID-19, age had a significant impact in four out the five months, while gender had an impact on two. The ethnicity, education, and health condition of people in the household all had an impact in one of the months. For significant values, respondents who were older (> 55 years old), female, non-White (non-Hispanic), with higher education levels (≥ bachelor’s degree), and with at least one at-risk individual in their household had a higher level of belief that handwashing protects against COVID-19. For handwashing effectiveness on foodborne illness, education showed an impact in only two of the months. In July, respondents with lower education levels (≤ bachelor’s degree) had a significantly higher level of belief that handwashing would protect them from foodborne illness. However, those with higher education levels (> bachelor’s degree) had a higher level of belief in August that handwashing would protect them.

Fig. 1. Trusted sources of food safety information (■) and COVID-19 information (▲) from April to August 2020.
3.4. Trusted sources of information

Survey respondents trusted different sources for COVID-19 and food safety information (Fig. 1). Throughout the five months, respondents trusted the FDA significantly more for food safety information than for COVID-19 information. Similarly, the FDA was also the most trusted source of food safety when compared to other sources; healthcare professionals came in second. However, respondents trusted the CDC, World Health Organization (WHO), and healthcare professionals significantly more for COVID-19 information than for food safety information. When asked “Who do you trust to give you food safety information during COVID-19,” many focus group participants throughout all three months mentioned government agencies, healthcare professionals, and scientists. Many connected scientists to the government since “most of them are working for government agencies” (female, 45–54, H1, July). A major theme for these choices was that these were credible sources that were backed by science: “Microbiologists understand microbes. We know, you know, it has an effect on this virus. They’re saying a lot of things that are scientifically proven, and all those things are safety things” (male, 55–64, LM, May).

Although most leaned toward trusting the government, a few focus group participants mentioned they were wary of trusting the government, because they may have political motives, personal agendas, they provided contradictory information, or because they lacked information. Throughout the three months, most focus group participants said they did not receive any food safety information from any source during the pandemic, other than the idea that the virus might be on packaging, or news about people using bleach to kill the virus: “I haven’t heard at all since last month. Food safety … the only thing I heard was that 30 percent of all Americans using bleach as a disinfectant are actually using it on food” (male, 45–54, H1, July). Some even mentioned that the government could have disseminated this information earlier: “The CDC, I won’t say they dropped the ball, but they haven’t mentioned anything about food safety and they did send a postcard to all 330 million Americans … which was basically printed guidelines, basically handle sanitation and very basic things. No food safety was mentioned, just basically washing your hands” (male, 45–54, H1, May).

Some focus group participants even expressed a lack of trust in anyone as a source of information. One participant mentioned that he did not know who to trust because of contradictory information received, offering the example of how CDC reversed its decision on masks: “[T]he CDC first said don’t wear a mask. It won’t help. And, of course, that’s reversed. Just kind of knowing that kind of a thing in other countries has been [practiced] for a long time. You question that a little bit too … it’s like, well, who can you really trust at all?” (male, 25–34, LM, May). Another participant mentioned trusting her instincts with food safety: “The CDC contradicts itself, WHO contradicts itself. Nobody really knows right now; you just kind of have to go with your gut instinct” (female, 45–54, H4, July). Although more people expressed this concern in May, a few participants were still questioning who to trust in June and July.

As seen in Fig. 1, social media was the least-trusted source of both types of information throughout the five-month survey study. Focus group participants shared similar sentiments during the three-month study. Participants agreed that social media spreads “misinformation.” Some mentioned inconsistencies on social media platforms: “I didn’t do social media because I can listen to one network and they’ll tell me one thing, and then flip over to another network and its completely different, so, I don’t believe them” (female, 65–, LM, June). However, some mentioned they would trust social media, but only if the information was verified scientifically: “So, I think social media is just, like I said, a grain of salt. Sometimes if I see that it is from [a] health professional, I can back that up by Googling that name [and think] okay, this is something to take serious. Otherwise it’s just this clickbait, or just weird stuff” (male, 35–44, LM, May).

