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Food Safety Knowledge, Perception and Self-Reported Practices of Reading Impaired Food Handlers in St. James, Jamaica

Marcia Thelwell-Reid[1], OD. PhD., Zandy U. Elliott[1] PhD. DHSc

[1]Joint Colleges of Medicine, Oral Health, and Veterinary Sciences, University of Technology (UTECH), Kingston, Jamaica, WI.

Abstract

Introduction: Jamaica's food safety has been a priority since the 1960s, but the population still faces foodborne illnesses due to improper handling, inadequate personal hygiene, and manufacturing lapses. Furthermore, 1 in 49 individuals contract illnesses annually from contaminated foods, highlighting the need for tailored education and training.

Research Objectives: The study seeks to determine how reading-impaired food handlers perceive food safety training. The study aims to ascertain the self-reported practices of reading impaired food handlers in relation to key food safety parameters. The objective is to ascertain the level of knowledge that reading impaired food handlers possess regarding key food safety parameters. To identify gaps in food safety knowledge among reading-impaired food handlers. The objective is to assess the variations in knowledge and self-reported practices between trained and untrained food handlers concerning key food safety parameters.

Materials and Methods: This study employed a comparative quantitative cross-sectional research approach to examine the knowledge, perceptions, and self-reported practices of reading impaired food handlers in St. James, Jamaica. The study comprised of 94 participants aged 18 and older embedded in the learning theories, behaviour-based training model, knowledge, attitude, and practice (KAP) model, social cognitive theory, and the knowledge sharing process model. A convenience sampling strategy was used to examine trained and untrained reading impaired food handlers, with a One-Way Anova and an independent sample t-test conducted in SPSS Version 28 and Microsoft Excel between June 2022 and July 2022.

Findings: The mean knowledge score among food handlers was 57.6%, below the Ministry of Health and Wellness, with only 17% passing. Trained handlers scored higher (21.3%) than untrained handlers (12.8%). Self-reported food safety practices were better among trained handlers (47% satisfactory) than untrained handlers (27%), showing a small but significant

difference. However, untrained handlers had slightly higher perception scores (81%) than trained handlers (78%).

Conclusion: The findings suggest that while training slightly improves food safety practices, it does not significantly enhance knowledge among reading-impaired food handlers. The high perception of food hygiene training among untrained handlers indicates a need for more accessible and effective training methods to improve knowledge retention and compliance with food safety standards.

Keywords: Food safety knowledge, perception and self-reported practices, reading impaired food handlers, St. James, Jamaica.

Introduction

Food safety has been a cornerstone of public health initiatives in Jamaica for many decades. Since the 1960s, the Ministry of Health has mandated training and certification for all individuals involved in commercial and local food hygiene, evolving from a medically focused approach to a comprehensive system emphasizing effective dissemination of food hygiene knowledge and practices (Ministry of Health Jamaica, 2001). Despite these efforts, the Jamaican population remains at risk for foodborne illnesses with each meal or beverage consumed. Foodborne diseases, defined as illnesses resulting from the ingestion of food or beverages contaminated by bacteria, viruses, parasites, or chemical agents, pose significant health challenges. Contamination can occur due to improper food handling, inadequate personal hygiene, and lapses during manufacturing, distribution, or storage. Therefore, implementing robust measures to safeguard food is imperative to mitigate the risk of illness.

Globally, the impact of unsafe food is profound. The World Health Organization (WHO) (2022) reports that each year, unsafe food causes 600 million cases of foodborne diseases and 420,000 deaths, with children under five years old comprising 30% of those affected. Additionally, an estimated 33 million healthy life years are lost annually due to the consumption of unsafe food (Ministry of Health Jamaica, 2001).

In the Caribbean, including Jamaica, foodborne diseases continue to escalate, significantly affecting public health and the economy. The Caribbean Public Health Agency (CARPHA) (2021) estimates that approximately 1 in 49 individuals contract foodborne illnesses annually from consuming contaminated foods, with over 40% of cases occurring in children aged 1-4 years. Moreover, more than 80% of cases are either unreported or undiagnosed, compounded by inadequate surveillance systems (CARPHA, 2021). Education and training of food handlers are pivotal in preventing foodborne illnesses. The Canadian Institute of Food Safety emphasizes the necessity of comprehensive food safety training for all food handlers to protect consumers from food poisoning, allergic reactions, and other health risks associated with contaminated food. Similarly, the Codex Alimentarius International Food Standards highlight that, given the annual morbidity associated with Salmonella, guidelines have been established for controlling its presence in beef and pork, underscoring education and training as key strategies(Codex Alimentarius, 2019; Guerra et al., 2016;Nkhebenyane& Lues, 2020). However, the effectiveness

of these training programs can be compromised when they are not tailored to the needs of all food handlers, particularly those with reading impairments. This study aims to examine the food safety knowledge, perceptions, and self-reported hygienic practices of reading-impaired food handlers in St. James, Jamaica, to inform the development of more inclusive and effective training methodologies.

Statement of the Problem

Foodborne illnesses remain a significant public health concern in Jamaica, despite the longstanding implementation of food safety regulations and mandatory food handler training programs. The Ministry of Health has required food safety training and certification since the 1960s, evolving the system to improve knowledge dissemination and food hygiene practices. However, gaps in knowledge and compliance among food handlers continue to contribute to outbreaks of foodborne diseases, which pose risks to public health and the economy (Ministry of Health Jamaica, 2001; CARPHA, 2021).

A critical yet understudied factor influencing food safety compliance is the impact of reading impairments among food handlers. The majority of food safety training programs rely on written materials and literacy-dependent assessments, potentially limiting comprehension and application of food hygiene principles among reading-impaired individuals. This creates a barrier to effective training and may lead to improper food handling practices, increasing the likelihood of food contamination.

Globally, the burden of foodborne diseases remains high, with an estimated 600 million cases and 420,000 deaths annually, disproportionately affecting vulnerable populations, including children under five years old (WHO, 2022). In the Caribbean, approximately 1 in 49 persons contracts a foodborne illness each year, but surveillance and reporting remain inadequate, making the true burden likely underestimated (CARPHA, 2021). Given these statistics, it is essential to explore whether existing food safety training programs adequately address the needs of all food handlers, particularly those with reading impairments.

This study seeks to examine the food safety knowledge, perceptions, and self-reported practices of reading-impaired food handlers in St. James, Jamaica. By identifying gaps in training effectiveness and food safety compliance among this group, the study aims to provide evidence-based recommendations for more inclusive training programs that ensure all food handlers, regardless of literacy level, can adhere to safe food handling practices.

Significance of the Study

Foodborne illnesses pose a major public health threat in Jamaica and the wider Caribbean, affecting individuals, healthcare systems, and the economy. Despite the implementation of food safety regulations and mandatory training programs, outbreaks persist due to gaps in knowledge, improper food handling, and hygiene practices among food handlers (CARPHA, 2021). One overlooked factor contributing to these challenges is the literacy level of food handlers, particularly those with reading impairments. This study is significant because it addresses a crucial yet underexplored issue in food safety management-whether food handlers with reading

impairments have adequate food safety knowledge, perceptions, and self-reported practices to ensure public health protection.

By investigating this issue, the study provided empirical data on how reading impairments affect the comprehension and implementation of food safety guidelines. This is particularly important as many existing training programs are designed with literacy-dependent materials, potentially limiting their effectiveness among individuals with reading challenges. The findings of this study highlighted the need for inclusive and accessible training programs tailored to diverse learning needs.

From a public health perspective, improving food safety knowledge and practices among all food handlers, including those with reading impairments, is essential for reducing the burden of foodborne illnesses. The World Health Organization (WHO) (2022) reports that unsafe food leads to 600 million cases of foodborne diseases globally each year, with children under five being the most affected. In the Caribbean, approximately 1 in 49 individuals contracts a foodborne illness annually, but underreporting and weak surveillance systems hinder accurate assessment of the true burden (CARPHA, 2021). Addressing literacy barriers in food safety training can contribute to stronger food safety compliance, reducing the prevalence of preventable foodborne illnesses.

Furthermore, the study holds practical implications for policymakers, public health officials, and food industry stakeholders. Findings may inform the development of more effective, literacy-inclusive food safety training strategies, ensuring that all food handlers-regardless of their reading abilities-are adequately equipped with the knowledge and skills necessary to maintain food hygiene standards. This could lead to policy changes in food handler certification programs and broader improvements in food safety education across Jamaica.

By identifying gaps and proposing solutions, this research aims to strengthen food safety management, enhance public health outcomes, and support Jamaica's ongoing efforts to maintain high food safety standards.

Research Objectives

To aim of this cross-sectional survey was to assess the knowledge, perception and self-reported practices of reading impaired food handlers in St. James with respect to key food safety parameters. The study objectives:

1. Determine how reading impaired food handlers perceive food safety training.
2. Ascertain the self-reported practices of reading impaired food handlers with respect to key food safety parameters.
3. Determine how knowledgeable reading impaired food handlers are with respect to key food safety parameters.
4. Identify gaps in food safety knowledge among reading impaired food handlers
5. Evaluate the difference in knowledge and self-reported practice between trained and untrained food handlers with relation to key food safety parameters.

Rationale of the Study

Food safety remains a critical public health priority in Jamaica, where foodborne illnesses continue to pose significant health and economic risks despite established food safety training programs. The Ministry of Health has mandated food handler certification for decades, yet foodborne disease outbreaks persist, indicating gaps in knowledge and compliance among food handlers (Ministry of Health Jamaica, 2001). One major but often overlooked factor contributing to these challenges is the impact of reading impairments on food safety training and adherence to hygiene practices.

Many food handlers in Jamaica come from diverse educational backgrounds, and a subset of this workforce may struggle with literacy. However, current food safety training programs primarily rely on written materials and standard assessments, potentially limiting comprehension for individuals with reading impairments. This creates a knowledge gap that may lead to improper food handling, increasing the risk of food contamination and foodborne diseases. Given the high global burden of foodborne illnesses-600 million cases and 420,000 deaths annually (WHO, 2022)-it is crucial to ensure that all food handlers, regardless of literacy levels, have the knowledge and skills necessary to maintain safe food practices.

This study was essential because it examines the food safety knowledge, perceptions, and self-reported practices of reading-impaired food handlers in St. James, Jamaica. By identifying the extent to which literacy challenges affect food safety compliance, this research will provide valuable insights into whether current training methods are effective for all food handlers or if modifications are needed to accommodate those with reading difficulties.

The study was particularly relevant in the Caribbean, where foodborne disease surveillance remains weak, and underreporting is prevalent (CARPHA, 2021). Addressing literacy barriers in food safety training could lead to improved public health outcomes by reducing the incidence of foodborne illnesses. Additionally, findings from this research could inform policy changes, advocating for the integration of more inclusive training methodologies such as visual aids, oral instruction, and interactive learning strategies to ensure that all food handlers are adequately trained. By exploring this critical issue, the study contributed to the broader goal of strengthening food safety education and ensuring that Jamaica's food safety standards are inclusive and effective in protecting public health.

Definition of Key Terms

Food borne illness: Also referred to as foodborne disease or food poisoning is any illness that results from the consumption of contaminated food (Adley&Ryan, 2016). Foodborne disease or food poisoning are caused by a multitude of agents such as bacteria, viruses, parasites, and fungus which enter the body (Adley&Ryan, 2016).

