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Perspectives About Food Safety in Diverse Low- And Middle-Income Countries

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PERSPECTIVES ABOUT FOOD SAFETY IN DIVERSE LOW- AND MIDDLE-INCOME COUNTRIES

by

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ABSTRACT

Concerns about unsafe food influence food choice, and consumption of unsafe foods increases morbidity and mortality, particularly in low- and middle-income countries. Actions to ensure safety of food are dominated by mitigation of biological and chemical hazards through supply-side risk management, disregarding individuals' experiences and perspectives of food safety. We aimed to identify and categorize perspectives about food safety in five countries. Five Drivers of Food Choice projects provided transcripts from 17 focus groups discussions and 303 interviews in Kenya, Ghana, India, Guinea, and Vietnam. We analyzed transcripts using a priori and emergent codes. Individuals constructed meaning about food safety through personal experience and social influences. Community and family members contributed knowledge about food safety. Concerns about food safety were influenced by reputations of and relationships with vendors. Concerns were amplified by mistrust of vendors' purposeful adulteration or unsafe selling practices and new methods used to produce food. Individuals were reassured of food safety by positive relationships with vendors; home-cooked meals; implementation of policies and regulations being followed; vendor adherence to environmental sanitation and food hygiene practices; cleanliness of vendors' appearance; vendors' or producers' agency to use risk mitigation strategies; and transparency in production, processing, and distribution of food. Individuals' perspectives about food safety influence food choices. The success of food-safety policies hinges on consideration of these perspectives in design and implementation.

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CHAPTER 1

INTRODUCTION

Rapid transitions in food systems occurring in low- and middle-income countries (LMICs) are shifting how food is produced, processed, and distributed. Globalization, urbanization, income growth, climate change, and changes in consumer demand are contributing to the changes and expansions seen in food value chains. While growing food value chains provide individuals with more options, the lengthened value chains allow more opportunities for food contamination from poor environmental conditions, inadequate sanitation, and cross-contamination. Increasing levels of food contamination heighten the risk of contracting food-borne illnesses (Grace, 2015; Jaffee et al., 2019). Among LMICs, food-borne diseases are frequent and, when coupled with chronic poor dietary intake, they contribute to poor development outcomes and increased mortality rates (Grace et al., 2018). In 2019, LMICs accounted for 53% of all foodborne illnesses and 75% related deaths (Jaffee et al.). Implementing food safety regulations to mitigate the consumption of potentially hazardous foods is paramount.

Initiatives previously implemented in LMICs have focused on ensuring food safety at the production and processing phases of the food supply chain (Constantinides et al., 2020), such as training farmers on appropriate agricultural practices and improving food handling practices among food vendors (Grace, 2015), but recent literature reflects that understanding what individuals consider about food safety when purchasing and

consuming foods is important. Testing the effects of food safety-based messaging on flour sales, Hoffman et al. (2021) found that combining an in-person marketing campaign with a temporary discount was successful in having individuals try the promoted brand for extended periods. When implemented alone, the price discount captured consumers' attention but did not build consumer awareness about the brand's food safety claim. Although the marketing campaign strengthened individuals' perceptions about the promoted brand, sales did not increase. Individuals' responses to the marketing and discount campaigns indicated that their direct food safety experiences were important drivers of food choices. Similarly, another study identified packaged foods' influence on food purchases. Individuals perceived health through a food safety lens and identified packaged foods to be safer for consumption, attributing increases in disease prevalence to food safety concerns, such as chemicals, contaminants, and adulteration, rather than concerns related to the nutritional content of the packaged food (Downs et al., 2018). Barriers associated with purchasing safe food products included affordability (Kariuki & Hoffmann, 2019; Downs et al., 2018), availability (Matumba et al., 2015), and a lack of trust in the institutions regulating food safety (Kariuki & Hoffmann, 2019).

Individuals' perspectives about food safety rely partly on food's smell, taste, attributes, and appearance as criteria for safe food consumption (Lagerkvist et al., 2021; Stampa et al., 2020). Prinsen et al. (2020) indicated that a food's appearance held higher value than how it was stored, and cultural norms reinforced the practices around food regulation. Recent studies have analyzed individuals' perceptions of food safety associated with certain foods (Young et al., 2017; Evans et al., 2020; Frievogel & Visschers, 2020; Nardi et al., 2020; Thompson et al., 2020; Vatral & Quinlan, 2021).

These studies found that specific subjective characteristics affect food safety risk perceptions, including attitudes (Young et al., 2017; Nardi et al., 2020), habits (Young et al., 2017), subjective norms (Young et al., 2017; Frievogel & Visschers, 2020; Vatral & Quinlan, 2021), self-efficacy (Young et al., 2017; Frievogel & Visschers, 2020), positive outcome expectancy (Frievogel & Visschers, 2020), knowledge and awareness of foodborne pathogens (Matumba et al., 2015; Thompson et al., 2020), perceived control, and preferences (Nardi et al., 2020). Optimism bias, a tendency to underestimate one's chances of experiencing a negative outcome, was seen amongst people with higher levels of education and decreased their perceptions of risk (Evans et al., 2020; Vatral & Quinlan, 2021).

Detailed knowledge about consumers' experiences and food safety perspectives is limited, considering the literature has typically focused on the supply value chain when addressing risks and mitigation related to food safety. Furthermore, the theoretical grounding for analyses on consumers' food safety experiences reflects a narrow set of ideas surrounding risk perception, failing to consider the prominent contextual and personal factors that influence an individual's food choice behaviors. Finally, the food safety risk assessments conducted thus far have viewed the supply value chain as the influential source on which the consumer value chain is highly dependent. Consequently, these assessments have not considered interactions between the two value chains and the impact individuals' perspectives may have on the consumer and supply value chains.

