

EatSafe: Evidence and Action Towards Safe,  
Nutritious Food

# Review of Food Safety Training in Low- and Middle-Income Countries

September 2022

*This EatSafe report presents evidence that will help engage and empower consumers and market actors to better obtain safe nutritious food. It will be used to design and test consumer-centered food safety interventions in traditional markets through the EatSafe program.*

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## ACRONYMS AND ABBREVIATIONS

BCD	Behavior-centered design
COM-B Model	Capability, opportunity, motivation - behavior
EatSafe	Evidence and Action Towards Safe, Nutritious Food
FBD	Foodborne disease
FBO	Food business operator
FHTM	Food hygiene training model
HACCP	Hazard Analysis and Critical Control Point
HIV/AIDS	Human Immunodeficiency virus and acquired immune deficiency syndrome
LMICs	Low and lower middle-income countries
RANAS	Risks, Attitudes, Norms, Abilities, and Self-Regulation
TPB	Theory of Planned Behavior
SMS	Short message service
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization

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## EXECUTIVE SUMMARY

Foodborne disease is a global problem that falls disproportionately on low- and middle-income countries (LMICs). Feed the Future's Evidence and Action Towards Safe, Nutritious Food (EatSafe) aims to improve the safety of nutritious foods bought and sold by millions of people every day in traditional food markets in LMICs. In this synthesis review, EatSafe evaluates the characteristics of successful food safety training interventions with the goal to inform EatSafe's own interventions in Nigerian and Ethiopian traditional food markets.

Previous EatSafe research has identified how food safety trainings have been developed as a standalone intervention or one component of a broader intervention package, seeking to increase the knowledge of consumers, vendors, and other food value chain actors (1–3). However, the characteristics that underlie intervention efficacy have yet to be explored in detail. Therefore, EatSafe assessed 16 food safety training approaches using a qualitative evaluation framework, or a list of behavioral theory-based research questions on training approach, audience, context, and training curricula. The following paragraphs summarize key results.

**Context, Audience(s), and Location:** Formative research is critical to understanding local contexts and the training needs of the target population. Audience considerations include how alike or different participants are to one another, as well as their existing knowledge of food safety. While trainings that engage heterogeneous audience groups (i.e., those with different roles in the food preparation process) are resource- and labor-intensive, these designs recognize the supply and demand dynamics inherent to food preparation. By contrast, most studies in this review trained homogeneous groups, which may alleviate social barriers to behavior change, given the importance of social norms. In terms of training location, home- or workplace-delivered training provide more observation and feedback opportunities, but often have higher resource and time costs. Centrally delivered training can be effective if participants can practice under supervision and engage in problem-solving with trainers.

**Trainers:** The relationship between trainers and participants is critical to engagement and training success. The most successful interventions built in time to allow relationships and trust to form between participants and trainers. Interventions that used trainers who had “expert” knowledge on food safety, or those with higher education, also had better results. While sustained individual contact between trainer and participant is desirable, many trainings targeting large populations leveraged group training sessions to minimize costs.

**Behavioral Theory and Motivation:** Systematic reporting on how food safety trainings leverage behavior change or cognitive learning theories in intervention design is generally lacking. Most food safety training courses targeting consumers, vendors, or communal food preparers did not use these theories to design interventions; by contrast, nearly all training for caregivers did so. Of the studies that did integrate theory in design, emotional drivers were only leveraged in childcare giver studies, while approaches involving food handlers relied on cognitive or educational models that rationalize behavioral choices. Likewise, motivation to attend training courses (i.e., participation) received minimal attention during intervention design for all target audiences and was reported only anecdotally and in retrospect. By contrast, motivation to apply new knowledge gained during training (i.e., adoption) was well-studied among child caregivers but lacking for communal food workers.

**Training Approach, Format, and Media:** EatSafe developed three categories for training approaches: subject-, learner- and problem-centered. Most studies used a subject-centered approach

(i.e., training on a list of food safety practices). Despite its relative rarity, learner-centered approaches, such as curricula relevant to food preparation role(s), can be immediately applied in the training environment. Most interventions leveraged a mixture of lectures, facilitated discussions, and hands-on, practical demonstrations, along with a variety of context-specific media to reinforce learning during and after training sessions. Use of problem-solving techniques increased training success and frequently provided ways to address context-specific challenges.

**Outcomes and Sustainability:** Most studies relied on behavioral observations, self-reported data, or surveys that measure changes in knowledge, attitudes, and practices (KAP), which, alone, does not guarantee the goal of safer food has been achieved. Objective measurements of food contamination or health outcomes after training were rare. Further, evaluations were completed shortly after intervention implementation, so sustained behavior changes were not identifiable. Across longer time scales and with appropriate support from local authorities, evaluators should be hired to ensure compliance with trained practices.

**Enabling Environment:** While most training courses reported at least some improvement in food safety behaviors that participants perceived to be under their control, behavior change was limited by a disabling physical space (i.e., poor infrastructure) or the public policy landscape (i.e., lack of funding for clean water or electricity in a market). Some studies successfully changed the social environment, addressing negative social norms; fewer studies sought to impact the policy environment by facilitating communication between local government and training participants or including involving internal training evaluators from local authorities.

Overall, trainings exhibit multiple nuanced characteristics across multiple domains. The variety of approaches described here illustrate the inherent complexity in designing food safety trainings in the informal food sector, strongly suggesting **no single intervention design will lead to successful outcomes across multiple contexts**.

Intervention designers can use this evaluation framework to prioritize design elements as they structure their training program. Although defining the audience, environment, and learning needs can assist with customization, intervention designers must determine trade-offs between quantity and quality (e.g., reaching a wide, heterogenous audience requires repeated training sessions over longer time periods). As such, EatSafe and other intervention designers should draw heavily on ethnographic and formative research to understand the context of the traditional markets where they work, and to empirically identify and account for i) nodes along target food value chains that contribute the greatest food safety risks; and ii) audience-specific learning needs. Programs should continuously evaluate training programs through reflective practice by trainers, actively seek feedback from participants, and strive to measure microbial or foodborne disease outcomes alongside behavior change.

## I. INTRODUCTION

Foodborne disease (FBD) is a global economic and public health problem. Foodborne hazards, including viruses and bacteria, parasites, chemicals, and toxins, cause symptoms that range from mild discomfort to life-threatening illnesses. The global burden of FBD is estimated to be similar to each of the “big three” infectious diseases (i.e., HIV/AIDS, malaria, and tuberculosis), in terms of disability-adjusted life years (4). FBD poses higher risks for young children and pregnant women, as well as elderly, immunocompromised, and malnourished people. Low- and middle-income countries (LMICs) bear 75% of the global FBD burden, particularly those in sub-Saharan Africa and Southeast Asia, despite accounting for only 40% of the global population (5). Traditional food markets are the “open air” markets where millions of people in LMICs buy and sell nutritious foods every day. They are part of the informal food sector, which generally lack adequate infrastructure and government oversight (i.e., regulation and enforcement of food safety standards) – posing significant food safety risks for consumers and vendors alike (6).

With this challenge, Feed the Future’s EatSafe: Evidence and Action Towards Safe Nutritious Foods (EatSafe) program seeks to improve food safety in traditional food markets. The EatSafe program develops and implements interventions to improve consumers’ and vendors’ knowledge, attitudes, and practices (KAP) related to food safety and the demand for safe food. When linked to the various factors that drive behavior (e.g., motivation, self-efficacy, the enabling environment, resources, etc.), KAP are foundational elements of empowerment.

Education, information exchange, and training programs support behavior change outcomes, as recognized in international recommendations for effective food safety action (7) (8). This review complements previous EatSafe research that examined consumer-facing media interventions, behavior change communication efforts, and food safety interventions in the informal sector, including the traditional food markets where EatSafe operates (1–3). The articles reviewed in these reports often incorporated food safety education and training into intervention design, either as a standalone intervention or one component of a broader intervention package. However, the details of these interventions, and the characteristics that underlie their success have yet to be explored in detail. Therefore, EatSafe undertook this review to:

- Consolidate existing literature on food safety trainings in LMICs, focusing on audiences in the informal food sector; and
- Identify the characteristics of intervention design that drive effective food safety trainings.

### *1.1. REPORT STRUCTURE*

This report first defines relevant terminology and describes four training and learning models to serve as conceptual guidance in this review ([Section 2](#)). EatSafe then describes the Methodology for the synthesis ([Section 3](#)) as well as the evaluation framework of four key characteristics (training approach, audience, context, and training curriculum), each with multiple questions embedded within them. Findings of the synthesis across relevant domains in the evaluation framework are presented in [Section 4](#). The report concludes with a discussion the implications for future research and EatSafe’s intervention design ([Section 5](#)).

## 2. THEORIES OF LEARNING

While many definitions exist, *learning* refers to the processes by which people acquire and retain new knowledge, skills, behaviors, and/or values to solve problems and identify opportunities. Many academic fields study learning (e.g., education, neuroscience, and psychology) and its application for improved outcomes (e.g., health behavior and promotion).

Like learning, training has a variety of definitions. To guide the work in this report, EatSafe defined key terms, as shown in **Table 1**. Note that EatSafe uses “participants” and “trainers” to categorize the two main parties in the articles included in this review.

**Table 1.** Definitions used in this review

<b>Training</b>	Focused process that seeks to enable effective learning by emphasizing applied skill building
<b>Food Safety Training</b>	An educational or informational intervention (either as part of a package of intervention measures, or as a standalone intervention) that enables participants to apply facts and process concepts to food safety practices.
<b>Curriculum</b>	An interactive system of instruction and learning with specific goals, contents, strategies, measurement, and resources. Desired outcome is successful transfer and/or development of knowledge, skills, and attitudes.
<b>Training Approach</b>	Training curricula delivered to at least one audience via at least one media to achieve process changes. May or may not reference learning theory
<b>Audience</b>	The group of participants to whom a curriculum is delivered.
<b>Media</b>	The channels via which the curriculum is delivered, including but not limited to written, visual, auidial, practical, or other forms of interactive media.
<b>Motivation</b>	To attend and complete trainings (i.e., participation); or, to translate new knowledge to action (i.e., adoption); can refer to the former, latter, or both

### 2.1. FOUR GUIDING MODELS FOR TRAINING-FOCUSED INTERVENTIONS

EatSafe identified four guiding learning models from a variety of fields to evaluate concepts likely to contribute to successful learning in training-focused food safety interventions (**Table 2**). These include:

- Race’s “Ripples on a Pond” model (9), from the field of adult education;
- Yeargin’s Knowledge-Sharing model (10), that applied educational theories to food safety training in high-income countries;
- Capability, Opportunity, Motivation, Behavior (COM-B) model from behavioral theory (11); and
- The “Three-legged Stool” model, which identifies the essential components for intervention success in informal food markets (12).