Food handler: Refers to anyone who directly handles, stores, transports, packages or un-package foods as well as theequipment and utensils used to prepare or serve food and/or surfaces that come into contact withfood (Bureau of Standards Jamaica, 2021).

Food hygiene practice: Refers to the necessary behaviours required for the proper preparation, washing, cooking, storing and preservation of food in ways that prevent cross contamination and spread of bacteria which could lead to food poisoning (Ibanga, 2020).

Food safety knowledge: The theoretical or practical understanding of the proper handling, preparation and storage such that it reduces the risk of food borne illness (Ibanga, 2020).

Key food safety parameters: Those major risk factors related toemployee behaviours and preparation practices in retail and food service establishments that prevent the spread of foodborne illness namely adequate handwashing, prevention of cross contamination, adequate temperature control, adequate cooking and using safe raw materials and water (Food Code, 2017).

Potentially hazardous food: Refers to any food which consists in whole or in part of milk or milk products, eggs, meat, poultry, rice, fish, shellfish, edible crustacean, raw-seed sprouts, heat-treated vegetables and vegetable products and other ingredients in a form capable of supporting rapid and progressive growth of microorganisms (Princeton University, n.d.).

Reading impaired: The term reading impaired can deduced as one's inability to obtain information from written words for whatever reason (Li et al., 2021).

Trained food handler: Any food handler who has been exposed to the national food handlers' certification training and has received a food handlers permit sometime in the past.

Literature Review

Food safety is a critical public health concern globally, with food handlers playing a pivotal role in preventing foodborne illnesses. While numerous studies have assessed food safety knowledge, attitudes, and practices (KAP) among food handlers, there is a paucity of research focusing on those with reading impairments (Köckerling et al., 2017; Lee, 2017; Nkhebenyane & Lues,2020). This literature review examines existing studies on food safety KAP among food handlers, highlighting epidemiological data from global, Caribbean, and Jamaican contexts.

Global Perspectives

Several studies worldwide have evaluated food safety KAP among food handlers. For instance, a study in Brazil assessed food safety knowledge, attitudes, and practices among school food handlers, revealing gaps in knowledge and practices that could compromise food safety (BMC Public Health, 2021). Similarly, research in the Gulf countries highlighted insufficient food safety knowledge among food handlers, with poor translation of existing knowledge into practice (BMC Public Health, 2021). These studies underscore the need for effective training programs tailored to the specific needs of food handlers.

However, there is a notable lack of research focusing on food handlers with reading impairments. This gap suggests that current training programs may not adequately address the needs of this group, potentially leading to improper food handling practices and increased risk of foodborne illnesses.

Caribbean Context

In the Caribbean, foodborne diseases are a significant public health issue. The Caribbean Public Health Agency (CARPHA) reported that approximately 1 in 49 individuals in the region acquire a foodborne illness annually, with over 40% of cases occurring in children aged 1-4 years (Caribbean Public Health Agency [CARPHA], 2021).Between 2005 and 2012, the number of reported foodborne illnesses in the Caribbean increased steadily, with Salmonella accounting for the highest number of cases (Morrison et al., 2022).

Despite these concerning statistics, there is limited research on the food safety KAP of food handlers in the Caribbean, particularly those with reading impairments. This lack of data hampers the development of targeted interventions to improve food safety practices among this vulnerable group.

Jamaican Context

In Jamaica, the Ministry of Health has mandated food handler training and certification since the 1960s, aiming to disseminate food hygiene knowledge and practices effectively (Ministry of Health Jamaica, 2001). Despite these efforts, foodborne diseases remain a concern. The epidemiology of food and waterborne illnesses at the community level is poorly understood, with limited information on disease burden available (Pan American Health Organization [PAHO], 2012).There is a dearth of studies focusing on the food safety KAP of food handlers with reading impairments in Jamaica. This gap indicates a need for research to examine whether current training programs are accessible and effective for all food handlers, including those with literacy challenges.

Epidemiological Studies

Epidemiological data highlight the burden of foodborne illnesses globally, regionally, and locally.The World Health Organization (WHO) estimates that unsafe food causes 600 million cases of foodborne diseases and 420,000 deaths globally each year, with children under five years old comprising 30% of those affected(Ministry of Health Jamaica, 2001).CARPHA's burden of illness study estimated that annually, about 1 in 49 persons in the Caribbean acquire a foodborne illness, with over 40% of cases in children aged 1-4 years(Caribbean Public Health Agency [CARPHA], 2021).Specific epidemiological data on foodborne illnesses in Jamaica are limited. The existing surveillance systems may not capture the true burden of these diseases, underscoring the need for comprehensive studies to inform public health interventions (PAHO, 2012).The literature indicates significant gaps in food safety knowledge and practices among food handlers globally, with a particular void concerning those with reading impairments. In the Caribbean and Jamaica, while foodborne illnesses pose substantial public health challenges, there is a lack of targeted research addressing the unique needs of food handlers with literacy challenges. Addressing this gap through focused studies and inclusive training programs is essential to enhance food safety and reduce the incidence of foodborne diseases.

Research Methodology

Research Design

This studyadapted a descriptive quantitative cross-sectional survey design, focusing on the assessment of the variables of perception, knowledge, and self-reported practices of reading impaired food handlers in St. James, Jamaica. The researchers obtained primary data using a survey that was be administered to a sample of reading impaired food handlers across varying sections of the parish. The study was conducted over a period of three weeks spanning July 2, 2022, to July 16, 2022. Because data was analysed and reported in terms of statistics geared towards describing a phenomenon that was happening at the present time, the descriptive quantitative cross-sectional approach was chosen. The causal comparative method was used to identify the relationship between food hygiene training (independent variables) and knowledge and self-reported practices (dependent variables). By scrutinizing these relationships with food safety training having already occurred, this further confirmed that the study adapted a descriptive approach rather than experimental. The survey method was chosen mainly because it can be used to collect data on varying topics from a large study group over a short period of time. For this study, the interview format was utilized over self-administered questionnaires because the study targeted only reading impaired food handlers.

Population and Setting

Given the timeline to complete the study, the parish of St. James in the Western region was selected as the study setting. St James was identified mainly because it was among the four parishes in the Western region with highest population of tourist for food handlers requesting training. The Ministry of Health and Wellness in Jamaica has regionalised health care delivery and as such four regions were created to facilitate efficiency in the delivery of all health services. Consequently, St. James trains on average of 1100 food handlers per month outside of the company requested in house trainings (Burgess, 2022). Approximately 20% of the total food handlers being trained monthly are reading impaired (Burgess, 2022). The national food handler's certification training program though not standardised is also delivered by regions with each parish using elements of the same training presentation prepared by the regional food safety officers. As per food safety legislation, all food handlers must attend and pass a mandatory training exercise to be granted a certificate to handle food. Therefore, an average of 220 food handlers would form part of the reading impaired pool and is the number from which the sample was be drawn.

Sample Selection and Sampling Procedures

The sample size was calculated using the Taro Yamane statistical formula for sample selection for finite populations which yielded a sample size of 94 food handlers (18 years and older). A 95% confidence interval and (.05) 5% margin of error. Of this 94, Fifty percent 50% (47) food handlers will be in the untrained category and act as controls. Both trained and untrained food handlers were recruited until the sample for both categories were reached. This was be done to

enable efficient use of time since there was uncertainty with who will show up on the day of data collection. An average of 5-40 food handlers were interviewed at each site daily.

A convenience sampling technique was utilized based on willingness to participate and to meet population criteria to be included in the study (Etikan et al., 2016). Therefore, the inclusion criteria were all food handlers who present at the site for training, voluntarily consent to participate in the study and were reading impaired based on if they identified as such. With these clear criteria, researcher subjectivity bias during selection was reduced. It is likely that there was also social desirability biases derived since the survey was not self-administered. To reduce this and improve the reliability of the study, respondents were briefed on the anonymity and confidentiality of their responses(Reid etal., 2022).Recruitment continued at each training site until the total sample size was achieved.

Data Collection Procedures

To prepare for the study, letters were sent to the Parish Manager for St James Public Health Services and the Regional Technical Director for the Western Regional Health Authority to request written approval to conduct the study. Prior to this, verbal endorsements were obtained from the Programme Specialist for Food Safety and the Regional Environmental Health Officer for the intention to conduct the study. Because approval took over a week to be obtained, preliminary population data supplied by Public Health Inspectors who administer training at the sites aided in the calculation of the sample size.

St. James has three training sites as mentioned earlier. There are 8-9 training days at the Holy Trinity Anglican Church which trains an average of 1000 persons per month (91% of total). Cambridge Health Centre accommodates one training day per month which trains 70 persons on average (6% of total). Maroon Town Health Centre seats on average 30 persons per month in 1 training day (3% of total). This sums to a total of 1100 persons monthly. The sample size was therefore distributed across the ratios of 91%, 6% and 3% of the total sample respectively. Consequently, data was collected from 85 persons at the main site, 6 persons at Cambridge Health Centre and 3 persons from Maroon Town Health Centre.

All training sites were visited, and the instruments administered as per the proportions outlined. Participants were informed about the purpose of the study and their voluntary participation. Their written consent was also used as permission granted to participate before the administration of the instrument.

A structured interview schedule was used to collect the primary data needed for this study. The instrument captured necessary information such as: socio demographic characteristics, knowledge and self-reported practices concerningcritical food hygiene and sanitation as well as questions targeting how food handlers perceive food safety training. Each instrument was administered during the waiting period between the pre-class interview and the start of the lecture. Furthermore, once a food handler was discreetly identified as reading impaired, they were then redirected to one of the researchers towards the back or side of the waiting area at which the study was introduced and their consent to participate requested. Each interview took no more than 15-20 minutes.

Instrumentation

A self-administered questionnaire was used to answer the survey question on the knowledge, perception and self-reported practicesof reading impaired food handlers(Thelwell-Reid, 2014). Permission to use elements of the tool was solicited and received. The instrument was divided into four sections namely: food hygiene knowledge, self-reported practices, food hygiene training perception and socio-demographic profile. The instrument captured necessary information on socio demographic characteristics, knowledge about the key food hygiene and sanitation parameters as well as the practices reported by food handlers with respect of food hygiene.

In assessing knowledge, 39 targeted questions were asked, and each correct response was assigned a score of one point. The responses were 'Agree', 'Disagree' or 'Don't Know'. If the answer was incorrect or a 'don't know' response was supplied, then no point was awarded. The questions assess general food safety knowledge, time temperature control, glove use, cross contamination and sanitization. The scores were then summed by tallying all correct responses then finding the percentage score. The percentage was subsequently compared to the national pass mark of 70% to determine if respondents were knowledgeable or not. To assess self-reported practices, 20 practices were presented for respondents to state the frequency in which those activities were done (Always, Sometimes and Never). Each correct response was awarded a score of 1 point. No score was allocated for incorrect responses. All the responses were then tallied and a score for practices determined in percentage.

To determine food hygiene perception, we designed another Likert-scale-based survey to examine the value food handlers place on food safety training. We asked: 'when seeking or continuing a job in food service or operating a food service business which of the following factors are you most concerned about?Four typical concerns were identified namely: 'ensuring that my food handlers permit is up to date', 'making as much money as possible', 'getting trained/re-trained to know how to handle food safely' and 'having a good customer service attitude.' Each respondent then rated these items on a 3-point Likert scale with the following anchors: 3 (very concerned), 2 (fairly/relatively concerned) and 1 (not concerned). The level of food handler emphasis was then determined by calculating the proportion of respondents who reported high concern for a factor. The factors were then be ranked and compared based on their total scores.

