

## Food Safety Knowledge Assessment Model for Pre-trained Food Handlers

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**The study developed and utilized a model for the assessment of food safety knowledge for pre-trained food handlers, with the aim of defining specific food safety training needs for food handlers with previous awareness in food safety. The recommended levels of knowledge for assessment were: awareness, as having previous exposure to food safety information through prior training; recall, as the ability to retrieve food safety knowledge as tested by face-to-face interview; and comprehension, as the ability to show translation of knowledge to practice as a skill in the vending environment of a food handler. These levels of food safety knowledge were utilized since deviations may result to health risks.**

**It was reported in this study that support resources as moderating variables were necessary for the translation of food safety knowledge to practice. The identified resources were falling under the control of managerial decision support by both street food business owners, as part of the private management to vending, and by local government entities contributing to public good of the vending business. Specifics to these resources were funds for street vending operations, provision of sanitary facilities, hiring of skilled manpower, and supply of appropriate utilities. The inclusion of moderating variables to the TNA model was recommended, in order to attain focus in the training of food handlers with previous awareness to the food safety information.**

Key words: street food, food safety knowledge, training needs assessment, food handlers

### INTRODUCTION

It has been shown that the exposure and acquisition of information do not necessarily translate to its effective practice (Omemu & Aderoju 2006). Barrett et al. (2005) reported that knowledge is differentiated to varying capacities of individuals to exercise judgments in different situations. Several researches have established that there was a large gap between acquired knowledge and practice in the fields of food science (Azanza et al. 2000), medicine (Eagle et al. 2003), and public health (Morrissey et al. 1997; Brownson et al. 2006). According to Eagle

et al. (2003), the American College of Cardiology has previously noted that there was a gap in the practice of clinical science and has emphasized the need to facilitate complete alignment of practice with pre-acquired knowledge in medical guidelines.

It was shown that there was also a significant gap between the translation of acquired knowledge into its application in a study conducted by Azanza et al. (2000) on food safety knowledge and practice by street food vendors doing their trade in a Philippine university environment. This gap was primarily attributed to the tendencies of street food vendors to compromise food safety due to business profits (Azanza et al. 2000). Street food business was variably defined as

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selling of fully prepared food (WHO 1996) or prepared-on-demand foods (Toh & Birchenough 1999; Azanza et al. 2000) in streets or other public places for immediate consumption (WHO 1996). Street food consumption is not only for convenience of those with limited time to cook but is already elevated to an acquired lifestyle for many (Fernandez 2002), particularly in the Philippines and most Asian countries.

The number of street food vendors increased over the years in many developing economies (Lues et al. 2006; Dealino-Tanquezon 2015) since street food vending operations require only relatively small number of personnel, low capitalization, simple food preparation skills, and very basic facility requirements. Street food vending businesses in Kenya (Mwangi 2002), Thailand (Nirathron 2006), and Ghana (Osei-Mensah et al. 2013) have shown considerable impact in generating employment. Unfortunately, many street food vendors tend to overlook the importance of food safety in the preparation of food they sell, which increases the risk of foodborne diseases and even cause unnecessary mortalities to its clientele (Buted & Ylagan 2014). Street food-related foodborne diseases were declared a major public health concern by international health agencies as early as 2006 (WHO-AFRO 2006).

Street-vended foods continue to be associated with foodborne disease outbreaks in the country even with the deliberate efforts of the Philippine government to ensure knowledge on food safety nationwide. Recent national records of foodborne disease outbreak involved street-vended *durian* candy that affected nearly 2000 people (Food Safety News 2015). The *durian* candy poisoning was attributed to poor worker hygiene at the production facility, resulting to staphylococcal food poisoning (Food Safety News 2015). Approximately one million children under the age of five die each year in South East Asia due to diarrhea caused by microbiological contamination of food and water (WHO 1999; WHO 2008).

Food safety training for food handlers in the Philippines is a regulatory requirement stipulated in the Philippine Food Safety Act of 2013 (Republic Act No. 10611). Article 5 Section 15 of this Act states that the Philippine local government units (LGU) shall be responsible for the monitoring and control of food safety including street food sale as part of the enforcement of the Code on Sanitation of the Philippines (Presidential Decree No. 856). Similarly, the US Food and Drug Administration (USFDA) Food Code 2013 regulate food establishment operations and ensure that food handlers are trained in food safety as important part of strengthening their food protection system (USFDA 2013).

It is significant to conduct a needs assessment as an important initial step to designing an effective training program (Sleezer 1993). Training needs assessment (TNA)

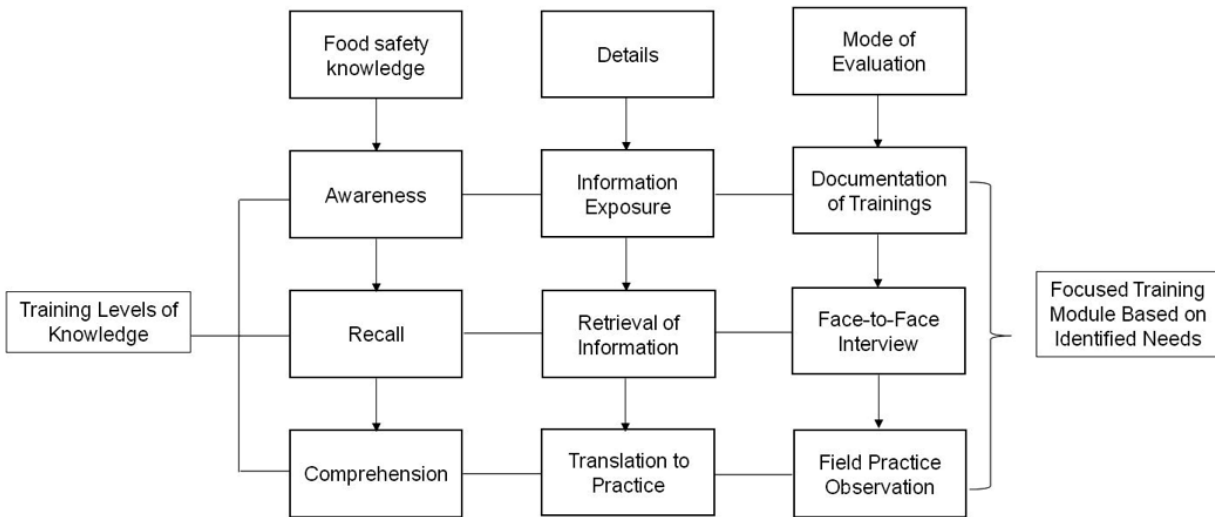
is a process of gathering data on appropriate training needs of manpower to capacitate the human resources of an organization (Miller & Osinski 1996; Brown 2002). An effective training activity include a TNA prior to the development of instructional objectives and training design, implementation, and evaluation (Miller & Osinski 1996). This present study developed and utilized a model for the assessment of food safety knowledge for pre-trained food handlers with the aim of defining specific food safety training needs for food handlers with previous awareness in food safety.

