ASSESSMENT OF THE FOOD SAFETY KNOWLEDGE, ATTITUDES AND HANDLING PRACTICES AMONG FOOD HANDLERS IN HOSPITAL FACILITIES OF MUFULIRA DISTRICT, ZAMBIA

BY

CHARLES NYENDWA

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THE UNIVERSITY OF ZAMBIA
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DECLARATION

I, Charles Nyendwa, do hereby declare that the contents of this thesis being submitted herein are my original work and have not been previously submitted to any University for the award of a degree or any other qualification.

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CERTIFICATE OF APPROVAL

The University of Zambia approves this dissertation of Charles Nyendwa as fulfilling the partial requirements for the award of the degree of Master of Science in Food Safety and Risk Analysis.

Internal Examiner (1)	**Signature**	**Date**
Internal Examiner (2)	**Signature**	**Date**
External Examiner (3)	**Signature**	**Date**
Chairperson (Board of Examiners)	**Signature**	**Date**
Principal Supervisor	**Signature**	**Date**

ABSTRACT

To prevent the spread of harmful bacteria, individuals who handle food must adhere to strict guidelines, including maintaining proper hygiene and following established food handling practices, particularly when preparing large quantities of food. Food handlers in the hospitals of Mufulira District play a vital role in preventing foodborne illnesses. The objective of this research was to assess the levels of knowledge, attitudes, and practices related to food safety among food handlers in hospital facilities.

The study focused on staff responsible for handling food within the hospitals. A random sampling technique was employed to choose the target group. A sample of 100 individuals was selected using systematic random sampling, with 35 participants from Hospital X, 20 from Hospital Y, and 45 from Hospital Z. Data on knowledge, attitudes, and practices were collected through a structured questionnaire. Additionally, Key informants were interviewed using guided questions to complement the quantitative data. Statistical analyses were performed using descriptive statistics, with one-way ANOVA employed to compare mean scores for knowledge, attitudes, and practices (KAP). A logistic regression model was utilized to test for associations between independent variables.

The findings showed that food handlers at Hospitals X and Z had inadequate knowledge (45.7% and 42.2%, respectively) and poor practices (48.6% and 42.2%, respectively) despite demonstrating positive attitudes (94.0% and 93.0%, respectively). At Hospital Y, food handlers exhibited fair knowledge (55.0%), positive attitudes (95.0%), and poor practices (50%). Overall, the hospitals showed inadequate knowledge (mean score: 46.0%), poor practices (mean score: 45.0%), and positive attitudes (mean score: 94.0%). Using established cut-off points (poor $\leq$ 53%, fair 54%-79%, good $\geq$ 80%), knowledge and practices were rated low, while attitudes remained positive. These results indicate potential risk of foodborne illnesses in hospitals, driven by inadequate food safety knowledge and poor handling practices.

Keywords: Food safety, Food handler, Knowledge, Attitude, Hospital.

DEDICATION

This research is dedicated to my mother (ANNIE NJOVU), who has been a constant source of belief and support throughout my journey. Even in the face of doubt from others, she has stood by my side, and without her trust in me, I would not have reached the point I am at today.

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Above all, I offer my gratitude and appreciation to God for the blessings and guidance I have received throughout my academic journey. As Hebrews 11:1 state, "Faith is the reality of what we hope for, the proof of what we do not see."

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LIST OFABBREVIATIONS AND ACRONYMS

FS	Food Safety
PRPs	Prerequisite Programs
MD	Mufulira District
HAIs	Hospital-Acquired Infections
QA	Quality Assurance
DHS	Diverse Healthcare Settings
GOV	Government institution
PRI	Private Institution
MIS	Mission Facilities
FS	Food Safety
KAP	Knowledge Attitudes and Practice
SOPs	Standard Operating Procedures
TM	Targeted Training Programs
CM	Corrective Measures
CAI	Critical Areas for Improvement
SWM	Storage and Waste Management
PA	Positive Attitudes
CP	Consistent Practices
CT	Continuous Training
CMN	Continuous Monitoring
HACCP	Hazard Analysis Critical Control Point
WHO	World Health Organization
FAO	Food Agriculture Organization
CCPs	Critical Control Points

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The assessment of food safety knowledge, attitudes, and practices (KAP) in healthcare facilities is critical to ensuring the well-being of both healthcare staff and patients. In Zambia, as in many low- and middle-income countries, foodborne illnesses remain a significant public health challenge, exacerbated by factors such as poor food handling practices, inadequate sanitation, and limited access to safe drinking water (WHO, 2015). Healthcare facilities, including hospitals, are not exempt from these challenges as they are often high-risk environments where vulnerable populations, including immuno-compromised patients, are at greater risk of acquiring foodborne infections (WHO, 2022).

Food safety in hospital settings is a multifaceted issue that involves both the knowledge and practices of healthcare workers involved in food preparation, handling, and serving, as well as their attitudes towards the risks associated with poor food safety practices. Several studies have shown that the lack of adequate food safety knowledge among healthcare workers is a key determinant of unsafe food handling behaviors, which can lead to foodborne outbreaks within hospitals (Griffith, 2000). In Zambia, where foodborne diseases such as cholera and typhoid fever are endemic, the need to assess food safety practices in hospital settings has become increasingly urgent (CIDRZ, 2017).

A robust understanding of the KAP related to food safety in hospitals is essential for designing targeted interventions to improve food safety and prevent foodborne illnesses.

Previous studies conducted in various settings across Africa, including Zambia, have highlighted gaps in the knowledge of healthcare workers regarding food safety protocols and the proper handling of food in hospital facilities (Ayele *et al.,* 2020). Hospital kitchens often face challenges related to inconsistent food safety training, inadequate resources for maintaining hygiene, and poor supervision of food handling practices (Ghosh,2021). Moreover, the attitudes of healthcare workers, which encompass their perceptions of the importance of food safety and their motivation to comply with established guidelines, are pivotal in shaping food safety practices (Mwape *et al.,* 2018).

In Mufulira District, a mining town in the Copperbelt Province of Zambia, the majority of the population has limited access to quality healthcare services, which are often strained by economic and infrastructural challenges (Kalungwishi *et al.,* 2022). This context may further complicate efforts to ensure food safety in hospitals, especially considering the high burden of communicable diseases and the lack of resources in some healthcare facilities. Thus, an assessment of the KAP of hospital workers regarding food safety in Mufulira is timely, as it can inform both local and national strategies to mitigate the risk of foodborne diseases in healthcare settings.

Addressing these gaps in food safety knowledge and practices is vital, as foodborne infections in hospitals can result in extended patient stays, increased healthcare costs, and in some cases, death **(**Hassan, A.*et al.* 2017). Therefore, understanding how food safety knowledge, attitudes, and practices manifest in Zambia's hospital settings is essential for improving hospital food safety standards and ultimately protecting patient health.

1.2 Hazards Associated with Food Contamination

1.2.1 Biological Hazards

Biological hazards are critical due to their role in food spoilage and food poisoning outbreaks. Contaminants can enter food premises through food handlers, raw foods, insects, rodents, animals, and environmental pollutants. Common sources of food poisoning bacteria include the nose, mouth, intestines, and skin of individuals (Ali, 2000). Food handlers' soiled hands may carry pathogens such as Staphylococcus aureus, especially if they have boils or cuts. Carelessness and poor hygiene can lead to contamination. To prevent foodborne illnesses, all food handlers must maintain high personal hygiene standards and wear appropriate protective clothing (Springer, 2007).