The scale was created within the context of the factors usually given much thought when seeking or continuing a job in food service or looking to start or continue a food service business. Consequently, the level of concern given to each factor provided a good indication of how much they value having a valid food handlers permit in their possession vs getting the knowledge needed to safely handle food. The interview schedule was pilot tested among 5 reading impaired food handlers of the Western Regional Health Authority (WRHA) to determine validity and reliability.

Operationalization

The following variables were assessed throughout this study:

Food hygiene training. A trained food handler was defined as any food handler who had been exposed to the national food handlers' certification training and received a food handlers permit sometime in the past. This independent variable was assessed by virtue of the number of training sessions attended in the past as is captured in part four of the interview schedule (e.g., 1, 2, 3). An untrained food handler never attended a training session in the past.

Foodhygiene knowledge. This dependent variable was assessed through responses given to the 40 statements presented at part one of the interview schedule. An example of a knowledge statement would be 'microbes responsible for food-borne illnesses grow well at room temperature.' The respondent would then state if they 'Agree, 'Disagree' or 'Don't Know'. Each correct response was awarded 1 point and each incorrect or 'don't know' response was awarded a score of zero. The scores were then tallied and a percentage derived. For food handlers to be regarded as knowledgeable in the key food safety parametres, they would have had to obtain a score of atleast 70%.

Food hygiene training perception. This dependent variable was assessed through the responses provided to a series of factors that are most often considered when attempting to get or continue a food service job or business. E.g., obtaining food hygiene training and getting certified are two such considerations and as such the respondents chose an option based on a scale of responses namely 'very concerned', 'fairly concerned' or 'not concerned' about each factor. If a respondent responds with very or fairly concerned, they were awarded a 2 or 1 respectively with a 0 score for not concerned. The greater the score, the greater the likelihood that they perceived food hygiene training as important. There was a total possible score of 4 from which a percentage was derived. Two other factors which are having good customer service and making as much money as possible were added to get a better understanding of what other factors might be viewed as more important and therefore perceived in a more positive light than what was required. These factors did not form part of the overall score since they were included as distractors.

Food hygiene practices. These were described as self-reported practices which could contribute to the spread of food borne illnesses. Each question was linked to the 5 key food safety parametres outlined in chapter one. An example of such a question was 'do you thaw frozen foods at room temperature?

A series of 19 other questions were asked and the respondents stated whether they practice the action 'always, 'sometimes' or 'never'. Scores were allotted for each response, with the correct response getting a score of 2 and sometimes responses (implying that the correct action was performed sometimes) was awarded a score of 1. No score was awarded for incorrect responses. The scores were then be tabulated and expressed as a percentage of 35 (total possible score). The ideal score for practice was also 70% and above.

Sociodemographic profile. Part four of the interview schedule was geared towards capturing information on the socio-demographic profile of the respondents. This was important in getting a clear picture about the type of people being studied by virtue of their age, sex, education level etc. Having this understanding helped researchers to make links that validate other study findings

and painted a picture of the study population in the Jamaican setting. For this section, nine questions were asked.

Data Analysis Plan

Data analysis was done according to the stated objectives. Upon completion of data collection, the data was tabulated, exported from google sheets and processed using the SPSS Statistical Package for the Social Sciences (SPSS)Version 28. Descriptive statistics such as the mean and standard deviation (*SD*) were reported. This was be done with the use of charts and tables coupled with narratives to describe specific findings. Inferential statistics was used to determine if there was a statistically significant difference between the knowledge and practice scores for both trained and untrained food handlers, we performed an independent sample t-test. Alpha level was set at 0.05 with a confidence level of 95%. A p-value less than 0.05 was considered statistically significant.

Ethical Procedures

To initiate data collection, informed consent was be obtained uponfirst interaction with participants; then the instrument subsequently administered. The participants were also given full disclosure concerning what the study was about, why it was being undertaken and what it is that will be asked of them. There were no penalties for those who refused to participate in the study or withdraw from it and each participant was reassured about the confidentiality and anonymity of the data they supplied. This was done by having each participant sign a consent form in the presence of an independent observer. This person wasa health worker present at the clinic who attested that the consent information was accurately explained, and that the participant apparently understood the information, and freely agreed to participate. Permission to conduct the study was sought and obtained from the Western Regional Health Authority. Based on the policies of research on human subjects by the Ministry of Health and the University, ethical approval was sought and obtained prior to data collection.

Theoretical Framework

The study examined food safety knowledge, perception and self-reported practices of reading impaired food handlers in St. James, Jamaica. The study was embedded in the knowledge, attitude and practice (KAP) model.

Theories of Learning (TL)

Although controversially defined, one author cites learning as a natural intellectual process of acquiring new skills and knowledge, through experience, study or teaching. It results in long term change in behaviour due to experience or practice (Surbhi, 2021). It isunderstood that no two learners are alike and the way every person learns will vary for numerous reasons(Fairbanks, 2021). To enhance the classroom experience and improve the likelihood of learning, educators must be mindful of the five main learning theories that can be utilized. These are cognitivism, behaviourism, constructivism, humanism and connectivism(Fairbanks, 2021). To supplement these theories, educators can also bolster their efforts by understanding and applying the

experiential, social or transformative learning theories. An understanding of these theories can help educators connect with varying types of learners by focusing on different learning styles and create teaching modalities that focuses directly on student needs and abilities (Western Governors University, 2020).

Moreover, to effectively review training programs, an in-depth analysis of how these learning theories can be applied is critical. The interconnected of these theories and relevance was reviewed.

Behaviour Based Training (BBT) Model

Because proper handwashing is a major deterrent to FBD spread. McFarland et al. (2019) reviewed a knowledge and behaviour-based training study looking at handwashing knowledge and behaviours among 88 restaurant employees. The variables knowledge and behaviour were assessed before and after a training intervention was given.

The goal was to determine the effectiveness of behaviour-based training on improving employees' handwashing behaviour. The knowledge-based training took the form of an online video followed by a quiz while the behaviour-based training was a motivational intervention with a motivational soap dispenser followed by a 10-minute weekly handwashing safety meeting. The soap dispenser triggered a speaker to play music for 18 seconds when used thereby presenting a clear indication of frequency of handwashing behaviour for employees to hear. In the safety meeting performance feedback was given, monetary rewards, and goal setting were stated. The researchers found that both training modalities improve employee behaviour independently and together, however, knowledge-based training alone was not enough especially during peak service times since rush hour service was too hectic for employees to take the time and wash hands properly. In essence, when there were not many working activities during low peak times, knowledge-based training would improve handwashing performance.

But when peak service time came, the knowledge-based training was not enough to initiate proper handwashing techniques. It was concluded that knowledge-based training is not enough to decrease risks of foodborne illnesses associated with hand washing practices.

As seen in a separate case control study conducted by Husain et al. (2016), 110 food handlers across 16 primary school canteens in Malaysia were assessed on the basis of food safety knowledge and behaviour. The goal was to determine if behaviour-based training had the potential to curb the spread of food borne illnesses. The training programme comprised three targeted areas namely: attitude, normative beliefs and perceived behavioural control. In looking at changing normative beliefs, the researchers shared the importance of complying with regulations and laws and reminded the employees of the role they must play. In targeting perceived behavioural control, the training aimed to reduce barriers while improving self-capability to perform expected tasks. Site visits were also done to help motivate and encourage the participants to reinforce their knowledge and skills with practice. Study participants were issued questionnaires to test their knowledge and report their practices and an observation checklist was used to validate practices. The study showed that there were improvements in knowledge related to personal hygiene and safe food preparation which was sustained for up to

12 weeks post intervention. However, there were no significant differences related to time-temperature abuse and cross contamination since these were perceived as more technical areas. This study proved that participants may tend to score themselves better with respect to self-reported practices over their actual practices post training since they were influenced by their improved knowledge. In summary, the study found that those given behaviour-based training models performed better on the job with respect to some key food safety parametres over those who didn't. The improved performance was also found to be more sustainable.

This study also reinforces the need to ensure that food handlers understand the importance and impact of food safety to demonstrate good behaviour (Husain et al., 2016).

Knowledge, Attitude and Practice (KAP) Model

The knowledge, attitude and practice model for education is based on the assumption that increasing one's personal knowledge will stimulate behaviour change. The KAP model divides the process of human behaviour change into three steps: acquiring knowledge, generating attitudes/beliefs, and forming practice/behaviours, during which human health behaviours can also be effectively changed (Wang et al., 2020). The general food safety trainings modalities used more frequently follow a knowledge, attitude, and practice (KAP) model, which is limited in effectiveness. McFarland et al. (2019) reiterated that many studies show that acquiring knowledge only predicted a negligible portion of behaviour.

Soon et al. (2020) used structured equation modelling as a confirmatory technique to determine the relationship between food safety knowledge, attitude and practice among consumers in Malaysia. Self-administered questionnaires from 787 participants were reviewed and the results showed that food safety knowledge had a negative and insignificant relationship with food safety practices. Therefore, it could be concluded that food safety knowledge does not directly affect food safety practices. One likely explanation was the optimistic bias phenomenon where consumers felt protected against certain food safety risks or 'it won't happen to me' perceptions. One limitation of this study was the relatively small number of respondents who were mostly tertiary level graduates.

Social Cognitive Theory (SCT)

The social cognitive theory refers to the acquisition of knowledge by direct observation, interaction, experiences, and external media influences. It is derived from constructing meaning and knowledge from social influences around us. It affirms that behaviour, environment, and personal factors are all inter-connected with a consequence action for every action (Gopalan et al., 2017). When captured in a classroom setting, adults learn better through interaction and observation. While psychologists globally agree that the environment one grows up in contributes to behaviour, the individual (cognition) also plays a vital role. Since people learn by observing others within the environment, the environment could also be determined by virtue of their way of thinking (cognition). When people observe a model individual performing a behaviour and the consequences of that behaviour, they remember the sequence of events and use this information to guide subsequent behaviours. Through observation of a model, learners will

also be promoted to engage in behaviour they already learned thus reinforcing the good behaviour. World renowned psychologist Albert Badura stated that self-regulation, self-efficacy, outcome expectancies and modelling/observational learning were the core concepts underpinning the social cognitive theory. With modelling/observational learning, four things must exist: ***Attention.*** Learners selectively give attention to specific social behaviour depending on accessibility, relevance, complexity, functional value of the behaviour or the learner's personal attributes such as cognitive capability, value preference and preconceptions. ***Retention***. Observe a behaviour and subsequent consequences, then convert that observation to a symbol that can be accessed for future re-enactments of the behaviour. Be mindful to ensure that when a positive behaviour is shown a positive reinforcement follows, with the same for negative behaviour. ***Production.*** Refers to the symbolic representation of the original behaviour being translated into action through repetition of the observed behaviour in seemingly appropriate contexts. During repetition of the behaviour, the learner receives feedback from others and can adjust their representation for future references. ***Motivation.*** Learners repeat a behaviour depending on responses and consequences the learner receives through feedback (Zhou & Brown, 2017).

In the classroom setting, modelling provides a good alternative to teaching new information. The teacher himself does not have to be the model but learners can be also. Describing the consequences of a modelled behaviour should increase the likelihood of performing the ideal behaviour in the future.