This study aimed to identify and categorize individuals' perspectives about food safety in six diverse LMICs to understand what shapes individuals' perspectives about food safety in these settings. Four research questions were developed to address the aim:

1. How do individuals construct meaning about food safety?
2. What sources of information contribute to individuals' knowledge about food safety?
3. What are individuals' concerns about food safety?
4. What assures individuals that they can trust the safety of foods?

CHAPTER 2

METHODS

2.1 SETTING AND SAMPLE

The DFC program funded 15 projects across Sub-Saharan Africa and south and southeast Asia. The projects generated evidence on the processes linking individuals' decision-making about food to their environment. Food safety was identified as an important driver of food choice in several DFC projects. The emergent data fomented the formation of the Food Safety Working Group comprising the lead author (SI) and six coauthors (SB, EK, SS, SC, EF, CB). DFC projects that addressed food safety conducted on six different countries were identified: Ghana, Guinea, Kenya, Tanzania, India, and Vietnam (Table 1). The current study used data from these six projects.

The six project study sites differed by urbanicity, with four urban (Ghana, Guinea, Tanzania, Vietnam), two peri-urban (Kenya, India), and one rural (Guinea). Samples across the six projects were composed of women and adolescent girls (Ghana), caregivers and mothers of children under five years of age (Guinea), male and female adults (Kenya, India), individuals living with HIV and their caregivers (Tanzania), and individuals responsible for household food purchases (Vietnam). These six studies used cross-sectional study designs and gathered evidence on food safety through in-depth interviews and focus group discussions.

Principal investigators from each project conducted a preliminary review of their data to extract transcripts that addressed food safety (Table 1). Projects in Ghana, Kenya,

Tanzania, and India provided complete transcripts, translated to English. For the Guinea and Vietnam projects, principal investigators provided excerpts from transcripts for select questions and responses related to food safety. The principal investigator from the Vietnam project translated the selected text. The DFC team hired a translator fluent in Guinean French to translate the Guinea transcript segments.

2.2 TEAM MANAGEMENT STRUCTURE

One Working Group member served as the lead analyst, who developed the codebook and coding scheme and trained the coding team in the analysis (SI). The team included a senior reviewer, who was highly knowledgeable in the subject matter, understood the study aims, and had previous experience with the data (SC). The senior reviewer collaborated with the lead analyst to develop the codebook and coding scheme and train the coding team. Two team members served as qualitative methodologists because of their expertise. They did not participate in the coding process to allow for objective assessments of the codebook and coding scheme. Furthermore, the qualitative methodologists provided guidance and feedback throughout the study. The coding team consisted of five Working Group members: the lead analyst, senior reviewer, and three coders.

2.3 DEVELOPING THE CODEBOOK

The lead analyst and senior reviewer familiarized themselves with the data and conducted preliminary coding to build the codebook. They both coded the same set of transcripts individually. For each pair of coded transcripts, codes were compared to identify and improve issues in the coding scheme. These two members met once a week to review the coded transcripts. This coding process was repeated until the codebook was

finalized, all emergent codes were identified, and intercoder agreement was high. Revisions to the codebook were made following team discussions between the lead analyst, senior reviewer, and two qualitative methodologists over the comprehensibility of each code. Subsequent modifications helped clarify code descriptions and classifications and finalize the codebook.

2.4 CODING PROCESS

The six projects provided transcripts from 17 focus group discussions and 343 in-depth interviews. Of these 360 transcripts, 305 contained data on food safety (17 focus group discussions and 288 interviews). The lead analyst and three coders coded transcripts from four countries (Ghana, Kenya, Tanzania, and India). The lead analyst and senior reviewer coded the transcript segments from Guinea and Vietnam. Also, the lead analyst and senior reviewer double-coded 20% of the transcripts from Ghana, Kenya, Tanzania, and India. A random number generator was used to select transcripts to be double-coded. The lead analyst and senior reviewer double-coded about half of the selected transcripts.

Leading the team throughout the coding process required regular communication and oversight (Giesen and Roeser, 2020). The lead analyst developed the reference materials to ensure members understood how to identify critical data: coding instructions for coding text sections, a detailed codebook, and an Excel document detailing transcripts assigned to each coder. The Excel spreadsheet was a shared document used as an organizational tool to allow the lead analyst to monitor the team's progress. Coders used the spreadsheet to notify the lead analyst of ambiguity among their assigned transcripts and request feedback.

Training sessions consisted of three rounds of coding. The senior reviewer and lead analyst were paired with a coder to review their work. The coder-reviewer pair coded their assigned transcripts independently. Weekly training meetings were held to compare each transcript pair and discuss discrepancies between the two coders. Following the third training session, the team reviewed the codebook and had discussions to ensure each member understood the coding process. Weekly team meetings continued throughout the first coding cycle to reflect on the process and address coders' comments.