**Motivation is key:** Motivation drives both the desire to learn and subsequent application of new knowledge, which is critical to the success of behavior change interventions. Both the COM-B and



Race models do not favor cognitive or behaviorist learning theory but emphasize the importance and the interaction of both reflective and automatic processes.

**Stages/Processes:** Whereas Race focuses on participant needs, Yeargin uses a six-step model that sequentially considers the stages by which trainers distill knowledge that is then implemented by participants. Yeargin displays commonalities with other models, such as the importance of incorporating opportunities for hands-on activities and discussion (Race's "Doing" and "Verbalizing / Assessing"); and in addressing environmental constraints to practices (the "three-legged stool" model). Yeargin's adoption step incorporates both "making sense" of the knowledge (Race), and decision-making around implementing the knowledge, driven by individual (e.g., attitude, ability, and self-efficacy) and inter-personal factors (e.g., interacting with colleagues and customers). These echo concepts from the COM-B model, that emphasize physical and psychological capabilities, and social opportunity (i.e., cultural and social norms) as critical enablers for an individual to perform a behavior.

**Knowledge to action:** Implementation of safer food practices is critical. Assessing intervention effectiveness requires understanding the context in which training can be applied, as well as potential barriers or opportunities that influence participants' ability to act (i.e., indicating that the training fulfilled its intended learning outcomes). Repeated practice and the use of rewards to retain appropriate responses may also be critical in determining habit formation.

**Table 2.** Learning models guiding review of training-focused interventions

**MODEL**

**Race’s “Ripples on a Pond” model (9)**

- From the field of adult education to provide educators with a practical tool for effective strategies in facilitating adult learning
- **Seven overlapping factors** of successful learning; the overlap implies that learning is not unidirectional, and the factors amplify and influence each other.
- Motivation (**wanting/needing**) to learn is core
- **Doing** involves repetition, practice, experience, or trial and error, and is reinforced by feedback – seeing the results or other people’s reactions.
- **Making sense** (realizing/ “digesting” new knowledge) is when participants begin to take ownership and fit new concepts into existing mental frameworks, discarding what is not important (**Feedback**).
- **Verbalizing** and **assessing** bring in social aspects of learning, recognizing that participants make sense of knowledge when they speak to other people and form judgements on others’ understanding.



**Yeargin’s Knowledge-Sharing Model (10)**

- Previously applied to food safety training in high-income countries
- Uses education to make sense of training (e.g., learning about microorganisms as a rationale for handwashing; the process of which needs to be learned); “Transfer of training” is a term that describes the generalization of the new skills to the work environment.
- Training is distinct from education: Education only relates to learning facts/concepts (“ideational innovation”), while training is the process by which concepts are applied; implies skill development (“process ideation”)
- **Six steps** split into two dyads: 1) Sharing knowledge from researcher to educator; 2) Sharing knowledge from educator to learner

**Dyad 1: Researchers to Educators**

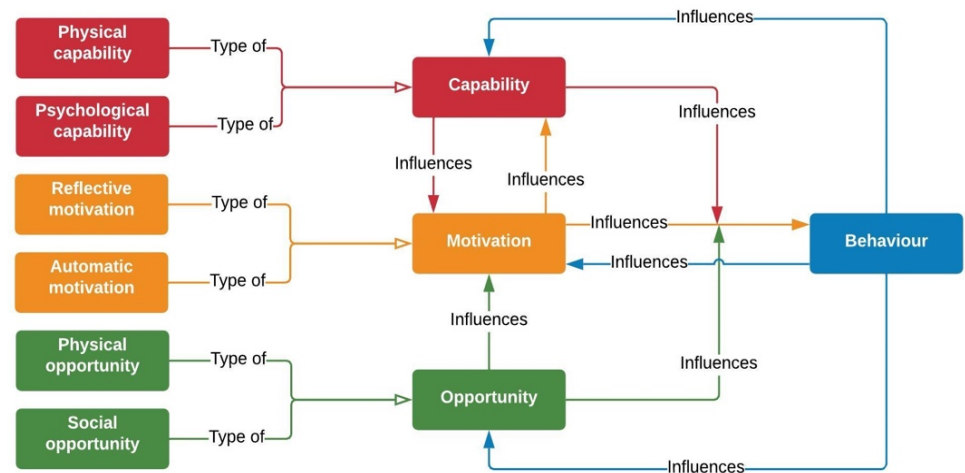
- **Generation:** Conduct literature review to inform food safety practices to be addressed in training
- **Adaptation:** Create messages about practical and relevant practice, specifically addressing actions food handlers should take, how to perform them, and why they are important
- **Dissemination:** Create a training plan including identifying the best mode of delivery

**Dyad 2: Educators to Learners**

- **Reception:** Incorporate opportunities for hands-on activities and discussions within training sessions
- **Adoption:** Ground training in appropriate behavior change theory to facilitate change beyond knowledge
- **Implementation:** Address environmental constraints to use of practices

## The Capability, Opportunity, Motivation, Behavior (COM-B) model (11)

- From behavioral theory, developed to assist those working on behavior change interventions to identify appropriate objectives
- Illustrates motivation as being influenced by both reflective and automatic processes (i.e., by both conscious decisions and instinctive or habitual behaviors)
- Posits that, at any given moment, a particular **behavior** will occur only when the person concerned has the **capability** and **opportunity** to engage in the behavior and is more **motivated** to enact that behavior than any other behaviors.
- Sociocultural norms are critical enablers for an individual to perform a behavior
- Capability and opportunity to perform a behavior influences motivation and links motivation and behavior



## “Three-legged Stool” model (12)

- Identifies the essential components for intervention success in informal markets
- **Three essential components for intervention success**
  - 1) Training and technologies
  - 2) An enabling environment (comprising physical infrastructure and attitude of authorities); and
  - 3) A motivation for behavior change.



### 3. METHODOLOGY

This targeted review of food safety training interventions in LMICs intended to capture, describe, and evaluate a wide range of relevant training approaches. To this end, EatSafe leveraged existing studies to identify peer-reviewed articles and reports, followed by a screening and prioritization process. EatSafe developed and tested an evaluation framework that was then applied to the articles selected for inclusion in this targeted review.

#### 3.1. ARTICLE IDENTIFICATION, SCREENING, AND PRIORITIZATION

**Identification.** EatSafe leveraged four studies to identify articles suitable for inclusion in this targeted review (**Table 3**). These studies included three existing reviews covering peer-reviewed articles published in English from 2000 to 2020, as well as one ongoing effort, that covers publications from 2000 to 2022. [Appendix 1](#) contains details on these four studies.

**Table 3.** Four studies leveraged for this review

TITLE (REF)	REVIEW	CONTEXT
Consumer-Facing Interventions to Improve Food Safety Perceptions and Practices in LMICs (1)	Scoping	LMICs
Food Safety Education, Training, and Technology Interventions in Africa and Asia (3,13)	Systematic	Low-income countries in South and Southeast Asia
	Systematic	Africa
Food Safety Training Approaches in LMICs (14)	Systematic	LMICs

**Screening.** With 250+ articles collected from the four studies above, EatSafe then screened the articles for the following inclusion criteria:

- Context: Low-and middle-income countries;
- Audience: Any aspect of food preparation in the informal sector (other than primary production), including slaughtering, processing, selling, purchasing, food preparation in food outlets, or food preparation at home;
- Descriptions of curriculum delivery, of which the primary focus was food safety, and which may contain elements of related topics;
- A change in at least one process likely to improve food safety (i.e., not a change in theoretical knowledge alone) must be an intended learning outcome; and
- An assessment of process change must be included in the evaluation.

**Prioritization.** Studies that met essential criteria were then assigned low, medium, or high priority. Studies were high priority if they provided a high-quality description of the training intervention and outcomes and contained either references to educational or behavioral theory or unique delivery media. Studies were low priority if the intervention description was poor, or the way the outcome had been measured seemed questionable. Studies were medium priority if the description of the intervention lacked sufficient detail for full evaluation per the Evaluation Framework below or were too similar to a high priority paper.

### 3.2. EVALUATION FRAMEWORK

Previous systematic literature reviews of food safety training have indicated the difficulty in quantitatively assessing intervention efficacy due to the inherent complexity, outcome heterogeneity, reporting bias, and paucity of randomized controlled trials in this area (15,16). This targeted review therefore concentrated on evaluating four specific characteristics of training interventions (**Table 4**). These characteristics closely relate to concepts from at least one of the four models EatSafe selected to guide the evaluation framework (i.e., Race, Yeargin, COM-B, Three-legged stool), which are specifically identified in [Appendix 2](#).

**Table 4.** Evaluation questions for studies included in this review

QUESTION
<b>TRAINING APPROACH</b>
What processes or practices does the training seek to change? Does the training approach rest on any underlying behavioral or educational theory?
<b>AUDIENCE</b>
Who are the target audience(s)? What characteristics are described (literacy, gender, occupation, previous food safety learning)?
<b>CONTEXT</b>
What is the environment in which participants are expected to apply the training? Is the training delivered on site or in a different location? Have any modifications been made to the social, physical or policy environment to enable training to be better applied?
<b>TRAINING CURRICULUM</b>
Can learning outcomes be identified? How many topics/modules are covered in the training? How was content determined? Can the training be classified as subject-centered, learner-centered, or problem-centered? How have messages been adapted to the target audience? What kind of media were selected? Who delivered the training? What motivated participants (want/need?) What were the opportunities for practicing the processes or practices? Does the training include formative assessments and/or feedback? Does the training include opportunities for verbalizing or assessing? How were learning outcomes evaluated? What evidence was there that participants had adopted the new knowledge into their practices?

## 4. FINDINGS

EatSafe ultimately selected 16 articles for inclusion in this review.<sup>1</sup> An abbreviated results table is shown in **Table 5**, with the additional details about intervention design, as well as the food safety practices targeted during training sessions, in [Appendix 3](#).

Some articles leveraged trainings as the sole intervention to improve food safety practices, while other delivered training as one component of a larger intervention (e.g., provision of equipment, soap/detergent, etc.). Many of the trainings were extremely complex, multi-faceted designs (e.g., regular inspections or extensive checklists).

Food safety trainings targeted food handlers at many points along the food supply chain, including slaughter, butchery, processing, trading, transporting, purchasing, and meal preparation and serving (commercial, communal, or home). As such, a range of food environments were covered. In **Table 5**, EatSafe categorized studies by target audience, including:

- Workers processing animal products (n=1);
- Consumers purchasing food and/or vendor training in informal markets (n=3);
- Commercial/communal food preparers (e.g., those serving food to the public in restaurants, hotels, schools, or hospital canteens, kiosks, street food vendors (n=7); and
- Caregivers and/or those preparing food at home (n=5)

<sup>1</sup> EatSafe identified an additional 20 articles that met inclusion criteria and were rated as “medium priority,” but halted evaluation of these studies during the final inclusion step of the review. These papers did not significantly add new information beyond those already reviewed.