## MATERIALS AND METHODS

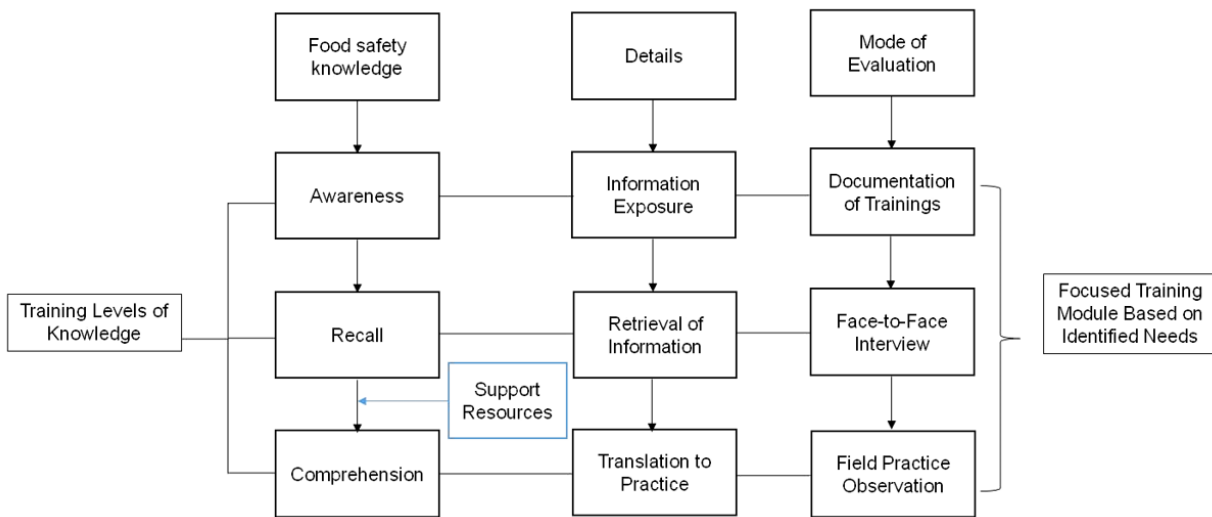
The Philippine Department of Science and Technology, National Capital Region (DOST-NCR), in collaboration with a Philippine LGU, commissioned the Department of Food Science and Nutrition, College of Home Economics, University of the Philippines-Diliman, Quezon City, Philippines to conduct training on food safety for pre-trained street food vendors as food handlers. A TNA was conducted as a pre-assessment of food safety knowledge of the pre-trained street food vendors to focus the commissioned training using the adopted model as shown in Figure 1. The identified various levels of knowledge of pre-trained food handlers in Figure 1 was adopted and modified from the previously developed cognitive-behavior model to Hazard Analysis Critical Control Points (HACCP) adherence by Azanza & Luna (2005). Knowledge, for this adopted and modified model, is a body of acquired facts (Azanza & Luna 2005). In this study, the acquired information was through a previous food safety training of food handlers as provided by a Philippine LGU health authority. However, this study redefined the working definitions of knowledge levels of pre-trained food handlers on food safety as follows: 1) awareness, as having exposure to food safety information through previous training (within a year of assessment); 2) recall, as having the ability to retrieve food safety information (Kintsch 1970; Anderson & Bower 1972); and 3) comprehension, as the proper translation of previously acquired food safety knowledge to practice (Krathwohl 2002) in their street food vending environment.

As seen in Figure 1, awareness was evaluated through acquisition of information by training. Recall was assessed through face-to-face interview based on the capability of food handlers to retrieve information that they are supposedly aware of. On the other hand, knowledge comprehension or translation to practice of the pre-trained street food vendors was evaluated through field practice observation in their vending environment. The adopted model was considered a new approach for the

**Title: Training Needs Assessment Model for Pre-trained Food Handlers**



**Figure 1.** Adopted and modified model from Azanza & Luna (2005) for the assessment of food safety knowledge of pre-trained food handlers



**Figure 2.** Revised model adopted and modified from Azanza & Luna (2005) for the assessment of food safety knowledge of pre-trained food handlers

development of a more effective food safety training module for pre-trained food handlers. The focused training module was to contextualize the identified needs of the pre-trained street food vendors as food handlers based on recall and practice of food safety knowledge.

**Tool for the assessment of comprehension of food safety information**

The LGU-assisted food safety training was based on the Code on Sanitation of the Philippines (PD 856 of 23 December 1975). The tool used in this study for the assessment of knowledge levels of pre-trained food

handlers was composed of two sections: (1) demographics of pre-trained food handler respondents, and (2) the listing of food safety provisions of the Code on Sanitation of the Philippines, which are used as information for food safety trainings of LGUs. Demographic details include: *name, health certificate, age, gender, civil status, educational attainment, daily take home income, and length of time in street food vending*. The listing of food safety information (Table 1) were used as bases for the evaluation of comprehension as recalled by respondents in face-to-face interview and the correct translation of recalled knowledge to practice in food vending as observed.