2.5 DATA ANALYSIS

A qualitative thematic analysis was used to identify themes important to food safety. We used Braun and Clarke's (2006) six-phase framework to guide the process of the thematic analysis: 1) becoming familiar with the data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining themes, and 6) reporting themes. During the first coding cycle, codes were determined on a semantic level, capturing the surface meaning of the data (Clarke and Braun, 2014). This coding decision was made considering the researchers' positionality and challenges in interpreting the data resulting from translations and cultural differences (Ho, 2019). The lead analyst conducted the second coding cycle, categorizing the first cycle of codes into themes. Development of themes consisted of sorting the codes and collating relevant coded data extracts to the identified themes. The finalized themes demonstrated meaningful coherence between data, representing internal homogeneity, and clear, identifiable distinctions between themes, representing external heterogeneity (Braun and Clarke, 2006). Codes listed under each theme were categorized to form subthemes. Pattern coding identified subthemes

from the transcript data (Saldaña, 2016). The subthemes organized similarly coded data and described the conditions and characteristics of each theme.

Transcripts were coded in Microsoft Word using the comments feature. Extracted codes and corresponding text segments were then converted from a Word document to an Excel document using a program written in Python 3.10.1. Matrices were developed for each project to tabulate the following for extracted codes 1) double coded (yes/no); 2) coder and double coder, if applicable; 3) transcript document label; 4) code; 5) text segment; and 6) interviewee's demographic information including age, sex, occupation, SES, and education. Available demographic information varied with each project.

Table 2.1 Description of the six projects from the Drivers of Food Choice portfolio providing data for the study.

Site	Urbanicity	Sample	Design	Method	How the study addressed food safety
Ghana	Urban	Women Adolescent girls	Cross-sectional	Photovoice (n=64)	Food hygiene, environmental sanitation, food adulteration, regulations
Guinea	Rural and urban	Mothers Vendors	Cross-sectional	In-depth interviews (n=89)	Food cleanliness, hygiene; food preparation
Kenya	Peri-urban	Adult men and women	Cross-sectional	In-depth interviews (n=60) Focus group discussions (n=7) Key informant interviews (n=19)	Food sources and handling along the supply chain; contamination; concerns about vendors
Tanzania	Urban	People living with HIV (PLHIV) and their caregivers	Cross-sectional	In-depth interviews (n=40)	Food-related strategies, constraints, issues affecting how caregivers feed PLHIV; food environment
India	Peri-urban	Adult men and women Anganwadi workers Farmers Village leaders Vendors and markets Shops and shopkeepers Banks	Cross-sectional	In-depth interviews (n=57) Focus group discussions (n=10)	Concerns over quality and safety of fruit, perceived changes in the food environment; poor taste of food attributed to pesticides; skepticism around vendors
Vietnam	Urban	Main person responsible for food shopping	Cross-sectional	In-depth interviews (n=14)	Food shopping practices and preferences; concerns; food environment mitigation strategies

CHAPTER 3

RESULTS

Fourteen themes related to food safety emerged from the data: 1) constructed narratives from personal experience, 2) constructed narratives from social influences, 3) sources of information, 4) vendor relationship and reputation, 5) vendor's appearance, 6) purposeful adulteration and unsafe selling practices, 7) environmental sanitation, 8) food hygiene practices, 9) transparency of home-cooked meals, 10) vendors' or producers' agency, 11) trust or mistrust in implementation of policies and regulations being followed, 12) mistrust of new methods used to grow and process foods, 13) transparency of process in the food supply chain, and 14) inadvertent contamination of food (Table 2).

Themes were highly permeated across the six projects, despite the differences in the samples and methods. Several themes were common throughout transcripts from most of the projects: constructed narratives from personal experience, vendor relationship and reputation, environmental sanitation, food hygiene practices, and mistrust of new methods used to and process foods (Table 3). Themes identified in over half of the transcripts were food hygiene practices (Ghana, Kenya, Guinea, Tanzania), environmental sanitation (Ghana, Kenya, Guinea), mistrust of new methods (India, Vietnam), constructed narratives based on personal experiences (Kenya and Vietnam), vendor relationship and reputation (Kenya and Vietnam), vendor's appearance (Guinea), and purposeful adulteration (Kenya).

3.1 HOW DO INDIVIDUALS CONSTRUCT MEANING ABOUT FOOD SAFETY?

Individuals constructed meaning about food safety through narratives based on their personal experiences and social influences. Foods deemed unsafe for consumption were attributed to external forces that compromised food safety. For example, one individual's direct experiences of witnessing unsafe food handling practices at two supermarkets caused them to doubt the processes used to test and certify food safety and question which retailers they could trust (Table 4). Experiences witnessing unsafe practices in food production and retail, such as farmers using chemicals in agriculture and vendors selling expired foods, were seen as compromising food safety.

Individuals associated health consequences with consuming unsafe foods. Individuals reported experiencing stomach disturbances (e.g., diarrhea, vomiting) and chronic pain due to consuming unsafe foods. Children and pregnant mothers were highly referenced when individuals discussed food taboos influenced by their culture, often linking consumption of certain foods to health consequences such as developmental delays in children and risks of miscarriage and respiratory issues in pregnant women.

The practices individuals learned to apply to prevent consumption of contaminated foods varied based on their daily experiences of witnessing unsafe food handling practices and the consequences associated with consuming unsafe foods. Some individuals described strategies they learned to minimize agrochemical exposure, such as soaking and washing foods and strictly eating home-cooked meals. Others described avoiding locations and vendors where they previously encountered foods that were unsafe for consumption. Cultural influences prohibited individuals from consuming foods in some settings, fearing health consequences that would result from other people

projecting negative thoughts onto their food. Religion was a source of influence prohibiting individuals from consuming certain animal-sourced foods such as pork and offal (organ meats), citing unsanitary conditions as reasons for avoiding these foods.