**Table 5. Abbreviated results table, by target audience**

AUTHOR (REF)	COUNTRY	TIME	AUDIENCE <sup>1</sup>	AREA <sup>2</sup>	THEORY	APPR-OACH <sup>3</sup>	FORMAT / MEDIA	ENABLING ENVI.	OUTCOME <sup>4</sup>	RESULT
<b>TARGET AUDIENCE: WORKERS PROCESSING ANIMAL PRODUCTS</b>										
Samaan (17)	Indonesia	18 mo	HT – <i>market managers, inspectors, poultry vendors</i>	Central	None	P	Monthly, 2-hr group sessions / Participants developed posters. <i>Surprise inspections.</i>	Physical, Policy	KAP, BO	Good
<b>TARGET AUDIENCE: CONSUMERS AND VENDORS</b>										
Lagerkvist (18)	Kenya	9 dy	HO – <i>Consumers</i>	Workplace	Own Model (IMBP)	S	“Role model” stand staffed by trained local sellers / factsheet	Physical, Social	Risk, emotions	Good
Riyanto (19,20)	Indonesia	6 mo	HO – <i>Children, aged 9-10 yr</i>	Central	None	S	Weekly, 1-hr group sessions / videos	None reported	KAP	Good
		6 mo	HO – <i>Street food vendors</i>	Workplace	None	L	Weekly, individual 20-30 min sessions	None reported	M, C	Good
Takeuchi (21)	Thailand	2 yr	HO – <i>Consumers in one province</i>	Central	None	S	1 group lecture / banners, pamphlets, posters	Physical	H/FBD	Moderate
<b>TARGET AUDIENCE: COMMERCIAL / COMMUNAL FOOD PREPARERS</b>										
Acikel (22)	Turkey	1 mo	HT – <i>Hospital kitchen staff</i>	Central	None	S	1 group lecture and demo / <i>no media</i>	None reported	K, BS, M	Poor
High-touch-high-tech (23,24)	India	1 yr	HO – <i>Hospital kitchen staff</i>	Blended	Own model	L	Self- and group training / films, manual, posters. <i>Monthly inspections</i>	Physical	KAP, BO	Good
Da Cunha (25)	Brazil	2 yr	HO – <i>School food handlers</i>	Blended	FHTM	S, P	5, 12-hour group sessions / handouts. <i>Internal and external individual inspections</i>	Physical, Social	KAP, BO	Good
Husain (26,27)	Malaysia	3 mo	HO – <i>School food handlers</i>	Blended	TPB	S	3, 1-2 hr group sessions with demos over 3 wks / posters. <i>Follow-up visit.</i>	Physical, Social	K, BS, BO	Moderate
Choudhury (28)	India	3 mo	HO – <i>Street food vendors; restaurant employees</i>	Central	None	S	15, 4-hour group sessions 2/wk / 3 mo with demos / flipcharts, posters, videos. <i>Assignments.</i>	Policy	KAP, BO	Good
Singh (29)	India	3 mo	HO – <i>Street food vendors</i>	Workplace	None	N/A	2, 30-min, individual counseling / posters	None reported	BO	Moderate

Sanny (30)	Malaysia	3 dy	HO – <i>Fast food handlers</i>	Workplace	None	S	1 group training and demo (no feedback) / posters	None reported	C, BO	Poor
<b>TARGET AUDIENCE: CAREGIVERS AND/OR THOSE PREPARING FOOD AT HOME</b>										
Hygienic Family (31–34)	Malawi	8 mo	HO – <i>Mothers of children aged 6-24 mo</i>	Blended	RANAS	P	16 group sessions (length not reported) / games, songs, bibs, bracelets. <i>Biweekly home inspections.</i>	Physical, Social	H/D, BO, BS	Good
Touré (35)	Mali	9 mo	HO – <i>Mothers of children aged 6-18 mo</i>	Home	None	L	6-8 hours of home discussions. / Demos. <i>Bi-weekly visits</i>	Physical	M, BO	Good
SafeStart (36)	Kenya	1 mo	HO – <i>Mothers of children aged 6-9 mo</i>	Home	BCD	P	Hardware provision and BCC campaign / calendars, stickers, SMS messages	Physical	BO, BS	Moderate
SuperAmma (37)	India	1 mo	HT – <i>Households with children aged 8-13 yr</i>	Central	Evo-Eco	S	School activities (videos/demos), community events (performances)	Physical, Social	BO	Moderate
Ideal Mother (38)	Nepal	3 mo	HO – <i>Households with children aged 6 – 59 mo</i>	Blended	Evo-Eco; BCD	S	12 meetings (6 group; 6 household) / “kitchen makeovers,” public pledging, dramas	Physical, Social	BO	Good

*Acronyms:* BCC (“behavior change communications”), BCD (“Behavior-Centered Design”), RANAS (“Risks, Attitudes, Norms, Abilities, and Self-Regulation”), FHTM (“Food Hygiene Training Model”), and TPB (“Theory of Planned Behavior”), IMBP (“Integrative Model Behavioral Prediction”); hr (“hour”), dy (“day”), wk (“week”), mo (“month”)

<sup>1</sup> HT = Heterogenous; HO = Homogenous

<sup>2</sup> EatSafe used the following terms to categorize training locations/areas:

- *Home / Workplace:* training delivered in the same location where learning will be applied (i.e., home for caregivers; workplace for vendors)
- *Central:* training delivered in a separate location from where the learning will be applied);
- *Blended:* a combination of training delivered centrally or at home or in workplace

<sup>3</sup> P = Problem-centered; S = Subject-centered; L = Learner-centered; N/A = Not able to evaluate from description.

<sup>4</sup> KAP = (Knowledge, attitudes, behaviors); K = Knowledge; BO = Behavior (observed); BS = Behavior (self-report); C = Chemical; M = Microbial; H/FBD = Health/foodborne disease case incidence; H/D = Health/diarrhea (self-report)



#### 4.1. AUDIENCE

Most, but not all, articles described demographics or characteristics of the training audience (e.g., gender and education levels). Trainings targeting caregivers and women preparing food at home generally reported low literacy, limited outside occupations, and other proxy indicators for poverty.<sup>2</sup> The characteristics of food workers in the training interventions varied, with some reporting low levels of low literacy while others had completed high school or even secondary education. Certain audience characteristics, such as literacy, did not appear to greatly affect the outcome of the training, as media had been specifically designed to account for these factors (see “Adaptation” section of this report).

Most articles included in this review described the delivery of training to audiences with little to no previous food safety training. Only a few studies trained mixed audiences in which some participants had no previous training while others had been exposed to it in previous jobs.<sup>3</sup>

Most (n=12) studies delivered training to homogeneous groups with similar demographics characteristics or occupational roles (“homogenous” groups), whilst others were more diverse and covered multiple audience types (“heterogenous” groups); (n=4). EatSafe characterized approaches to audience types in **Table 6**, defined by whether trainings targeted the same or different food safety practice and training curricula.

**Table 6.** Approaches to audience types

AUDIENCE	APPROACH	EXAMPLE
Homogeneous	Same practice, same curriculum	Street food vendor group trained in food hygiene
Heterogeneous	Same practice, same curriculum	Chefs and cooks, servers, waiters, dishwashing and cleaning staff in hospital canteens, trained in handwashing and personal hygiene (22)
Heterogeneous	Same practice, different curricula	Children and adults learning about handwashing with soap at critical times, using different media and behavioral motivators (37)
Heterogeneous	Different practice, different curricula	Street food vendors trained in food hygiene whilst preparing food; schoolchildren simultaneously trained in selecting safer food for purchase (19,20)

Of the four studies that targeted heterogenous audience types, results were mixed. For example, a food hygiene and handwashing training course delivered to kitchen staff with non-overlapping roles (i.e., food preparers, servers, or cleaners; heterogenous group) reported little behavior change (22), while another intervention (28) with a similar approach and audience size (i.e., street-food vendors

<sup>2</sup> An exception is SuperAmma (37), that delivered handwashing training in the community and described characteristics of participating villages, rather than individual participants. However, it did note that over 80% of participants lived within a few meters of a standpipe, and all households owned soap.

<sup>3</sup> This is likely due to legal rules for food handler training in Turkey and India, among other countries.

and food handlers in small kiosks, where individuals would cover multiple roles of food preparation, serving and cleaning) reported considerable changes across several behavioral outcomes.

Most studies focused on audiences in a node of the single food value chain, rather than considering the transactional nature between groups. For example, although several interventions targeting commercial/communal kitchen food preparers covered the importance of selecting unspoiled produce, no study mentioned focus on the drivers that led food handlers to select suppliers. Further, one study that trained fast food workers on a new frying technique failed to investigate whether altered colors and textures were acceptable to customers, resulting in little uptake of the new procedure (30).

Involving heterogeneous audiences in training interventions can be beneficial when the training is designed using a problem-solving approach, as diverse participants can then enhance discussion (e.g., participatory training with market managers, sanitation inspectors, and poultry vendors reported a high degree of success through involving different stakeholders (17)).

#### 4.2. TRAINING LOCATION/AREAS

Most interventions took place in central or blended areas (n=11 of the 16 included studies), while the remainder occurred at home or in the workplace (n=5). Of those in the communal food preparers category, the review only identified studies relating to schools and hospitals (rather than, for example, workplace canteens catering for healthy adults). In the last category, caregivers and mothers of infants and young children were primarily trained in their homes, as expected.

Centrally delivered training required fewer resources to train more people, and thus, had larger audiences. Training that involved visits to homes or workplaces required more staff, so most articles described either pilot interventions delivered by one or two researchers, or those that tapped into existing networks (see the “Trainers” section of this report). Although training coupled with the observation of behaviors in the workplace or home perhaps provided more opportunities for participants to receive feedback, some classroom-based or centrally delivered training provided many hands-on, practical opportunities.

#### 4.3. USE OF BEHAVIORAL OR LEARNING THEORIES

Eight of the 16 articles included in the review had a theoretical underpinning to the training, all of which describe how intervention elements were related to concepts in the theoretical models.