Relatively, when asked which platform would be the best for disseminating food safety information, some focus group participants throughout the three months of discussions mentioned that use of social media is a good way to “get the word out” or to “advertise”: “Even if a credible source was presented on Facebook or social media, that wouldn’t necessarily be a bad thing because I have seen some things from the CDC on social media and, of course, I checked their website and there it was. … I think we’re all responsible enough to know that just blindly believing isn’t a good idea” (female, 55–65, H2, July).

4. Discussion

4.1. Risk perceptions and behavior change

The COVID-19 pandemic has caused behavior and lifestyle changes in many consumers, including the addition of stress-coping mechanisms and preventive practices (Mason et al., 2020; Thomas & Feng, 2021). A recent study by Yuen et al. (2020) on panic-buying during a health crisis concluded that consumers with a high-risk perception of contracting a disease were more likely determined to partake in activities to protect themselves in LM to lower those risks. Likewise, some of these changes in preventive practices may be due to increased risk perceptions of contracting COVID-19 due to the highly contagious nature of the virus (Centers for Disease Control and Prevention, 2020a; Thomas & Feng, 2021). The present study reported that survey respondents and focus group participants were more concerned about contracting COVID-19 from other people rather than from food, perhaps because SARS-CoV-2 has not been declared a foodborne pathogen (Desai & Aronoff, 2020; Olaimat et al., 2020). However, this study still reported some perceived risks of contracting the virus through food. This perception about risk may be due to news reports in June 2020 about food becoming contaminated with SARS-CoV-2, which was then contracted by those who handled the food (BBC News, 2020; Pang et al., 2020). This change in risk perception may have prompted consumers to adopt not only good-food-handling practices but also poor ones, such as washing fruits and vegetables with soap (Thomas & Feng, 2021). Food safety educators need to be aware of increased risk perceptions during a time of health crisis to help consumers adopt good food-handling behaviors and to continue them even after the health crisis.

A significant behavior change during the COVID-19 pandemic was an increase in consumer handwashing practices (Thomas & Feng, 2021). Consumers may have increased their frequency of hand washing in response to the persistent recommendations of government agencies as a means to prevent the spread of COVID-19 (Centers for Disease Control and Prevention, 2020b; U.S. Food and Drug Administration, 2020; World Health Organization, 2020a). However, this study reports a possible disconnect between handwashing and food safety, evident in the responses of survey participants who reported believing that handwashing protects them from contracting COVID-19 more so than protecting from foodborne illnesses. This perception may cause consumers to stop washing hands after the pandemic, as the threat of COVID-19 decreases. Based on health belief models and behavioral change, there is a strong correlation between risk perception and behaviors (Sulat et al., 2018). This may cause consumers to drop this behavior after the pandemic, a possibility confirmed by consumers’ self-reports of anticipated reductions in their hand hygiene practices after the COVID-19 pandemic (Thomas & Feng, 2021). Handwashing is an essential food safety behavior, and discontinuing this behavior may cause an increase in foodborne illnesses (Centers for Disease Control and Prevention, 2016).

4.2. Social determinants of risk perceptions and behavior

Because social determinants also may influence overall risk perceptions, they can be valuable in deciding which groups need food safety materials (Centers for Disease Control and Prevention, 2019). This study analyzed social determinants using survey data, and found that only
some were notably significant. In this study, males perceived a greater risk of contracting COVID-19 from food. A previous study that assessed consumer pet-food safety found that males are more likely than females to perceive that children are at risk of becoming ill from handling pet food (Thomas & Feng, 2020). Males’ higher risk perceptions in food handling situations may be due to lack of confidence and knowledge about food preparation (Schaeffer, 2019; Taillie, 2018). However, female respondents had a greater belief that handwashing would protect from COVID-19. This may indicate that although males have a higher risk perception, they may not be following proper guidelines to prevent becoming ill with COVID-19. This may indicate that males, as a group, are not taking preventive health measures to avoid other diseases, including foodborne illness. Previously, men have been found to take part in risky behaviors, which may ultimately lead to lower life expectancies, compared to women (Baker et al., 2014).