3.2 WHAT SOURCES OF INFORMATION CONTRIBUTE TO INDIVIDUALS' KNOWLEDGE ABOUT FOOD SAFETY?

The healthcare system, media, and social networks acted as bases of knowledge about food safety. Individuals typically sought knowledge from healthcare settings when admitted for food-related illnesses, reporting that hospitals and health clinics provided information about the food source contributing to the individual's sickness (Table 4).

Individuals cited TV and radio news sources as media sources that contributed to their knowledge on food safety. The three sources relayed information on adulterated foods, exposing retail establishments selling low-quality products, processing units following poor hygiene and environmental sanitation practices, and cultivators using chemicals to produce foods. In these reports, cases of adulteration and unsafe selling practices were often linked with health consequences.

Much of the information spread by social networks of community members was linked to adulteration. Animal-source foods were commonly targeted as being adulterated. Multiple interviews described a similar story of butcheries tricking consumers into buying human flesh. Individuals described limiting and, at times, entirely avoiding consuming meat products due to fear incited by this story circulated by community members.

Knowledge about food safety was also gathered from family members. Family members communicated mistrust in vendors' hygiene practices and guidance on where to

purchase foods deemed safe for consumption. Individuals were informed of vendors' poor hygiene practices by older family members, frequently citing their mothers and grandparents as sources. Family members also shared information on strategies for determining which vendors to purchase foods from, referencing environmental sanitation cues that pose potential contamination risks such as surrounding flies and littered retail spaces. In addition, family members guided individuals on where to buy safe food and what safe food handling practices to follow during food preparation.

3.3 WHAT ARE INDIVIDUALS' CONCERNS ABOUT FOOD SAFETY?

Individuals cited concerns about vendors as a source that threatens the safe distribution of foods, purposeful adulteration or unsafe selling practices, mistrust of methods used to grow and process foods, inadvertent contamination of food, and transparency of process in the food supply chain (Table 4). Individuals were concerned about vendors' food preparation and hygiene practices, citing vendors' use of contaminated food items and dirty water during food preparation or covering of prepared foods with a dirty cloth, and unsanitary environments. For example, some individuals described the presence of houseflies around food as a risk to food safety, and others pointed out a vendor's proximate location to gutters as a risk. In addition, individuals' experiences purchasing expired or uncooked foods or interacting with an unpleasant vendor led them to believe specific vendors' food was unsafe for consumption. Individuals frequently shared health consequences associated with consuming contaminated foods discussing food safety concerns, e.g., contracting diseases from polluted environments.

Other concerns regarding vendor-related practices emerged when individuals discussed intentional adulteration and unsafe selling practices. Individuals attributed their fears of food malpractice to vendors using food additives to increase foods' appeal, sewage water to irrigate foods, uncleaned containers to pack and store foods, and relabeling expired foods. Vendors' poor hygiene practices were seen as a reflection of their intention, representing vendors as willing to compromise food safety for profit.

Individuals were skeptical about the methods used to grow and process foods due to the prevalence of chemicals in crops and animal-source foods. They reported being wary of the effects farmers' use of agrochemicals like fertilizers and pesticides to grow crops would have on their health. Antibiotics and growth hormones induced similar concerns amongst individuals, relating their use on livestock to adverse health effects. Individuals most often referenced recent emerging diseases, a shorter life expectancy, and decreased energy and strength as health consequences resulting from consuming foods that contain chemicals.

Apart from agrochemicals used to produce food, inadvertent forms of food contamination throughout the supply chain were found to be another concern to food safety. These concerns focused on the nearby environment where food was grown and sold. Individuals questioned the safety of foods grown near sewage; they frequently spoke of health consequences that might ensue from foods exposed to toxins. Concerns of food contamination during the retail phase were about the vendors' proximity to the contaminated sites such as gutters or sewage plants.

Individuals expressed concerns about the transparency of the food supply chain process regarding the production to processing and retail phases. Concerns of food

adulteration and food malpractice were commonly cited across all levels of the supply chain. During the food production phase, individuals were skeptical about the safety of the food's source, for example, questioning farmers' intentions for slaughtering livestock, suspecting it was killed due to an illness where the seller was at risk of losing profit. Issues with food adulteration, proper storage provisions, and cleanliness were commonly identified concerns during the processing phase.

Individuals felt wary of actions taken during the processing phase, questioning whether the retailer followed hygiene practices while storing, distributing, and selling foods. As individuals identified the points at which food safety is likely to be compromised, they also recognized the breadth and depth of health consequences that could ensue, indicating that risks to food safety can occur at all levels across the production, distribution, selling, and purchasing, and consumption phases. Individuals shared perceptions of the stages at which unsafe food practices can occur and what that may mean for exposure rates; unsafe food practices occurring at the production and processing phases could impact entire communities compared to unsafe practices at the household level.

3.4 WHAT ASSURES INDIVIDUALS THAT THEY CAN TRUST THE SAFETY OF FOODS?

Five themes highlight the vendor's role in assuring food safety: positive reputation and relationship with the individual, clean appearance, agency, sanitary environment around the outlet, and food hygiene practices. Two other themes indicate transparency was vital to earning individuals' trust: transparency of home-cooked meals and implemented policies and regulations were followed.

Individuals believed food was safe for consumption following an assessment of the vendor's environment and food hygiene practices. Vendors who prepared hygienic foods in a sanitary environment were trusted to provide safe food. Hygiene practices ranged from verifying the food source to serving food on clean dishes. Positive interactions between the vendor and individual, where the vendor was perceived as welcoming, assured the individual they could trust the safety of the vendor's food. Aside from the vendor, individuals indicated that food inspectors' presence around the retail outlets reassured the food's safety.