1.2.2 Chemical Hazards

Chemical contamination in hospital food facilities can arise from the presence of cleaning agents, food additives, pesticides, and other toxic substances. Such chemical contaminants may enter food directly through improper storage, handling, or food preparation practices (WHO, 2010). Harsh cleaning agents, including bleach, ammonia, and other disinfectants, can inadvertently contaminate food if not thoroughly rinsed off or if improper handling procedures are followed. This type of contamination poses significant health risks, particularly to patients with compromised immune systems or allergies (Vladimirov, 2011). A notable example occurred in 2021 in the Copperbelt Province of Zambia, where pesticide-contaminated chicken shawarma resulted in 230 hospital admissions across Kitwe, Chingola, Ndola, and Mufulira (Ministry of Health, 2021). This incident underscores the critical need to address these risks.

To mitigate such hazards, it is essential to implement stringent controls over the use of cleaning agents and pesticides, provide comprehensive training to food handlers on safe handling practices, and conduct regular monitoring of food storage and packaging materials

1.2.3 Physical Hazards

Physical hazards in food safety refer to foreign objects that unintentionally enter food products, posing significant risks to consumers (Codex Alimentarius Guideline, 2008). Unlike biological and chemical hazards, physical hazards consist of non-edible items such as glass, metal fragments, plastic, stones, and wood, which can contaminate food during processing, handling, or serving.

In fast-paced environments like hospitals, the risk of physical hazards is heightened due to factors such as equipment mishandling, improper storage, and failures in quality control. The consequences of physical hazards can range from minor injuries to severe internal harm, particularly affecting vulnerable populations such as the elderly and young children (Nghiem *et al.,* 2018). Therefore, it is essential for hospitals to uphold stringent food safety standards to protect patients from both foodborne illness and physical harm (Rane, 2018).

1.3 Food borne Infections

Vulnerable populations, including the elderly, young children, and immuno-compromised individuals in hospitals, face significant risks from foodborne infections (Odeyemi *et al*., 2016). These illnesses not only threaten patient health but also disrupt healthcare operations and incur substantial costs. Hospital-acquired infections, such as

diarrheal diseases, place additional strain on resources, leading to increased hospitalization costs and service disruptions. Prioritizing proper food handling and hygiene practices is essential to mitigate these risks and protect patient well-being (Kruse, 2011).

Foodborne outbreaks can cause severe disruptions, such as the suspension of meal services, the implementation of quarantine measures, and the enhancement of infection control protocols (WHO, 2018). These disruptions negatively impact patient nutrition and create an atmosphere of fear among both patients and staff. Moreover, the economic burden of foodborne outbreaks, borne by government and public health sectors, underscores the urgent need for effective food safety measures.

1.4. Problem statement

There is a lack of research focused on the role of food handlers in the transmission and control of foodborne diseases, particularly within hospital settings in Zambia. However, several studies conducted in different contexts indicate that nosocomial diarrhea is a prevalent issue in hospitals, childcare facilities, and nursing homes (Githiri *et al.*, 2009).

Challenges such as inadequate food safety knowledge among food handlers, unhygienic practices, and concern attitudes significantly compromise the safety of the food supply chain in hospitals. These issues not only pose a direct threat to vulnerable patient populations including the elderly, young children, and immuno-compromised individuals but also increase the risk of foodborne infections. The consequences of such outbreaks include compromised patient health, rising hospitalization costs, and disruptions to healthcare services, highlighting the urgent need for improved food safety measures.

In 2018, patients in Mufulira District reported experiencing diarrhea after consuming meals prepared in hospital kitchens. Diarrheal related mortalities are unfortunately common in health facilities (Ronald Ross General Hospital Annual Report, 2018). However, it remains unclear how many of these mortalities are attributable to healthcare associated infections. Consequently, the specific causes of these diarrheal outbreaks remain unidentified, and no comprehensive investigation has been conducted to determine the factors contributing to the occurrence of diarrhea cases in hospitals within the Mufulira District.

According to the World Health Organization (WHO), five key factors, all under the responsibility of food handlers, are directly linked to food contamination and foodborne infections: unhygienic practices, insufficient sanitation, inadequate cooking procedures, improper storage without regard to temperature requirements, and cross-contamination, as well as sourcing food from unsafe suppliers (WHO, 2015).

To prevent foodborne infections among hospital patients, it is essential that hospital food handlers are well versed in food safety practices. This study aims to assess the knowledge, attitudes, and practices (KAP) of food handlers regarding food safety in selected health facilities within the Mufulira District. Since patient meals are critical for recovery and require both a balanced diet and safe preparation, addressing foodborne infections resulting from poor food handling practices is of paramount importance (Cecilia *et al.,* 2007).

1.5 Justification of the study

Foodborne diseases in hospital settings pose significant risks to vulnerable populations, including the elderly, children, and immunocompromised patients. While studies have

highlighted foodborne issues in various hospitals, there is a lack of research focusing on the role of food handlers in the transmission and control of these diseases within hospitals in Zambia. In Mufulira District, a 2018 diarrheal outbreak linked to hospital food raised concerns, yet no comprehensive investigation has been conducted to identify the specific causes or food safety challenges contributing to these outbreaks.

Food handlers are critical to food safety, as improper practices such as inadequate sanitation, poor storage, and cross-contamination are key contributors to foodborne infections (WHO, 2015). However, food handlers in many hospital settings often lack adequate food safety knowledge, leading to increased risks of foodborne outbreaks (Muinde & Kuria, 2005; Cecilia *et al.,* 2007). The absence of research on food handler practices in the Mufulira District further exacerbates the problem, making it difficult to develop effective interventions.

This study assessed the knowledge, attitudes, and practices (KAP) of food handlers in Mufulira District hospitals to identify gaps and improve food safety protocols. Addressing these deficiencies was critical for preventing foodborne outbreaks, safeguarding patient health, reducing hospitalization costs, and ensuring the overall quality of healthcare services. By filling this research gap, the study provided insights that can inform targeted interventions and improve food safety in healthcare facilities across Zambia.

1.6 Significance of the Study

i. Public Health**:** Understanding the knowledge, attitudes, and practices of food handlers in hospitals was crucial for ensuring the health and safety of patients who are vulnerable to food borne diseases.

ii. This study has the potential to inform policy and practice by offering evidence-based recommendations for hospital management, health policymakers, and public health officials. By identifying specific areas of weakness in food safety protocols,

iii. Training and Education**:** the study can guide the development of stronger food safety regulations, staff training initiatives, and monitoring systems. Improved food safety measures will not only mitigate the risk of outbreaks but also enhance the overall quality of healthcare services by ensuring that food, an essential part of patient recovery, is prepared and handled in a safe and hygienic manner

iv. Research Contribution: The study contributed to the existing body of knowledge by providing insights into food safety practices in hospital settings, a relatively under-researched area in Zambia.

1.7 Research Questions.

1) Are food handlers knowledgeable about food safety?
2) Do food handlers have positive attitudes about food Safety?
3) Do food handlers have good safety practices toward food safety?

1.8 Study Objectives

1.8.1 General Objective

To assess the knowledge, attitudes and practices among food handlers regarding food safety in hospital facilities of Mufulira district, Zambia.

1.8.2 Specific Objectives

1. To assess the level of knowledge among food handlers in hospital facilities of Mufulira District, Zambia.
2. To evaluate food handlers' attitude towards food safety in hospital facilities of Mufulira District, Zambia.
3. To examine food safety practices among food handlers in hospital facilities of Mufulira District, Zambia.