Knowledge Sharing Process (KSP) Model

Knowledge sharing is broadly defined as the process of moving from knowledge generation to knowledge implementation (Yeargin et al., 2021). According to Yeargin et al. (2021)one underlying assumption with today's food hygiene training programmes is that food handlers do not engage in safe practices because of a lack of knowledge. Therefore, the training is solely centered around improving knowledge. However, food handlers often run into issues having returned to the work environment to try and implement the new knowledge. This often results in very little success. One explanation for this is that the context in which the training is done, and the implementation context differ, making it difficult for the food handler to transfer what they learned into practice. It was therefore concluded that there needs to be a holistic understanding of the connection between knowledge, the organization, and its environment if knowledge implementation is to be achieved. The authors went further to state that knowledge about an expected behaviour is a prerequisite to action, but knowledge alone does not guarantee action. Food handlers often do not do what they have been taught, not because of lack of knowledge, but because of preferences for old habits, forgetfulness, inconveniences in the moment, preferences for the path of least resistance, motivated reasoning or because of organizational and environmental factors, such as job traits, work culture, and group norms. It is understood that behaviour change has many complex influences, beyond knowledge gain, which can be explained through behavioural theories.

In response, the researchers proposed an innovative approach that could effectively help food handlers to translate knowledge generation into knowledge implementation. As shown in figure 1, the model comprised six steps (generation, adaptation, dissemination, reception, adoption, and

implementation) organized into two dyads: (1) transfer between researcher (or knowledge generators) and educator and (2) transfer between educator and food handler (or knowledge implementers). Each step operates simultaneously but can be explained by virtue of their linear relationship.

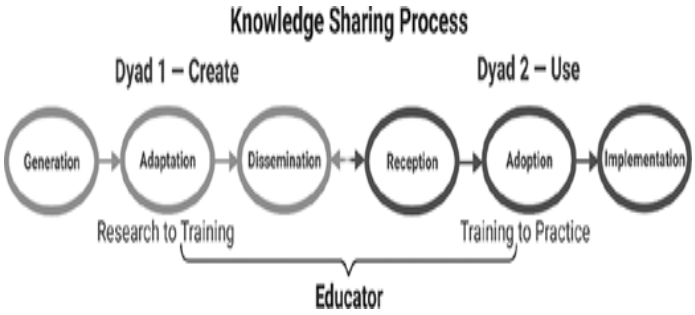

Figure 1: Six Step Knowledge Sharing Process

Figure 1 adopted from Yeargin et al. (2021). *Journal of Food Protection*, *84*(11), 1852-1862. https://doi.org/10.4315/JFP-21-146

Dyad 1-Knowledge Sharing Between Researcher and Educator

Knowledge generation. This is the accumulation, comprehension, and evaluation of data primarily derived from empirical study findings. The researcher mentioned that in a time when information is so widely accessible through the internet, it is critical that the scientific community not be an inadvertent source of misinformation. Systematic literature reviews are crucial to enacting evidence-based learning. In addition to this approach, realist reviews and narrative reviews are also commonly used to synthesize evidence. The realist review is a method that considers the context, or setting, for which an intervention is applied with a focus on "what works for whom, in what circumstances, in what respect, and how".

Realist reviews are particularly helpful for clarifying the complexities of behaviour-change interventions (e.g., training food handlers to "properly" wash hands) via the context-mechanism-outcome configuration, which allows knowledge generators to identify contextual elements that promote or impede the act of receiving and ultimately implementing knowledge during knowledge dissemination.

Knowledge adaptation. Refers to the process of translating knowledge into practice messages that can be used to inform training programs. The more skills or competencies associated with practice messages, the more difficult they will be to understand and apply. Conversely, when practice messages are found to be both demonstrable and independent, the benefits of adopting the practices, as well as the extent to which one can do so is increased. This validates the claims made by Zhou and Brown (2017). Knowledge should, most of the time, be supported by implicit and tacit knowledge. Explicit knowledge includes data sets and research papers, whereas implicit knowledge is the application of explicit knowledge. Tacit knowledge is the most difficult to address, as it is knowledge gained from personal experience and context. If all three forms of knowledge are not addressed in training, knowledge might be viewed as not applicable, hence, impeding implementation of safe food handling practices. As such food safety practice messages,

at a minimum, need to center on both the "what" and the "how". For example, a common practice message may be "wash your hands"; however, this only provides the "what" in its most simplistic form. Conversely, a more expansive practice message such as "wash your hands vigorously for 20 seconds with soap and water" provides the how along with the what.

To guide knowledge adaptation, the Centers for Disease Control and Prevention (CDC) created the CDC Clear Communication Index, which includes 20 scored items representing the most important characteristics that enhance and aid one's understanding of information specifically, the index assesses materials in seven areas: (1) main message and call to action, (2) language, (3) information design, (4) state of the science, (5) behavioural recommendations, (6) numbers, and (7) risk. The first four areas are considered core components of any communication product, while the last three areas are specific to your communication objective. For instance, behavioural recommendations are a key aspect of food safety training because one of the primary objectives is to change behaviour through adoption and implementation of the received knowledge by the food handler. To accomplish this, these recommendations should (1) be specific actions that food handlers can take to protect their health or the health of others, (2) provide a reason why the recommendation is important, and (3) include specific directions about how to perform the behaviour. To illustrate, a behavioural recommendation during food handler training could be 'washing hands removes harmful germs and prevents the spread of disease. To properly wash hands, first, wet your hands with clean running water and lather with soap. Next, rub your hands together for at least 20 seconds. Finally, rinse your hands with clean running water and thoroughly dry.' In essence, adapting generated knowledge into clear, actionable messages will aid in knowledge adoption and implementation by the food handler.

Knowledge dissemination. This is the last step in dyad 1 and looks at the mode of delivery used to communicate adapted knowledge to knowledge implementers. The value of adapted knowledge in terms of leading to knowledge implementation is dictated by effective methods used to disseminate knowledge to knowledge implementers. With respect to the knowledge implementer, the gap between knowledge reception and knowledge implementation can be partially explained by poor dissemination.

Dissemination serves three primary purposes, increase awareness, improve understanding, and influence action, with knowledge implementation as the end goal. Barriers to knowledge sharing are present from the onset and rooted in psychological and social hurdles.

However, even when efforts are put forth to overcome these barriers, minimal impact (i.e., understanding facts and concepts that lead to adoption) is often due to a poorly planned dissemination strategy. e-Learning is increasingly being used as a mode of delivery, as it is commonly perceived to be a lower cost and more accessible alternative to in-person instruction.

The disadvantages also need to be considered, particularly as these can impact training outcomes. First, educator-learner engagement is typically lower than it is for in-person instructional settings, which can lead to decreased motivation and achievement. In addition, perceived learning and satisfaction by the learner was reported to increase when an educator is physically present. Other concerns include the varying levels of computer literacy of learners, lack of robust

Internet services, fear of technology, as well as the instructional setting being more impersonal. No matter the mode of delivery, food safety training needs to consider and properly address factors that can influence dissemination effectiveness. These factors fall into four major categories, including information (scientific basis, source), clarity of contents (perceived relevance, strength of message), perceived values, preferences, beliefs (personal experience, willingness to adopt innovations), and context (culture, timing, resource constraints)

Dyad 2-Knowledge Sharing Between the Educator and Food Handler

Knowledge reception. This is one's first contact with disseminated knowledge, or in simple terms how the educator teaches. Teaching should be grounded in adult learning theory, which establishes a set of assumptions about how adults learn. The theory suggests learning should be problem-based and collaborative rather than didactic, emphasizing equality between the educator and learner.

Adult learning theory defines the six attributes of adult learners: (1) internally motivated and self-directed, (2) bringing life experiences and knowledge to learning experiences, (3) goal oriented, (4) relevancy oriented, (5) practical, and (6) desire to be respected. These learner attributes are particularly important when considering food safety training, as most training is conducted with working adults who are expected to return to the work setting and implement the new knowledge. One way to operationalize adult learning theory is to use a problem-based learning (PBL) approach. The PBL approach is a learner-centered pedagogy, originating in medical education that focuses on learners working on real-world problems. PBL allows the learner to express varying perspectives in terms of identifying barriers, facilitators, and solutions. Case studies are often used to help learners (1) construct flexible knowledge, (2) develop effective problem-solving skills, (3) develop self-directed learning skills, (4) become effective collaborators, and (5) become motivated to learn. With its emphasis on learning through problem solving, PBL builds on one's existing knowledge and expertise (i.e., tacit knowledge). Moreover, collaborative problem solving is a central theme for PBL, as it takes advantage of individual strengths by allowing the entire training group to address problems that might be too difficult for one individual alone.

Knowledge adoption. Regarded as one's cognitive processing of new knowledge to determine if they will implement that knowledge. Adoption of knowledge is influenced by internal factors that the food handler has control over, such as intrapersonal factors (e.g., ability, attitude, self-efficacy) and interpersonal factors (e.g., interactions with colleagues and customers). It was suggested that knowledge adoption typically follows the pathway of the adoption of innovations model, which establishes that one must first become aware of an idea before forming an attitude toward it. Upon forming an attitude, one will then decide if they will implement the idea. Therefore, careful consideration of how the educator teaches is critical. Most food safety training programs rely on the passive diffusion of information.

The passive diffusion approach assumes that the more an individual is exposed to a given content, the more likely they will adopt it, leaving no alternatives to individual preferences. Many also follow the knowledge, attitude, and practice model where knowledge is transferred

from the educator to the learner with the assumption that upon acquiring new knowledge, one will change one's attitude, which will then lead to action.

Training focused on the knowledge, attitude, and practice model has been shown to increase knowledge but has largely been ineffective at influencing and/or sustaining attitudes and behaviour change. For adoption of information to occur, individuals go through a two-step evaluation process leading to three possible adoption outcomes: strong, weak, or faint. If one decides knowledge is applicable for immediate use, strong adoption occurs. If they decide it is not immediately applicable, but archive it for later use, weak adoption occurs. Faint adoption occurs when one decides it is neither applicable for immediate nor future use. In the context of food safety training, the food handler is presented with both an ideational innovation and a process innovation, where the former is used to rationalize the latter.

For example, food safety training participants are introduced to the idea that microorganisms, something one cannot see, exist and can be transferred within the food preparation environment by personal behaviours (e.g., poor hand hygiene practices).

Based on these ideas, food handlers are then tasked with how to control them without further instruction. Food handlers are typically presented with explicit knowledge about how to improve hand hygiene, such as wash hands frequently and thoroughly, but they are not trained on (1) how to incorporate the additional burden of time into their normal processes or (2) the potential negative impacts that frequent hand washing may have on personal health (e.g., dermatitis) Therefore, participants of food safety training are strongly adopting the ideational knowledge of food safety but weakly or faintly adopting process knowledge.

Knowledge implementation. This refers to one putting knowledge into practice. Implementation of knowledge is influenced by external factors often beyond the control of the food handler. These factors include company culture, policies, resources, employment conditions, and physical attributes of the work setting (e.g., work-setting layout and available equipment). To implement knowledge effectively, one must be able to do so in the work setting. However, many factors can impede knowledge implementation, such as lack of resources, including financial resources, time, and facility. While knowledge was positively associated with the ability and willingness to invest in food safety practices, it was not a statistically significant predictor as compared with financial limitations. The researchers also assert that the physical characteristics (e.g., layout and available resources) of the work environment are associated with knowledge implementation, as they are a facilitating condition. Facilitating conditions can serve as a perceived enabler or barrier in the environment influencing one's perception of ease or difficulty of performing a task. The influence of context, defined as the environment or setting in which the shared knowledge is to be implemented, is receiving increased attention.