Individuals were assured that food was safe when vendors wore appropriate workwear, clean aprons, and gloves while handling food. A neat appearance implied that the vendor worked in a clean environment, followed hygiene practices and regulations, and was knowledgeable about safe food preparation practices. Findings from vendor interviews conducted in Guinea were congruent with the results reported by individual consumers regarding the methods used to ensure food is safe for consumption. Amongst vendors, responses concentrated on hygiene practices, such as maintaining cleanliness, avoiding contamination, properly storing foods, and maintaining control over the food production and preparation. Some vendors actively participated in food production to know the food source and prevent contact between the food and pesticides. Ensuring control over the stages of food preparation typically meant securing a neat location for sales and overseeing the production process. To ensure safety, vendors acknowledged following hygiene guidelines and regulatory food procedures and inspections.

Individuals felt assured of the safety of the vendor's food after witnessing a clean retail space, including the surrounding area and inside the vendor's shop. Individuals felt

comfortable purchasing foods from places that appeared to be tidy, organized, sanitized, and ventilated. Individuals and vendors used mitigation strategies to ensure food safety: personal hygiene, cross-contamination prevention, storage, cooking temperatures, and serving. Personal hygiene consisted of practices such as handwashing and wearing clean clothes. Individuals felt cross-contamination could be prevented by cleaning the designated cooking area and using clean dishware. When considering storage methods, individuals cited avoiding storing perishable foods because of improper storage facilities. Individuals' descriptions of the cooking process often included boiling the foods to reduce the chemicals and pollutants contaminating the foods. The fourth strategy described methods individuals used when serving foods, following best practices to limit food contamination.

Individuals trusted the safety of foods cooked at home more than those purchased from vendors, commonly stating that preparing foods at home brought them comfort in knowing food hygiene and environmental sanitation practices were followed (Table 4). Individuals projected confidence in their cooking practices, attributing their knowledge in safe food preparation to a lower risk of contracting food-related sicknesses, unlike buying foods prepared by vendors. Connections were identified linking individuals' trust in the safety of purchased foods to the implemented food-related policies and regulations were being followed. Individuals considered decreased reports of foodborne illness cases and increased presence of inspection officers as evidence of food retailers following food safety guidelines. Cues from retailers helped individuals confirm food safety regulations were observed, including issuing stamps and packaging labels to represent inspected foods.

Table 3.1. Descriptions of the fourteen emergent themes about perspectives on food safety.

Theme	Description
Constructed narratives from personal experience	A way for individuals to construct their interpretation of food safety. These narratives are rooted in one's ideologies, everyday practices, personal experiences, and ways of thinking, and provide individuals with insight or an understanding of what food safety means to them, including related practices, processes, and consequences.
Constructed narratives from social influences	A way for individuals to construct their interpretation of food safety. These narratives are influenced by their culture, religion, rituals, and social traditions. These narratives help the individuals shape their understanding of food safety, including related practices, processes, and consequences.
Sources of information	Individuals reported information disseminated from media (tv, radio), healthcare workers (health clinics, doctors, nurses), teachers, peers (family members, friend) as a source that contributed to knowledge of food safety (whether valid or false information).
Vendor relationship and reputation	Individual's belief that vendor's food is safe/ unsafe is contingent upon the relationship that forms from previous experience or vendor's reputation. The vendor's reputation is verified by the community and (in)validates the source and quality of food.
Vendor's appearance	Individuals were influenced to believe food was safe or unsafe depending on the cleanliness of vendors (dressed in appropriate clothing- hairnets, gloves, without visible stains, sweat).
Purposeful adulteration or unsafe selling practices	Individuals' mistrust of vendors stemmed from concerns of changes in taste and appearance of food due to added substances meant to prolong shelf life, and exposure of food malpractice (i.e., relabeling expired foods, reselling foods). Individuals indicate health consequences associated with the unsafe selling practices.
Environmental sanitation	Individuals were influenced to believe food was safe or unsafe depending on physical environment around the shop/retail area and food area (presence of litter and flies).

Food hygiene practices	Individuals were influenced to believe food was safe or unsafe depending on practices followed when preparing food (handwashing practices, use of clean or unclean water, foods covered to ensure cleanliness, washing foods, cleanliness of dishes).
Transparency of home-cooked meals	Individuals felt food prepared at home was thought to be safer than meals obtained outside of the home, based on the hygiene practices applied (i.e., handwashing practices, covering foods, washing fruits/ vegetables).
Vendors' or producers' agency	Individuals believed that the quality and safety of their food was validated by their utilization of risk mitigation strategies, including their capacity to trace and control the products, ingredients, supplies, processing operations included throughout the food production chain. (i.e., one trusts their own ability to acquire, process, prepare food safely; they/ their family eat(s) the same foods they sell, use the same process to prepare foods for consumers as they would for themselves, controlling where foods sold).
Trust or mistrust in implementation of policies and regulations being followed	Individuals were influenced to believe food was safe or unsafe depended on whether the local food system had the ability to enforce and enhance quality control, inspect food to determine safety (expiration date, poor package quality), and whether the vendors abided by to the food safety rules being implemented.
Mistrust of new methods used to grow/process food	Individuals' mistrust of new methods and technologies used during food production/ harvesting phase (i.e., use of pesticides, bioengineered genes, fertilizers, antibiotics, growth hormones, by-products).
Transparency of process in food supply chain	Individuals were influenced to believe that food was safe or unsafe depending on their trust/mistrust in each of the stages and the types of roles involved (farmers, distributors, retailers) during the production, processing, and distribution stages within the food supply chain.
Inadvertent contamination of food	Individuals cited concerns of foods coming into contact with chemicals or other contaminants from pesticide or sewage runoff, due to location of where food is produced in relation to the application/contaminated site.