1.9 Conceptual Framework

This study was guided by the conceptual model presented in Figure 1.1 below. Five key variables were identified as influencing food safety: attitudes, practices, perceptions, socio-demographic factors, and the level of knowledge of food handlers. Various variables and factors can affect food safety in food service facilities (Smith, 2020). For instance, individuals who lack knowledge or possess negative attitudes are more likely to engage in improper practices.

Inadequate hygiene practices, as argued by Ismail *et al.* (2016), can lead to foodborne illnesses. The improper execution of procedures, failure to adhere to protocols, and a lack of training in Hazard Analysis Critical Control Points (HACCP) programs may

compromise food safety in food service units. HACCP provides a cost-effective system for food service operations to manage and control food safety risks effectively.

The level of education also impacts on how individuals perceive food safety. Without formal education on food safety, it is challenging for individuals to adhere to established standards and practices. Individuals who have never been educated about food safety are less likely to follow proper food handling protocols.

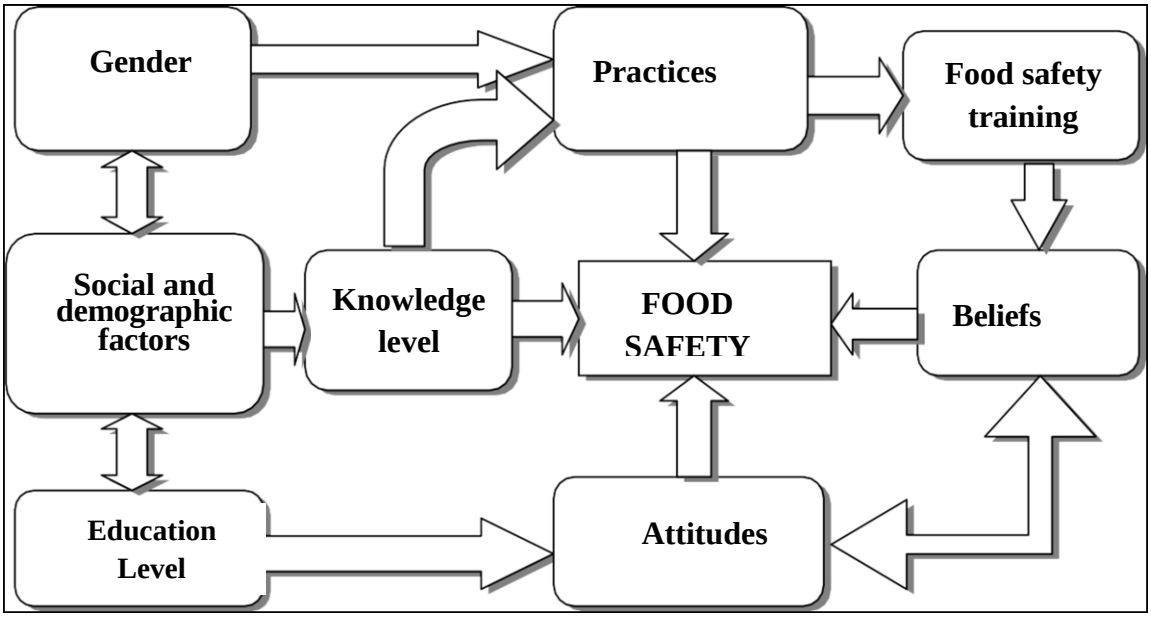

Figure 1.1. Conceptual framework (Source: Kaferstein, 2003).

1.10 Operational Definitions

Food Safety Knowledge: The understanding and awareness of food safety principles, guidelines, and practices among food handlers in hospital environments. It includes knowledge about proper cooking temperatures, hygiene practices, cross-contamination prevention, and other essential aspects related to safe food handling and preparation (Codex Alimentarius Guideline, 2001).

Attitudes Toward Food Safety: Perceptions, beliefs, and feelings of food handlers regarding the importance of food safety in their work. It encompasses their willingness to adhere to food safety protocols, their confidence in the effectiveness of these practices, and their overall commitment to maintaining a safe food supply chain in hospital settings (Codex Alimentarius Guideline, 2008)

Food Safety Practices: The observable actions, behaviors, and routines followed by food handlers during various stages of food preparation, handling, and service within hospital environments. It includes activities such as handwashing, proper storage, use of protective equipment, cooking procedures, and overall hygiene practices aimed at preventing foodborne contamination (Codex Alimentarius Guideline, 2001).

Hospital Facilities: Specific areas within healthcare facilities where food is prepared, handled, and served to patients. This includes hospital kitchens, food preparation areas, food service units, and any other areas directly involved in the food supply chain within the hospital premises.

Food Handlers: Individuals employed within hospital environments who are directly involved in food preparation, handling, and service. This includes kitchen staff, cooks, food servers, and any other personnel responsible for ensuring the safe and hygienic delivery of food to patients within the hospital settings (Codex Alimentarius Guideline, 2008).

Mufulira District, Zambia: The specific geographical area under consideration for this study. It includes all hospitals, healthcare facilities, and related food service units within Mufulira District where food handlers are employed, and food is prepared and served to patients.

Vulnerable Populations: Individuals within hospital facilities who are at an increased risk of developing severe complications due to foodborne illnesses. This includes elderly patients, young children, pregnant women, and immunocompromised individuals. These populations are more susceptible to the adverse effects of contaminated food and are the primary beneficiaries of the study's focus on enhancing food safety practices (FAO and WHO, 2001)

Food Safety Training Programs: Organized educational initiatives designed to impart knowledge and skills related to safe food handling and preparation. These programs can include workshops, seminars, on-the-job training, or formal courses aimed at enhancing the food safety knowledge of food handlers. The effectiveness of these programs is measured by the improvement in food safety knowledge, attitudes, and practices among the participants (Codex Alimentarius Guideline, 2008).

Food Safety Regulations and Guidelines: The official standards, rules, and protocols set forth by local and national health authorities, as well as international organizations such as the World Health Organization (WHO) and the Food and Agriculture Organization (FAO). These regulations outline the specific requirements for food handling, storage, preparation, and service within healthcare facilities. Compliance with these regulations is a fundamental aspect of ensuring the safety of the food supply chain (FAO and WHO, 2001)

Hygiene Protocols: The established guidelines and procedures related to personal cleanliness, sanitization, and disinfection within hospital environments. These protocols include standards for hand hygiene, cleaning and sanitizing food preparation surfaces and equipment, and maintaining overall cleanliness in food service areas. Adherence to

hygiene protocols is essential for preventing the spread of food borne pathogens (Food Safety act, 2019).

Food Contamination: The presence or introduction of harmful substances, including bacteria, viruses, chemicals, or foreign objects, into food items. In the context of this study, food contamination specifically refers to situations where food served in hospital environments is compromised, leading to the risk of foodborne illnesses among patients. Contamination can occur at any stage of the food supply chain, from procurement to preparation and serving (Codex Alimentarius Guideline, 2008)

FIFO protocol (First In, First Out) is a critical practice that ensures older food items are used before newer ones.

Temperature control: refers to the practice of maintaining food and beverage products within specific temperature ranges to ensure safety and quality.

Foodborne pathogens: are microorganisms, such as bacteria, viruses, and parasites, that can contaminate food and cause illness when ingested.

Quality Assurance in Food Service: The systematic processes and measures implemented to ensure that food served in hospital environments meet established standards of safety, nutrition, taste, and presentation. This includes regular inspections, monitoring of food handling practices, feedback mechanisms, and continuous improvement initiatives to uphold the quality and safety of the food supply chain. (FAO and WHO. 2006).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Global Perspective on Food Safety.