This study revealed that age also had an impact on risk perception and behavior. For all months, younger adults (≤55 years of age) perceived a greater risk of contracting COVID-19 from food than did older adults. This contrasts with previous studies in which younger people were found to have a lower risk perception of food safety prior to the pandemic (Kim, 2007; Millairen & Halpern-Felsher, 2002). However, a recent study of risk perceptions and coping strategies of Germans during the COVID-19 pandemic by Gerhold (2020) found results similar to those in the current study: older adults believed that they were less likely to be infected with COVID-19. There may be a connection between trust in preventive practices and risk perceptions. For almost all months, older adults believed that handwashing could protect against COVID-19, compared to younger adults. Therefore, this elevated belief that handwashing is protection against COVID-19 may lower their perceived risk.

Ethnicity was another noteworthy social determinant in the current study. Similar to younger adults, those who were not White (non-Hispanic) perceived a higher risk of contracting COVID-19 from food. Similar to the findings of this study, previous studies found that Whites had a lower fear of exposure to environmental and health risks (Finucane et al., 2000; Flynn et al., 1994; Freimuth et al., 2017).

4.3. Trusted sources and dissemination of information

Depending on the level of trust, sources of information can influence consumers to decide whether to partake in certain activities (Balog-Way & McComas, 2020). The survey data showed that most people trusted the FDA for food safety information, while they trusted the CDC, WHO, and health professionals for COVID-19 information. Focus group participants emphasized that they trusted these sources for food safety information during COVID-19, because they were the experts and had scientific credentials. A previous study on the trust of food labels across different time zones across the United States found that all the countries trusted “expert” sources for food information, but the United States had very low trust in government-derived food information (Rupprecht et al., 2020). Similarly, focus group participants in this study expressed frustration and a lack of trust toward government agencies, due to contradictory information and a lack of information throughout the pandemic. For example, WHO reversed its initial recommendation against wearing masks (CNN World, 2020; World Health Organization, 2020c). A previous focus group study investigating consumers’ trust of food-related information showed that consumers lost trust when they perceived the information source being less transparent (Bruhn & Feng, 2021). Although consumers trust the government, they may not understand how the government makes decisions based on available information. Previous studies show that governments all over the world adopt policies through different pathways, including through learning, negotiated agreements, and the diffusion and transfer of ideas across governments (Hunter, 2020; Sabatier & Weible, 2014; Weible et al., 2020). Due to the novel nature of the COVID-19 virus, updating the public throughout the pandemic is important. However, as seen in the present study, a change in information may cause a decline in consumer trust. Government agencies need to be aware of how the transparency of their decisions can have an impact on consumers.

This study found that consumers trusted health professionals for food safety information. However, previous studies have reported that health professionals are not confident in their own food safety knowledge (Chen et al., 2020; Wong et al., 2004). A recent study on YouTube video content analysis of food safety and COVID-19 information by Thomas et al. (2021) found that a popular video hosted by a healthcare professional contained improper food safety practices. Similar to government agencies, healthcare professionals need to understand their impact; they should conduct research on a topic to ensure that their information is accurate. This will reduce the risk of consumers practicing harmful behaviors, such as washing fruits and vegetables with soap (Government of Canada, 2020; U.S.; Food and Drug Administration, 2018).

Although social media were not highly trusted sources of food safety information among consumers in this study, focus group participants said social media would be useful to disseminate information. Because of a continuous increase in Internet usage, use of social media has become a budget-friendly way to spread information rapidly about health and food safety (Abdelin et al., 2017; Overbye et al., 2017; Zhang et al., 2019). However, because consumers seek out health information online, the spread of misinformation may cause them to practice poor food safety behaviors (Chou et al., 2018; Suarez-Lledo & Alvarez-Galvez, 2021). Food safety experts must collaborate with social media influencers in order to provide more accurate, science-based information on popular and trusted platforms.