**Table 1.** Food safety provisions for food establishments on Chapter III of the Code on Sanitation of the Philippines (P.D. 856)

<b>Section on Chapter 3 of the Code on Sanitation of the Philippines</b>	<b>Details necessary for knowledge and practice assessment</b>
Sanitary permit	<i>Valid sanitary permit issued by local health office accompanied by proof of pest control and results of water potability analysis Display of sanitary permit in the establishment</i>
Health certificates	<i>Vendor is holder of valid health certificate after completing physical examination by accredited physicians, medical requirements (stool, sputum), &amp; attended HIV/AIDS seminar. Health certificate ID is worn in upper left portion of the working garments of the vendors. Health certificate is renewed yearly Health certificate is non-transferrable</i>
Quality & protection of food	<i>Meat &amp; fish supplies procured from approved sources monitored by LGU Raw fruits &amp; vegetables are thoroughly washed with potable water. Perishable &amp; refrigerated foods are stored at <math>\leq 7^{\circ}\text{C}</math>. Cooked food is kept at <math>\geq 60^{\circ}\text{C}</math> for a maximum of 4 h.</i>
Structural requirements of food establishments	<i>Room/space that may contaminate food (i.e. sleeping apartment) are not used for food handling. Food carts are made of smooth, washable, and impervious materials. There is enough floor space for efficient working There is enough light and ventilation for food handling. Wash-hand basins are placed in convenient locations &amp; maintained in good working condition.</i>
Use of food-service spaces	<i>Food-service spaces are not used as sleeping quarters or storage area for personal effects and live animals. Any person not connected with food preparation are not allowed in food-service spaces.</i>
Food handlers	<i>Clean &amp; complete working garments including apron, hairnet, face mask, gloves, and closed shoes are always worn. Food handlers always observe good personal hygiene. Food handlers wash hands thoroughly with soap and water then dry.</i>
Vermin control	<i>Food-service space is protected from pests and animals. Vermin reduction program is actively implemented. Food establishment is protected from toxic chemicals during disinfecting operations.</i>
Toilet and washing facilities	<i>Available clean toilet &amp; washing facilities for all personnel in appropriate places. Toilet rooms not directly opening in food preparation areas Hand-washing facilities have adequate hot &amp; cold running water and paper/cloth towel.</i>
Disposal of refuse	<i>Refuse cans for immediate use are available. Designated places for disposal of waste are separate from food-handling operations Waste containers are vermin proof and easily cleaned. Waste containers are tightly covered at all times.</i>
Equipment and utensils	<i>Equipment and utensils are easily cleaned and not made of toxic materials (lead-soldered &amp; cadmium-lined piping fixtures) Food-contact surfaces constructed of materials that are impervious, non-toxic, corrosion-resistant, easily cleanable, durable &amp; resistant to chipping.</i>
Proper washing of utensils	<i>Utensils are scraped &amp; pre-rinsed to remove food articles. Utensils are cleansed in warm water (<math>49^{\circ}\text{C}</math>) with soap or detergent If running water is not available, wash-water is changed frequently</i>
Bactericidal treatment	<i>Methods of sanitizing eating &amp; drinking utensils include: - immersion for at least half a minute in clean hot water (at least <math>77^{\circ}\text{C}</math>) - immersion for at least 1 min in a lukewarm chlorine solution 50ppm - any other method approved by the local health authority</i>
Handling of washed utensils	<i>Drying methods for washed utensils: - drain dry in wire racks without using drying cloth - store in a self-draining position to permit ready air-drying Drying cloth on which to store dishes temporarily should be clean &amp; changed frequently.</i>

Table 1 continued next page . . .

Storage of washed utensils	<p><i>Washed utensils are stored in clean, dry place, protected against vermin &amp; other contamination.</i></p> <p><i>Cups, bowls, and glasses shall be inverted for storage.</i></p> <p><i>Utensils shall be inverted/covered if not in closed cupboards.</i></p> <p><i>- utensils should not be stored in open cabinets below the working top levels</i></p> <p><i>Racks, trays, shelves, &amp; drawers made of impervious, non-toxic, corrosion-resistant, smooth, durable, and resistant to chipping.</i></p> <p><i>Felt-lined drawers not acceptable, but clean &amp; removable towels for lining can be used.</i></p>
Dry storage of non-perishable Foods	<p><i>Designated spaces, lockers, cupboards, racks, shelves and containers shall be used.</i></p> <p><i>All spaces, lockers and cupboards constructed of quality materials</i></p> <p><i>Recommended temperature for non-perishable foods: 10-15°C except when stored in the preparation and serving spaces</i></p>
Refrigerated storage of perishable foods	<p><i>Perishable foods are kept at <math>\leq 45^{\circ}\text{F}</math> (<math>7^{\circ}\text{C}</math>) except during preparation or for immediate serving.</i></p> <p><i>For extended storage periods, <math>4^{\circ}\text{C}</math> is recommended.</i></p> <p><i>Fruits &amp; vegetables are stored in cool rooms</i></p> <p><i>- frozen foods: not more than <math>-12^{\circ}\text{C}</math></i></p> <p><i>- meat and fish: <math>0 - 3^{\circ}\text{C}</math></i></p> <p><i>- milk &amp; milk products: <math>5 - 7^{\circ}\text{C}</math></i></p> <p><i>- fruits &amp; vegetables: <math>7 - 10^{\circ}\text{C}</math></i></p> <p><i>Refrigerators shall be clean, odor-free, with thermometer, &amp; with sufficient shelving.</i></p>
Food servicing operations	<p><i>Hand contacts with food or drink shall be avoided:</i></p> <p><i>- fingers not used to serve butter, ice, or similar items</i></p> <p><i>- sugar served in covered dispensers or in single serve packages</i></p> <p><i>Food-contact surfaces of containers and utensils shall not be handled.</i></p> <p><i>Disposable cups, plates, spoons, etc, purchased in sanitary cartons.</i></p> <p><i>Clean cloths, napkins, spoons, towels stored in clean places separate from soiled items.</i></p> <p><i>Spoons, spatulas, dippers, scoops used intermittently shall be kept in running water or maintained at <math>77^{\circ}\text{C}</math> and frequently changed.</i></p>