2.1.1 Food Safety Knowledge among food handlers

Knowledge is a fundamental component of the Knowledge, Attitudes, and Practices (KAP) framework that influences food safety practices. Numerous studies have assessed the level of knowledge among food handlers in hospitals. For instance, Fitzgerald *et al*. (2017) conducted a study in Ireland that analyzed food safety knowledge among hospital staff. They found that while many individuals possessed basic knowledge, significant gaps existed concerning specific practices, such as cross-contamination and safe cooking temperatures.

Similarly, Scharff *et al.* (2016) investigated food safety knowledge among food handlers in various healthcare facilities in the United States. Their research revealed that, although many food handlers demonstrated a foundational understanding of food safety protocols, substantial gaps remained in their practical application, particularly in high-risk areas such as food storage and preparation. The authors advocated for enhanced training programs that emphasize practical skills and real-world applications.

In the UK, McGowan *et al.* (2020) assessed the impact of training programs on the knowledge of food handlers in NHS hospitals. Their findings indicated that structured training significantly improved food safety knowledge, particularly with regard to hygiene practices.

A systematic review by Liu *et al*. (2021) synthesized findings from multiple studies on food safety knowledge and practices among food handlers in the U.S. The review highlighted persistent gaps in knowledge and practice across various demographics, emphasizing the need for tailored educational interventions that address the specific challenges faced by food handlers in different healthcare settings.

Additionally, a notable study by López-Galvez *et al.* (2019) in Spain examined the knowledge levels of food service staff in hospitals. The research found that, while staff generally understood basic food safety concepts, there was a lack of specific knowledge regarding cross-contamination and appropriate food storage temperatures.

2.1.2 Food Safety Attitudes among food handlers

The attitudes of food handlers are crucial in determining their adherence to food safety practices. Research conducted in Italy by Borrelli *et al.* (2021) explored the relationship between attitudes and food safety compliance among hospital kitchen staff. Their findings revealed that positive attitudes towards food safety were associated with higher compliance rates.

A study in Germany by Fischer *et al.* (2022) highlighted that while food handlers generally held positive attitudes towards food safety, misconceptions about certain practices such as the safety of reheating food persisted. Addressing these misconceptions is vital for improving food safety practices, as identified in their analysis.

In the United States, a study by Kim and Lee (2019) examined the impact of managerial support on food safety behaviors among hospital food handlers. Utilizing surveys and

observational data, the research demonstrated that managerial encouragement and reinforcement positively influenced adherence to food safety protocols. This finding underscores the pivotal role of supportive leadership in fostering a culture of food safety within hospital settings.

In Malaysia, research conducted in 2013 aimed to examine the beliefs and attitudes of food handlers regarding food safety and to identify obstacles they perceived in practicing safe food handling (Jabbar & Al-Shahri, 2013). The findings revealed that the attitudes of food handlers significantly influence their behavior regarding food safety, leading to a notable enhancement in their commitment to safe food handling practices.

Additionally, research by Parvinen *et al.* (2020) explored the psychological factors influencing food safety behaviors among hospital food handlers. Their findings indicated that individual attitudes towards food safety significantly impacted compliance with food safety practices. The authors suggested that addressing psychological barriers through motivational strategies could lead to improved food safety outcomes.

2.1.3 Food Safety Practices by Food Handlers.

The practices of food handlers in hospitals are critical indicators of food safety. A comprehensive study by Pérez-Rodríguez *et al.* (2020) in Portugal assessed the food handling practices of hospital staff. The results revealed that, although knowledge and attitudes were generally positive, practical adherence to safety protocols such as proper handwashing and food temperature monitoring was inconsistent. This discrepancy underscores the need for targeted interventions to facilitate behavior change.

In Malaysia, a study conducted by Tajul Ariffin *et al*. (2016) provided valuable insights into the actual practices of food handlers, revealing significant differences between knowledge and behavior. Despite adequate knowledge levels, only 55% of respondents reported consistently washing their hands before food preparation. This gap suggests that additional factors, such as organizational culture and the effectiveness of training programs, may influence compliance. Zailani *et al.* (2020) support this assertion, indicating that inadequate supervision and insufficient training are significant barriers to the proper implementation of food safety practices in Malaysian healthcare settings. These findings highlight the need for comprehensive training programs that not only enhance knowledge but also promote adherence to safe food handling practices.

Similarly, García *et al.* (2023) conducted research in France that identified barriers to effective food handling practices among hospital staff. Factors such as high workloads, insufficient staffing, and a lack of resources were found to contribute to non-compliance with food safety protocols. This study underscores its practical implications and calls for systemic changes in hospital food service operations.

A study by Osaili *et al*. (2011) emphasized that a lack of understanding regarding basic food hygiene practices and proper storage temperatures among food handlers can contribute to the transmission of foodborne diseases. It is essential for food handlers to prioritize food safety and enhance their knowledge of storage practices to prevent foodborne illnesses resulting from improper handling. Most foodborne illness outbreaks are attributed to human error in food handling, underscoring the importance of food safety training for all individuals involved in food preparation.

In a related study, Gunter *et al.* (2018) explored the impact of organizational culture on food safety practices among hospital food handlers. Their findings indicated that a positive organizational culture, characterized by strong leadership support and clear communication of food safety standards, was associated with improved adherence to safe food handling practices. This underscores the importance of managerial involvement in fostering a culture of food safety.

Additionally, Barrabeig *et al*. (2010) examined the role of an asymptomatic food handler in a norovirus outbreak in Barcelona, Spain, in 2005. The outbreak affected several individuals, with seven stool samples from food handlers, one of whom was asymptomatic. This case illustrates that asymptomatic food handlers can still carry infectious agents, highlighting the necessity of consistent food safety practices, particularly regarding hand hygiene.

In Australia, Rane (2018) investigated how environmental factors, such as hospital architecture and layout, influence food safety practices. The study employed observational evaluations to identify areas vulnerable to contamination and recommended architectural adjustments, such as repositioning change rooms and toilets and improving lighting, to enhance food safety measures. This research emphasizes the importance of incorporating architectural considerations into food safety protocols within hospital environments.

2.2.0 Regional Perspective of Food Safety among Food Handlers.

Examining the regional perspective on food safety in healthcare facilities within Southern and East Africa, excluding Zambia, provides a detailed understanding of the

challenges and innovative strategies specific to this geographical context. These countries share similar healthcare infrastructure, economic challenges, and cultural nuances, all of which influence food safety practices in hospital facilities.

2.2.1 Food safety Knowledge among food handlers toward food safety (training)

The systematic review by Mellor *et al*. (2015) identified a significant knowledge gap regarding essential food safety practices among food handlers in various African nations. While many respondents demonstrated a basic understanding of food safety concepts, critical knowledge about safe food storage, cooking temperatures, and the prevention of cross-contamination was often lacking. Similarly, Akhter *et al.* (2018) reported that food handlers in several African countries were unaware of recommended practices, leading to unsafe food handling.

Furthermore, Ntsama *et al*. (2019) conducted a study in Cameroon and found that a considerable percentage of food handlers were unaware of the health risks associated with improper food handling practices. This lack of knowledge can directly contribute to the prevalence of foodborne illnesses, underscoring the need for targeted educational initiatives.

In Ghana, a study by Abdulai *et al.* (2020) evaluated food safety knowledge and practices among food handlers in hospitals. The results revealed significant deficiencies in knowledge regarding foodborne pathogens and safe food handling techniques. The authors emphasized that targeted educational interventions are crucial for enhancing the food safety competencies of hospital staff.