**Targeting caregivers:** Four of the five studies targeting caregivers, and half of all studies that leveraged a behavioral theory, were extensions of WASH studies and focused on a handful of practices like handwashing with soap before food preparation and feeding children. They all used behavioral learning theories that rely on reinforcement learning by disrupting physical/social settings and using emotional drivers to change behaviors (i.e., BCD, RANAS, Evo-Eco).<sup>4</sup>

**Targeting food handlers:** The three studies targeting food handlers in hospitals and schools leveraged specific educational or behavioral theories, though they did not explicitly describe how the

<sup>4</sup> Beyond caregivers, only one program (“SafePork”) was identified as a good example of how to use Nudge Theory – the behavioral science concept that uses positive reinforcement and indirect suggestions as ways to influence decision-making – to create training materials for pork slaughterhouses and butchers (41). However, this article only describes formative research and thus outcomes are not yet available.

models related to specific elements of training. While these models may mention the importance of physical environments and social norms (e.g., emphasizing manager approval for more hygienic behaviors), there is no reference to emotional drivers, in contrast to the child caregiver studies. Some articles described the theoretical literature in preparing training (e.g., Da Cunha (25) described incorporated Food Hygiene Training Model developed by Seaman (39)), while others did not define it as foundational to the training approach.

**Targeting consumers.** Only one study targeting consumers leveraged a theoretical model, and it was one developed by the authors. After analyzing consumers' perceived risk and anticipated regret to accept exposure to a food safety risk, the authors then built a separate theoretical model (18).

#### 4.4. APPROACH

In nearly all studies included in this review, researchers identified a presumed need for the target audience to receive food safety training, as opposed to developing training as a response to participant demand. However, two of the 16 studies noted participants may have had an above-average interest in being trained (e.g., (35) recruited mothers from nutrition education sessions; (21) recruited all consumers in an area with a recent FBD outbreak). Further, 15 of the 16 studies did not provide participants with explicit learning outcomes or expected results of the training.<sup>5</sup>

To analyze how interventions approached training, EatSafe identified three types: subject-, problem-, and learner-centered trainings. Most trainings (n=8) were **subject-centered** curricula; that is, instructors compiled a list of topics on which they believed participants should be trained. A few studies (n=4) used **problem-centered** curricula, encouraging participants to define the problem and formulate their own solutions. **Learner-centered** training was the least common (i.e., training content was specifically tailored to each participant).

**Subject-centered:** Most studies included in this review leveraged this approach, including three of the four studies targeting consumers or vendors. For example, (21) targeted an entire province on the dangers of raw pork consumption in response to a recent *Streptococcus suis* outbreak.

**Problem-centered:** Food preparers in school kitchen in Brazil (25) that were invited by “tutors” (i.e., teachers and municipality staff) to report challenges, make suggestions to improve sanitation practices, and implement an action plan during regular monitor visits. The wet market project in Indonesia provides an apt description of problem-centered curricula (17):

*“A participatory approach ... [where] problems were posed and potential solutions discussed at monthly consultation meetings held at the markets until acceptable options emerged.” The participants in this training were additionally provided with subject-specific “key messages”, that included “education and awareness of how avian influenza is transmitted; ... market zoning to prevent public access to potentially contaminated areas; ... appropriate cage design and holding practices; ... properly designed utilities, such as drainage systems, and batch processing.”*

<sup>5</sup> The exception was (28), a classroom-based course in where the first 40 minutes of each of timetabled lesson included “climate setting and motivation” and “clarify training objectives/content,” (see [Appendix 4](#)).

**Learning-centered:** Training of hospital food businesses in India (23,24) is one example of successful learner-centered curricula. The lead trainer conducted monthly inspections, though visits were less focused on problem-solving and more on suggested no-cost/low-cost improvements that were acceptable to the food handlers. Likewise, in a study of caregivers preparing weaning foods at home in Mali (31–33) trainers gave individual, home-based training where they imparted selected messages and demonstrations based on observations of the learners' practices. The training was reported to be highly effective, with the conversion to re-heating stored food before feeding as a remarkable change in behavior. This involved a “non-trivial investment of effort and attention” due to the cooking fuels available (wood or charcoal):

*“The field worker wrote down all deviations ... in weaning food preparation and handling. At the end of each session, the fieldworker discussed with the mother any observed deviations from corrective actions and noted the mothers' explanations and their suggestions if any. Finally, they recalled corrective messages and requested an appointment for the next visit. This began with a recall of the previous visit's observed deviations and the corrective actions needed.”*

#### 4.5. TRAINERS

Beyond researchers or research assistants, larger-scale interventions that required a higher quantity of trainers identified people from the local network of community health workers, community volunteers (e.g., “food hygiene monitors” (38)), teachers (25), university graduates (31–34), or facilitators from a local events company (37).<sup>6</sup> In general, studies that used trainers with higher levels of education and/or education specific to health and food safety had better results as compared to those that used teachers, volunteers, or facilitators as trainers (37) (25). One study (36) highlighted the importance of investigating the relationships between trainers and participants before the start of the intervention to avoid undermining its success.<sup>7</sup>

All interventions targeting food workers (n=7) involved researchers in the delivery of content, though the most successful were those that delivered training over a longer time (e.g., several months). This result may reflect the incorporation of inspections with individual feedback as an intervention component, and/or prolonged contact between trainer and participants that allowed the parties to build relationships, enhancing the probability that participants will adopt new knowledge.

#### 4.6. CURRICULUM

**Content and pre-testing:** Almost all studies reviewed developed their own training materials, rather than utilizing existing resources from elsewhere. Most studies designed training content using a variety of sources, frequently including international standards and guidelines developed by the World Health Organization and Codex Alimentarius. Several studies across multiple audiences pre-tested training content and media with expert stakeholders and participants themselves.

<sup>6</sup> In (37), the authors noted the training became progressively more successful in villages visited later during the study, presumably as the implementors became more familiar with the content.

<sup>7</sup> In (36), research assistants were paired with community health volunteers because the latter were viewed as less trustworthy by the local community (i.e., they were perceived as favoring relatives or friends in the distribution of hardware).

**Formative research:** Multiple studies focusing on both workplace and home environments conducted formative research using a Hazard Analysis and Critical Control Point (HACCP) assessment to understand participants' training needs. However, only two studies, both on child caregivers, evaluated behavioral drivers as part of their formative research before intervention design (31–34,38).

**Target food safety practices:** Most training courses targeted several practices to reduce contamination during the food preparation process, i.e., cleaning utensils with soap; storing utensils off the floor; storing cooked food in lidded containers; proper reheating of cooked food; hygienic feeding of young children, especially around weaning; and using potable water (see [Appendix 3](#) for more detail). Some trainings, however, only targeted a single food safety practice – usually one that was critical to the control of a specific food-associated risk (e.g., changing the frying process of French fries to reduce acrylamide (30); deterring consumption of raw pork to reduce *Streptococcus suis* infections (21)). Of the interventions that delivered trainings as a component of a larger intervention (e.g., provision of equipment, soap/detergent, etc.), the target food safety practices and training curricula closely aligned with those other intervention components.

**Message framing:** Most studies framed messages about food safety positively and/or used negative frames to highlight the benefits of positive messages. For example, the SuperAmma campaign (37) used a positive role model mother as its central figure, and framed messages around nurture, affiliation and status; it also included a comical male character whose disgusting habits were humorously contrasted with those of SuperAmma, thus using both positive and negative framing of messages to alter behaviors. In a Kenyan study targeting consumers (18), positive message framing were used to motivate consumers to choose safer foods; this was seen as a preferable approach over fear-based motivation given that the target audience had relatively high food safety knowledge.<sup>8</sup>

#### 4.7. TRAINING FORMAT

Lectures were widely used to train participants. Practical demonstrations, either by the trainer or by participants identified as already using good practices, were often leveraged as activities to better enable participants to successfully transfer the training skills acquired (see [Appendix 4](#) for an example of training curricula that included hands-on demonstrations). Games were also used to explain microbiological contamination and spread (e.g., GloGerm™, Hot Potato, Poo Tag) in both group-based and individual trainings. For individual training, guided practice was also mentioned as a delivery medium.

**Impact of literacy:** Interventions targeting literate audiences provided written guidance and manuals for self-instruction, some of which were extremely detailed, and record-keeping practices for monitoring improvements in food hygiene. For low literacy audiences, a variety of alternative media were used to make messages memorable (e.g., short slogans like “Clean food, happy baby” (36), parades involving the local schoolchildren to embed slogans into the community (37), writing folk songs with food safety messages (38)).

<sup>8</sup> The SafePork study excluded from this review (40) pre-tested both positive and negative framing but reached no conclusion as to which might be preferable. The authors planned to trial both in the intervention (see example in [Appendix 5](#)).

#### 4.8. MEDIA AND COMMUNICATION ASSETS

Interventions used a wide variety of media and communication assets to explain training content. Films, both fiction and non-fiction, puppet shows, role plays, songs, and skits were all mentioned in group sessions for both child caregiver and food worker trainings. Other community-based activities in household-based training courses included parades, events, public pledging, awarding of certificates, and photo boards with pictures of successful participants; however, these assets were not featured in food worker training.

Memory aids such as posters, calendars, stickers, schoolbook covers, bibs, and bracelets were distributed in many projects. One study (29) observed that participants used assets intended to be wall calendars as place mats by participants, which suggested that this innovation increased participant adoption of the knowledge (i.e., they found their own ways to improve hygienic practices with the tools provided).

**Use of multiple media:** Each study leveraged several training media, so it was difficult to disentangle which intervention media components delivered the most impact and/or which could be omitted in future without impacting training efficacy. Only one study that used SMS text messages sent to participants' mobile phones (36) appeared to ask for feedback from participants; although some participants found SMS messages useful, the frequency (twice daily) was "too much" for some, whilst others did not understand them. Further, they reported that participants did not find stickers, which duplicated messages from calendars, useful.

**Adaptation to context:** Though most interventions considered adapting messages to their target audience, not all explicitly described how they did so.<sup>9</sup> Generally, media and communication assets (e.g., photographs, films, posters, manuals) represented local people, environments, and practices. While one study used their own in-house design team, others used local companies. Other novel ways to adapt messages to the target audience included using local folk heroes or designing cartoon characters to represent local characters (23). Beyond literacy, some studies adapted materials based on economic considerations (e.g., profit for vendors or poverty for households).

#### 4.9. ENABLING ENVIRONMENT

Ten of the 16 articles examined at least one of three components of the enabling environment, and seven covered multiple components. Overall, 10 articles examined the physical environment, while the social and policy environments were covered in five and two articles, respectively.

**Physical environment:** Most training interventions included some modifications of the physical environment (e.g., posters, stickers, or other communication materials like flags). Some interventions substantially changed the environment in which target practices occur (e.g., constructing handwashing stations or dishracks, redesigning market spaces, providing hardware like equipment, soap/detergent, etc.), while others had participants advocate additional changes (e.g., helping participants request and contact relevant authorities to improve infrastructure or redesign spaces to aid hygienic workflows).

<sup>9</sup> The SafePork study (40) excluded from this review implemented interventions in multiple countries using the same messages but with images in presentations/booklets with photographs taken locally.