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### Pre-testing of the assessment tool

Ten randomly selected pre-trained street food vendors in the campus of a local university were approached by interviewers and asked for their willingness to participate in the pre-testing of the assessment tool. The interviewers in this study were graduates of Food Technology course. The demographic profile of each food handler was evaluated first. Then, the food handlers were instructed during the interview to listen to the statements on food safety provisions of the Code on Sanitation of the Philippines as indicated in Table 1. They were asked to respond whether each of the statement was *correct*, *incorrect*, and *no knowledge if correct*. During the pre-testing, the respondents suggested that additional response of *maybe correct* should be added to indicate uncertainty of correctness of responding street food vendors. Further, it was suggested that space for comments be allotted to further explain responses.

### Survey of food safety knowledge of pre-trained food handlers

The actual survey using the pre-tested revised food safety assessment tool was conducted during Feb-Mar 2016 in the street food vending environment of 53 participating pre-trained food handlers. These included 42 vendor-business owners and 11 vendor-employees who were actively involved in the preparation and selling of street

foods. Vendor-business owners were those vendors who actually own the street food vending business and doing the vending themselves as well. On the other hand, vendor-employees were hired by the vendor-business owners to assist in the vending of the street foods. Each participating street food vendor was interviewed face-to-face during the most convenient time in their stall. During the face-to-face interview, information contained in the Code on Sanitation of the Philippines related to safe food vending that were also used as topics for the previous training of the food handlers were read (Table 1) to each respondent vendor. The respondents were asked whether the read information were: *correct*, *incorrect*, *maybe correct*, and *no knowledge if correct*. The respondents were informed that they can explain their responses as part of the interview process.

Per food safety information item assessed, Equation 1 was used to calculate the percentage comprehension of food handlers (grouped either as vendor-business owners or vendor-employees) who correctly recalled the information (Table 1). Respondents who gave answers aside from the coded correct response were rated not able to retrieve the food safety information assessed and therefore considered without recall of that information.



$$(1) \text{ Percent (\%)} \text{ recall} = \frac{\text{Number of pre-trained street food vendors who correctly recalled information related to food safety}}{\text{Number of pre-trained street food vendors (n) per group}} \times 100$$

(information retrieval)

where n=11 for vendor-employees, and n=42 for vendor-business owners.

The translation to practice of each participant who recalled information correctly was observed. If recalled food safety knowledge was translated to correct practice, then Equation 2 was used to calculate percent (%) knowledge translation to practice (comprehension).

$$(2) \text{ Percent (\%)} \text{ comprehension} = \frac{\text{Number of pre-trained street food vendors who correctly recalled information and translated to practice}}{\text{Number of pre-trained street food vendors (n) with comprehension per group}} \times 100$$

(knowledge translated to practice)

### Statistical analysis

Data gathered through survey were tabulated and categorized as means, frequencies, ratios, and relative percentages to express the results. Associations of demographic characteristics and practices were assessed using Chi-square test with alpha ( $\alpha$ ) = 0.05.

## RESULTS AND DISCUSSION

### Demographic profile of the street food vendors

The demographic profile of the 53 street food vendor respondents, namely 11 vendor-employees and 42 vendor-business owners, is summarized in Table 2. The street food vendor participants can generally be described as married women in their thirties (vendor-employees) and fifties (vendor-business owners) who attended at least high school or secondary level education. This profile of street food vendors is similar to the profiles reported by Nurudeen et al. (2014) and Odonkor et al. (2011) in Africa

in which majority of the street food vendors were women (81%) with mean age of 38. These findings indicate that food vending businesses are generally predominantly practiced by women in various parts of the world.

A study by Dealino-Tanquezon (2015) similarly reported that street food vendors in Intramuros, Manila, Philippines generally attained secondary education. Students at the age of 12-13 are prepared for four formal education years at the secondary level and culminates at ages 16-17 (UNESCO, 2009). Secondary level formal education is also part of the basic education but is expanded to include general, vocation, and technical education (UNESCO, 2011). Given the educational background of the participating street food vendors, it may be inferred that the participating 53 pre-trained street food vendors are quite capable of learning and becoming knowledgeable of food safety issues through training.

Increased biological age is reported to be cognizant of diminished cognitive functions (Crawford, 2004). However, Lorge (1940) established that this decline in cognitive function is only based on the speed of learning but not necessarily on the intellectual power. Thus, the participating pre-trained street food vendors with ages ranging from thirties to fifties may still have the learning absorptive capability through training for food safety although with hurdle of diminished speed.

In terms of income, vendor-business owners have higher daily take home intake ranging from Php 501-1000 (\$10-20 as of 29 Nov 2016, Exchange Rates UK, 2016) compared to the vendor-employees who earn below Php 500 (<\$10 as of 29 Nov 2016). The daily earnings of street food vendors are not fixed and depend on gross sales per day. In the Family Income and Expenditure Survey conducted in 2015, a Filipino family of five needed a minimum income of Php 9,140 (\$184 as of 29 Nov 2016) every month (Philippine Statistics Authority 2016) or about Php 300 (\$6) per day to meet the very basic food and non-food needs. This income range may provide very tight budget for the families of the street food vendors, especially if the vendor is the only breadwinner. Compromises in food safety practices can happen during vending operations particularly for those under the control of the street food vendor-business owners who are responsible for funding and management of the vending business. During the face-to-face interviews, some vendor-business owners raised the issue of being unable to provide sufficient water for cleaning due to limited facilities and bringing plenty of water from their homes is costly.

