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The U.S. Government's Global Hunger & Food Security Initiative

EatSafe: Evidence and Action Towards Safe, Nutritious Food

Report of review of indicators in Nigeria:

A Stakeholder Consultation and Evaluation of Draft EatSafe Indicators

Revised September 2021



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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.

Recommended Citation: Global Alliance for Improved Nutrition. 2021. Report of review of indicators in Nigeria: A Stakeholder Consultation and Evaluation of Draft EatSafe Indicators. A USAID EatSafe Project Report.

Acknowledgements: This review was undertaken, and the report written, by Augustine Okoruwa, Teale Yalch, and Caroline Smith Dewaal with useful feedback provided by Bonnie McClafferty.

Agreement Type

Cooperative Assistance

Agreement Number

7200AA19CA00010/Project Year 2 output

Period of Performance

June 31, 2019 – July 30, 2024

Geographic Scope

Global Food Security Strategy Countries

USAID Technical Office

Bureau for Food Security (BFS)/Office of Market and Partnership Innovations (MPI)

Agreement Officer Representative

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This document was made possible through support provided by Feed The Future through the U.S. Agency for International Development (USAID), under the terms of Agreement #7200AA19CA00010. The opinions expressed herein are those of the Global Alliance for Improved Nutrition (GAIN) and do not necessarily reflect the views of USAID or the United States Government.



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EXECUTIVE SUMMARY

During Phase I (FY2020, 2021), EatSafe monitored a set of custom Indicators to track the generation and dissemination of new evidence on food safety in traditional markets in Nigeria. Moving into Phase II (2022-2024), when food safety interventions are to be piloted in target traditional markets in Nigeria, EatSafe’s indicators must be adapted for the interventions deployed and the local context.

To evaluate potential Custom Indicators for EatSafe for Phase II of the program, GAIN organized two stakeholder workshops in Abuja and Birnin Kebbi, Nigeria in April and May 2021. The Abuja and Kebbi State meetings had 25 and 27 participants, respectively, representing other USAID and Feed the Future-funded activities, as well as federal, state, and local Ministries, Departments, and Agencies (MDAs), rapporteurs, non-governmental organizations, and professional associations, among other representatives.

In total, the stakeholders discussed 11 potential indicators covering consumer and vendor knowledge, feelings and attitudes at both the Abuja and Kebbi State meetings, and recommended the following indicators:

CUSTOM INDICATORS RECOMMENDED AT BOTH ABUJA AND KEBBI STATE MEETINGS
CONSUMERS
<i>Knowledge:</i> Percent of consumers who mention food safety as a concern when asked what they consider when shopping for food
<i>Feelings and Attitudes:</i> Percent of consumers who rank food safety as “important” or “very important”
Percent of consumers who report having chosen one type of food/product over another because they thought it was safer
VENDORS
<i>Knowledge:</i> Percent of vendors who report that food safety is an important consideration in selecting suppliers
<i>Feelings and Attitudes:</i> Percent of vendors who report they have an important role in assuring food safety for the products they sell
Percent of vendors who report discussing food safety with their suppliers.

I. INTRODUCTION

The goal of EatSafe: Evidence and Action Towards Safe, Nutritious Food, is to enable lasting improvement in the safety of nutritious foods in informal market settings. EatSafe has three objectives and three corresponding expected results over two phases:

Table 1. Projected Objectives, Expected Results and Phases

PROJECT OBJECTIVES	EXPECTED RESULTS	PROJECT PHASES
Consolidate and generate knowledge and evidence about: consumer values and perceptions related to food safety; gender roles and norms that may influence food-related behavior among consumers, vendors and other actors; and quantified food safety risks in informal markets.	1. Increased and consolidated knowledge and evidence of food safety risks in informal markets	Phase I (PYs 1 and 2)
Develop and test tools and approaches for consumers and informal market vendors to communicate about and/or reduce food safety risks.	2. Novel tools and approaches developed to engage consumers and vendors on food safety risks	Phases II and III (PYs 3, 4, 5)
Generate evidence of how to engage and empower consumers to demand safe, nutritious foods.	3. Increased evidence of the impact of consumer-facing interventions on food safety-related behaviors	

The project objectives and results will be accomplished in two phases in each EatSafe country. Phase I is addressed through rigorous reviews and secondary research. Phases II will be addressed through the design, implementation, and assessment of a series of experimental interventions that will generate evidence. The result of this staged approach is to ensure that EatSafe builds on existing best practices, with interventions that are adapted in response to emerging knowledge.