**Policy environment:** Only two studies incorporated public policy and/or advocacy with intervention design.<sup>10</sup> In training for street-food vendors in India (28), trainers helped participants obtain licenses from the city authority “to avoid eviction for unhealthy practices,” using the benefits of compliance as an incentive – an activity that may have increased participants’ motivation to complete the training. In a study of two wet markets in Indonesia (17), a complete redesign and upgrade of market infrastructure was complemented by approval from the municipal authority to leverage sanitary inspectors and market managers to monitor pork vendors’ adoption of food safety guidelines. Furthermore, the municipal authority committed funding to maintain new infrastructure, including water provision and electricity. The authors noted this was an essential component of the project’s success, as it allowed vendors to implement new hygiene practices without financial cost.

**Social environment:** Though a few articles considered how social environments related to intervention design or uptake, only the studies that directly referenced behavioral or educational models (n=6) deliberately incorporated it into the study. Some trainings included all relevant people (e.g., all household members in a kitchen or workers in a business), showing films or theatre to sensitize them to food safety issues as a group. Other interventions used written agreements between participants and kitchen managers, or public pledging within communities for participants to commit to maintaining new practices. To model food safety behaviors, some studies used images or video testimonials of important local figures (e.g., leaders, teachers, or politicians) or highlighted the actions of participants who were already performing the target behaviors.

#### 4.10. MOTIVATION

As noted in Table 1, EatSafe has defined motivation via two pathways: participation and adoption. Overall, evidence from the studies included in the review was systematically lacking for the former, and positive for the latter – but only among child caregivers:

Motivation to attend and complete food safety trainings (i.e., <b>participation</b> )	<ul style="list-style-type: none"> <li>• Almost entirely unreported, except anecdotally and in retrospect; should be considered explicitly in future studies</li> <li>• Can be part of a positive feedback loop (10), where initial reluctance may become interest, as participants see the relevance of training to their everyday lives</li> </ul>
Motivation to translate new knowledge on food safety practices to action (i.e., <b>adoption</b> )	<ul style="list-style-type: none"> <li>• Anecdotally reported in studies targeting communal food handlers, while well-studied among child caregivers</li> <li>• Findings align with behavioral models (e.g., COM-B), that participants use both conscious and unconscious thought processes to perform even apparently simple behaviors</li> <li>• Factors: explaining the reasons for practices allow participants to rationalize and perform new behaviors; highlighting positive feelings associated with good performance; addressing actual and perceived barriers as part of training</li> </ul>

<sup>10</sup> A study in Brazil (25) mentioned the national policy environment as a reason for focusing on street food vendors, though policy was not incorporated as a component within intervention design – thus, it is excluded from this category.

Studies applied various techniques to increase participant motivation. While many studies distributed hardware (e.g., soap, disinfectant, paper towels, storage containers, buckets, and cooking or eating utensils) as part of intervention design, the authors did not discuss whether hardware was provided to motivate attendance. One study (35) provided materials in response to participant feedback on implementation barriers.

**Among food handlers:** While studies targeting food handlers noted relatively high motivation to attend trainings, no study purposively aimed to identify motivators to change behavior in intervention design. Anecdotally, the main motivators mentioned for food workers were professional pride and recognition of the importance of their role in food safety, along with economic interests and avoiding legal interference for poor practices. One study (28) motivated participation by helping vendors obtain licenses from the local authority and developed training curricula that included recommendations to upgrade attractiveness of foods sold, thus improving business profitability. Overall, the authors described food handlers' motivations as follows:

*"The felt need for food safety training was present strongly among food handlers though not expressed." (23,24)*

*"The vendors in our study were receptive to the health education intervention as it was for the first time in their life they had experienced any such awareness talk related to their profession. They welcomed it..." (29)*

*"All the vendors had a very positive attitude. This was a matter of their daily bread and butter and when they realized that the better service they gave, the more they were to gain, they attended the sessions very attentively." (28)*

**Among caregivers:** Because most studies targeting caregivers were organized around behavior change theories, the motivators to change behavior were more explicit – however, such motivations usually referred to the entire intervention and were not necessarily specific to training. Some studies leveraged multiple motivators through food safety messages (e.g., provoking feelings of disgust, nurturing, group affiliation, and status), while others disrupted social environments to change habits (e.g., (37) incorporated men into household discussions around food preparation). One study (36) that delivered hardware with a simple message (i.e., "Clean food, happy baby") intentionally excluded education as an intervention component. However, the authors found that participants demanded it. The hardware intervention (i.e., disrupting physical environment) delivered moderate success, but participants wanted to be able to rationalize their behaviors with training and knowledge:

*"Caregivers needed and wanted to receive information and education about food hygiene. Specifically, they knew that maintaining food hygiene was important but had not linked food hygiene to specific behaviors and practices in the home. They needed information on why and how to improve hygiene ... These results suggest that education may be a critical component of food hygiene interventions, alongside the use of other theory-driven behavior change techniques, because it increases the acceptability and likeability of the intervention." (36)*

#### 4.1.1. PRACTICING, PROVIDING FEEDBACK, VERBALIZING AND ASSESSING

Most studies incorporated opportunities for participants to practice under supervision and receive feedback on their performance in either group or individual sessions in the home or workplace. Quizzes and puzzles to self-test knowledge were used occasionally; one study (28) included two



assignments as part of the final sessions that had participants demonstrate their adoption of the new knowledge to the trainer. Multiple studies across different target audience groups included inspections of the workplace / home kitchen (i.e., observation of participants performing food preparation, discussing deviations and improvements), and were generally effective. By contrast, one study (30) that intentionally refrained from providing feedback on performance showed little change in behavior. Allowing participants to observe and comment on each other's performance was also used successfully in a group setting.

Other opportunities to assess and verbalize were mostly found in the problem-based learning approaches (see "Curriculum" section of this report). For example, one of the child caregiver studies (31–34) convened group discussions to encourage participants to talk together about the "what" and "why" for critical handwashing times. The same study also promoted discussions around learning activities to reinforce social learning and positive group norms, as well as provide role modelling behaviors for participants.

#### 4.12. EVALUATED OUTCOMES, ADOPTION, AND REPORTED RESULTS

**Evaluated Outcomes:** Most (n=11) studies evaluated multiple outcomes, spanning changes in participants' knowledge, attitude, and practice (KAP) and behavioral outcomes (i.e., training adoption via self-report or observation). Of the 13 studies that evaluated behavioral outcomes, nine relied on observations to assess training effectiveness, three used both self-report and observations, and one used only self-reported data. Only four studies evaluated microbial or chemical outcomes in food: some included record keeping of regular microbiological and toxicological testing, as well as things such as storage temperatures and stock expiry. Only two studies evaluated human health outcomes.

**Observed Behaviors:** While many participants exhibited improved behaviors that they believed to be under their control, overall hygiene did not improve primarily due to physical barriers (e.g., poor kitchen layout, location of food vending stalls). Evaluations were all conducted within a relatively short time frame after intervention implementation, so sustained behavior changes were not generally identifiable. Interestingly, one intervention (25) noted that compliance with the target food safety practice decreased in line with holidays over the two-year observation period, suggesting repeat training sessions are necessary to ensure sustainability.

**Results:** Most studies reported good or moderate outcomes (n=9 and n=5, respectively) with full or partial adoption of behaviors; the remaining two studies reported poor outcomes. EatSafe defined good as most or all target processes improving with training or, (where behaviors were not observed, a change in an empirical food safety measure); moderate as uptake of behavioral change in only some target processes, or only some parts of the target audience or no statistically significant overall food safety change despite behavior change, and poor as no or very limited uptake of behavior change in target processes. Apart from the study on French fries (30), the two studies that reported the least improvement in behaviors were both short in duration – up to six hours delivered in three, once-weekly sessions (26,27) or a single, one-day session (22). One of these two studies (26,27) that utilized TPB found only a small improvement in knowledge, with little translation of knowledge to action in the workplace.

Only one study (36), among child caregivers, commented on scalability and affordability. The authors concluded that the delivery method (i.e., six to eight hours of individual visits during the first three weeks, followed by fortnightly visits for nine months), was neither affordable nor effective at scale,

despite being highly successful in changing participants' behaviors and achieving a sustained reduction in microbial contamination of food.

## 5. DISCUSSION

This study initially aimed to describe and categorize training approaches, but rapidly found that even within a small selection of studies (n=16), each study contained a unique training approach with context-specific elements (e.g., location, audience type, media used, trainers, etc.) purposefully mixed and matched to fit participants' learning needs and available resources. Organized by the four characteristics of the evaluation framework, **Table 7** summarizes the variety of design factors and context-specific elements of the interventions included in this review.<sup>11</sup> The evaluation framework developed for this review may provide a useful basis for considering where and how other novel intervention design components may contribute or detract from training outcomes, as well as minimum essential considerations for designing future training interventions.

**Table 7.** Summary of training design characteristics from the 16 included articles

QUESTION	FINDINGS
<b>TRAINING APPROACH</b>	
What processes or practices does the training seek to change?	<ul style="list-style-type: none"> <li>• Variable quantity and task complexity.</li> <li>• Minimum of 1 practice, though most focused on 3-5; maximum of 95; see <a href="#">Appendix 3</a></li> </ul>
Does the training approach rest on any underlying behavioral or educational theory?	<ul style="list-style-type: none"> <li>• 8 (half) of included studies, 4 of which targeted caregivers during food preparation at home</li> </ul>
<b>AUDIENCE</b>	
Who are the target audience(s)?	<ul style="list-style-type: none"> <li>• Workers processing animal products (n=1)</li> <li>• Consumers purchasing food and/or vendor training in informal markets (n=3)</li> <li>• Caregivers and/or home food preparers (n=5)</li> <li>• Commercial/communal food preparers (n=7)</li> <li>• Further aggregated into 4 types (<b>Table 6</b>) targeting same/different food safety practices and curricula</li> </ul>
What characteristics are described?	<ul style="list-style-type: none"> <li>• Gender</li> <li>• Occupation</li> <li>• Poverty, or other proxy measure</li> <li>• Education level and literacy</li> <li>• Previous food safety learning/training</li> <li>• Access to clean water and soap</li> </ul>
<b>CONTEXT</b>	
What is the environment in which participants are expected to apply the training?	<ul style="list-style-type: none"> <li>• Homes</li> <li>• Traditional/informal markets</li> <li>• Commercial/communal kitchens (e.g., schools, hospitals, businesses)</li> </ul>

<sup>11</sup> The articles in this review are not representative of the proportion of all trainings that applied these various components.