The environment where the vending stall were situated is under the control of an LGU that implements the ordinance on *Security of Registered Vendors in the Workplace*. Also, all those who sell food are required to secure Health or

**Table 2.** Demographic profile of participating pre-trained street food vendors (n=53) with awareness of food safety concepts.

Demographic profile	Street Food Vendors (n=53)			
	Vendor-business owner (n=42)		Vendor-employee (n=11)	
	Frequency	%	Frequency	%
<b>Health Certificate*</b>	42	100	11	100
<b>Age, years</b>				
≤ 30	1	2	5	45
31-40	9	21	3	27
41-50	12	29	2	18
> 50	20	48	1	9
<b>Gender</b>				
Female	37	88	9	82
Male	5	12	2	18
<b>Civil Status</b>				
Single	3	7	4	36
Married	31	74	5	45
Separated	2	5	1	9
Widowed	6	14	1	9
<b>Educational Attainment</b>				
Primary (Elementary)	2	5	2	18
Secondary (High school)	26	62	7	64
Tertiary (College)	9	21	1	9
Vocational	5	12	1	9
<b>Daily Take Home Income, Php</b>				
100-500	12	29	8	73
501-1,000	20	48	1	9
> 1,000	9	21	2	18
No answer	1	2	0	0
<b>Length of time in street food vending</b>				
< 1 year	0	0	2	18
1 - 20 years	35	83	8	73
21 - 40 years	7	17	1	9

Sanitation Certificate issued by the LGU health authority under the ordinance of *Issuance of Vending Permit*. Part of the requirements imposed by LGU health authority to the street food vendors is the acquisition of medical certificate after the conduct of medical examination and participation in food safety trainings covering the Sanitation Code of the Philippines. Majority of the respondents have been in the street food business within 20 years. All of the respondents have valid health certificates during the time of the assessment. However, only 60% of the surveyed respondents (i.e., vendor-business owners) acquired valid sanitary permit. Based on the comments registered by the respondents, sanitary permits were renewed yearly and at the time of this present study, some of the vendor-

business owners were still processing their sanitary permit renewal while others are still awaiting release of the official permits.

### Food safety knowledge

The 53 participating pre-trained street food vendor survey respondents were considered to have full awareness level since they have all attended food safety-related trainings based on the Code on Sanitation of the Philippines, within a year of the assessment (Table 3). However, it has been established that awareness level of food safety knowledge does not necessarily translate to safe food handling. Theoretically, the food handler should have both the

ability to recall the food safety-related information and properly translate the knowledge to actual practice in their vending environment. The study by Dealino-Tanquezon (2015) indicated that mere attendance to food safety and sanitation seminars and trainings did not create much impact on practices of street food vendors. Dealino-Tanquezon (2015) study specifically indicated that street food vendor attendance to food safety and sanitation trainings were not effectively translated to use of gloves, proper handwashing, use of work apparel, prevention of cross-contamination through food handling, and proper personal hygiene.

Table 3 presents that all participating food handlers had 100% awareness on the teaching modules used by LGU health authority based on the provisions of Chapter III of the Code on Sanitation of the Philippines (P.D. 856). The seminars or trainings provided by the LGU included topics such as personal hygiene and good housekeeping, water supply sanitation, food sanitation laws, rules and regulations, measures to prevent cross-contamination, and Presidential Decree 522 and 856 and other City Ordinances pertaining to health.

The identified levels of knowledge for the TNA of pre-trained food handlers was modeled from the previously developed cognitive-behavior paradigm to Hazard Analysis Critical Control Points (HACCP) adherence by Azanza & Luna (2005). Anderson & Bower (1972) previously cited that recall involves retrieval of words in a statement by a search of long-term memory and the recognition of retrieved words based on contextual information.

This study limited the level of knowledge assessment to awareness, recall, and comprehension due to the nature of food safety provisions or information and the implication of deviations to health risks based on practice of knowledge. Strict recall and translation of knowledge to practice without any form of deviation are perhaps quite critical to food safety control in food handling and vending.

### Recall

The food safety information recall and translation to practice of the pre-trained street food vendors are summarized in Table 3.

**Table 3.** Food safety knowledge comprehension and knowledge translation of pre-trained street food vendors (n=53) based on provisions of Chapter III of the Code on Sanitation of the Philippines (P.D. 856).

Section on Chapter 3 of the Code on Sanitation of the Philippines	Details for assessment of knowledge and practice	Recall <sup>a</sup> (%)		Comprehension <sup>b</sup> (%)		Comments
		Vendor-employee (n=11)	Vendor-business owner (n=42)	Vendor-employee (n=11)	Vendor-business owner (n=42)	
Health certificate	<i>Vendor is holder of valid health certificate after completing physical examination, medical requirements (stool, sputum), and HIV/AIDS seminar.</i>	11 (100)	42 (100)	11 (100)	42 (100)	
	<i>Health certificate is renewed yearly.</i>	11 (100)	42 (100)	11 (100)	42 (100)	
	<i>Health certificate is non-transferrable</i>	11 (100)	42 (100)	11 (100)	42 (100)	
Structural requirements	<i>Any room/space that may contaminate food (i.e. sleeping apartment) should not be used for food handling</i>	11 (100)	42 (100)	11 (100)	42 (100)	
	<i>Walls, ceilings, &amp; floor of food carts should be made of smooth, washable, and impervious materials</i>	11 (100)	42 (100)	11 (100)	42 (100)	
Use of food-service spaces	<i>Food-service spaces used solely for food-related activities should not be used - as living/sleeping quarters - as storage area for personal effects and animal/live fowl</i>	11 (100)	42 (100)	11 (100)	42 (100)	
	<i>Any person not connected with food preparation not allowed in food-service spaces</i>	11 (100)	42 (100)	11 (100)	42 (100)	
Vermin control	<i>There is an existing vermin reduction program</i>	11 (100)	42 (100)	11 (100)	42 (100)	
	<i>Food establishment protected from toxic chemicals during derating/disinfecting operations</i>	11 (100)	42 (100)	11 (100)	42 (100)	

Table 3 continued next page . . .