In a study conducted in Ethiopia by Abebe *et al*. (2018), food safety knowledge among hospital food handlers in Addis Ababa was assessed. The findings indicated that, while most respondents were aware of basic food safety principles, there was a notable gap in their practical application. The researchers highlighted the necessity of implementing regular training programs to reinforce safe food handling practices and address the identified knowledge gaps.

Another study by Melaku *et al.* (2020) in Ethiopia focused on the knowledge, attitudes, and practices (KAP) of food handlers in the Amhara region. The results revealed that many food handlers lacked adequate knowledge about foodborne pathogens and proper food handling techniques. The researcher concluded that enhancing educational initiatives and awareness campaigns could significantly improve food safety practices among hospital staff.

Yared *et al.* (2020) conducted a systematic review of food safety knowledge, attitudes, and practices among food handlers across Ethiopia. Their review revealed a consistent trend of knowledge-practice gaps and emphasized the need for comprehensive strategies to improve food safety education and training.

2.2.2 Food Safety Attitudes among food handlers toward food safety

Biruk (2019) explored the attitudes of food handlers towards food safety in selected hospitals in Ethiopia. The research found that while food handlers expressed a positive attitude towards food safety, this did not always translate into safe practices. The study emphasized that intrinsic motivations, such as personal responsibility and concern for patient health, were crucial in influencing food safety behaviors.

Similarly, Aboagye *et al*. (2019) examined the attitudes of food handlers towards food safety in health facilities across Ghana. Their research found that, although food handlers expressed positive attitudes, several factors such as heavy workloads and inadequate supervision hindered their adherence to safe food handling practices. The study underscored the need for supportive management practices to foster a culture of food safety.

Fikadu *et al.* (2019) investigated the impact of managerial support on food safety behaviors among food handlers in Ethiopian hospitals. The study demonstrated that supportive leadership and management commitment significantly enhanced adherence to food safety protocols. This finding underscores the importance of cultivating a culture of food safety within healthcare institutions.

The attitudes of food handlers towards food safety were also assessed by Yared *et al*. (2020) in Ethiopia. Their findings indicated a mixed perspective among respondents; while many acknowledged the importance of food safety, some exhibited complacent attitudes, believing that adherence to basic hygiene practices was sufficient to prevent foodborne illnesses. Approximately 30% of participants held the belief that foodborne illnesses were unlikely if hygiene measures were followed. Such attitudes can significantly impact compliance with food safety protocols and reflect findings from Zemichael *et al.* (2019), which underscored the role of attitudes in influencing food safety practices. There is a clear need for targeted interventions to alter these perceptions among food handlers.

Additionally, Ntsama *et al.* (2019) in Cameroon noted similar findings, indicating that food handlers often underestimated the risks of foodborne illnesses, which affected their commitment to adhering to safety practices. These attitudes highlight the necessity for interventions aimed at changing perceptions and reinforcing the importance of rigorous food safety practices.

2.2.3 Food Safety handling Practice among food handlers

Research conducted in various countries within the African region has revealed a strong correlation between attitudes and practices related to food handling. In Bahir Dar, Ethiopia, a study by Nigusse *et al*. (2012) found that individuals' beliefs regarding food handling significantly influenced their actual practices. Similarly, Kibret *et al.* (2012) reported that the educational background of food handlers in central Nigeria played a crucial role in determining their food handling practices.

Additionally, Osei (2021) examined food safety practices in public hospitals in Kumasi, Ghana. Their findings indicated that, while many food handlers were aware of the importance of hygiene, they often lacked the necessary resources and facilities to implement safe practices effectively. The study called for improvements in infrastructure and resource allocation to enhance food safety compliance.

Furthermore, Tadesse *et al.* (2017) investigated food safety practices in hospitals within the Southern Nations, Nationalities, and Peoples' Region (SNNPR) of Ethiopia. The study identified that inadequate resources, such as a lack of proper equipment and facilities, contributed to unsafe food handling practices. Participants expressed the need for improved infrastructure and resources to facilitate better food safety compliance.

2.3 Local Perspective of Food Safety

Examining the local perspective on food safety in healthcare facilities within Zambia offers a detailed understanding of the challenges faced and the innovative strategies implemented to enhance food safety practices. Several studies conducted within Zambia provide valuable insights into the intricacies of food safety management in local hospital environments.

2.3.1 Food Safety Knowledge among food handlers

Nkandu (2011) focused on the implementation of food safety regulations within Zambian healthcare facilities. The study examined the enforcement of existing guidelines and identified challenges faced by regulatory authorities. Findings emphasized the need for strengthened enforcement mechanisms and increased awareness among hospital administrators and food handlers to ensure compliance with food safety regulations.

Additionally, Phiri and Ngosa (2020) further highlighted that the lack of regular training sessions was a significant barrier to improving food safety practices among hospital staff. Their study underscored the necessity for continuous education programs tailored to the specific needs of food handlers in healthcare settings.

Sibanda and Chileshe (2019) assessed food hygiene knowledge and practices among food handlers in Kitwe and found similar trends, with participants expressing a desire for more comprehensive training on food safety. They recommended the development of structured training programs that incorporate practical demonstrations to enhance understanding and retention.

Zimba and Nkhata (2021) reviewed food safety knowledge and practices in rural health facilities and reported a critical need for intervention strategies aimed at educating food handlers, particularly in underserved areas with limited access to resources. Their findings emphasized the importance of community engagement in promoting food safety practices.

Chanda *et al.* (2021) explored the impact of food safety education programs on hospital food handlers. The study evaluated the effectiveness of interactive workshops and practical training sessions in improving food safety knowledge and practices. Post-training assessments revealed significant positive changes in food handling behaviors, underscoring the value of continuous education in enhancing food safety standards within Zambian hospitals.

A study conducted on the knowledge, attitudes, and practices of food handlers in restaurants in Kabwe, Zambia, concluded that there was a significant relationship between the levels of knowledge and food hygiene practices (Chipabika, 2014).

2.3.2 Food safety Attitudes among food handlers.

Phiri *et al.* (2017) conducted a study that reviewed patients' perceptions and attitudes towards the safety of food served in hospitals. Through surveys and focus group discussions, patients expressed concerns about the risk of foodborne illnesses during their hospital stays. This research highlighted the crucial role of transparency and effective communication between hospitals and patients in fostering trust and confidence in the safety of meals provided within healthcare facilities.

Mathews and Mweemba (2021) evaluated food safety knowledge and attitudes among food handlers in Ndola. They found that, despite a positive attitude towards food safety, there was a disconnect in the application of safe practices, particularly in high-risk areas such as food preparation and storage. This finding corroborates the work of Mwansa and Mumba (2017), who noted that personal attitudes toward food safety do not always translate into safe practices.

Musonda *et al*. (2020) investigated the socio-economic factors influencing food safety practices among food handlers in local hospitals. Surveys and interviews identified economic constraints and limited access to resources as significant barriers to implementing proper food safety measures. This study underscored the importance of addressing socio-economic disparities and providing adequate resources to ensure equitable food safety standards among hospital staff.

2.3.3 Food Safety Handling Practice among food handlers

Kankwenda and Zulu (2020) examined the role of technology in enhancing food safety practices in Zambian hospitals. Their research explored the implementation of digital monitoring systems and assessed their impact on real-time food safety management. Positive outcomes, such as immediate notifications of temperature deviations and storage issues, highlighted the potential of technology to facilitate prompt corrective actions and maintain food safety standards.