What is the location of training or area where training is held?	<p>3 types</p> <ul style="list-style-type: none"> <li>• Central (separate from daily settings of operations)</li> <li>• Home/Workplace</li> <li>• Blended (mix of both)</li> </ul>
Have any modifications been made to the environment to enable training to be better applied?	<p><b>Physical</b></p> <ul style="list-style-type: none"> <li>• Provision of hardware (e.g., buckets, utensils)</li> <li>• Provision of consumables (e.g., soap, disinfectant)</li> <li>• Suggesting/co-designing layout/workflows improvements</li> <li>• Assist with access to funding for infrastructure updates</li> </ul> <p><b>Social</b></p> <ul style="list-style-type: none"> <li>• Discussions with specific groups on challenges</li> <li>• Highlight existing good practices by peers (e.g., using competitions or photographic displays)</li> <li>• Highlight support from locally respected figures</li> <li>• Public pledges</li> <li>• Involving internal personnel or peers in monitoring</li> <li>• Problem solving discussions with different social groups (e.g., vendors and market managers)</li> </ul> <p><b>Policy</b></p> <ul style="list-style-type: none"> <li>• Assist with permit/ license acquisition</li> <li>• Assist with access to municipal funding for continued service provision (e.g., clean water, electricity)</li> </ul>

### TRAINING CURRICULUM

Can learning outcomes be identified?	<ul style="list-style-type: none"> <li>• Learning outcomes should clearly and specifically define who, when, what, and how of training content, which were rarely explicitly mentioned in included studies</li> </ul>
How many topics / modules are covered in the training?	<ul style="list-style-type: none"> <li>• Highly variable.</li> <li>• Not necessarily correlated to quantity of target food safety practices, as some could be covered over multiple sessions and address different aspects (e.g., learning rationalization, performance, then addressing social and attitudinal barriers)</li> </ul>
How was content determined?	<ul style="list-style-type: none"> <li>• HACCP assessments, formative research, adaptation after pre-testing</li> <li>• Guidelines from WHO and Codex Alimentarius</li> </ul>
Can the training be classified as subject-centered, learner-centered or problem-centered?	<ul style="list-style-type: none"> <li>• Predominantly <b>subject</b>-centered</li> <li>• Other approaches (<b>problem</b>-centered and <b>learner</b>-centered) used occasionally</li> </ul>
How have messages been adapted to the target audience?	<ul style="list-style-type: none"> <li>• Feature local people</li> <li>• Appropriate for audience literacy</li> <li>• Low-cost / no-cost suggestions to improve hygiene</li> <li>• Including features to improve profitability</li> <li>• Selecting tailored messages based on participant observation</li> </ul>
What kind of media were used?	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Demonstrations (live or filmed)</li> <li>• Guided practice (e.g., role play)</li> <li>• Games, puzzles, quizzes, and competitions</li> <li>• Facilitated discussions</li> </ul>

	<ul style="list-style-type: none"> <li>• Self-instruction manuals</li> <li>• Entertainment (e.g., films, plays, skits, puppet shows); songs and song composition</li> <li>• Parades, events, public pledging, photo boards</li> <li>• Memory aids (e.g., posters, stickers, wall calendars, table mats, book covers, bracelets, bibs)</li> </ul>
Who delivered the training?	<p>One or a combination of:</p> <ul style="list-style-type: none"> <li>• Researcher</li> <li>• Trained employees of the research team (local graduates, professional nutritionists or field staff)</li> <li>• Community health workers</li> <li>• Trained internal personnel (mentors from local authority)</li> <li>• Trained community members</li> <li>• Professional events company</li> </ul>
What motivated the participants (want / need?)	<ul style="list-style-type: none"> <li>• To attend: Rarely reported. Possibly a growing appreciation of the knowledge gained through attendance in a positive feedback cycle.</li> <li>• Assistance in obtaining licenses</li> <li>• Selection of audiences with higher motivation to learn</li> <li>• Emotions including disgust, nurture, status, group affiliation, social norms, identifying positive feelings (around soap use), professional pride, economic drivers, avoidance / minimization of risk</li> </ul>
What were the opportunities for practicing the processes?	<ul style="list-style-type: none"> <li>• Guided practice featured in most trainings</li> <li>• Practical sessions (market redesign, kitchen makeovers, constructing hardware)</li> </ul>
Does the training include formative assessments and/or feedback?	<ul style="list-style-type: none"> <li>• Quizzes (Self-assessed or group work)</li> <li>• Written assessments</li> <li>• Inspections of workplace / home</li> </ul>
Does the training include opportunities for verbalizing or assessing?	<ul style="list-style-type: none"> <li>• Facilitated problem-solving</li> <li>• Facilitated discussions</li> <li>• Peer-to-peer feedback</li> </ul>
How were learning outcomes evaluated?	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Self-reported behaviors</li> <li>• Microbiological / chemical testing</li> <li>• Reported clinical outcomes (diarrhea frequency)</li> </ul>
What evidence was there that participants had adopted the new knowledge into their practices?	<ul style="list-style-type: none"> <li>• Observation during repeated inspections of partial or complete adoption of behaviors</li> <li>• Behaviors under participants' control were most likely to change, whereas those requiring infrastructure change required additional resources</li> <li>• Participants deliberately not exposed to knowledge requested training to understand new process</li> </ul>

### 5.1. STUDY LIMITATIONS

As noted above, EatSafe developed a list of theory-based research questions from which relevant information on the various intervention design components were extracted. The difficulties of categorizing extremely complex and multi-faceted interventions is a recognized limitation for these

reviews, noted by other authors as an obstacle to quantitatively assess intervention efficacy (15,16). Similarly, the studies included in this review rarely collected empirical data on microbiological or health outcomes. Such a result confirms other recently published global reviews, which found that most food safety training interventions assessed changes in knowledge, with a sizable minority measuring behavior change, and only a few reporting on a microbiological or FBD outcomes (15,16).

Like all others, this review will be affected by publication bias. Because studies that report negative outcomes are less likely to be published, it is difficult to identify components of intervention design that contributed to ineffective interventions. Further, published studies may omit certain findings relevant to intervention success (e.g., negative participant feedback).

Four of the 16 approaches included in this review (i.e., Riyanto (19,20), High-touch-high-tech (23,24) Husain (26,27), and Hygienic Family (31–34)) required EatSafe to review multiple articles to understand the whole training approach, often inferring descriptions of time and location to link articles published by the same author or group of authors about the same project.<sup>12</sup>

## 6. CONCLUSIONS

This synthesis review aimed to highlight key design characteristics that influence the effectiveness of food safety training interventions in LMICs. Foremost, understanding the context for providing training is critical. EatSafe and other training designers should utilize ethnographic and formative research to understand the context of the traditional markets where they work, and to empirically identify and account for i) nodes along target food value chains that contribute the greatest food safety risks; and ii) audience-specific learning needs.

The characteristics of intervention design that drive effective food safety trainings presented here closely align with findings from other recent global systematic literature reviews. Our key conclusions are that increased knowledge and improved behaviors from food safety training (15,16) require formative research,<sup>13</sup> together with a “learning needs” assessments to adapt materials for target context(s) and audience(s). The design of training should include purposeful application of learning and behavior change theories. Training approaches should emphasis developing trustful relationships between participants and trainers and integrating opportunities for discussion, practice, and individualized feedback during training session. Finally, training should recognize obstacles inherent in the enabling environment and encourage problem-solving with participants to address physical, policy and social environmental barriers as they begin transferring knowledge to action.

### 6.1. IMPLICATIONS FOR INTERVENTION DESIGN

Several key considerations emerge from this study, complemented by the experience of the authors. First, successful food safety training approaches leverage **behavior change or learning theory** that:

<sup>12</sup> These articles either i) described projects that delivered more than one curriculum to different audience groups that interact with each other (e.g., vendors sourcing safe food which are then purchased by consumers); or ii) delivered training curriculum to the same audience using several media but describe each media in multiple publications without additional clarification. EatSafe classified both of these types of studies as a single training approach, though with multiple article citations.

<sup>13</sup> In (15), the use of formative research in the design of interventions demonstrated a larger effect size on attitude and belief outcomes.

- Design multi-faceted approaches, enabling participants to strategically target deeper learning engagement with design elements they find most useful;
- Explicitly identify the theoretical bases that influence specific training components;
- Account for participants' existing practice and process knowledge, then train on specific "when, where, and how" to target improvement for a manageable number of practices;
- Provide communication assets and memory aids to overcome barriers to implementation and/or reinforce correct performance;
- Gather participant feedback to evaluate and improve existing and new programs;
- Support the program's theory of change; and
- Incorporate potential scale and sustainability considerations.

Successful food safety training interventions allocate **time and resources** to:

- Conduct or access formative research to understand the context and target audience(s);
- Engage with multiple audiences to determine necessary trade-offs;
- Consider technological innovations to deliver core concepts, thus allowing trainers to undertake more complex tasks rather than lecture delivery;
- Use the same key messages in different activities so participants to internalize messages;
- Practice, observe, and provide feedback on new skills;
- Evaluate changes in hazard and risk, beyond KAP and behavioral observations;
- Evaluate multiple intervention characteristics, particularly for sustainability impacts.

Successful food safety training interventions are built upon **trust**, so that:

- Participants see trainers, who have a background in health, hygiene, or food safety, as credible sources with whom they can build relationships;
- Participants and trainers have opportunities for individual practice, if possible in the environment in which they will perform the behavior;
- Trainers recognize the barriers participants face to implement new practices, and are committed to helping them solve problems in ways that are affordable and sustainable;
- Training is used as an opportunity to build trust between disparate groups (e.g., participants, regulators, inspectors, program providers).

Successful food safety training interventions move **knowledge to action** so that:

- Participants are motivated to apply their knowledge after the intervention ends;
- Physical, social, and policy barriers to implementing new practices are addressed;
- Participants can problem solve and apply new knowledge to overcome limitations of the physical environments (e.g., infrastructure);
- Participant feedback is integrated into program evaluation and learning opportunities; and
- Approaches can be scaled and disseminated more widely across audience(s) and context(s).

While not all successful approaches meet all these criteria, and following these criteria is not a guarantee of success, available evidence suggests that carefully considering and designing around these factors will increase the probability of success.

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## 8. APPENDICES

### 8.1. APPENDIX I: DETAILED METHODS

#### SCOPING REVIEW OF CONSUMER-FACING FOOD SAFETY INTERVENTIONS (1)

Studies were eligible for inclusion in the scoping review if they had a consumer focus, a food safety focus, and were an intervention attempting to change knowledge, attitudes, beliefs or behaviors/practices related to food safety. There were no geographical limits, but only studies published in English were included. Only studies published since 2000 were included. The full search strategy, including the syntax for search terms of the seven databases searched, are available in Appendix 1 (page 41) of the original review (1).