Table 3.2. Appearance of themes expressed as a percentage of total (n) number of transcripts in each country.

Theme	Ghana (n=64)	Kenya (n=82)	India (n=44)	Guinea (n=63)	Vietnam (n=14)	Tanzania (n=39)
Constructed narratives from personal experience	17	62	25	0	57	46
Constructed narratives from social influences	2	16	34	0	0	26
Sources of information	34	40	16	0	14	38
Vendor relationship and reputation	48	65	2	41	79	28
Vendor's appearance	14	33	0	65	0	13
Purposeful adulteration or unsafe selling practices	14	70	7	2	29	21
Environmental sanitation	75	56	2	73	0	33
Food hygiene practices	69	78	45	87	50	59
Transparency of home-cooked meals	42	18	2	2	0	15
Vendors' or producers' agency	0	9	7	13	0	8
Trust or mistrust in implementation of policies and regulations being followed	9	37	5	2	43	5
Mistrust of new methods used to grow and process foods	5	38	61	0	64	46
Transparency of process in food supply chain	0	32	0	11	14	10
Inadvertent contamination of food	2	12	0	0	0	36

Table 3.3. Reports of individuals' perspectives of food safety, categorized by theme.

Theme	Example quotations
How do individuals construct meaning about food safety?	
Constructed narratives from personal experience	*"Although your vegetables is dirty, but it still can be recognized as 100% clean if you used you money to lobby. The society now is like that. It is not transparent. So it's hard for me to say the food is safe or not, even foods was tested. I only trust if it is foods from my family. I was dissatisfied with the supermarket when I saw that. I feel so upset about these two supermarkets. But lay people do not have the voice to complain and give feedback."* (Vietnam)
Constructed narratives from social influences	Culture *"Elder people ask them not to eat, they also restrict them to eat banana. (…) They think that it may cause breathing problems."* (India) *"Absolutely I have such a feelings, I worry about this mango Azam juice because there are some rumours. I bought the juice there was someone who told be those juices have maggots, this has remained in my mind, I am really scared about this. They say the juices stay for a long time eventually they get maggots, even if you will look at expiry date it doesn't help."* (Tanzania) Religion [Pork]: "*The bible prohibits it (…) The second thing pigs eat all the dirty things that they come across. (…) D: we do not eat pork it has been refused […] In the bible it is written or has been refused. D: Demons were chased into them"* (Kenya) [Offal]: "*Akorinos believe that all the organs (…) involved in a circulatory system that is all the organs where blood passes, (…) those organs plus blood should be disposed of and if they are not, they cannot take or eat those parts. Also they believe if the animal is taken with all those organs, together with the blood also they cannot eat that, yeah. They cannot eat because of their religious beliefs*" (Kenya)
What sources of information contribute to individuals' knowledge about food safety?	
Sources of information	Healthcare system [Hospital]: *"When you go to the hospital you are asked what did you eat yesterday, you tell them I ate meat; they tell you that meat had a problem."* (Kenya)

[Nurse]:
"So I listen to the education given at the hospital and I eat based on that." (Ghana)

Media
[TV, news sources]:
I: "So, who told you madam that if you use medicine to the crop , it is not good and it is harmful?"
P: "In TV, in news they will tell…" (India)

[Radio]:
"I once heard in a radio and because I am also a Chef I know because we have been instructed about food safety. For food to be good and safe it should not be dirty for example after preparing food you go to a washroom without washing your hands with soap then you touch food, sometimes hands have some bacteria. Or you touch different things then you just get into a room you take an onion and you start cutting it." (Tanzania)

Social networks
[Community]:
"Nowadays people are not very sure if the meat they are eating is animal or it belongs to a human being, we hear at times that human meat has been found in a butchery." (Kenya)

[Family]:
"Our grandfather told us not to eat kenkey. The reasons our grandfather gave was that the way kenkey is prepared is usually not in a hygienic condition." (Ghana)

"He will advise me that and tell me that it is not good. If I am going to cook such things, he tells be not to cook them. Or he will show me the way I can use them, then he will teach me before I will cook it and eat." (Ghana)

What are individuals' concerns about food safety?

Vendor relationship and reputation	*"You know there are other waakye sellers around and they don't prepare the food in hygienic conditions. They are also sold close to the gutter and there are stones in the food so I prefer to buy at this particular food vendor."* (Ghana)
Purposeful adulteration or	*"One time there was a woman who was telling us that the milk has not expired but if you look closely you find that there are two expiry*