Schmitt *et al*. (2010) investigated the causes of diarrheal cases among individuals seeking treatment at a health clinic serving two townships in Lusaka. The study involved analyzing food preparation and storage practices in 17 households, revealing

the presence of Salmonella in leftover foods. It was determined that these organisms were responsible for causing diarrheal diseases, resulting from poor hygiene practices among food handlers in the affected households. This underscores the significance of implementing proper handling practices to prevent such illnesses.

Luka and Kachapulula (2019) focused on hygiene practices among food handlers in public hospitals, noting that hand hygiene was frequently neglected. They suggested that increased awareness campaigns targeting handwashing techniques, and the proper use of personal protective equipment could lead to improved compliance. Chibanga and Mweemba (2016) conducted a comprehensive study in Lusaka, revealing that while food handlers demonstrated a basic understanding of food safety principles, their practical application was often lacking. The authors emphasized the importance of ongoing training and supervision to bridge the knowledge-practice gap.

The absence of an organized surveillance system is evident due to the lack of proper structural organization and insufficient allocation of resources toward monitoring foodborne diseases. Instances of these illnesses are seldom reported, and there is virtually no exchange of information among regulatory bodies. Consequently, the extent and severity of issues related to foodborne illnesses remain unknown (FAO/WHO, 2005).

In August 2012, a total of 129 cholera cases were documented in Mpulungu, located in northern Zambia. Similarly, between January and April 2016, Lusaka reported and confirmed over 600 cholera cases, resulting in more than 10 fatalities (Ministry of Health, 2012; 11 April 2016). Furthermore, between October 2023 and March 2024, a

total of 20,577 cholera cases were documented in 71 districts across Zambia, resulting in more than 699 deaths. The outbreak of cholera prompted authorities to order schools nationwide to remain closed after the end of the year holiday (Ministry of Health, 2024).

2.4.0 Legal Framework in Zambia

The legal framework governing food safety in Zambia is a multifaceted system designed to ensure the protection of public health and the prevention of food-borne illnesses. Central to this framework is the Food and Drugs Act of 1978, a foundational piece of legislation that empowers regulatory authorities to oversee the production, distribution, and sale of food products, including those served in hospitals. The Act provides the legal basis for setting and enforcing standards, with authorities having the ability to inspect food establishments and take legal action against violations.

Legal Framework in Zambia has been implemented through the appointing members to the health Committee; the Minister from the ministry of health must ensure that there is fair representation of both genders, as well as representation of the youth and individuals with disabilities, in accordance with the Constitution. Additionally, the Act establishes the National Food Laboratory, which is responsible for examining, analyzing, and conducting research to determine the quality, effectiveness, and safety of food items. The Act also grants certain individuals such as Environmental health officers and veterinary officers the authority to enter lands or premises where food items are manufactured in order to inspect them, take samples for investigation, and perform related duties.

In 2009, Zambia introduced the Food and Drugs (Amendment) Act, which bolstered the country's food safety regulations. This amendment introduced stringent penalties for non-compliance, underlining the government's commitment to ensuring adherence to food safety standards. It also granted health inspectors increased authority, enabling them to enforce food safety regulations across various establishments, including hospitals.

Essentially, the Act prohibits the sale, importation, exportation, manufacturing, or storage of food items that are contaminated, adulterated, and unsafe, contain poisonous or harmful substances, or are generally unfit for human consumption. It also forbids the handling of food without obtaining a certificate of compliance or a health inspection report. Similarly, it stipulates that food must be transported and stored in a manner that preserves its composition, quality, and purity. The Act includes extensive provisions to prevent deception in the labeling, packaging, and misleading advertising of food items, and considers the contravention of these specific prohibitions as an offense (Food Safety Act, 2019)

2.4.1 Challenges of Legal Framework in Zambia by Food Industries.

The food industry is currently confronting a range of regulatory and compliance obstacles pertaining to the composition of food, marketing practices, and traceability. These challenges encompass every aspect of the food supply chain, starting from ingredient sourcing and culminating in consumer satisfaction. To illustrate, emerging food trends such as vegan, vegetarian, and organic necessitate the establishment of new regulations. The aim is to ensure a level playing field for all food producers and prevent consumers from being deceived. Moreover, regulations pertaining to front-of-pack

labeling and country of origin labeling have been implemented to enhance transparency in the food market (Musonda, 2020).

The food industry faces a major challenge when it comes to ensuring compliance with regulations, as these regulations are constantly changing. These changes can pertain to various aspects such as privacy, data breaches, governance, and recalls. Furthermore, different regulators at the local levels have varying approaches, which necessitates that compliance professionals within a company are well-versed in the specific regulations applicable to all the locations where the company operates. Moreover, there has been a significant increase in the number of consumers who demand transparency regarding a company's sourcing and supply chain activities. This growing consumer demand has led to a greater emphasis on corporate reputation, particularly in terms of how work is conducted and the compliance principles and expectations in place for employees and business partners. Lastly, due to sluggish organic growth and pressures from stakeholders to enhance value, consolidation is occurring rapidly within the food industry (Sichilima, 2019).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Design

Mixed methods (Concurrent Nested) study design was used to assess food safety knowledge, attitudes, and handling practices among food handlers within the Mufulira District, Zambia. Both structured questionnaire and key informants interviews were conducted. The quantitative approach was used to establish the practices, knowledge and attitudes levels in food safety while the qualitative approach was used to support the quantitative data. Furthermore, the qualitative data was embedded in the quantitative data.

3.2 Study Area

Mufulira District, located in the Copperbelt Province of Zambia, was selected as the study area due to its diverse range of health facilities and a population of approximately 200,182, according to the 2022 Zambian Census. The district is divided into three constituencies: Mufulira, Kantanshi, and Kankoyo. Additionally, Mufulira shares an international boundary with the Democratic Republic of Congo.

Geographically, Mufulira District is situated at coordinates 12°32'08.0"S and 28°14'31.0"E, with latitude of 12.535556 and a longitude of 28.241944. The district lies at an average altitude of 1,274 meters (4,180 feet) above sea level and covers an area of 1,637 square kilometers. It is further divided into 30 wards: David Lunda, Fibusa, Luansobe, Butondo, Mokambo, Mutundu, Kangwa, Nsuluka, Shinde, Kamuchanga, Maina Soko, David Kaunda, Minambe, Mupambe, Bwembya, Silwizya, Bwafwano, Murundu, Mulungushi, Leya Mukuka, Chachacha, Kafue, Kansuswa, Kasempa,

Kawama, Hanky Kalanga, Bwananyina, Bufuke, John Kampengele, Buntungwa, Kwacha, and Mpelebe. The district is drained by several streams, including Luansobe, Butondo, Mupambe, and Kansuswa, which eventually feed into the Kafue River, located approximately 15 kilometers west of the township (Mopani Copper Mine, 2004).

The district has developed around the Mopani Copper Mine, one of the largest copper mines in Zambia. While mining remains the primary economic activity in Mufulira, agriculture and small-scale trade also contribute significantly to the local economy. Mufulira is home to a culturally diverse population, with various ethnic groups enriching the community's social fabric.

Mufulira District is served by several healthcare facilities that address the medical needs of its residents. The primary hospitals include Ronald Ross General Hospital, Kamuchanga District Hospital, Malcom Watson Hospital, and Kawama Hospital. These institutions offer a wide range of services, such as emergency care, outpatient consultations, maternal and child health, and surgical procedures. Together, they play a pivotal role in the health system of the Copperbelt Province (Ministry of Health, 2024).

In addition to these hospitals, numerous health centers and clinics throughout the district provide essential healthcare services, including preventive care, vaccinations, and health education. These facilities are particularly important for improving access to healthcare in rural areas, where residents may face difficulties reaching larger hospitals.