During Phase I, EatSafe monitored a set of custom Indicators to track the generation and dissemination of new evidence on food safety in traditional markets. Those indicators are less relevant as the project moves into Phase II, so we engaged in a global exercise to identify potential custom Indicators for EatSafe to use during the testing of interventions. Due to

differences between countries and communities, different custom Indicators may also be needed for use in Phase II in other countries.

The EatSafe Phase II indicator(s), once finalized, will focus on the impact of the interventions chosen for use in Kebbi State, Nigeria to change consumer and/or vendor awareness, beliefs, and actions related to food safety. Information gleaned from the custom Indicators can be used to make recommendations about which interventions should be scaled up or replicated elsewhere and to improve intervention design in future EatSafe countries.

EatSafe's consultation with stakeholders in Nigeria was designed to solicit their views on each custom Indicator. Two meetings were convened with the relevant food safety stakeholders – in Abuja on 22 April 2021 and in Birnin Kebbi on 20 May 2021 (where EatSafe will conduct its research on consumer demand interventions). The indicators were assessed collectively to decide whether they were (a) adaptable to the EatSafe project; (b) should be modified; or (c) reserved for future discussion and consideration. A summary of the workshop agenda and discussions appears in [Appendix 1](#).

In Abuja, eight of the eleven EatSafe Custom Indicators were recommended as suitable for use with few modifications made while the remaining three were reserved for future discussions and consideration. At the Kebbi meeting, six out of the eleven EatSafe custom indicators were recommended as suitable for use and two additional indicators were suggested by the stakeholders. Overall, six indicators were supported by stakeholders in both Kebbi and in Abuja as custom indicators for Phase II of the EatSafe program in Nigeria. The results of stakeholder evaluation of all EatSafe custom indicators appear in [Appendix 2](#).

This report details the indicators, findings from the stakeholder consultations and recommendations for the EatSafe monitoring plan. It focuses on consumers and vendors only (as per EatSafe's mandate) and does not include indicators that relate to other actors across supply chains or enabling environments that shape the safety of food in markets. Due to differences between countries and communities, different custom indicators may also be needed for use in Phase II in other countries, so a broad set of indicators was identified.

2. OBJECTIVES

The objectives of the EatSafe Indicators Evaluation Workshop were to:

- Introduce to the stakeholders the proposed EatSafe custom food safety indicators;
- Evaluate indicators with input from relevant stakeholders against the set criteria; and
- To narrow down and select indicators that are relevant and applicable to the EatSafe project in Nigeria.

3. PARTICIPANTS

The indicator review meeting in Abuja had 25 participants in attendance, including:

- USAID Nigeria Nutrition Lead;
- EatSafe Nigeria Team;
- GAIN Nigeria M&E Officer;
- National Food Safety & Quality Program/National Food Safety Management Committee;
- Nigerian Institute of Food Science and Technology;
- Ministries, Departments and Agencies (MDAs, including Federal Ministries of Health; Federal Ministry of Agriculture and Rural Development; Federal Ministry of Environment; Federal Ministry of Science and Technology; Federal Ministry of Industry, Trade, and Investment; Federal Ministry of Women Affairs; and Federal Ministry of Water Resources);
- Regulatory & Allied Agencies, including Standards Organization of Nigeria (SON); National Environmental Standards and Regulations Enforcement Agency, Federal Competition and Consumer Protection Commission; Nigeria Agricultural Quarantine Service; Nigeria Centre for Disease Control;
- Other USAID/Feed the Future funded Activities (Agricultural Extension and Advisory Services, Integrated Health Program and Breakthrough Action-Nigeria; and
- Rapporteurs.

The indicator review meeting in Kebbi State had 27 participants in attendance, including:

- Feed the Future's Agriculture Extension Advisory Services;
- EatSafe Nigeria Team;
- Chairperson, Kebbi State Food and Nutrition Committee;
- Market Manager, Birnin Kebbi Central Market;
- Non-governmental organizations: Bright Girls and Active Support for Rural Initiatives;
- MDAs (*Federal*: Standard Organization of Nigeria-SON and National Agency for Food Administration and Control - NAFDAC; *State*: Ministries of Agric, Budget and Economy Planning, Animal Health; *Local*: Birnin Kebbi LGA);
- Community and Religious Leaders;
- Professional Associations – Nigerian Veterinary Medical Association;
- Two Rapporteurs;
- Food Processors - Labana Rice, Birnin Kebbi; and
- Media.