4.4. Limitations

The researchers carefully planned and executed the study, but some limitations need to be addressed. First, because the survey was distributed to an online panel, survey respondents and focus group participants may not accurately represent all U.S. consumers. Some consumers were not included in this study due to lack of Internet connection; however, those consumers who were left out may have provided different insights. Second, because the focus group discussions were voluntary, those who joined may have had stronger views on the topic than those who opted against volunteering. The states with lower numbers of COVID-19 cases also had lower participation rates, which suggests that researchers may not know the views of those regions. Along with that, dropping out or failure to show up to focus group sessions is an additional limitation that affected this and previous longitudinal focus group studies (Greyl et al., 2017; Lam et al., 2004). Scheduling conflicts, emergencies, loss of interest, forgetting the appointment, or even Internet connectivity issues with the online platform were possible reasons for failure to join or all three discussion sessions. Further, some participants also might have been confused about session appointment times, because they lived in different time zones across the United States. Next, although the survey questions were pilot-tested for face validity, other validation methods were not used. Some questions that should have been in the survey were not included due to the limited number of questions allowed on the survey. Lastly, the data from this study are self-reported and not observed behavior. There may be discrepancies between the consumers’ self-reported practices and their actual practices (Bruhn, 2014; Feng & Bruhn, 2019).

5. Conclusions

One major change brought on by the COVID-19 pandemic was an increase in handwashing practices. However, many consumers may not be connecting this practice to food safety, which may cause them to decrease their handwashing frequency after the pandemic. The level of risk perception that consumers have may coincide with the preventive practices they take. Higher levels of risk perception may mean that they are more willing to make changes. Food safety educators need to guide consumers on proper food safety habits so that consumers will continue
to practice these habits after the pandemic is over and risk perceptions decrease. When disseminating food safety information, educators need to consider trusted sources and most frequently used platforms. Food safety educators can use these platforms to engage with consumers, continuing to remind them of the importance of mitigating the risk of foodborne illness. Scientists can help consumers retain confidence in authority figures by providing scientific evidence when recommendations change over time.

CRedit authorship contribution statement

Merlyn S. Thomas: Conceptualization, Conception, and design of study, Acquisition of data, Formal analysis, Writing – original draft. Drafting the manuscript. Approval of the version of the manuscript to be published. Yaohua Feng: Formal analysis, Revising the manuscript critically for important intellectual content, Approval of the version of the manuscript to be published, Conceptualization, Conception, and design of study.

Acknowledgments

This work was partially supported by the National Institute of Food and Agriculture, USDA Hatch project SI016049, 2020-68012-31822. We thank the following individuals for their expertise and assistance: Tressie Barrett-Boudreaux, Cai Chen, Han Chen, Rose Ernst, Juan Archila-Godinez, Ishani Roychowdhury, and Ziyou Zhang.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodcont.2021.108279.

References

Afederal, A., Datta, D., & Datta, A. (2020). COVID-19: Reflections on trust, truthfulness, and food safety. Journal of Food Protection, 83, 1139–1141.
Affleck, T., & Witter, A. (2021). COVID-19: The role of stigma and discrimination in public health responses. Canadian Journal of Public Health, 112, 15–20.
Aggarwal, A., & Gandhi, T. (2020). Food safety and COVID-19: A systematic review. International Journal of Food Science and Nutrition, 71, 215–228.
Ahlbrandt, K., & Aronoff, D. (2020). Food safety and COVID-19. Food Control, 109, 106845.
Ahn, E., & Park, K. (2020). Antimicrobial food safety practices in households during the COVID-19 pandemic. Food Control, 112, 107135.
Akobeng, A. (2012). Understanding and interpreting confidence intervals. British Journal of Obstetrics and Gynaecology, 119, 283–286.
Albani, M., & McCall, L. (2020). COVID-19: What parents need to know. Journal of Human Nutrition and Dietetics, 33, 1079–1085.
Al-Keylani, Y., & Haddad, R. (2020). Food safety and COVID-19: A review. International Journal of Food Safety, Nutrition, and Public Health, 16, 215–222.
Alvarenga, M., & Almeida, P. (2021). Food safety and COVID-19: A systematic review. Food Control, 113, 108255.
Alvarenga, M., & Almeida, P. (2021). Food safety and COVID-19: A systematic review. Food Control, 113, 108255.
Alvarenga, M., & Almeida, P. (2021). Food safety and COVID-19: A systematic review. Food Control, 113, 108255.
Alvarenga, M., & Almeida, P. (2021). Food safety and COVID-19: A systematic review. Food Control, 113, 108255.
Alvarenga, M., & Almeida, P. (2021). Food safety and COVID-19: A systematic review. Food Control, 113, 108255.
Alvarenga, M., & Almeida, P. (2021). Food safety and COVID-19: A systematic review. Food Control, 113, 108255.
M.S. Thomas and Y. Feng