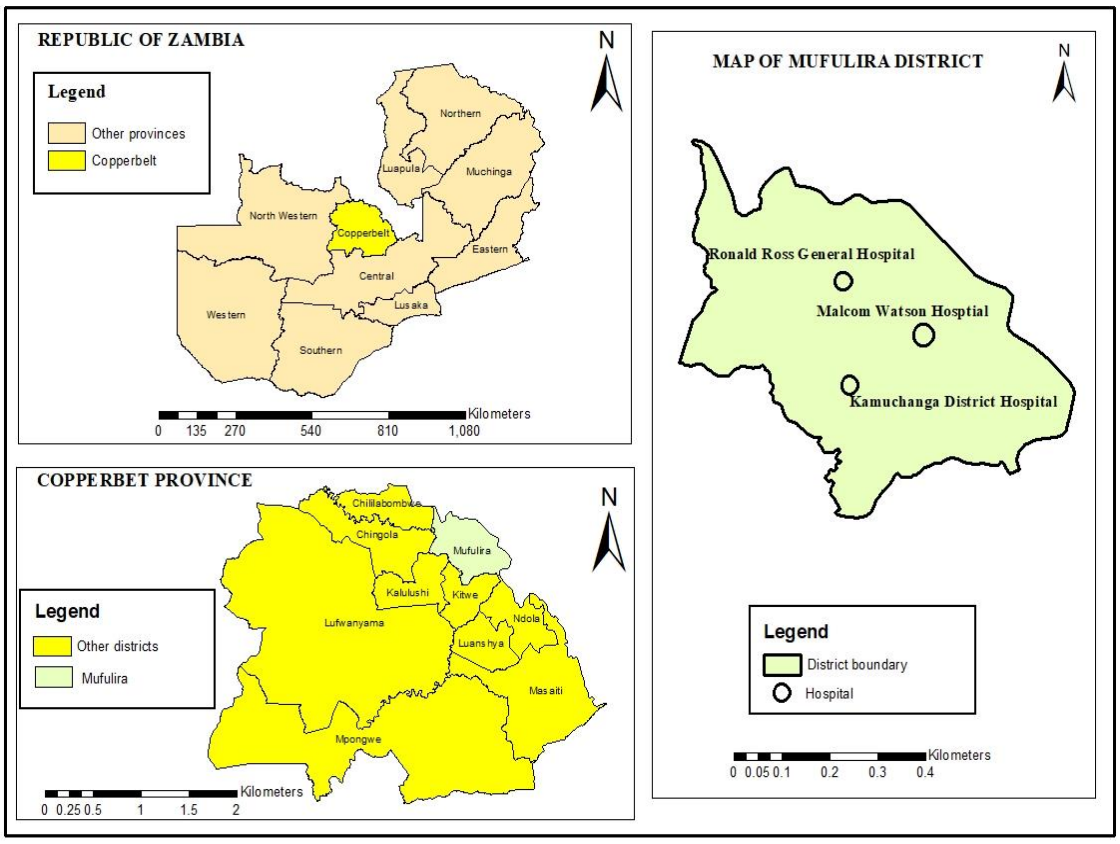

Figure 3.1: Map of the Republic of Zambia showing the study area and sampling points. (Source: generated from Arc GIS software).

3.3 Scope of the study

The study was conducted in a single district, **Mufulira District**, and focused on assessing the knowledge, attitudes, and practices of food handlers, as well as every third member of hospital staff involved in food handling at the selected hospitals: Kamuchanga District Hospital (GRZ), Malcolm Watson Hospital (Private), and Ronald Ross General Hospital (GRZ).

3.4 Study Population

The population for this study comprised food handlers, including cooks, waiters, quality controllers, catering officers, kitchen managers, nutritionists, and nutritional educators

working in hospitals within the selected hospitals in Mufulira District (table 3.1). Specifically, the study focused on individuals responsible for cooking, preparing, and serving food to patients, as well as every third member involved in food handling.

Table 3.1: Inclusion and Exclusion Criteria (the number of years one served did not matter)

INCLUSION	**EXCLUSION**
1. All food handlers who are involved in cooking, preparing and serving food in the selected hospitals of Mufulira district such as cooks, nutritionists, catering officers and quality controller,	Food handlers not directly participating in meal preparation and service such as, doctors, and laboratory personnel.
2. All food handlers above the age of 18 years old.	No subject under the age of 18 were recruited in the study or those that were incapacitated due to any conditions (health or mentally).

3.5 Determination of Sample Size

The sample size was generated using sampling technique formula drawn from Mugenda (1999). The formula below was used to find the sample size of population for this study $n = Z^2Pq/d^2$ Were: Z = Standard normal deviate at the required confidence level 1.96

P = the proportion in the target population estimated to have characteristics being measured (0.5), q = (1- P), d = Level of statistical significance (0.05) Calculations: Taking 3 as the total number of hospitals the sample size was calculated as follows. Since $n = Z^2Pq/d^2$, $n = 1.96^2 (0.5 \times 0.5)/0.05^{2,}$ n = 384 nf= Sample size in population

less than 10,000. N = Estimated target population nf = n/1+ (n/N), nf = 384/ 1+(384)/135 **nf = 100**

The estimated target population size was 100 food handlers in Mufulira district.

3.6 Sampling Techniques for Hospitals

A multistage sampling approach was employed to select the hospitals for the study. Stratified sampling was used to allocate hospitals into their respective strata. This involved dividing the institutions into smaller subgroups, or strata, based on their geographical location: Mufulira Constituency, Kantanshi Constituency, and Kankoyo Constituency. From seven (7) health facilities in Stratum A, one (1) facility was selected; from four (4) health facilities in Stratum B, one (1) was included; and from six (6) health facilities in Stratum C, one (1) was selected. The institutions were randomly chosen to represent the study area.

For the participants, all willing and available food handlers employed in the selected hospitals were invited to participate in the study. This included every third staff member involved in food handling at various levels. No minimum number of years of experience as a food handler was required for inclusion. This approach facilitated the collection of data from the participants, as outlined by Gravetter and Forzano (2012).

The study comprised three hospitals in total: two public and one private. In Hospital X, thirty-five (35) participants were recruited; in Hospital Y, twenty (20) participants were recruited; and in Hospital Z, forty-five (45) participants were recruited.

3.7 Data Collection tools and procedure

This study utilized three types of instruments, namely: questionnaire, observational checklist, and key informant interviews.

3.7.1 Questionnaire

A structured questionnaire with closed-ended questions in English (Appendix II) was developed through an in-depth literature review and administered face-to-face to study participants (food handlers) to collect information on their socio-demographic characteristics and to assess their knowledge, attitudes, and practices regarding food safety.

The first part of the questionnaire aimed to determine the socio-demographic characteristics of the food handlers, including gender, age, education level, work type, and work responsibilities**.**

The second part of the questionnaire focused on assessing the food handlers' knowledge. This section comprised 10 questions, each with two possible responses: “Yes” or “No”**.** The questions were designed to evaluate the participants' understanding of food safety, contamination, pathogens, handwashing, temperature control, and hygienic practices.

The third part of the questionnaire assessed the participants' attitudes towards food safety. This section contained 10 questions, with two possible responses: “Yes” or “No”**.**

The final section of the questionnaire addressed food safety practices. In this part, food handling practices were evaluated based on participants' responses regarding personal

hygiene and other safe food handling practices. This section also included 10 questions with two possible responses: “Yes” or “No”**.** For all questions related to knowledge, attitudes, and practices, participants were required to justify their chosen answers.