4. CRITERIA FOR EVALUATING EATSAFE INDICATORS

The criteria set for evaluating the Custom EatSafe indicators include:

- Is the indicator appropriate in the context of other USAID investments?
- Is the indicator measurable? (Indicators are expected to be measurable)
- Is the indicator worded appropriately to ensure understanding by stakeholders?
- Are there cultural issues that would impact the use of the indicator?
- Are there gender issues that would impact the use of the indicator?
- What type of data collection strategy would be most useful for this indicator?
- Is this indicator generally applicable, or only relevant to specific interventions?

5. FINDINGS

Six indicators total, three each covering consumer and vendor knowledge, feelings and attitudes, were recommended by the stakeholders at both the Abuja and Kebbi meetings – as shown in the rows with asterisks in **Table 2** (i.e., numbers 1, 2, 5, 6, 7, and 10).

Table 2. Comparison of Selected Custom EatSafe Indicators: Abuja and Birnin Kebbi Meetings

INDICATORS		RECOMMENDED AT	
		KEBBI	ABUJA
CONSUMERS			
1 *	Knowledge: Percent of consumers who mention food safety as a concern when asked what they consider when shopping for food	Yes	Yes
2 *	Feelings and Attitudes: Percent of consumers who rank food safety as “important” or “very important”	Yes	Yes
3	Percent of consumers who report preferentially buying food with a certification label or from a vendor with a food safety certification	No	No
4	Percent of consumers who report having discussed food safety with a food vendor	No	Yes
5 *	Percent of consumers who report having chosen one type of food/product over another because they thought it was safer	Yes	Yes
VENDORS			
6 *	Knowledge: Percent of vendors who report that food safety is an important consideration in selecting suppliers	Yes	Yes
7 *	Feelings and Attitudes: Percent of vendors who report they have an important role in assuring food safety for the products they sell	Yes	Yes
8	Percent of vendors who rank food safety as “important” or “very important” when deciding what products to sell	No	No

9	Percent of vendors who display visual markers, such as certificates or licenses, of food safety training or performance	No	No
10 *	Percent of vendors who report discussing food safety with their suppliers.	Yes	Yes
11	Percent of vendors who report purchasing food safety equipment in the last 12 months.	No	Yes

5.1 DISCUSSION

In evaluating workshop responses to the specific criteria applied (see section 4 of this report), the recommended indicators were scored similarly to those that were not recommended. Recommendations instead reflected the local contexts, the limits of the EatSafe project, and stakeholder preferences. The rationales for excluding specific indicators are described below.

Indicator #3 was not evaluated by the group in Abuja, as it was placed in the “parking lot.” Local and national stakeholders at the Kebbi meeting were not familiar with food safety certification or labels. Nigeria does not have a single national certification or mandatory food safety labels for bulk unpackaged food commodities (e.g., cereals, grains, legumes, meat, fresh fruits and vegetables) sold in traditional markets. Consequently, it was not recommended as a custom indicator for measurement as it has no baseline for reference.

Though it ranked the same as others when evaluated by criteria, Indicator #4 was not selected by the Kebbi group. This decision may reflect the current low levels of knowledge of food safety risks and limited interactions between vendors and consumers on food safety issues during transactions. It could also be related to gender, sociocultural, and religious limitations impacting interpersonal and trade discussions in the marketplace.

Indicator #9 was not recommended by either group, but reasons for doing so were not defined. In Abuja, it was put in the “parking lot” for later discussion; in Kebbi, it met the criteria in a manner comparable to those that were selected. As noted above, the display of visual markers other than branding is not currently a recognized or common practice in traditional markets in Nigeria. There are no competent authorities that issue these certifications or certify compliance with regards to raw commodities.

Indicator #11 was recommended at the workshop in Abuja but not in Kebbi. The reason for its non-selection was not clear, as it met the same criteria as those that were selected. In the target Kebbi markets, the majority of the vendors sell raw commodities that require neither processing equipment nor specialized packaging materials. Cereals and legume grains are sold in bulk using jute bags and sold in popular small market measuring bowl units called “Mudu.” Therefore, the need for additional equipment was not be well understood.