unsafe selling practices	*stickers on the package so even when it has expired, they remove the first sticker so that it seems as if it has not yet expired."* (Kenya)
Mistrust of new methods used to grow and process food	*"At that time there weren't these many pesticides, only crops were grown with manure, same crops, but they used to use manures, there weren't fertilizers. Now manure they are using and fertilizers also they are using equally. Now diabetes, bp, thyroid, cancer all diseases coming, why it is coming you should know. All that we are cultivating, they are going into our stomach, somebody who ate is getting diseases*." (India)
Inadvertent contamination of food	*"It is dirty water in general from latrines or dirty sewages, and about spinach I worry because they sprout so fast to the point I wonder I wonder how is that."* (Tanzania)
Transparency of process in food supply chain	*"Safety issues can arise at any level. Like at the production level you may find that a person is taking a sickly cow to the slaughterhouse and then at the slaughterhouse if the sickly cow is not inspected it will be sold to the retailers and that will be bad. At the retailer level like me you may find that maybe the retailer is selling meat that has overstayed and also some unhygienic practices and at the consumer level you may find also unhygienic practices and also the person has not cooked well […] In short everyone has a part to play when it comes to safety."* (Kenya) *"I2: Even though you buy pork from the familiar vendor, you still need to check it?"* *"R2: Yes. He does also buy from the producers, he does not feed the pigs by himself. Hence, he may not know about the safety of the pigs. If the pigs are not safe but producers tell the lie, he will still believe in it. However, general speaking, in Vietnam, producers and sellers do not care consumers, they just care the profit."* (Vietnam)
What assures individuals that they can trust the safety of foods?	
Vendor relationship and reputation	*"It may be that if I know a place where it is safe and well-nourished, then I'm willing to come and buy from there and not always convenience in the first place."* (Vietnam)
Transparency of home-cooked meals	*"Someone cooking outside I do not know the kind of hygiene she has… Maybe she has not washed her hands but she has been cutting onions with her dirty hands. I will be affected at the end of the day but when I am cooking at home, I will wash my hands, I will wash the vegetables, I will get the hygiene."* (Ghana)
Trust in implementation of policies and	*"Rules are strict due to government oversight or the veterinaries from the government makes sure whatever products comes from there is very safe. Also, you see we need business permits…"* (Kenya)

regulations being followed	*"R2: This is the Van Noi clean vegetables cooperative in Dong Anh district. They must have a certificate, if you want to check it, just pass by there. R1: That is the vegetables, which you can verify the origin by visiting their farm."* (Vietnam)
Environmental sanitation	*"I like the way she keeps the surroundings so neat. So, once you eat at a neat place, you will not fall sick. But if there is a gutter around and it is not covered and flies from the gutter comes and land on your food, you can get Cholera. So, to avoid all this, I like buying food from her because her place is always neat."* (Ghana)
Food hygiene practices	*"The signs that show that the food is healthy when the saleswoman is clean by her clothes, these plates are clean, she washes them with soap."* (Guinea) *"There is a specific butchery where I go to purchase meat. I like the butchery because of its outlook. There are several butchers at our place, other butchers use machete to cut meat but this one cuts meat with a machine. Using a machine is good because it doesn't involve touching the meat frequently."* (Tanzania)
Vendor's appearance	"*There is a seller that I trust because she is clean, , I do not buy because I like her, but because of her*" (Guinea)
Vendors' or producers' agency	*"When I prepare the meal I sell, I take part of that meal for my family's food. So my family eats what I sell. With this, there is no doubt about the quality of hygiene of the meal that I sell."* (Guinea)

CHAPTER 4

DISCUSSION

From qualitative thematic analysis to capture individuals' food safety perspectives across six diverse low- and middle-income countries, 14 themes emerged, reflecting how individuals' environments construct and shape their understanding of food safety, ultimately influencing their food choice. Our findings provide insight into the meanings that individuals assign to food safety and how the information they receive shapes their narratives about food safety, informs their concerns and provides them with a sense of reassurance.

Individuals' past experiences with food provide them with information about food's intrinsic characteristics to help them recognize changes in food's appearance and taste. Sensory level changes in foods familiar to individuals were often attributed to food malpractice. Differences in the food's sensory features influenced individuals to believe the food's perceptual features were compromised, particularly regarding the nutritional content, health value, and quality. Leng et al. (2016) identified similar findings; individuals' first impression of the food's intrinsic properties was reason enough to sow ideas of mistrust in food vendors' abilities to uphold food safety.

Cognitive processes shape skills, knowledge, attitude, liking and preference, anticipated consequences, and personal identity (Chen & Antonelli, 2020). Knowledge plays a critical role in explaining food choice variation (Wardle et al., 2000). An

individual's decision-making process concerning food choice utilizes evaluation-based components such as attitude, liking, and preference (Steenkamp, 1997). These components were captured when individuals we studied cited concerns about foods exposed to environmental contaminants. Some individuals assessed the safety of food items through sensory evaluations and described their aversion towards purchasing foods near contaminated sites. Individuals reported a preference for purchasing foods from specific shops, citing previous vendors' proximity to contaminated areas, indicating individuals conduct food safety evaluations through comparison. Anticipated health consequences were frequently documented when individuals discussed new food production and processing methods. The prevalence of chemicals, such as antibiotics, fertilizers, growth hormones, and preservatives was often connected to poor health outcomes, including emerging diseases and a shorter life expectancy.

Individuals' habits and experiences influence the narratives they construct about food safety. Recent studies have suggested the importance of understanding the role of habitual patterns in shaping food choice preferences (Leng et al., 2016; Young et al., 2017). External forces contributed to individuals' understanding of food safety. Understanding how individuals come to interpret food safety through their interactions with external forces demonstrates the importance of considering the role of experiences and habits in decision-making processes. Some cues external to food cues are associated with food products and refer to information individuals retrieve from food items such as the brand, label, and packaging (Fernqvist & Ekelund, 2013).