	<i>Food-service space shall be constructed &amp; maintained as to exclude vermin</i>	11 (100)	42 (100)	11 (100)	42 (100)	
Disposal of refuse	<i>Refuse cans for immediate use only</i>	11 (100)	42 (100)	11 (100)	42 (100)	
	<i>Designated places for disposal of waste are separate from food-handling operations</i>	11 (100)	42 (100)	11 (100)	42 (100)	
Food	<i>Disposable cups, plates, spoons, etc, purchased in sanitary cartons</i>	11 (100)	42 (100)	11 (100)	42 (100)	
servicing operations	<i>Clean cloths, napkins, spoons, towels stored in clean places separate from soiled items</i>	11 (100)	42 (100)	11 (100)	42 (100)	
Sanitary permit	<i>Valid sanitary permit issued by local health office accompanied by proof of pest control and results of water potability analysis.</i>	11 (100)	42 (100)	NA	25 (60)	
Food handlers	<i>Always wear clean &amp; complete working garments including apron, hairnet, face mask, gloves, and closed shoes</i>	11 (100)	42 (100)	9 (82)	37 (88)	
	<i>Always observe good personal hygiene</i>	11 (100)	42 (100)	5 (45)	27 (64)	
Disposal of refuse	<i>Tightly covered at all times</i>	11 (100)	42 (100)	2 (18)	7 (17)	
Equipment	<i>Equipment and utensils are easily cleaned and don't pose health hazards</i>	11 (100)	42 (100)	5 (45)	13 (31)	
and utensils	<i>Food-contact surfaces constructed of materials that are impervious, non-toxic, corrosion-resistant, easily cleanable, durable &amp; resistant to chipping</i>	11 (100)	42 (100)	6 (55)	20 (48)	
Washing	<i>Utensils are scraped &amp; pre-rinsed to remove food articles</i>	11 (100)	42 (100)	0 (0)	11 (26)	
of utensils	<i>If running water is not available, wash-water is changed frequently</i>	11 (100)	42 (100)	0 (0)	11 (26)	
Sanitary permit	<i>Display of sanitary permit in the establishment</i>	11 (100)	42 (100)	0 (0)	0 (0)	Permits not displayed visibly.
Health certificate	<i>Worn in upper left portion of the working of vendors</i>	11 (100)	42 (100)	0 (0)	0 (0)	Health certificate IDs not worn visibly.
Quality & protection of food	<i>Cut meat &amp; fish procured from approved sources</i>	11 (100)	42 (100)	NA	--- <sup>c</sup>	Vendors purchased from convenient & accessible, large established wet markets. Cooked food displayed at ambient temperatures.
	<i>Perishable &amp; refrigerated foods stored at <math>\leq 7^{\circ}\text{C}</math></i>	11 (100)	42 (100)	NA	---	
	<i>Cooked food kept at temperature not lower than <math>60^{\circ}\text{C}</math> not more than 4 h</i>	11 (100)	42 (100)	NA	0 (0)	
	<i>Raw fruits &amp; vegetables thoroughly washed with potable water</i>	11 (100)	42 (100)	0 (0)	0 (0)	
Structural requirements	<i>Light and ventilation not hinder food handling</i>	11 (100)	42 (100)	---	---	Vending stalls not properly maintained and not in good condition.
	<i>There should be enough floor space for efficient working</i>	11 (100)	42 (100)	---	---	
	<i>Wash-hand basins should be placed in convenient locations and maintained in good working condition</i>	11 (100)	42 (100)	NA	0 (0)	No wash-hand basins available
Food handlers	<i>Wash hands thoroughly with soap and water then dry</i>	11 (100)	42 (100)	0 (0)	0 (0)	Lack of hand washing facilities

Table 3 continued next page . . .

Toilet and washing facilities	<i>There are adequate &amp; clean toilet &amp; washing facilities for all personnel in appropriate places</i>	11 (100)	42 (100)	---	---	Lack of adequate dedicated toilet & handwashing facilities for vendors
	<i>Toilet rooms not directly opening in food preparation areas</i>	11 (100)	42 (100)	---	---	
	<i>Hand-washing facilities adequate, within or adjacent to toilet room</i> - hot & cold running water - paper or cloth towel	11 (100)	42 (100)	---	---	
Disposal of refuse	<i>Vermin proof and easily cleaned</i>	11 (100)	42 (100)	---	---	Trash bags as temporary waste storage prior to collection at the end of the day
Washing of utensils	<i>Utensils are cleansed in warm water (49°C) with soap or detergent</i>	11 (100)	42 (100)	---	---	No provisions for warm water and limited water supply
Bactericidal treatment	<i>Eating &amp; drinking utensils thorough cleaning will be subjected to:</i> - immersion for at least half a minute in clean hot water (at least 77°C) - immersion for at least 1 min in a lukewarm chlorine solution 50ppm	11 (100)	42 (100)	---	---	Chlorine solutions not used to sanitize utensils
		11 (100)	42 (100)	0 (0)	0 (0)	
Handling of washed utensils	<i>Drying methods for washed utensils:</i> - drain dry in wire racks without using drying cloth - store in a self-draining position to permit ready air-drying <i>Drying cloth on which to store dishes temporarily should be clean &amp; changed frequently</i>	11 (100)	42 (100)	0 (0)	11 (26)	No provisions for drying of washed utensils.
		11 (100)	42 (100)	0 (0)	11 (26)	