While each workshop developed overlapping recommendations, the final recommendations are based on considerations outside the criteria developed by EatSafe. These context-specific findings can inform the development of criteria used to evaluate indicators with stakeholders.

6. CONCLUSIONS

EatSafe has analyzed several EatSafe Custom Indicators for Phase II and has consulted with stakeholders in Nigeria, including in the city where EatSafe will conduct its research on consumer demand interventions. The consultations have provided stakeholder views, with stated preferences for 6 of the 11 potential indicators on consumer and vendor knowledge, attitudes, and practices. Stakeholders also provided several examples of other Custom Indicators to consider. However, it isn't clear why some of the indicators were preferred over others, as they are virtually indistinguishable when considered against the criteria.

Once the EatSafe intervention is chosen for use in Kebbi State, Nigeria, EatSafe will consider those recommendations when it selects one or two Custom Indicators to measure the project's impact on changing consumer or vendor awareness, beliefs, and actions with respect to food safety. This information can be used to make recommendations about which interventions should be scaled up or replicated elsewhere and to improve intervention design in future EatSafe countries. The indicators will also assist EatSafe in generating evidence of how to engage and empower consumers to demand safe, nutritious foods.

In PY3, EatSafe may also evaluate existing Feed the Future indicators which might be appropriate for field testing, with or without modifications, as part of the effort to develop food safety indicators for Feed the Future to consider for further development and adoption.

Recommendations for Intervention Design and Future Studies under EatSafe

EatSafe Nigeria aims to generate the evidence and knowledge to increase consumer demand for safe food and substantially improve the safety of nutritious foods in informal market settings in Nigeria. Central to EatSafe's work is understanding and potentially shaping the motivations, attitudes, beliefs, and practices of consumers and food vendors. While EatSafe will undertake novel primary research on consumer and vendor motivations and practices, it is essential that this work is informed by and builds on what has already been done, both in terms of methods used and results obtained. Based on the results of this stakeholder mapping, we recommend EatSafe consider the following lessons in the design of its future interventions:

- EatSafe Custom Indicators for Phase II will benefit from this input from both national and local stakeholders.
- Stakeholders expressed support for indicators covering both consumer and vendor knowledge, attitudes, and practices.
- Several additional indicators were recommended by both Abuja and Kebbi stakeholders, which should be considered depending on the EatSafe intervention.
- Once the EatSafe intervention is identified, the Custom Indicators for Phase II will be selected, and may include one or more from the list of potential indicators.
- Evidence from the Cohort survey or other data collection methods may also contribute to the selection of the indicator.
- EatSafe should consider additional work in PY3 to identify and pilot Feed the Future indicators for food safety.
- The indicators not chosen for use in Kebbi will also be useful as a starting point for consideration in other countries where EatSafe operates.

7. APPENDICES

7.1 APPENDIX I. WORKSHOPS ON REVIEW OF EATSAFE NIGERIA INDICATORS

GAIN, in collaboration with USAID, organized two stakeholder workshops:

- **Abuja (April 22, 2021):** Fountain Hall, Rockview (Royale) Hotel, Wuse
- **Birnin Kebbi, Kebbi State (May 20, 2021):** Saffar Guest Inn Limited, Gesse

This Appendix provides an abbreviated overview of meetings structure. Additional documents and materials related to the workshops are available upon request, including concept note, agenda, PowerPoint presentations, media files (i.e., audio), photos, and attendance list.

Each meeting followed the same structure, starting with an introduction by Dr. Nwando Onuigbo-Chatta, EatSafe Nigeria Research Associate who gave participants a description of the background, aim, scope of the review exercise, objectives and criteria for evaluation.

Background: The indicators' review falls under EatSafe Activity 1.2: *Develop Conceptual Framework and Indices linking food safety and nutrition in support of USAID's Feed the Future strategy* with two sub-activities:

- Activity 1.2.5 – develop potential EatSafe Custom food safety indicators for use in Phase II of EatSafe; and
- Activity 1.2.6 – evaluate the proposed indicators in collaboration with Nigerian stakeholders to narrow down and select indicators that are relevant to EatSafe's geographical setting.

Aim: The meeting aimed to evaluate proposed EatSafe Custom Indicators with USAID Nigeria, and national and regional food safety stakeholders to ensure that they are appropriate and measurable in the context of USAID investments in the field.