As context differs between settings and can change over time, understanding the application context and addressing it in training is more likely to lead to improved training outcomes. There is empirical evidence also to support the role of context to implementation interventions, demonstrating that context matters to intervention effectiveness.

To conclude, training that addresses both the evidence that supports safe food handling and the context in which evidence will be implemented is needed if we are to reduce the burden of illness attributed to foodborne disease. Importantly and noteworthy, simply gaining knowledge about safe food handling does not decrease the risk for foodborne disease but implementing this knowledge does. The components mentioned is not an exhaustive list of actions but is a starting point for educators who wish to rethink how to approach the design and delivery of training initiatives (Yeargin et al., 2021).

Results

The objective of this study was to assess the knowledge, perception and self-reported practices of reading impaired food handlers in St. James with respect to key food safety parametres. This was done by comparing the knowledge, perception levels and self-reported practices of reading impaired food handlers being trained for the first time to those who were trained at least once before. Ultimately, the researchers would get an understanding as to the effectiveness of the Ministry's mandatory food handlers training methodologies. In this chapter, the data collected will be analysed and presented through descriptive and inferential statistics by the use of SPSS version 28.0 and Microsoft Excel. This chapter also includes a discussion of the findings, recommendations, and limitations.

The sample size for this study remained at 94 food handlers who were identified as reading impaired at the food handlers training sessions held in St. James. Of this number, 47 respondents were placed in a control group as these persons have never attended a food handlers training session in the past. The total sample comprised of 88 persons from the main site and 6 persons from Cambridge Health Centre with an average of 5-35 food handlers interviewed at each site on a Monday, Thursday, or Saturday between June 27, 2022, and July 16, 2022. No data was collected from the training site at Maroon Town Health Centre due to the researchers' inability to obtain the three respondents originally targeted for the sample. The turnout for the one session held was very small and as such, this subsample was taken from the main site in Montego Bay to compensate. The overall response rate was 100%.

Socio-demographic Profile

The respondents' sociodemographic profile is shown in table 1. As was expected, about 84% were ordinary food service workers with the males dominating the survey by 10.6%. The most prevalent age group was between 19-35 years as this accounted for almost 40% of the respondents with an average age of around 36.8 years. Almost half of the respondents completed high school with only one respondent who never attended formal schooling. Just about 3 out of every 10 responses came from food handlers were employed in some type of restaurant, cookshop, canteen or catering service with 26% wanting to or is employed in the hotel sector. About 31% of the respondents were working in food service in excess of 10 years.

Table 1: Demographic Profile of Reading Impaired Food Handlers (n=94)

Variable	n	%	Mean
Gender			
Male	52	55.3	
Female	42	44.7	
Age			
12-18	10	10.6	
19-35	37	39.4	36.8
36-49	26	27.7	
50+	21	22.3	
Length of time as a food worker			
<1 year	26	27.7	
1-5 years	27	28.7	
6-10 years	12	12.8	
>10 years	29	30.9	
Highest level of education			
Primary or elementary	28	29.8	
High or secondary	46	48.9	
College of university	2	2.2	
Skills training	17	18.1	
None	1	1.1	
Type of food service business (n=92)			
Hotel	24	25.5	
Restaurant/canteen/catering	29	30.9	
Factory	1	1.1	
Bakery	6	6.4	
Supermarket/wholesale	6	6.4	
Food shop/bar	17	18.1	
Vendor	7	7.4	
Nursing home	1	1.1	
Meat shop	1	1.1	
Current position (n=93)			
Food worker	78	83.9	
Supervisor	4	4.3	
Manager	5	5.3	
None	6	6.4	
Received six months or more of formal food safety training			
Yes	17	18.1	
No	77	81.9	

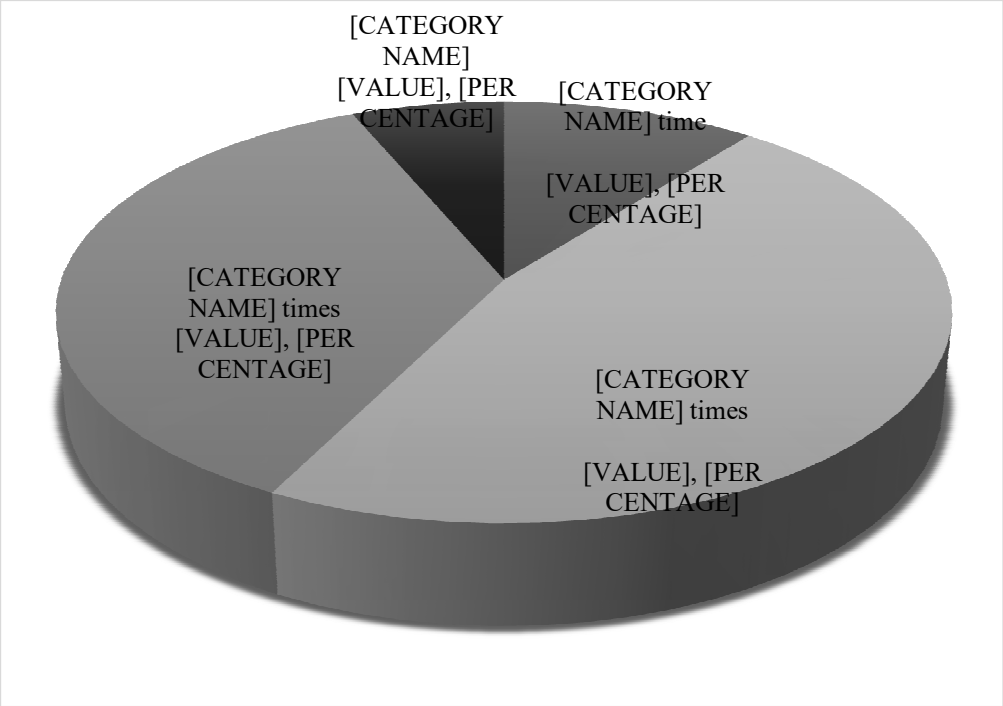

Figure 1: Number of Food Handlers Trainings Attended (n=47)

Figure 1 illustrates the frequency of responses as per number of training sessions attended. For the 47 respondents who were already trained food handlers, almost half would have attended a training 2-5 times before with 36% attending a training greater than 5 times.

Food Safety Knowledge

Table 2. Frequency of Food Safety Knowledge Scores (n=94)

No	Statement	Responses % (n)			Mean percentage of correct responses ± SD
		Correct answer	Incorrect answer	Do not know answer	
Food Borne Disease Transmission					49.5 ± 20.0
1	Fresh eggs can have salmonella	53.2 (50)	19.1 (18)	27.7 (26)	
2	Fresh meat always has microbes on the surface	20.2 (19)	14.9 (14)	64.9 (61)	
3	Canned foods may have harmful microbes	59.6 (56)	22.3 (21)	18.1 (17)	
4	Healthy people can cause illness by carrying germs to food.	67.0 (63)	27.7 (26)	5.3 (5)	
5	It is normal for fresh chicken to have Salmonella	23.4 (22)	53.2 (50)	23.4 (22)	
6	Lettuce and other raw vegetables might have harmful microbes.	75.5 (71)	16.0 (15)	8.5 (8)	

7	Foods served cold (salads) do not have to be disinfected.	52.1 (49)	30.9 (29)	17.0 (16)	
8	Cooked foods do not have microbes	40.4 (38)	47.9 (45)	11.7 (11)	
9	Foods prepared too long in advance might give microbes time to grow.	78.7 (74)	14.9 (14)	6.4 (6)	
10	You can tell if a food is dangerous to eat by its look, smell or taste.	21.3 (20)	75.5 (71)	3.2 (3)	
11	The HIV virus can be spread through food.	47.9 (45)	39.4 (37)	12.8 (12)	
12	Cholera can be spread through food.	54.3 (51)	9.6 (9)	36.2 (34)	
Personal Health & Hygiene					65.3 ± 29.9
13	Hands can be washed with water alone after handling raw meat.	78.7 (74)	20.2 (19)	1.1 (1)	
14	You can prepare food with a wound on the hand if the wound is covered with a bandage.	52.1 (49)	40.4 (38)	7.4 (7)	
15	After washing, hands may be dried with a kitchen towel	34.0 (32)	62.8 (59)	3.2 (3)	
16	It is not necessary to wash hands to handle food that is already cooked	7.4 (7)	91.5 (86)	1.1 (1)	
17	After using the toilet, we should always wash hands with soap and water	95.7 (90)	4.2 (4)	0 (0)	
18	When wearing gloves, you can handle cooked foods after handling raw meat	79.8 (75)	19.1 (18)	1.1 (1)	
19	Hands should be properly washed after sneezing or blowing your nose	100 (94)	0 (0)	0 (0)	
20	When you leave the kitchen and go outside, you should change the footwear	51.1 (48)	31.9 (30)	17.0 (16)	
21	After using the bathroom, hands can be washed in the kitchen sink	93.6 (88)	6.4 (6)	0 (0)	
22	Wearing gloves while handling	60.6 (57)	26.6 (25)	12.8 (12)	

	food protects the food service staff from infection				
Contamination/ Cross Contamination					70.5 ± 19.7
23	Food-borne disease can result from storing raw meat and cooked foods in the same refrigerator	64.9 (61)	25.5 (24)	9.6 (9)	
24	Foods prepared with many steps increases the handling and possibility of contamination of the food	61.7 (58)	17.0 (16)	21.3 (20)	
25	Foods can be contaminated with microbes by coming in contact with unsafe foods	91.5 (86)	1.1 (1)	7.4 (7)	
26	Food preparation surfaces can contaminate foods	83.0 (78)	6.4 (6)	10.6 (10)	
27	Ready to eat foods (e.g., vegetables) can be prepared on the same cutting board that was used to prepare meat	79.8 (75)	16.0 (15)	4.3 (4)	
28	Soap and water can be used to kill all harmful microbes on cutting boards after preparation of raw meat	36.2 (34)	60.6 (57)	3.2 (3)	
29	Prepared or ready-to-eat foods are stored on the top shelf in a refrigerator that also stores raw food	54.3 (51)	43.6 (41)	2.1 (2)	
30	Cutting boards, meat slicers and knives should be sanitized after each use	92.6 (87)	3.2 (3)	4.3 (4)	
Temperature Control					45.1 ± 19.5
31	Foods that need to be kept hot should be at 60°C or above	53.4 (51)	6.4 (6)	39.4 (37)	
32	Leftovers should be reheated to a minimum temperature of 75°C	46.8 (44)	8.5 (8)	44.7 (42)	
33	Microbes may grow because prepared food was left at room temperature for a long period	80.9 (76)	6.4 (6)	12.8 (12)	
34	Cooked foods might be safely stored in the refrigerator at 5°C	42.6 (40)	21.3 (20)	36.2 (34)	

35	Foods should be slowly cooled at room temperature before storage in the refrigerator	9.6 (9)	84.0 (79)	6.4 (6)	
36	Refrigeration kills all the bacteria that might cause food-borne illnesses	47.9 (45)	33.0 (31)	19. (18)	
37	Frozen foods should be thawed on the counter or in the sink	29.8 (28)	62.8 (59)	7.4 (7)	
38	After thawing, meat might be held for 5 hours at room temperature	56.4 (53)	20.2 (19)	23.4 (22)	
39	Foods stored at 40°C is being held in the temperature danger zone	38.3 (36)	11.7 (11)	50 (47)	
Mean Knowledge Score was 57.6 ± 22.3					

According to Table 2 above, the area of contamination/cross contamination had the highest average correct responses (*M*=70.5, *SD*=19.7) with the statement 'soap and water can be used to kill all harmful microbes on cutting boards after preparation of raw meat' having the lowest number of correct responses with only 36.2% of the respondents answering correctly. In contrast 93% believed that cutting boards, meat slicers and knives should be sanitized after each use, indicating a disparity in the understanding of sanitization. On the other hand, the area of temperature control received the lowest number of correct responses (*M*=45.1, *SD*=19.5). Only 10% thought that foods should not be slowly cooled at room temperature before storage in the refrigerator.