$$a = \left( \frac{\text{Number of pre-trained street food vendors who correctly recalled information related to food safety}}{\text{Number of pre-trained street food vendors (n) per group}} \right) \times 100 \quad \text{where } n=11 \text{ for vendor-employees and } n=42 \text{ for vendor-business owners;}$$

$$b = \left( \frac{\text{Number of pre-trained street food vendors who correctly recalled information and translated to practice}}{\text{Number of pre-trained street food vendors (n) with comprehension per group}} \right) \times 100;$$

c=not verifiable

For this study, recall was defined as the ability to search and retrieve relevant food safety information from long-term memory. The pre-trained street food vendors also recalled (100%) the food safety information as reflected in Table 3. During the face-to-face interview, the respondents recalled food safety information that they previously became aware of in the LGU-sponsored food safety training and responded to the presented food safety-related provisions of the Code on Sanitation of the Philippines. Information recall of the pre-trained street food vendors was calculated based on the number of respondents who provided *correct* response to the food safety-related provisions that were read to them. The

participants who gave answers aside from the *correct* response were considered to have no ability to recall food safety information. Although both vendor-employees and vendor-business owners in this study recalled food safety information based on the provisions of the Code on Sanitation of the Philippines, they were unable to fully translate their knowledge to actual practice in their vending environment.

It was previously hypothesized that information is first retrieved from memory during the process of recall (Kintsch 1970; Anderson & Bower 1972). Similarly, recall in the revised Bloom's Taxonomy of Educational

Objectives was classified under the cognitive process *remember* which was defined as the retrieval of relevant knowledge from long-term memory (Krathwohl 2002).

### Comprehension

In the revised Taxonomy, the cognitive process *comprehension* was changed to *understand*. The cognitive process *understand* was defined as determining the meaning of instructional messages, including oral, written, and graphic communication (Krathwohl 2002).

As shown in Table 3, all 53 pre-trained street food vendors were able to translate their knowledge to practice (100%) regarding the following provisions from the Code on Sanitation of the Philippines. These include having sole ownership of a valid health certificate; suitable room/space used for food handling and use of appropriate materials for their food stalls; use of space for food-related activities only; having vermin control measures; having designated places for waste materials; and separation of clean utensils from soiled items. These recalled food safety information were translated to practice by the pre-trained street food vendors mainly due to 1) provisions by the LGU namely space for waste management, food preparation, and food service operations; and 2) the fact that these were audit document requirements that were frequently monitored and inspected.

Both vendor-business owners and vendor-employees, however, showed limited knowledge translation to practice as indicated in the results of the calculated percentages on the following major provisions of the Code on Sanitation of the Philippines: sanitary permit, food handlers, disposal of refuse, equipment and utensils, and washing of utensils. Only 60% of the vendor-business owners had valid sanitary permit. Also, higher percentage of vendor-business owners practiced wearing clean and complete working garments (88%), good personal hygiene (64%), pre-rinsing of utensils prior to washing and frequent changing of wash-water (26%), and drying methods for washed utensils (26%) compared to vendor-employees. However, these were not necessarily lack of comprehension rather it is the lack of a moderating variable which hinders vendor-employees to translate recalled information to practice. These intervening moderating variables include support resources including funds for street vending operations, sanitary facilities, skilled manpower, available potable water supply, and managerial support from the business owners (private) and local government authorities (public). Further, in this study, age, gender, and level of education of the street food vendors were not significantly ( $p>0.05$ ) associated with their comprehension or translation of their knowledge to practice. Similar results were established for street food vendors in Florianopolis, Brazil (Cortese et al. 2016) and

Port-au-Prince, Haiti (Samapundo et al 2015) wherein no statistical difference was found between the food safety attitudes of the vendors in relation to their demographic profile (i.e., gender, age, location, and education).

However, daily income was significantly associated ( $p<0.05$ ) with practices of the street food vendors including usage of clean and non-toxic materials for equipment and utensils, scraping and pre-rinsing of utensils, frequent changing of wash-water, and proper drying methods for washed utensils. Tessema et al. (2014) reported similar association between income and food handling practices of street food vendors in Dangila town, Ethiopia. They reported that food handlers with lower monthly income were 60.5% less likely to have good food handling practices compared to those with higher monthly income. On the other hand, Mamun et al. (2013) found that higher income group of street food vendors in Dhaka, Bangladesh might pay less attention to their hygienic practices as they focus on their sales and customers to increase earnings. For this study, street food vendors who earn more on a daily basis have more resources to pay for the operation expenses thus, they probably have more capacity to comply with food safety requirements than those with lower daily income.

Vendor-employees have limited means of practicing their food safety knowledge compared to the vendor-business owners since they do not have the same level of decision-making capabilities and they only follow instructions from their employers. Specifically, vendor-employees have no control over areas involving sources of raw materials such as meat, storage of cooked foods, location and provision of wash-hand basins, and provision and maintenance of wash-hand basin. The vendor-business owners have control regarding these provisions. The vendor-business owners must transfer knowledge to their hired vendors to make them successful employees (Desouza & Awazu 2006). In all SMEs researched by Desouza and Awazu (2006), the transfer of knowledge was found to be predominantly done through socialization. Knowledge transfer occurred via formal and informal socialization methods such as weekly meetings between the owner and employees wherein the owner shares her insights from the week's activities.

Vendor-employees showed higher percentage of knowledge translation to practices than the vendor-business owners in the provisions concerning keeping waste containers covered (18%) and using appropriate materials for food-contact surfaces (55%). This higher translation of knowledge to practice is perhaps the result of their constant exposure in their daily tasks as vendor-employees in vending operations. Further, there were some items under the provisions which were not verifiable due to the nature of street food vending that inhibits

vendors from practicing their food safety knowledge (Table 3). These provisions that were not verifiable were also not directly controlled by either the vendor-employees or vendor-business owners. Specifically, the street food vendors had difficulty practicing food safety provisions for refrigeration of perishable foods, lighting and ventilation during food handling, floor space, vermin-proof stall, adequate toilet and handwashing facilities, and warm water for utensil washing.