Scope of the Review: A total of 17 indicators were proposed for review which comprised of eleven EatSafe Custom food safety indicators and six Feed the Future indicators. These were evaluated using a set of seven criteria. After evaluation, 6 Custom Indicators were recommended to assess EatSafe's phase two interventions. While six Feed the Future indicators were discussed in the Abuja meeting, the same review was not conducted in Kebbi, so those findings will be included in additional work in PY3.

Criteria for Evaluating Indicators

- Is the indicator appropriate in the context of other USAID investments?



Dr. Nwando Onuigbo-Chatta during the Food Safety Indicators Review Meeting in Birnin Kebbi held on 20th May, 2021

- Is the indicator measurable? (Indicators are expected to be measurable)
- Is the indicator worded appropriately to ensure understanding by stakeholders?
- Are there cultural issues that would impact the use of the indicator?
- Are there gender issues that would impact the use of the indicator?
- What type of data collection strategy would be most useful for this indicator?
- Is this indicator generally applicable, or only relevant to specific interventions?

Discussion on Review of EatSafe Indicators

The discussion was moderated by Philip Ortese (GAIN Nigeria M&E Officer) and Dr. Augustine Okoruwa (EatSafe Head of Country Programs) in Abuja, and by Dr. Okoruwa in Kebbi State (see photos below). The session focused on the evaluation of each indicator against the criteria, and together deciding if (a) it is adaptable/applicable to the EatSafe project; (b) it should be modified; or (c) it should be reserved for future discussion and consideration.



Cross Section of Participants at the Food Safety Indicators Review Meeting in Birnin Kebbi held on 20th May, 2021



A Cross Section of Participants at the Food Safety Indicators Review Meeting on 22nd April, 2021

Evaluation of EatSafe Custom Indicators using the 7 criteria

Stakeholders were presented with printed copies of the indicators and criteria for evaluation. At the end of deliberations in Abuja, eight EatSafe Custom Indicators were recommended for use with few modifications made while the remaining three were reserved for future discussions and consideration (Table 1). On the other hand, at the end of the Kebbi meeting, six EatSafe Custom Indicators out of the eleven were recommended and considered suitable for use while two indicators were suggested as additional indicators to consider (Table 2).

Several Feed the Future standard Indicators were discussed in Abuja, both with and without modifications to make them more suited to measure food safety outcomes. These results are still under consideration by EatSafe for future work.

Closing Remarks

In his closing remarks at both events, Seun Elere, EatSafe Nigeria Senior Program Assistant, thanked all the participants for their attendance and participation in the review/evaluation process. On behalf of GAIN and other implementing partners, he encouraged them to continue their collaboration with GAIN on the project to ensure access to safe nutritious food in traditional markets in Nigeria.



Some of the Participants at the Food Safety Indicators Review Meeting held on 22nd April, 2021

7.2 APPENDIX II. EVALUATION OF INDICATORS AGAINST CRITERIA

ABUJA WORKSHOP

S/NO	INDICATOR	INDICATOR EVALUATION CRITERIA							SELECTED
		Is the indicator appropriate in the context of other USAID investments?	Is the indicator measurable?	Is the indicator worded appropriately to ensure understanding by stakeholders?	Are there cultural issues that would impact the use of the indicator?	Are there gender issues that would impact the use of the indicator?	What type of data collection strategy would be most useful for this indicator?	Is this indicator generally applicable, or only relevant to specific interventions?	
CONSUMERS									
1	Knowledge: Percent of consumers who mention food safety as a concern when asked what they consider when shopping for food	yes	yes	yes	no	no	Quantitative method of data collection agreed using questionnaires, with listed options including food safety	Generally applicable to USAID investment but relevant to specific interventions	Yes
2	Feelings and Attitudes: Percent of consumers who rank food safety as "important" or "very important"	yes	yes	Percent of consumers who rank food safety as important	no	no	Likert scale Quantitative data collection method (FGD). Subjective questions should include options for important, not important and neutral. Mixed methods for both for further learning	Specific to intervention	Yes
3	Percent of consumers who report preferentially buying food	Parking lot (to be discussed and reconsidered later)							No