Likewise, 63% believed that frozen foods should be thawed on the counter or in the sink. Half of the respondents were not sure whether foods stored at 40°C were being held in the temperature danger zone. The area of food borne disease transmission also received one of the lowest average scores which stood at (*M*=49.5, *SD*=20.0). A little over 75% of the respondents thought that one could tell if a food was dangerous to eat by its look, smell or taste. Similarly, another 75% believed that lettuce and other raw vegetables might have harmful microbes. There was a deficiency in the awareness of prevalent bacteria affecting food since just over half of the respondents were of the view that fresh chicken does not have salmonella. The two key food safety parametres of temperature control and food borne disease transmission were identified as the main gap areas for knowledge.

The area of personal hygiene received a mean score of correct responses (*M*=65.3, *SD*=29.9). All of the respondents were of the view that hands should be properly washed after sneezing or blowing the nose with 96% saying that hands should always be washed with soap and water after using the toilet. About 92% thought that it was not necessary to wash hands to handle food that was already cooked. When asked if one could prepare food with a wound on the hand if the wound was covered with a bandage, there was a small gap of 11.7% between those who agreed and disagreed indicating that the respondents may have an incorrect understanding of the subject.

Table 3. Frequency of Food Hygiene Knowledge Scores by Category

Category of food handler (n=94)	**Food Hygiene Knowledge Score**		
	Satisfactory %(n)	Unsatisfactory %(n)	Total %(n)
Untrained (n=47)	12.8 (6)	87.2 (41)	100 (47)
Trained (n=47)	21.3 (10)	78.7 (37)	100 (47)
Total	17.0 (16)	83 (78)	100 (94)

According to Table 3, 78 of the respondents were not knowledgeable about the key food safety parametres. All these respondents would have received less than 70% when assessed for knowledge. From this number, 87% were attending food handlers training for the first time. Returning applicants had better knowledge than new applicants since 21% in comparison to 12% received 70% or higher for their overall knowledge score.

Table 4. Independent Sample t-Test for Knowledge Scores for Trained and Untrained Reading Impaired Food Handlers (n=94)Showing t-Test: Two-Sample Assuming Unequal Variances

	Untrained	**Trained**
Mean	54.88271	58.81069
SD	12.69346	13.70843
Variance	161.1239	187.9210632
Observations	47	47
Hypothesized Mean Difference	0	
df	92	
t Stat	-1.44138	
P(T<=t) one-tail	0.076455	
t Critical one-tail	1.661771	
P(T<=t) two-tail	0.15291	
t Critical two-tail	1.986377	

To determine if there was a statistically significant difference between the knowledge scores obtained from both trained and untrained food handlers, a two-sample independent t-test was done. The null hypothesis was tested, where the mean difference was zero indicating that there was no difference between the knowledge of trained and untrained food handlers. The mean knowledge score of trained food handlers (n = 47) was 58.8% (SD = 13.7), and the mean knowledge score of the untrained food handlers was 54.9% (SD = 12.7). When the t test was performed, the results from the unequal variances assumed test indicated that there was no statistically significant difference in mean knowledge scores for trained and untrained reading impaired food handlers, t (94) = -1.441, alpha = 0.05. The p-values for both one tailed and two tailed tests were 0.15 and 0.08 respectively which are greater than alpha.

Food Safety Self-Reported Practices

The results found that 63% of the respondents reported practices that were regarded as unsatisfactory for good food hygiene. Table 5 will provide a breakdown per practice question.

Table 5: Reading Impaired Food Handlers Self-Reported Practices Frequency of Responses

No	Question	Responses % (n)		
		Always	Sometimes	Never
1	Do you wash your hands before touching unwrapped raw foods?	70.2 (66)	27.7 (26)	2.1 (2)
2	Do you wash your hands after touching unwrapped raw foods?	70.2 (66)	27.7 (26)	2.1 (2)
3	Do you wash your hands before touching cooked foods?	71.3 (67)	27.7 (26)	1.1 (1)
4	Do you wash your hands after touching cooked foods?	54.3 (51)	37.2 (35)	8.5 (8)
5	Do you use separate utensils when preparing raw and cooked foods?	60.6 (57)	29.8 (28)	9.6 (9)
6	Do you thaw frozen foods at room temperature?	38.3 (36)	41.5 (39)	20.2 (19)
7	Do you check the expiry dates of all products?	55.3 (52)	40.4 (38)	4.3 (4)
8	Do you use a thermometer to check temperature?	10.6 (10)	22.3 (21)	67.0 (63)
9	Do you use gloves when serving unwrapped ready to eat foods?	25.5 (24)	35.1 (33)	39.4 (37)
10	Do you wash your hands before using gloves?	48.9 (46)	17.0 (16)	34.0 (32)
11	Do you wash your hands after using gloves?	54.3 (51)	13.8 (13)	31.9 (30)
12	Do you wear an apron or uniform when serving food?	59.6 (56)	23.4 (22)	17.0 (16)
13	Do come to work when ill with a fever, upset stomach or diarrhea?	2.1 (2)	6.4 (6)	91.5 (86)
14	Do you use a handkerchief or rag when suffering from a cold?	48.9 (46)	33.0 (31)	18.1 (17)
15	Do you wear a hat or head covering when serving food?	75.5 (71)	21.3 (20)	3.2 (3)
16	Do you wear jewellery when serving food?	0.0 (0)	10.6 (10)	89.4 (84)
17	Do you disinfect cutting boards after each use?	60.6 (57)	35.1 (33)	4.3 (4)
18	Do you use kitchen towels to dry utensils?	41.5 (39)	36.2 (34)	22.3 (21)
19	Do you sanitize utensils after washing them?	62.8 (59)	29.8 (28)	7.4 (7)
20	Do you have separate shoes for use in the food establishment?	41.5 (39)	20.2 (19)	38.3 (36)

Approximately 70% of the respondents practiced hand washing before and after touching raw food and before touching cook food whereas about half of the respondents said that they washed their hands after touching cook food. Utensils separation for raw and cook food was always done by approximately 61% of the respondents whilst 30% observed this practice occasionally. The data shows that majority (79%) of the respondents thaw frozen food at room temperature whether always or sometimes. In addition, just over half (55%) of the respondents religiously check expiration dates of products before usage. The continuous use of thermometers to ensure the requisite temperature of food items was reached or maintained was reportedly practiced amongst

the minority (11%). Whilst only 26% of the respondents declared that they always use gloves when serving unwrapped ready-to-eat food, more respondents always practiced hand washing before and after glove use in respect to what they would have done if it is that they were using gloves.

However, it was noted that 49% and 54% of the food handlers washed their hands before and after wearing gloves respectively.Regarding protective clothing such as apron, it was more commonly utilized as it was reported that 60% and 23% of the respondents wore it always or sometimes respectively. The number of food handlers who indicated that they attend work whilst they were ill with fever, diarrhoea or any other contagious conditions were deemed negligible (2%). On the other hand, it was noted that almost half of the respondents (49%) used a handkerchief or rag when suffering from a cold. Majority (76%) of the food handlers mentioned that they take precautions such as always wearing hair cover when serving food and 89% never wore any jewellery for said activity. The practice of using the kitchen towel to dry utensils was noted to be done always or sometimes by 77% of the respondents and 93% respondents sanitizing utensils after washing.

Table 6. Summary of Select Self-Reported Practices Between Untrained and Trained Reading Impaired Food Handlers

Practice	% Food Handlers (n)			
	Untrained (n=47)		Trained (n=47)	
	Correct response	Incorrect response	Correct response	Incorrect response
Do you come to work when ill with a fever, upset stomach or diarrhea?	89.4 (42)	10.6 (5)	93.6 (44)	6.4 (3)
Do you use kitchen towels to dry utensils?	25.5 (12)	74.5 (35)	19.1 (9)	80.9 (38)
Do you wash your hands before touching unwrapped raw foods?	63.8 (30)	36.2 (17)	76.6 (36)	23.4 (11)
Do you use a thermometer to check temperature?	12.8 (6)	87.2 (41)	8.5 (4)	91.5 (43)
Do you sanitize utensils after washing them?	72.3 (34)	27.8 (13)	53.2 (25)	46.8 (22)

Table 6 outlined five randomly chosen practices across the same food hygiene knowledge categories which are expected among food handlers as they carry out their daily work. The practice of attending work whilst ill with a fever or diarrhoea was more prevalent amongst the untrained food handlers. It was seen where the 11% of the new food handlers gave incorrect answers to this practice whereas only 6% of the trained food handlers gave incorrect answers. On the contrary, (81%) of the trained food handlers gave incorrect answers for the practice of using kitchen towel to dry utensils when compared to the incorrect answers given by the untrained which was 74%. It was also seen where food handlers who were previously trained gave better responses to the question about hand hygiene practices before touching raw food. Seventy-seven

percent of the previously trained food handlers washed their hands before touching raw food whilst 64% of the untrained food handlers observed said practice. Regarding the sanitary handling of utensils as mentioned above the untrained food handlers provided more correct answers. This was evident where 72% provided correct answers to the question about sanitizing utensils after washing when compared to 53% of the ones who were already trained. Lastly, majority of the respondents gave incorrect responses to the practice of using a thermometer to monitor temperature. Most notably, when compared to untrained food handlers, more trained food handlers gave incorrect responses (92% vs 87%).

Table 8. Frequency of Self-Reported Practices by Category

Category of food handler	Practice results		
	Satisfactory %(n)	Unsatisfactory %(n)	Total %(n)
Untrained (n=47)	27.7 (13)	72.3 (34)	100 (47)
Trained (n=47)	46.8 (22)	53.2 (25)	100 (47)

Table 8 above, provides further clarity with respect to the self-reported practices amongst the untrained and trained food handlers. It can be observed that only 28% of the untrained group possessed satisfactory food handling practices. In comparison, almost half (47%) of the trained group reported satisfactory practices.