All 53 pre-trained street food vendors were not able to translate their food safety knowledge to practice related to display of sanitary permit, wearing health certificate IDs, washing of raw fruits with potable water, washing of hands thoroughly with soap and water, and use of chlorine solutions as sanitizers for utensils. It is important for food handlers to have the necessary and adequate facilities such as water supply and sanitary facilities to ensure food safety and cleanliness. In general, there was a lack of funds for street vending operations, infrastructure (sanitary facilities), manpower, potable water supply, and managerial support from the business owners (private) and local government authorities (public). These were identified as the moderating variable as support resources that help street food vendors translate their food safety knowledge into practice. According to Yapp and Fairman (2006), some factors that prevent compliance to regulatory requirements in the food business include lack of trust in food safety legislation and the enforcing officers. Further, a lack of motivation and commitment to the objective of the food safety may also affect the comprehension of food handlers.

Figure 2 below shows the training needs assessment model including the support resources acting as a moderating variable to help food handlers transition from recall towards comprehension or translation of food safety knowledge to practice. The original model (Figure 1) was only applicable to food handlers vendor-business owners who have higher decision-making capabilities compared to vendor-employees. The translation of food safety knowledge to practice of hired vendor-employees is directly influenced by the vendor-business owners.

The results of this study are comparable to other studies, which reported street food vendors as having sufficient knowledge to ensure hygienic handling and preparation of food (Omemu & Aderoju 2006; Rheinlander et al. 2008). However, this knowledge was not necessarily translated into safe food handling practices (Omemu & Aderoju 2006; Rheinlander et al. 2008) due to unavailability of adequate water and sanitary facilities in most of the street food vending sites surveyed thus limiting the capacity of the vendors to maintain personal hygiene and cleanliness of the area (Omemu & Aderoju 2006). The study of Azanza et al. (2000) reported that the relatively high

level of knowledge in handwashing and its translation to practice by street food vendors may be attributed to the availability of handwashing facilities. Moreover, Van Kampen et al. (1998) reported that the lack of available handwashing facilities and poor knowledge concerning hygiene were correlated with improper food-handling practices of street food vendors in Jakarta, Indonesia.

## CONCLUSION

The study assessed the food safety knowledge of pre-trained food handlers to identify the training needs. A TNA model was developed and utilized to evaluate the food safety knowledge of food handlers. The food safety information recall of these street food vendors was assessed through face-to-face interview while comprehension was evaluated through field observation of practices. This study limited the level of knowledge assessment to awareness, recall, and comprehension due to the nature of food safety provisions or information. The food safety information provided by different regulating agencies is intended to be disseminated, recalled, and practiced by all food handlers to address food safety issues since deviation to food safety provisions can increase risk of foodborne diseases among consumers.

In this study, 11 pre-trained vendor-employees and 42 pre-trained vendor-business owners were surveyed. They can be generally described as married women in their 30s (vendor-employees) and 50s (vendor-business owners) who attended at least high school or secondary level education. The pre-trained street food vendors recalled the provisions in Chapter III of the Code on Sanitation of the Philippines. In addition, all 53 pre-trained street food vendors were able to translate their knowledge to practice regarding the following provisions from the Code on Sanitation of the Philippines. These include having sole ownership of a valid health certificate, suitable room/space used for food handling and use of appropriate materials for their food stalls, use of space for food-related activities only, having vermin control measures, having designated places for waste materials, and separation of clean utensils from soiled items. These recalled food safety information were translated to practice by the pre-trained street food vendors since the LGU provided space for waste management, food preparation, and food service operations. Further, the vermin control and health certificate were part of the requirements during inspection or audit thus the food handlers practice these more frequently compared to the other provisions on the Code on Sanitation of the Philippines.

However, both vendor-business owners and vendor-employees had low comprehension on some provisions



under sanitary permit, food handlers, disposal of refuse, equipment and utensils, and washing of utensils. About 60% of the vendor-business owners operated in areas with sanitary permit. Also, higher percentage of vendor-business owners were able to practice their knowledge regarding washing of used utensils and personal hygiene compared to vendor-employees. Vendor-employees have limited means of practicing their food safety knowledge relative to the vendor-business owners since they do not have the same level of decision-making capabilities and they only follow instructions from their employers.

Further, there were provisions that were not verifiable due to the nature of street food vending that prevents vendors from practicing their food safety knowledge. These provisions that were not verifiable were also not directly controlled by either the vendor-employees or vendor-business owners. The street food vendors were unable to practice some provisions under structural requirements, quality and protection of food, food handlers, vermin control, toilet and washing facilities, disposal of refuse, and washing, sanitizing, and handling of utensils.

Food safety is a major public health problem that relates to both human health and economic development (WHO 2002), and countries all over the world are affected by a range of food-related diseases (Schlundt 2002). Street food vending is known to pose a high risk of foodborne illness and it is a major food safety concern due to microbial contamination and environmental contamination (Rheinlander et al. 2008). Food safety information provided by different regulating agencies is intended to be disseminated, recalled, and practiced by all food handlers without deviations since any deviations to these food safety provisions risks such as foodborne diseases for consumers may be an outcome.

For the street food vendors in this study, having food safety knowledge does not essentially equate to observance or compliance to the requirements. Regular training/seminar is needed to educate and advocate the importance of environmental sanitation and safe food handling practices especially proper hygiene. Refresher trainings are recommended to help in retention of obtained knowledge regarding food safety. Further, provision of support resources – such as sanitary facilities (infrastructure), potable water supply, and managerial support from the business owners (private) and local government authorities (public) – is also recommended. Since street food vendors in this study are monitored almost weekly by the LGU due to their proximity to the Health Office, sampling of the street foods for relevant testing, is also recommended.

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