Parra, P. A., Kim, H., Shapiro, M. A., Gravani, R. B., & Bradley, S. D. (2014). Home food safety knowledge, risk perception, and practices among Mexican-Americans. Food Control, 27, 115–125.

Pressman, P., Naidu, A. S., & Clemens, R. (2020). COVID-19 and food safety: Risk management and future considerations. Nutrition Today, 55, 125–128.

Richard, B., Sivo, S., Orlowksi, M., Ford, R., Murphy, J., Boote, D., & Witta, E. (2018). Online focus groups: A valuable alternative for hospitality research. International Journal of Contemporary Hospitality Management, 30, 3171–3191.

Rolison, J. J., & Hanoch, Y. (2015). Knowledge and risk perceptions of the Ebola virus in the United States. Preventive Medicine Reports, 2, 262–264.

Rupprecht, C. D., Fujiyoshi, L., McGreevy, S. R., & Tayanu, I. (2020). Trust me? Consumer trust in expert information on food product labels. Food and Chemical Toxicology, 137, https://doi.org/10.1016/j.fct.2020.111170.

Sabatier, P. A., & Weible, C. M. (2014). Theories of the policy process. Westview Press.

Saldana, J. (2015). The coding manual for qualitative researchers. Sage publishing.

Scafe, M. (2019). Among U.S. couples, women do more cooking and grocery shopping than men. Pew Research Center. https://www.pewresearch.org/fact-tank/2019/09/24/among-u-s-couples-women-do-more-cooking-and-grocery-shopping-than-me-n/.

Sjöberg, L. (2000). Factors in risk perception. Risk Analysis, 20(1), 1–12.

Laerd Statistics. (2015a). McNemar’s test using SPSS Statistics. https://statistics.laerd.com/premium/spss/mcnemar-test-in-spss.php.

Laerd Statistics. (2015b). Paired-samples t-test using SPSS Statistics. https://statistics.laerd.com/premium/spss/pst/paired-samples-t-test-in-spss.php.

Laerd Statistics. (2017). One-way ANOVA using SPSS Statistics. https://statistics.laerd.com.

Suárez-Lledó, V., & Alvarez-Galvez, J. (2021). Prevalence of health misinformation on social media: Systematic review. Journal of Medical Internet Research, 23(1), Article e17187.

Sulat, J. S., Prabandari, Y. S., Sanusi, R., Hapsari, E. D., & Santoso, B. (2018). The validity of health belief model variables in predicting behavioral change. Health Education, 118(6), 499–512.

Taillie, L. S. (2018). Who’s cooking? Trends in U.S. Home food preparation by gender, education, and race/ethnicity from 2003 to 2016. Nutrition Journal, 17(1), 41.

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. American Journal of Evaluation, 27(2), 237–246.

Thomas, M., & Feng, Y. (2020). Risk of foodborne illness from pet food: Assessing pet owners’ knowledge, behavior, and risk perception. Journal of Food Protection, 83(11), 1998–2007.

Thomas, M., & Feng, Y. (2021). Food handling practices in the era of COVID-19: A mixed-method longitudinal needs assessment of consumers in the United States. Journal of Food Protection. https://doi.org/10.4315/JFP-21-006.

Thomas, M., Haynes, P., Archila-Godinez, J. C., Nguyen, M., Xu, W., & Feng, Y. (2021). Exploring food safety messages in an era of COVID-19: Analysis of YouTube video content. Journal of Food Protection. https://doi.org/10.4315/JFP-20-463.