Table 9: Independent Sample t-Test for Practice Scores for Trained and Untrained Reading Impaired Food Handlers (n=94) Showing t-Test: Two-Sample Assuming Unequal Variances

	Untrained	*Trained*
Mean	58.67021	64.73404
Variance	213.8182	195.7158
Observations	47	47
Hypothesized Mean Difference	0	
df	92	
t Stat	-2.054239	
P(T<=t) one-tail	0.021395	
t Critical one-tail	1.661585	
P(T<=t) two-tail	0.042789	
t Critical two-tail	1.986086	

To determine if there was a statistically significant difference between the self-reported practice scores obtained from both trained and untrained food handlers, another two-sample independent t-test was done. The null hypothesis was tested, where the mean difference was zero indicating that there was no difference between the self-reported practices of trained and untrained food handlers. The mean practice score for trained food handlers ($n = 47$) was 64.7% ($SD = 14.0$), and the mean practice score of the untrained food handlers was 58.7% ($SD = 14.6$). When the t test was performed, the results from the unequal variances assumed test indicated that there was a small statistically significant difference in the mean practice scores for trained and untrained reading impaired food handlers, t (94) = -2.054, alpha = 0.05. The p-values for both one tailed and two tailed tests were 0.02 and 0.04 respectively which are less than alpha.

Food Hygiene Training Perception

Food hygiene training perception was derived based on how the respondents rated two factors on a Likert's scale. The higher the percentage score, the greater their level of perception for the subject.

Table 10. Summary of Food Hygiene Training Perception

No	Factor	Responses % (n)		
		Very concerned	Fairly concerned	Not concerned
1	Ensuring that my food handlers permit is up to date	76.6 (72)	16.0 (15)	7.4 (7)
2	Getting trained/re-trained to know how to handle food safely	67.0 (63)	13.8 (13)	19.1 (18)
		Mean ± SD (%)	Range (%)	
Untrained (n=47)		81 ± 29.6	0-100	
Trained (n=47)		78 ± 34.7	0-100	

Table 9 shows the distribution of respondents' perception towards the mandatory food hygiene training. The majority (77%) of the respondents had a high perception about obtaining a valid food handlers permit and getting trained/retrained to handle food safely (67%) since they thought these two factors were very concerning. The findings also suggest that the respondents perceived getting the actual permit as more concerning than getting the training to handle food. Almost 1/5 (19%) were not concerned about the training.

The overall mean perception score stood at 81% (*SD*, 29.6) for the untrained food handlers making them have a higher food hygiene training perception over the trained food handlers (mean score of 78% with *SD*, 34.7). Lastly, the 16 respondents who got satisfactory scores for food hygiene knowledge received a mean perception score of 98.4 which could suggest that those who perceive food safety training as important are generally more knowledgeable on the key food hygiene parametres.

Although negligible, it was found that the highest mean knowledge, practice and perception scores were obtained from those food handlers who did not receive any formal education and would have learnt how to handle food through repeated exposures and observation (1% of the total). In contrast, those who completed more than 6 months of skills training in food hygiene reported the lowest knowledge and perception scores. Additionally, those who were working in food service for greater than 10 years were found to be more knowledgeable and had reported safer food handling practices as it concerns the key food safety parametres. Perception scores were varying education levels and length of time in the trade. Those food handlers who completed some type of skills training reported the poorest food hygiene knowledge and practices while those working more than 10 years had the highest food hygiene training perception. Lastly those food handlers who attained some level of college education had the highest food hygiene training perception.

Table 11: Attribution of Food Hygiene Knowledge, Self-Reported Practices and Perception Scores to Educational Level and Work Experience

Para-metre	Highest Educational Level Attained					Work Experience			
	Primary or Elementary (n=94)	High School (n=94)	College or University(n=94)	Skills Training (n=94)	None (n=94)	<1 Year (n=94)	1-5 Years (n=94)	6-10 Years (n=94)	>10 Years (n=94)
	Mean score %					**Mean score %**			
Knowledge	57.3	56.6	65.4	51.6	69.2	54.6	53.5	54.5	63.0
Self-Reported Practices	62.2	58.8	65.0	58.7	77.5	57.3	59.4	59.0	68.9
Perception	79.9	76.6	100	63.2	100	75.0	69.4	81.3	91.1

Summary of Findings

So far, data has been presented to answer the five research questions outlined in the first chapter with the goal to determine the effectiveness of the mandatory food hygiene training of the Ministry of Health and Wellness. We assessed knowledge, perception and self-reported practices of both trained and untrained reading impaired food handlers to assess the differences if any having included the untrained group as controls. Descriptive statistics in the form of frequencies, means, ranges and standard deviations were used to address the first four objectives while inferential statistics was used to address the final objective.

Just over half of the food handlers sampled were males (55%) with the total falling in the 19-35 age range (mean being 37 years). One third of the respondents worked in the restaurant and catering industry as well as worked more than 10 years respectively. High school was found to be the highest level of formal schooling for half of the respondents (49%).

The knowledge assessment was based on four key food safety factors: food-borne diseases, personal health and hygiene, contamination/cross contamination, and temperature control. Food handlers had higher mean scores for cross-contamination and personal health and hygiene and lowest on temperature control. Food handlers exhibited limited knowledge in holding temperatures, thawing of frozen food and whether it was safe to handle food with a wound. It was found that the mean knowledge score for the sample of 94 food handlers was 57.6% which was 12.4% below the minimum pass mark set by the Ministry of Health and Wellness for obtaining a food handlers permit.

Overall, 17% of the sample passed the test. However, when analysed by group, the untrained food handlers (n=47) were less knowledgeable than the trained food handlers (n=47) with only 12.8% passing the test as opposed to 21.3%. The results of the independent sample t-Test for knowledge scores for both groups proved that there was no statistically significant difference in

the knowledge levels for both groups.Like knowledge, the trained food handlers reported better food safety practices when compared to the untrained group. Only 27% of the untrained group received satisfactory scores when compared to the trained group's 47%. The major concerns were with the thawing of frozen food, using the thermometer to monitor food temperatures, using a rag or handkerchief when one has a flu and checking expiry dates. The results of the independent sample t-Test for practice scores for both groups proved that there was asmall statistically significant difference in the practice level for both groups.Lastly, the untrained food handlers demonstrated the highest perception levels for food hygiene training over the trained food handlers. The mean scores where 81% and 78% respectively. Generally, those with the highest knowledge scores also had the highest perception scores.

Discussion

As we have seen in chapter one, the lack of knowledge on food safety and poor food handling practices are major contributors for food-borne disease globally. This discussion will seek to justify the findings, make comparisons to what exists in the literature as well as describe the implication for public health.

Sociodemographic profile

Within the Jamaican population, more males tend to be illiterate when compared to females (Wilson-Harris, 2016). This finding was also confirmed by this study since most of the respondents were indeed male. It is likely because females tend to complete more years of schooling than males and are generally more interested in formal education than males for several reasons. During the time of data collection, many food handlers were seeking to obtain their food handlers permits to work in food stalls and booths for an upcoming special event called Reggae Sumfest. This is likely the reason why so many respondents were in the restaurant/catering category. Another 25% were people employed or hoping to be employed in the hotel sector. St. James is the tourist capital of western Jamaica and as such, this finding is not far-fetched. Like this study, the study by Tegegne & Phyo, 2017, we did not find a significant association between educational status and food safety knowledge level since there was no visible trend in the mean scores. Indrahadi and Wardana (2020) states that Socio-demographics are the strongest factors which influence student's academic achievement. This implies that educators must understand the demography of their target audience to align learning modalities to reach this audience.

Food hygiene knowledge

As it concerns food safety knowledge, seventeen percent (17%) of all reading impaired food handlers sampled obtained a satisfactory score. This differed from Reid, 2015 who studied similar variables among the literate and found that 42% of the sample passed the knowledge assessment. It was then further uncovered that 21.3% of the trained food handlers demonstrated satisfactory knowledge when compared to the untrained (12.8%). Irrespective of this, there was no statistically significant difference between the trained and the untrained with respect to the knowledge scores. This data is concerning since it would be expected that untrained reading

impaired food handlers would perform much poorer than the trained group, which would suggest that the food hygiene training has no significant positive impact.

It therefore begs the question, how effective is the current food hygiene training for the reading impaired food handlers? This question is important since both reading impaired and literate food handlers were exposed to the same training and it is possible that the pace of delivery may have been unsuitable to the reading impaired group. This may also be due to the technical language used during the training sessions given that there were no special language provisions made for the reading impaired. This could explain why reading impaired persons seek assistance to break down the technical terms and obtain clarity during the test. Whilst it is reasonable to break down technical terms, it would defeat the purpose of an assessment should the facilitators provide clues and suggestions made to directly help the food handler to identify answers for the purposes of passing an exam.

The pass rate among reading impaired food handlers for the training assessment in the parish of St. James is approximately 98% according to the Food Safety Specialist for the parish(Brown, 2022). The aforesaid background is quite contrary to the findings of this study where most respondents had poor knowledge and failed to provide correct answers to specific questions that also form part of the food handlers permit assessment. (make a link with the background information and the inequity in testing where PHIs give clues to help food handlers during oral exam. This may be the reason for the high pass rate among the illiterates.). The findings provided a statistical breakdown of the key food hygiene parameters and their respective knowledge scores. Where disease transmission was concerned, the respondents obtained a mean score (%) of 49.5 ± 20, personal health and hygiene 65.3 ± 29.9, contamination 70.5 ± 19.7 and temperature control 45.1 ± 19.5. The overall mean knowledge score was 57.6 ± 22.5. The legal requirement for working in a food establishment in Jamaica is a Food Handlers Permit, as such, it is expected that holders of said permit possess the requisite knowledge to handle food safely in the establishment. This study suggests that most of the areas critical to food borne disease prevention, reading impaired food handlers, failed to meet the minimum standard where knowledge was concerned. Prevention of microbial proliferation is of utmost importance and as such given that the temperature control parameter received the least mean score, concerns were raised about the safety of the food provided for the public.

Most of the respondents (30.9%) had working experience within the food industry for over 10 years, as such, compounded knowledge is likely to be attributable to what is being practiced. It was proposed by Edem (2011), that secondary school leavers would possess the requisite competence to grasp contents and as such training in food safety and hygiene would be sufficient to elevate the knowledge level to where it is required. On the contrary it is evident that the level of schooling received did not directly influence the literacy level and by extension did not have any positive implication on the competence to grasp contents. This study showed that almost 49% of the respondents were secondary school leavers, whilst 18% would have received skills training to improve practice and knowledge specific to the field of food safety and hygiene. This study further went contrary to Raji et al., (2021), where it was seen that there was a significant increase (56.7%, $p < 0.001$) in knowledge amongst the trained food handlers as compared to the same food handlers who were not trained. Because of the respondents are line staff who have a

direct contact with food, the importance of having sufficient knowledge to ensure food safety is paramount.

Food hygiene perception

Tuglo et al.(2022) found that good attitude is an influencing factor of food handling practice which can decrease the risk of foodborne illness. Individuals' perception of a particular subject will in some way influence their attitude towards that subject. The findings of this study suggest that more food handlers perceive the food handlers permit as more important than the actual training required to get it. This could possibly be an explanation for the low knowledge and practice scores since the emphasis would have been placed on getting the document rather than grasping what was taught and translating it in the workplace. The untrained group had higher perception scores when compared to the trained group very likely because when persons are embarking on a new venture for the first time, they tend to have a positive attitude and have greater enthusiasm towards it. As such their outlook on the subject would have been a more optimistic one. This was also evident during data collection, where during the screening phase, majority of those who declined to participate were persons who were trained in prior years. To them, attending food handlers training was more of a routine that they are not really excited about. Over time, this thinking affects perception levels especially if aspects of the training are not improved.