#### FOOD SAFETY TRAINING IN ASIA AND AFRICA (3)<sup>14</sup>

In both reviews, studies were included if they described interventions involving vendors or delivered in market settings, or at the community or household level. The exclusion criteria for the Asian review were interventions not related to foodborne hazards, studies conducted only in laboratories or research farms, those focusing on prevalence or risk factor analysis, and those implemented outside the selected countries. The exclusion criteria for the Africa review were only assessments of willingness to pay, WASH interventions focused on specific groups (e.g., pregnant women), and those implemented elsewhere in the value chain (farm, slaughter, etc.), with the exception of two relevant papers that described interventions at slaughter. A subjective quality assessment criterion was applied for both reviews (**Table A1**), but EatSafe only excluded articles judged to be of poor quality in the Asia study. The full search strategy, including syntax for search terms, are available in Appendix 2 (page 53) of the original review (3).

**Table A1.** Publication quality assessment criteria for food safety interventions in Africa and Asia

POOR	MEDIUM	GOOD
No acknowledgement of biased sampling process	Biased sampling acknowledged and accounted for	Unbiased selection of subjects/samples (probabilistic sampling)
Data analysis inappropriate for research question proposed	Limitations in data analysis acknowledged and accounted for	Methods are scientifically sound and accurately described
Methods unclear or incomplete	Some details on methods are lacking but methods are understandable and sound	Data analysis judged to be appropriate for the research question
Reported results are incomplete or obviously inaccurate	Reported results appear to be valid, although may not be fully complete	Reported results are complete and appear to be valid

<sup>14</sup> Note: the initial search (13) covered 2000 to 2017; EatSafe used the same search syntax to update the previous review with papers published between 2017 and 2020, as shown in Appendix 2, page 53 of (3).

## REVIEW OF FOOD SAFETY TRAINING MATERIALS: *Unpublished, courtesy of H. Pal (14)*

Given that this work is unpublished, only the syntax for database searches is included here. Studies published between 2000 and 2022 in English are eligible for inclusion. Studies must focus on food safety training and be conducted in LMICs.

### SCOPUS

TITLE-ABS-KEY ( "food safety training" OR "food training" OR "food hygiene training" OR "food handler" OR "food education" OR "food safety educations" OR "training program" OR "Food safety intervention" OR "training design" ) AND ( "LMIC" OR "Underdevelop\*" OR "Street food" OR "Dukaan" OR "kiosk" OR "ambulant vendor\*" OR "car boot shop\*" OR "road side store\*" OR "corner store\*" OR "mandi\*" OR "canteen" OR "farm worker" OR "handler" OR "retailer" OR "value chain actor" OR "stakeholder" OR "fresh produce" OR "low income" OR "illiterate" OR "poor" OR "meat market" OR "food borne disease" OR "food borne illness" ) AND ( "Quality Control" OR "quantif\*" OR "prevent\*" OR "control" OR "difference in difference" OR "instrumental variables" OR "matching" OR "RCT" OR "cRCT" OR "meta-analysis" OR "design" OR "delivery" OR "focus group" OR "learning model" OR "training model" OR "training method" OR "HACCP" ) AND ( "before and after" OR "knowledge" OR "attitude" OR "practice" OR "behavi\*" OR "certificat\*" OR "efficacy" OR "outcome" OR "improve\*" OR "qualit\*" OR "pre and post test" OR "contamination" OR "microbial safety" )

### CAB Direct

("food safety training" OR "food training" OR "food hygiene training" OR "food handler" OR "food education" OR "food safety education" OR "training program" OR "Food safety intervention" OR "training design") AND ("Underdevelop\*" OR "Street food" OR "mandi\*" OR "farm worker" OR "handler" OR "retailer" OR "value chain actor" OR "food borne disease") AND ("Quality Control" OR "quantif\*" OR "prevent\*" OR "design" OR "focus group" OR "learning model" OR "training model" OR "training method") AND ("knowledge" OR "attitude" OR "practice" OR "behavi\*" OR "efficacy" OR "outcome" OR "improve\*" OR "qualit\*" OR "before ? after")

### Web of Science

("food safety training" OR "food training" OR "food hygiene training" OR "food handler" OR "food education" OR "food safety education" OR "training program" OR "Food safety intervention" OR "training design") AND ("LMIC" OR "Underdevelop\*" OR "Street food" OR "Dukaan" OR "kiosk" OR "ambulant vendor\*" OR "car boot shop\*" OR "road side store\*" OR "corner store\*" OR "mandi\*" OR "canteen" OR "farm worker" OR "handler" OR "retailer" OR "value chain actor" OR "stakeholder" OR "fresh produce" OR "low income" OR "illiterate" OR "poor" OR "meat market" OR "food borne disease" OR "food borne illness") AND ("Quality Control" OR "quantif\*" OR "prevent\*" OR "control" OR "difference in difference" OR "instrumental variables" OR "matching" OR "RCT" OR "cRCT" OR "meta-analysis" OR "design" OR "delivery" OR "focus group" OR "learning model" OR "training model" OR "training method" OR "HACCP") AND ("before and after" OR "knowledge" OR "attitude" OR "practice" OR "behavi\*" OR "certificat\*" OR "efficacy" OR "outcome" OR "improve\*" OR "qualit\*" OR "pre and post test" OR "contamination" OR "microbial safety")

## 8.2. APPENDIX 2: EVALUATION FRAMEWORK AND GUIDING MODELS

QUESTION	RELATION TO MODELS	
<b>TRAINING APPROACH</b>		
What processes or practices does the training seek to change?	Approach meets definition of training	Yeargin
Does the training approach rest on any underlying behavioral or educational theory?	Prioritization criteria	EatSafe
<b>AUDIENCE</b>		
Who are the target audience(s)?	Inclusion criteria	EatSafe
What characteristics are described (literacy, gender, occupation, previous food safety learning)?	“Learner inputs” Social opportunity	Race COM-B
<b>CONTEXT</b>		
What is the environment in which participants are expected to apply the training?	Physical opportunity Enabling environment	COM-B 3-legged stool
Is the training delivered on site or in a different location?	Implementation	Yeargin
Have any modifications been made to the environment (social, physical or policy) to enable training to be better applied?	Enabling environment Technology provision Implementation Physical opportunity Social opportunity	3-legged stool 3-legged stool Yeargin COM-B COM-B
<b>TRAINING CURRICULUM</b>		
Can learning outcomes be identified?	Approach meets definition of training “Making Sense” Reception (Learner)	Yeargin Race Yeargin
How many topics/modules are covered in the training?	All	
How was content determined?	Generation	Yeargin
Can the training be classified as subject-centered, learner-centered, or problem-centered?	Reception	Yeargin
How have messages been adapted to the target audience?	Adaptation	Yeargin
What kind of media were selected?	Dissemination	Yeargin
Who delivered the training?	Dissemination	Yeargin
What motivated participants (want / need?)	All models	
What were the opportunities for practicing the processes or practices?	“Doing” Reception Physical capability	Race Yeargin COM-B

Does the training include formative assessments and/or feedback?	Feedback	Race
Does the training include opportunities for verbalizing or assessing?	“Verbalizing”	Race
How were learning outcomes evaluated?	“Assessing” Training efficacy	Race EatSafe
What evidence was there that participants had adopted the new knowledge into their practices?	“Making sense” Adoption Physical capability	Race Yeargin COM-B

### 8.3. APPENDIX 3: COMPLETE RESULTS TABLE

AUTHOR (COUNTRY)	DESCRIPTION	TARGET FOOD SAFETY PRACTICES
<b>TARGET: PROCESsing ANIMAL PRODUCTS</b>		
Samaan (Indonesia) / (17)	<ul style="list-style-type: none"> <li>• Two wet markets selling poultry, monthly 2-hour training and consultation sessions</li> <li>• Market managers, sanitary inspectors, and poultry vendors</li> <li>• 18-months in duration</li> <li>• Redesigned markets to improve hygiene and workflow</li> <li>• Posters with protocols for disease inspection/notification were displayed</li> </ul>	<ul style="list-style-type: none"> <li>• Identify avian influenza infection in chickens</li> <li>• Wear rubber boots and plastic aprons</li> <li>• Clean cages daily</li> <li>• Use soap when cleaning chopping boards, knives and defeathering machines</li> </ul>
<b>TARGET: CONSUMERS PURCHASING FOOD (WITH OR WITHOUT VENDOR TRAINING)</b>		
Lagerkvist (Kenya) / (18)	<ul style="list-style-type: none"> <li>• Consumers purchasing kale in a Kenyan market</li> <li>• Willingness to pay experiment: additional money for kale sourced from farms following hygienic measures/sold on stands with upgraded facilities/trained sellers.</li> </ul>	<ul style="list-style-type: none"> <li>• Willingness-to-pay for safer kale production and handling at the market (experimental)</li> </ul>
Riyanto (Indonesia) / (19,20)	<ul style="list-style-type: none"> <li>• <i>Consumer focus:</i> Schoolchildren ages 9-10 (n=112)</li> <li>• Weekly, 1-hour training, over 6 months in duration</li> <li>• Included school health unit teachers, videos, and books.</li> </ul>	<ul style="list-style-type: none"> <li>• Choose safe street food</li> </ul>
	<ul style="list-style-type: none"> <li>• <i>Vendor focus:</i> Mobile street food vendors (n=27)</li> <li>• Weekly, 20–30-minute one-to-one training, over 6 months in duration</li> <li>• Sanitation officers gave intensive guidance to vendor during food processing</li> </ul>	<ul style="list-style-type: none"> <li>• Cook food properly</li> <li>• Store food safely/at correct temperature</li> <li>• Choose fresh, good quality raw materials</li> <li>• Wash raw food/appropriately use safe raw materials</li> <li>• Do not use expired ingredients/chemical preservatives</li> </ul>
Takeuchi (Thailand) / (21)	<ul style="list-style-type: none"> <li>• Targeted ~487,000 consumers in one province</li> <li>• One lecture on the dangers of raw pork consumption and <i>Streptococcus suis</i> infection</li> </ul>	<ul style="list-style-type: none"> <li>• Avoid raw pork consumption</li> <li>• General hygiene measures (handwashing, cooking) at home, restaurants, and slaughterhouses</li> </ul>

- Known healthcare volunteers who regularly work in the province conducted the lecture
- Supporting posters, pamphlets, banners, were displayed in public settings (schools, markets, offices, hospitals).