	with a certification label or from a vendor with a food safety certification								
4	Percent of consumers who report having discussed food safety with a food vendor	yes	yes	yes	no	no	Quantitative method of data collection agreed using questionnaires	specific to intervention	Yes
5	Percent of consumers who report having chosen one type of food/product over another because they thought it was safer	yes	yes	Percent of consumers who chose one type of food over another based on food safety	no	no	Quantitative method of data collection agreed using questionnaires	specific to intervention	Yes
VENDORS									
6	Vendor Knowledge Percent of vendors who report that food safety is an important consideration in selecting suppliers	yes	yes	Percent of vendors who reported food safety as an important consideration in selecting suppliers	no	no	Quantitative method of data collection agreed using questionnaires	specific to intervention	Yes
7	Vender Feelings and Attitudes Percent of vendors who report they have an	yes	yes	Percent of vendors who reported having an important role in ensuring food safety for the food	no	no	Quantitative method of data collection agreed using questionnaires	specific to intervention	Yes

	important role in assuring food safety for the products they sell			products they sell					
8	Percent of vendors who rank food safety as “important” or “very important” when deciding what products to sell	Not needed as we already have one indicator for vendor’s feelings and attitude							No
9	Percent of vendors who display visual markers, (e.g., certificates or licenses, of food safety training or performance)	Parking lot (to be discussed and reconsidered later)							No
10	Percent of vendors who report discussing food safety with their suppliers	yes	yes	Percent of vendors who reported discussing food safety with their suppliers	no	no	Quantitative method of data collection agreed using questionnaires	specific to intervention	Yes
11	Percent of vendors who report purchasing food safety equipment in the last 12 months	yes	yes	Percent of vendors who reported using food safety tools in the last 12 months.	no	no	Quantitative method of data collection agreed using questionnaires	specific to intervention	Yes

KEBBI STATE WORKSHOP

S/NO	INDICATOR	INDICATOR EVALUATION CRITERIA							SELECTED
		Is the indicator appropriate in the context of other USAID investments?	Is the indicator measurable?	Is the indicator worded appropriately to ensure understanding by stakeholders?	Are there cultural issues that would impact the use of the indicator?	Are there gender issues that would impact the use of the indicator?	What type of data collection strategy would be most useful for this indicator?	Is this indicator generally applicable, or only relevant to specific interventions?	
CONSUMERS									
1	Knowledge: Percent of consumers who mention food safety as a concern when asked what they consider when shopping for food	Yes	Yes	Yes	No	No (Enumerators will be male to male respondents and female to female respondents)	Interview, questionnaires, one on one	generally applicable	Yes
2	Feelings and Attitudes: Percent of consumers who rank food safety as "important" or "very important"	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	Yes

3	Percent of consumers who report preferentially buying food with a certification label or from a vendor with a food safety certification	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	specific interventions applicable to packaged products and not fresh products	No
4	Percent of consumers who report having discussed food safety with a food vendor	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	No
5	Percent of consumers who report having chosen one type of food/product over another because they thought it was safer	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	Yes
VENDORS									
6	Knowledge: Percent of vendors who report that food safety is an important consideration	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	Yes

	in selecting suppliers								
7	Feelings and Attitudes: Percent of vendors who report they have an important role in assuring food safety for the products they sell	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	Yes
8	Percent of vendors who rank food safety as “important” or “very important” when deciding what products to sell	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	No
9	Percent of vendors who display visual markers, such as certificates or licenses, of food safety training or performance	Yes	Yes	Yes	No	No	observation is the most critical here. Also interview	generally applicable	No
10	Percent of vendors who report discussing	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one	generally applicable	Yes

	food safety with their suppliers								
11	Percent of vendors who report purchasing food safety equipment in the last 12 months.	Yes	Yes	Yes	No	No	Interview, questionnaires, one on one and observation	generally applicable	No
ADDITIONAL (PROPOSED) INDICATORS									
1	Vendor Practices Percentage of vendors that practice FIFO in the sale of their food produce. ¹	Yes	Yes	Yes	No	No	Interview, observation	specific	Yes
2	Consumer Feelings and attitudes percentage of consumers who consider hygiene as a factor for food safety	Yes	Yes	Can be modified	No	No	Interview, questionnaire	generally applicable	Yes

¹ FIFO is a common supply chain strategy for efficient and safe product distribution. FIFO allows food vendors to distribute products based on their arrival date, following the assumption that food safety risks increase proportionally in relation to storage time. For more information, see Hertog, M. L., et al., (2014). Shelf life modelling for first-expired-first-out warehouse management. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 372(2017), <https://doi.org/10.1098/rsta.2013.0306>.