Ungar, M., Duque, L. F., & Hernandez, D. (2011). Can focus groups be used for longitudinal evaluation? Findings from the medellin early prevention of aggression program. International Journal of Multiple Research Approaches, 5(1), 40–51.

United States Census Bureau. (2010). Decennial census datasets. https://www.census.gov/programs-surveys/decennial-census/data/datasets-2010.html.

U.S. Food and Drug Administration. (2018). Selecting and serving produce safely. http://www.fda.gov/food/buy-store-serve-safe-food/selecting-and-serving-produce-safely#-text=Wash%20thoroughly%20under%20running%20water%20with%20no%20rinse-recommended.

U.S. Food and Drug Administration. (2020). Help stop the spread of coronavirus and protect your family. https://www.fda.gov/consumers/consumer-updates/help-stop-spread-coronavirus-and-protect-your-family.

Weible, C. M., Nohrstedt, D., Cairney, P., Carter, D. P., Crow, D. A., Durnova, A. P., Heikilä, T., Ingold, K., McConnell, A., & Stone, D. (2020). COVID-19 and the policy sciences: Initial reactions and perspectives. Policy Sciences, 53(2), 225–241.

Wong, S., Marcus, R., Hawkins, M., Shallow, S., McCombs, K. G., Swanson, E., Anderson, B., Shiferaw, B., Garman, R., & Noonan, K. (2004). Physicians as food-safety educators: A practices and perceptions survey. Clinical infectious diseases, 38, S212–S218. https://doi.org/10.1086/381589.

Woodlytt, C. R., Finneman, C. A., & Stephenson, R. (2016). In-person versus online focus group discussions: A comparative analysis of data quality. Qualitative Health Research, 26(6), 741–749.

World, C. N. N. (2020). WHO stands by recommendation to not wear masks if you are not sick or not caring for someone who is sick. https://www.cnn.com/2020/03/30/world/coronavirus-who-masks-recommendation-trnd/index.html.

World Health Organization. (2020a). Basic protective measures against the new coronavirus. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public.

World Health Organization. (2020b). Coronavirus disease 2019 (COVID-19) situation report – 32. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200221-sitrep-52-covid-19.pdf?sfvrsn=48028809_2.

World Health Organization. (2020c). Coronavirus disease (COVID-19) advice for the public: When and how to use masks. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-use-masks.

Xu, M., Pralick, D., Zheng, J. Z., Wang, B., Yu, X. M., & Feng, C. (2017). The differences and similarities between two-sample t-test and paired t-test. Shanghai Archives of Psychiatry, 29(3), 184.

Yang, L. L., Khalid, M. L., Duong, M. D., Kessinger, J. N. B., Ong, B. N., Drape, T. A., Williams, R. C., Archibald, T., Chapman, B. J., & Boyer, R. R. (2019). Consumer response to mechanically tenderized beef (MTB) and MTB labels: An exploratory focus group study. Journal of Food Protection, 82(9), 1484–1495.

Ye, Y., Zhang, Q., Ruan, Z., Cao, Z., Xian, Q., & Zeng, D. D. (2020). Effect of heterogeneous risk perception on information diffusion, behavior change, and disease transmission. Physical Review E, 102(4), 042314.

Yuen, K. F., Wang, X., Ma, F., & Li, K. X. (2020). The psychological causes of panic buying following a health crisis. International Journal of Environmental Research and Public Health, 17(10), 3513.

Zhang, C., Fan, C., Yao, W., Hu, X., & Mostafavi, A. (2019). Social media for intelligent public information and warning in disasters: An interdisciplinary review. International Journal of Information Management, 49, 190–207.

De Zwart, O., Veldhuijzen, I. K., Richardus, J. H., & Brug, J. (2010). Monitoring of risk perceptions and correlates of precautionary behaviour related to human avian influenza during 2006-2007 in the Netherlands: Results of seven consecutive surveys. BMC Infectious Diseases, 10(1), 114.