### TARGET: COMMERCIAL / COMMUNAL FOOD PREPARERS

Acikel (Turkey) / (22)	<ul style="list-style-type: none"> <li>• Hospital kitchen staff (n=83, in groups of 8)</li> <li>• Theoretical lecture and practical demonstration of handwashing given by single trainer</li> </ul>	<ul style="list-style-type: none"> <li>• Handwash with soap</li> <li>• Maintain personal hygiene (avoid smoking, gum chewing, touching face/hair, wearing watches or jewelry; do shave and use tissues)</li> <li>• Clean workstation</li> <li>• Use towels (not using aprons)</li> </ul>
High-touch-high-tech (India) / (23,24)	<ul style="list-style-type: none"> <li>• Food handlers in hospital food businesses (n= 264)</li> <li>• Short training films, self-instruction manual, posters, and onsite training through personal interactions.</li> <li>• Monthly inspections carried out in all hospital food businesses with low- or no-cost suggestions for improvement.</li> <li>• Duration of 1-year</li> </ul>	<ul style="list-style-type: none"> <li>• Design layout of premises, equipment, toilets, ventilation, drainage, and waste disposal</li> <li>• Maintain pest control</li> <li>• Control ventilation, temperature</li> <li>• Package/store food</li> <li>• Maintain personal hygiene</li> <li>• Prevent cross-contamination;</li> <li>• Monitor quality of incoming water, ice, ingredients</li> <li>• Maintain records</li> </ul>
Da Cunha (Brazil) / (25)	<ul style="list-style-type: none"> <li>• Food handlers (n=365, in 68 schools)</li> <li>• 5, 12-hour sessions (in groups of &lt;30 people), held every 6 months for 2 years in duration</li> <li>• Trained internal monitors visited weekly to evaluate compliance</li> <li>• Every 3 months, site visits to implement in situ action plans with external evaluators.</li> </ul>	<p>95 items, divided into 11 thematic areas:</p> <ul style="list-style-type: none"> <li>• Buildings and facilities</li> <li>• Food storage and meal distribution</li> <li>• Integrated pest management</li> <li>• Controls and records</li> <li>• Waste management</li> <li>• Health and safety of employees</li> <li>• Water control</li> <li>• Equipment and utensils</li> </ul>

Husain (Malaysia) / (26,27)	<ul style="list-style-type: none"> <li>• Food handlers (n=52, in 8 schools)</li> <li>• 3, 1-2 hour weekly training</li> <li>• Follow-up visits after 3 weeks</li> </ul>	<ul style="list-style-type: none"> <li>• Food storage</li> <li>• Handwashing processes and equipment</li> </ul>
Choudhury (India) / (28)	<ul style="list-style-type: none"> <li>• Mobile street food vendors and small restaurant owners/employees (n=52)</li> <li>• 15, 4-hour sessions, delivered twice weekly for a duration of 3 months.</li> </ul>	<ul style="list-style-type: none"> <li>• Proper storage of ingredients, cooked food, drinks</li> <li>• Avoid cross-contamination</li> <li>• Serve potable water and ice</li> <li>• Serve food in hygienic containers</li> <li>• Maintain personal hygiene;</li> <li>• Wash utensils/store cleanly</li> <li>• Cart/store kitchen construction for cleanliness and ventilation</li> <li>• Waste disposal</li> </ul>
Singh (India) / (29)	<ul style="list-style-type: none"> <li>• Mobile street food vendors (n=20)</li> <li>• 2, 30-minute individual counselling at vendor location, for a duration of 3 months</li> <li>• Follow-up with posters displaying food safety dos and don'ts</li> </ul>	<ul style="list-style-type: none"> <li>• Source, transport, store raw materials</li> <li>• Choose vending location</li> <li>• Clean vending cart, utensils, and cutting tools</li> <li>• Maintain personal hygiene</li> <li>• Prepare, handle, serve food</li> <li>• Waste disposal</li> <li>• Pest control activities</li> </ul>
Sanny (Malaysia) / (30)	<ul style="list-style-type: none"> <li>• Fast food restaurant handlers (n=7)</li> <li>• One-off onsite training and fryer demonstration to reduce acrylamide formation in French fries.</li> <li>• Given an explanation about acrylamide; provided color card and instructions; asked to reproduce under supervision</li> </ul>	<ul style="list-style-type: none"> <li>• Fry food at recommended time and temperature</li> </ul>

**TARGET: CAREGIVERS AND/OR THOSE PREPARING FOOD AT HOME**



<p>The Hygienic Family (Malawi) / (31–34)</p>	<ul style="list-style-type: none"> <li>• Child caregivers (n=20 in one village)</li> <li>• Males included, given their role as financial managers and decision makers.</li> <li>• Alternate “cluster meetings” with the group and household visits, for a duration of 8 months</li> </ul>	<ul style="list-style-type: none"> <li>• Handwashing with soap before food preparation, child feeding, or eating</li> <li>• Wash utensils with soap</li> <li>• Keep utensils and cooked food on an elevated place</li> <li>• Proper left-over food reheating</li> <li>• Other, related to WASH</li> </ul>
<p>Touré (Mali) / (35)</p>	<ul style="list-style-type: none"> <li>• Mothers (n=30 intervention, n=30, control)</li> <li>• Trained by female graduates (one graduate per 10 mothers)</li> <li>• Home visit-based training, including 6-8 hours of contact time in the first 3 weeks, followed by fortnightly visits for a duration of 9 months.</li> </ul>	<ul style="list-style-type: none"> <li>• Use potable water</li> <li>• Wash dishes with water/soap</li> <li>• Handwashing with running water/soap after using latrine, cleaning a child, touching contaminated material, before preparing food, before feeding child or eating</li> <li>• Proper left-over food reheating</li> </ul>
<p>SafeStart / Kenya (36)</p>	<ul style="list-style-type: none"> <li>• Mothers of children 6-9 mo (n=40)</li> <li>• Hardware provision (handwashing bucket with tap, liquid/bar soap, infant feeding bowl/spoons, storage containers), followed by behavior change communication (BCC) campaign 8 weeks later</li> <li>• Researcher and community health volunteers visited one week after hardware delivery to gather feedback</li> <li>• BCC messaging included wall calendars, and stickers, as well as conversations about how food hygiene related to their child’s happiness/success</li> <li>• Follow-up SMS messages for a duration of 1-month</li> </ul>	<ul style="list-style-type: none"> <li>• Handwashing with soap before feeding or food preparation</li> <li>• Feed children with clean utensils</li> <li>• Hygienic child food storage</li> <li>• Proper left-over food reheating</li> </ul>
<p>SuperAmma (India) / (37)</p>	<ul style="list-style-type: none"> <li>• Households with children aged 8-13 (n=348)</li> <li>• School-based activities (e.g., recording handwashing of themselves and family members) and community events (door-to-door visits and small neighborhood events outside homes)</li> </ul>	<ul style="list-style-type: none"> <li>• Handwashing with soap after defecation and cleaning a child, and before food preparation or eating</li> </ul>

	<ul style="list-style-type: none"> <li>• Community events delivered by a professional event agency using street theatre troupe experienced in performing about social issues</li> <li>• Two interventions (one short, over nine days; the other long, over 25 days); both included reinforcement activities</li> </ul>	
Ideal Mother (Nepal) / (38)	<ul style="list-style-type: none"> <li>• Households (n=120)</li> <li>• Trained by 15 Food Hygiene Motivators, across 6 group trainings and 6 household visits for a duration of 3 months</li> <li>• Household visits included a 3-month workplan, kitchen makeover, and food preparation observation</li> <li>• Communal events included public pledging, competitions, dramas, and discussions providing advice to a fictional mother on tackling barriers to food hygiene.</li> </ul>	<ul style="list-style-type: none"> <li>• Clean child food-serving utensils using soap before serving food</li> <li>• Handwashing with soap by mother before feeding, and by child before eating</li> <li>• Store cooked food in containers with tight-fitting lid</li> <li>• Proper left-over food reheating</li> <li>• Serve only treated water to the child</li> </ul>

#### 8.4. APPENDIX 4: EXAMPLES OF LESSON PLANS


Training of street food vendors in India (28). *Reproduced with permission from M. Choudhury.*

INTERVENTION 7: PERSONAL GROOMING AND ADOPTION OF GOOD HABITS				
#	Activity Content	Time (Min)	Training Method	Teaching Aids
1	Reporting and attendance	20	-	-
2	Climate Setting and motivation	20	Interactive Lecturette	Poster
3	Clarifying training objectives	10	Interactive Lecturette	Flip Chart
4	Clarifying training content	10	Lecturette	Flip Chart
5	Tea Break / Informal Chat	20	-	-
6	Daily and routine activities of personal hygiene.	20	Interactive Demonstration	Flip Chart
7	Keep yourself well-groomed and dressed while working in the unit.	20	Interactive Demonstration	Flip Chart
8	Selection/use of sanitizers and detergents for washing of your hands, clothes and for bathing	20	Interactive Demonstration	Flip Chart, Object
9	Good communication skills and tips, good customers' treatment.	20	Interactive Lecturette	-
10	Complete demonstration and participant interaction (6-9 min)	30	-	Role play
11	Evaluation and conclusion	20	-	Hand out
<i>Total</i>		210 (3.5 hr)		

INTERVENTION 8: CONSERVATION OF NUTRIENTS				
#	Activity Content	Time (Min)	Training Method	Teaching Aids
1	Reporting and attendance	20	-	-
2	Climate Setting and motivation	30	Interactive Lecturette	Drama/Role Play
3	Clarifying training objectives	10	Interactive Lecturette	Flip Chart
4	Clarifying training content	10	Lecturette	Flip Chart
5	Tea Break / Informal Chat	20	-	-
6	Nutrients and vitamins in a food pyramid and their importance in human nutrition	30	Interactive Lecturette / Demonstration	Chart, Object, Games
7	Availability of nutrients in a food basket.	30	Demonstration	Object
8	Managing relevant food supplies and nutrients/ vitamins at affordable price.	30	Puppet Show	Paper Puppet
9	Skills of nutrient conservation	40	Interactive Lecturette	Chart, Poster
10	Evaluation and conclusion	20	-	Hand out
<i>Total</i>		240 (4 hr)		

8.5. APPENDIX 5: EXAMPLES OF TRAINING MATERIALS

Framing of food safety messages (40). Reproduced with permission from M. Hennessey.

POSITIVE FRAMING	NEGATIVE FRAMING
<p data-bbox="227 367 690 451"><b>Rửa sạch tay và các thiết bị đúng cách</b></p>  <p data-bbox="186 957 730 997"><b>giúp cải thiện an toàn thịt lợn</b></p>	<p data-bbox="876 367 1315 409"><b>Tay và các thiết bị bẩn</b></p>  <p data-bbox="820 945 1372 987"><b>dẫn tới thịt lợn bị nhiễm bẩn</b></p>
<p data-bbox="162 1003 706 1066"><i>“Proper washing of hands and equipment improves pork safety”</i></p>	<p data-bbox="787 1003 1258 1066"><i>“Dirty hands and equipment leads to contaminated pork”</i></p>

VIDEOS USED IN TRAININGS (23)

 <p data-bbox="170 1543 750 1659">Narrated video to demonstrate food safety processes in commercial/ communal kitchens, used in training (language: Hindi) Source: <a href="#">YouTube Link</a></p>	 <p data-bbox="803 1543 1393 1690">Comic video including Indian folk hero Bethal King Vikramaditya to sensitize food handlers on food hygiene/consumer safety Source: <a href="#">YouTube Link</a></p>
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