The relatively high perception scores between both groups (77% and 67%, respectively) suggest that most of the respondents knew and understood the importance and relevance of safe food handling and getting certified to do same. This finding was concurred by studies done by Sharma et al. (2019) and Gomes de Freitas et al. (2019) which also declared that despite having good food hygiene perception, it does not translate into knowledge and practice in the workplace setting for various reasons we will explore later. These studies similarly had varying risk perception scores in their findings.

The survey also found that all the respondents who completed some type of college education had the highest perception scores (100%). This validates the finding that those who were more knowledgeable in the key food safety parametres also had the highest level of food hygiene training perception. This is likely because these persons would have been exposed to a higher level of learning and could better appreciate the importance of food safety and the role they play. Additionally, those who were exposed to some type of skills training area as their highest level of school may have been mostly concerned about improving their skill area which in most cases is not linked to food hygiene. This type of outlook tends to cause the ranking of the skill area as very important and everything else not so important since it is the skill that often enables to individual to make a livelihood. In many cases, these persons are seeking certification to embark on an economic activity involving food to supplement their existing income.

Perception is the process whereby persons select, organize, and interpret information. People tend to pay attention to information that is more salient; therefore, delivering our messages enthusiastically in the content of our communication will affect salience (University of Minnesota Libraries, 2016). As we are aware, the process of teaching and learning involves

direct communication with learners. This can be affected by the way one views the training and the outcomes. In other words, perception is a likely barrier to effective learning outcomes. The ultimate goal must be to devise ways to improve the perception of food handlers training among people in general. What aspects of the process make it unappealing to people? Is the information presented directly applicable? These are questions that can be answered in future research. From a public health standpoint, if knowledge and practices are to be improved, the perception of the training and the process must be looked at with the view to effect some change in the minds of food handlers.

Food safety self-reported practice

Only 37% of the respondents reported satisfactory food hygiene practices. When assessing length of work experience, those who were working more than 10 years reported better practices. Although the rate of satisfactory food handlers was low when compared to the literature, the findings were synonymous (Lema et al., 2020). The fact that over 70% of the respondents thawed food at room temperature could be due to inconvenience created by thawing the food using approved methods. For example, if the food is to be thawed under cold running water, persons will complain about overuse of water which has economic implications. In addition, due to poor meal planning and inadequate resources, thawing in the refrigerator would not be beneficial. Because of these and other issues, people often resort to the easiest option which is leaving the food in the sink or on the counter. It would be interesting to see how food handlers perceive the risk of such practice. As this could also be a major factor influencing behaviour. The public implications of this practice can be devastating especially when the food thawed for hours and if it will form part of a meal with little to no further processing.

Only 55% of the respondents routinely check food expiration dates before use. According to Akabanda et al. (2017) and Letuka et al. (2020) this finding differs from the study which found that 17% and 84% respectively routinely checked expiration dates. The finding could be attributed to the notion that Jamaican's seldom read packages and labels, as it is seen as time consuming and won't change the ultimate decision. In most cases, if the food is visually appealing with no signs of abnormality, then no further checks will be done. Additionally, there may also be issues with the understanding of the different date labels or general forgetfulness.

Only 11% of the respondents always used thermometers to ensure the requisite temperature of food items. When further assessed, 87% of the untrained did not use thermometers, with the same being said for 92% of the trained food handlers. About 21% reported the use of the thermometer for temperature monitoring always (Hamed & Mohammad, 2020). Reid (2015) reported a similar 26% but differed from Fariba et al. (2018) which noted that 78% always used a thermometer to check if meats and poultry are cooked thoroughly. Consistent use of the thermometer appears to be a challenge for most jurisdictions. In the case of our study, it could be because of adequate training on how to use it since this is not a topic that is talked about in clear detail in the training. In most cases, food handlers are told to use it but not necessarily how to use it as this is often left up to the employer. This is often not translated into the workplace since, there may also be the non-existence of such equipment, or they are only used by some staff members.

Recommendations for Further Research

There is a need for further research into the Ministry of Health's training regime for food handlers. A similar study needs to be replicated across all the parishes in Jamaica to get a more comprehensive understanding of the training effectiveness island wide. These studies can include actual observation of practices in the work setting since self-reported studies do have a degree of limitation with respect to persons stating their actual practices.

Moreover, the degree to which information is disseminated to food handlers in a way that it can be translated into practice is somewhat dependent on the skill level of the trainers themselves. A study of this nature would uncover any deficiencies that may exist among the trainers. A deeper look into varying training modalities could be undertaken to determine which ones offer the greatest benefit to reading impaired food handlers. A pre and post-test could be administered to see if there statistically significant differences. Finally, we recommend that a study be done to look at all the other factors that could affect knowledge retention and translation into practice. There may be other workplace, social, economic or psychological factors that could affect training outcomes.

Conclusion

The current study reveals that reading impaired food handlers had poor knowledge as it concerns the key food safety parameters of food borne disease transmission, personal health and hygiene, contamination/cross contamination, and temperature control. The training received did have some benefit since the trained persons received better mean knowledge scores than the untrained, although not statistically significant. The two key food safety parameters of temperature control and food borne disease transmission were identified as the main gap areas for knowledge. The same could be said about practice, where the trained reported better food hygiene practices when compared to the untrained; this being marginally statistically different. Many food handlers demonstrated questionable practices when asked to report their frequencies of critical food hygiene activities. Because these were self-reported, it is very likely that the practices may not be synonymous to what obtains. Overall, majority of the food handlers had positive perceptions about the training, however it would appear that the food handlers permit has greater importance in the minds of food handlers rather than grasping and applying the information presented. Further study is needed to examine this more closely. There needs to be some revision to the existing training regime if improved knowledge and practices are to be achieved among the reading impaired group with less emphasis on giving assistance. This revision should also examine the way the content is being shared as well as the facilitators delivering the information.

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Appendix A: Knowledge, Attitude and Practice Survey Scale

Part 1: Assessment of Food Hygiene Knowledge

Please state whether you 'agree', 'disagree' or 'don't know' to the following statements.

Food-borne Disease Transmission	**Agree**	**Disagree**	**Don't Know**
1. Fresh eggs can have salmonella			
2. Fresh meat always has microbes on the surface			
3. Canned foods may have harmful microbes			
4. Healthy people can cause illness by carrying germs to food.			
5. It is normal for fresh chicken to have Salmonella			
6. Lettuce and other raw vegetables might have harmful microbes.			
7. Foods served cold (salads) do not have to be disinfected.			
8. Cooked foods do not have microbes			
9. Foods prepared too long in advance might give microbes time to grow.			
10. You can tell if a food is dangerous to eat by its look, smell or taste.			
11. The HIV virus can be spread through food.			
12. Cholera can be spread through food.			
Personal Health & Hygiene	**Agree**	**Disagree**	**Don't Know**
13. Hands can be washed with water alone after handling raw meat.			
14. You can prepare food with a wound on the hand if the wound is covered with a bandage.			
15. After washing, hands may be dried with a kitchen towel			
16. It is not necessary to wash hands to handle food that is already cooked			
17. After using the toilet, we should always wash hands with soap and water			
18. When wearing gloves, you can handle cooked foods after handling raw meat			
19. Hands should be properly washed after sneezing or blowing your nose			
20. When you leave the kitchen and go outside, you should change the footwear			
21. After using the bathroom, hands can be washed in the kitchen sink			
22. Wearing gloves while handling food protects the food service staff from infection			

Contamination/Cross Contamination	Agree	Disagree	Don't Know
23. Food-borne disease can result from storing raw meat and cooked foods in the same refrigerator			
24. Foods prepared with many steps increases the handling and possibility of contamination of the food			
25. Foods can be contaminated with microbes by coming in contact with unsafe foods			
26. Food preparation surfaces can contaminate foods			
27. Ready to eat foods (e.g., vegetables) can be prepared on the same cutting board that was used to prepare meat			
28. Soap and water can be used to kill all harmful microbes on cutting boards after preparation of raw meat			
29. Prepared or ready-to-eat foods are stored on the top shelf in a refrigerator that also stores raw food			
30. Cutting boards, meat slicers and knives should be sanitized after each use			
Temperature Control	**Agree**	**Disagree**	**Don't Know**
31. Foods that need to be kept hot should be at 60°C or above			
32. Leftovers should be reheated to a minimum temperature of 75°C			
33. Microbes may grow because prepared food was left at room temperature for a long period			
34. Cooked foods might be safely stored in the refrigerator at 5°C			
35. Foods should be slowly cooled at room temperature before storage in the refrigerator			
36. Refrigeration kills all the bacteria that might cause food-borne illnesses			
37. Frozen foods should be thawed on the counter or in the sink			
38. After thawing, meat might be held for 5 hours at room temperature			
39. Foods stored at 40°C is being held in the temperature danger zone			

Part 2: Assessment of Food Handlers Self-Reported Practices

Please state whether you 'always', 'sometimes' or 'never' practice the following activities.

Food handling practice	Always	Sometimes	Never
1. Do you wash your hands before touching unwrapped raw foods?			
2. Do you wash your hands after touching unwrapped raw foods?			
3. Do you wash your hands before touching cooked foods?			
4. Do you wash your hands after touching cooked foods?			
5. Do you use separate utensils when preparing raw and cooked foods?			
6. Do you thaw frozen foods at room temperature?			
7. Do you check the expiry dates of all products?			
8. Do you use a thermometer to check temperature?			
9. Do you use gloves when serving unwrapped ready to eat foods?			
10. Do you wash your hands before using gloves?			
11. Do you wash your hands after using gloves?			
12. Do you wear an apron or uniform when serving food?			
13. Do come to work when ill a fever, upset stomach or diarrhea?			
14. Do you use a handkerchief or rag when suffering from a cold?			
15. Do you wear a hat or head covering when serving food?			
16. Do you wear jewellery when serving food?			
17. Do you disinfect cutting boards after each use?			
18. Do you use kitchen towels to dry utensils?			
19. Do you sanitize utensils after washing them?			
20. Do you have separate shoes for use in the food establishment?			

Part 3: Assessment of Food Handlers Perception on Food Hygiene Training

When seeking or continuing a job in food service or operating a food service business which of the following factors are you most concerned about? Please respond to each factor based on 'very concerned', 'fairly/relatively concerned' and 'not concerned'.

Factors	Very concerned	Fairly/ relatively concerned	Not concerned
Ensuring that my food handlers permit is up to date			
Making as much money as possible			
Getting trained/re-trained to know how to handle food safely			
Having a good customer service attitude			

Part 4: Sociodemographic Profile

These questions seek to find out some things about you.

1. What is your gender?
   ☐ Male ☐ Female
2. How long have you worked as a food handler?
   ☐ Less than one year ☐ 1 to 5 years ☐ 6 to 10 years ☐ over 10 years
3. What age group do you belong?
   ☐ 12-18 years ☐ 19-35 years ☐ 36-49 years ☐ 50+ years
4. What is your the highest level of education?
   ☐ Primary ☐ Secondary ☐ College or University ☐ Skills training ☐ None
5. What type of food service business are you employed/self-employed in?
   _____
6. Is this your first food handlers' training session?
   ☐ Yes ☐ No
7. If no, how many training sessions have you attended before? _____
8. What is your present position?
   ☐ Food Worker ☐ Supervisor ☐ Manager ☐ Administrative ☐ None
9. Have you any formal training in food preparation such as classes at HEART or cooking/catering school?
   ☐ Yes ☐ No

Thank You For Your Participation!