Additional food-external cues include the social environment, such as the information individuals receive from their social networks and media outlets, and the

physical environment, referring to the retail settings, such as the vendor's appearance, food hygiene practices, and environmental sanitation. The type of information individuals received about food safety depended on the source from which they received the information. For example, individuals who sought knowledge about food safety from healthcare systems typically reported receiving a diagnosis for food-related illnesses. Those who reported media outlets as their source for food safety information primarily described cases of unsafe food practices or reports of adulteration that lead to outbreaks of foodborne illnesses. Individuals who received information from their social networks provided wide-ranging information on food safety. In some instances, individuals shared rumors depicting extreme instances of adulteration, ultimately transmitting fear, and influencing individuals' perspectives regarding the safety risks associated with the production and processing of food products. In addition, individuals received information on the importance of safe food preparation and maintaining sanitary environments and advice on which retailers were considered trustworthy based on their food safety practices. These findings indicate the importance of the social environment as an influential role in shifting individuals' perspectives about food safety, whether through raising concerns about phases of food production and processing or disseminating knowledge around safe food practices.

The physical environment provided individuals with information regarding the retailer's adherence to food safety regulations. The vendor's hygiene, namely their attire, informed individuals whether they could be trusted to provide safe food. Individuals linked the vendor's appearance to the retail environment and food hygiene practices, assessing all three simultaneously to conclude whether the vendor's food was safe for

consumption. Mistrust in food vendors' ability to follow safe food practices led individuals to buy prepackaged foods, equating fewer instances of food contamination with healthiness. Nordhagen et al. (2022) found that although the risk of exposure to contaminants such as bacteria is lower in prepackaged foods, many of these foods are poor in nutrients. They contain high fat and sugar that is associated with the risk of non-communicable diseases (Reardon et al., 2021; Popkin et al., 2020). This study reinforces the findings from Nordhagen et al. regarding the tendency of individuals to use binary thinking about the safety of foods and, in this particular context, associate processed or packaged foods as safer for consumption than unprocessed foods. The results highlight the influence of retail food environments in shaping individuals' food choices regarding healthy or unhealthy foods.

Sociocultural factors also shape perspectives about food (Chen & Antonelli, 2020). Societal influences and cultural norms direct individuals to decide which foods are safe or unsafe to consume. For example, food taboos were frequently reported, and the consumption of these foods was connected to increased health risks.

The food policy environment directly affects the quality and quantity of food along the supply chain (Davis et al., 2021). Their implementation influences individuals' trust in the safety of the food produced (Le et al., 2020). Effective implementation of food policies through cues in retail provided individuals with validation of regulations being followed (e.g., vendors following environmental sanitation standards and signage including stamps and food labels offering evidence of food inspection).

Nevertheless, individuals raised concerns regarding food safety due to mistrust in the implemented food policies, citing the authorities' lack of commitment to fighting corruption, describing instances of witnessing banned products on the market or approval of vendor licenses without conducting regulatory inspections. Further concerns were that the policies and regulations were unreliable, reporting inconsistencies in food inspections and classification of safety standards. Food policies and regulations were seen as unresponsive to its citizens and failed to improve food safety conditions. Individuals demanded government involvement to fight corruption, provide services to communities, allow fairness in regulation, and develop higher standards of hygiene practices. Individuals' experiences, influenced by shared values and beliefs, and food policies and regulations, highlight how the macroenvironment shapes food safety perspectives at the individual level.

This analysis on individuals' perspectives about food safety supports recent advances in the literature documenting the importance of understanding individual food choices for developing and improving food-related interventions (Lindgren et al., 2018). Food choice processes derive from the individual's experiences and are specific to their context (Blake et al., 2021). An individual's dynamic nature is reflected in their decision-making processes, with shifts occurring throughout their life course (Sobal & Bisgni, 2009). This paper highlights the complex nature of individual decision-making in the context of food safety. Given what is known about the multiple levels of influence of food choice (Monterrosa et al., 2020), we expect individuals' perspectives on food safety to form through similar interactions transcending across the personal, social, and environmental level seen themes related to food safety emerged.

CHAPTER 5

CONCLUSION

This analysis on individuals' perspectives about food safety supports recent advances in the literature documenting the importance of understanding individual food choices for developing and improving food-related interventions (Lindgren et al., 2018). Food choice processes derive from the individual's experiences and are specific to their context (Blake et al., 2021). An individual's dynamic nature is reflected in their decision-making processes, with shifts occurring throughout their life course (Sobal & Bisgni, 2009). This paper highlights the complex nature of individual decision-making in the context of food safety. Given what is known about the multiple levels of influence of food choice (Monterrosa et al., 2020), we expect individuals' perspectives on food safety to form through similar interactions transcending across the personal, social, and environmental levels.

This analysis used data from projects that were implemented in parts of Africa and Asia and that provided information about food safety. Although the samples used in the current study were not representative of all LMIC populations, the projects that contributed data were diverse with respect to the sample demographics, urbanicity, and geographic location. While the projects used for this analysis did not explicitly seek to assess individuals' food safety perspectives, evidence of the prominence of topics related to food safety perspectives reinforces the importance of engaging in individuals'

perspectives of food safety for future interventions. An assessment of how food-safety policies relate to food safety behaviors will provide a deeper understanding of how the policy environment influences and shapes the consumers' food choice behaviors and practices.

Our study explored perspectives about food safety across six diverse LMICs to expand understanding of people's food-safety perspectives and offer insight into how individual perspectives may affect food choices. Considering food-safety perspectives is important in addition to the biological and chemical attributes regarding what is used to grow and process foods that might be harmful. Thoroughly evaluating food-safety perspectives requires attending to how food choices are influenced by people's perspectives about the food in their environment. The findings from this study highlight the complex nature of individual decision-making in the context of food safety. Multidisciplinary research is necessary to map out the individual- and societal-level elements that interact to form individuals' perspectives of food safety and influence food choice.

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