3.7.2 Observation Checklists.

An observation checklist (Appendix I) was used to assess the availability of running water, sanitary facilities, lighting, waste management, and food safety practices at the three selected hospital premises. The checklist also evaluated whether food was stored and cooked at appropriate temperatures, whether chemicals were stored separately from food, and whether cross-contamination was prevented. Additionally, the checklist verified that staff used gloves, maintained clean hands, wore proper protective gear, and that change rooms and bathrooms were available for food handlers.

Upon gaining access, the necessary documents required for staff working as cooks and verifying adherence to food safety protocols were observed for two hours. This included checking documents such as food handler certificates, health permits, medical exams, training records, standard operating procedures (SOPs), and waste management records. All documents were provided in hard copy by the kitchen managers. The results were recorded in the checklist for analysis, and the documents were returned to the kitchen managers.

3.7.3 Key informants guide (Appendix iii)

Three key informants were purposively selected, with one informant from each hospital: a nutritionist from Hospital Y and one catering officer from each of Hospitals X and Z. These participants provided valuable insights into food service operations, patient care, rodent control, nutrition, and food sourcing. An interview guide focused on food safety

was developed and used to gather information from the key informants. The researcher meticulously recorded their responses in a notebook.

3.8 Establishing KAP scores

The Knowledge, Attitudes, and Practices (KAP) variables were evaluated to determine the respondents' food safety performance scores. For the KAP assessments, the questions administered were answered with "YES" or "NO." A correct response was awarded 10 points, while an incorrect or "I don't know" response received 1 point (Kainga *et al*., 2022). Overall, KAP mean scores ranged from 1 to 10, with percentage mean scores ranging from 1% to 100%. The mean scores were calculated based on the assessed variables. Individual KAP mean scores were derived for comparison, with the mean scores or percentage mean scores classified as follows: poor (≤ 5.3 or ≤ 53%), fair (5.4–7.9 or 54%–79%), and good (≥ 8.0 or ≥ 80%, respectively). These classifications were adapted from criteria outlined by Norhaslinda *et al.* (2016).

3.9 Data Analysis

The data from the questionnaires were entered and coded into numerical values using Microsoft™ Excel 2019, creating datasets. All datasets were subsequently cleaned, validated, and uploaded into the Statistical Package for Social Sciences (IBM SPSS Statistics, version 26) for analysis.

3.10 Statistical analysis of data

Analytical and descriptive statistics were conducted to generate the results. In this study, the outcome variables (knowledge, attitude, and practice) scores of the respondents regarding food safety, as well as the independent variables, including sex,

ages, and educational level, were identified. Univariate analysis was used to produce the frequency and proportions of the measured variables.

Quantitative data were analyzed using IBM SPSS Statistics (version 26) and Microsoft Office Excel 2019. Descriptive statistics, such as frequencies, means, percentages, and standard deviations, were calculated. The Shapiro-Wilk test was used to assess the normality of the data, and the results indicated that the data were normally distributed.

Knowledge, attitude, and practice (KAP) mean scores, derived from individual percentage scores, were treated as continuous variables. An independent two-sample t-test was conducted to compare the mean scores of continuous variables across independent factors, including the three study hospitals (Kamuchanga District Hospital, Ronald Ross General Hospital, and Malcolm Wattson Hospital) and sex (males and females). Statistical significance was considered at a p-value < 0.05, with equal variances assumed across all hospitals. Analysis of variance (ANOVA, with post-hoc tests using the Tukey method) was performed to compare mean scores and/or mean differences in KAP scores between respondents' professional categories, educational levels, and age groups. The Levene test was employed to verify the assumption of homogeneity of variances, which was confirmed at a p-value > 0.05. Significant differences in the mean KAP scores between comparable groups were considered at a p-value < 0.05.

Analysis of factors associated with KAP scores was conducted using bivariate analysis and a step wise binary logistic regression model. In the bivariate analysis, for categorical variables with dichotomous outcomes (the level of KAP performance),

Pearson chi-square was fitted to test the association of independent variables, and the significant association was considered at p value<0.050. a linear regression model was run to assess the association of other independent factors, the percentage of individual KAP scores was used as an outcome variable. The independent variables retained significance at a cut-point of p≤0.20 and were considered for the next step (Alarakol *et al.,* 2020).

A stepwise binary logistic regression model (Forward-Likelihood Ratio method) was used to assess the strength of associations and identify predictors of the outcomes of interest. The outcome variables (KAP scores) with binary outcomes were fitted to the model, and statistical significance was determined at a 95% confidence interval, with a p-value < 0.05 considered significant. An odds ratio (OR) > 1 indicated a positive predictor, while an OR < 1 was considered a protective factor. The model's fit was validated using the Omnibus test of model coefficients, where factors with p-values < 0.05 were considered statistically significant. The goodness-of-fit of the model was assessed using the Hosmer-Lemeshow test, with a non-significant p-value (p > 0.05) indicating a good fit.

For the qualitative data, information was collected from key informants at hospitals X, Y, and Z. A thematic analysis approach, utilizing open coding, was employed to analyze the data. Themes and categories were organized in NVivo, and comprehensive thematic descriptions were developed based on the key informants' perspectives on food safety within the context of hospital food services. The responses from the key informants were compared, and meaningful conclusions were drawn.

3.11. Ethical Considerations

The approval to conduct research was obtained from University of Zambia Biomedical Research Ethics Committee (UNZABREC-4544-2023) (Appendix IV).The Mufulira District Health Office provided institutional authorization (appendix V). Additionally, permission was sought from the Medical Superintendents of the hospitals. Participants' consent was considered and dealt with professionally by explaining and clarifying to respondents the objectives of the study and ensuring their confidentiality.

CHAPTER FOUR

4.0 RESULTS

This chapter presents the analysis of questionnaire responses from 100 food handlers in Mufulira District hospitals, focusing on their knowledge, attitudes, and practices regarding food hygiene and safety. The results are organized by study objectives and include frequencies, tables, pie charts, and a logistic regression model.

4.1 Socio-demographic characteristics of the study population

Table 4.1 shows that most respondents, 55 (55%), were female. The majority, 56 (56%), were over 26 years old. In terms of education, 29 (29%) had completed primary education, 37 (37%) had secondary education, and 32 (32%) had tertiary education. Additionally, 4 (4%) had no formal education.

Table 4.1: Background Characteristics of Food Handlers in hospital X, Y, Z (n=100)

Characteristic	Hospital X	Hospital Y	Hospital Z
Age Group			
18-20 years	5 (5%)	3 (3%)	4(4%)
21-26 years	10 (10%)	5 (5%)	17 (17%)
Above 26 years	20 (20%)	12 (12%)	24 (24%)
Gender			
Female	20 (20%)	8 (8%)	27 (27%)
Male	15 (15%)	12 (12%)	18 (18%)
Education Level			
None	2 (2%)	0 (0%)	0 (0%)
Primary	5 (5%)	5 (5%)	19 (19%)
Secondary	18 (18%)	10 (10%)	9 (9%)
Tertiary	10 (10%)	6 (6%)	16 (16%)

Table 4.2 shows the distribution of study participants according to their occupations in the Mufulira District hospitals. The data indicates that 10% were nutritionists/dietitians,

66% were cooks/waiters, 6% were catering officers,3% and 9% were kitchen managers and quality controllers, respectively. Additionally, 8% were Nutrition Educators.

Table 4.2: Distribution of the study participants according to occupation in the Mufulira Districts three Hospitals.

Occupation	**Frequency (%)**			**TOTAL**
	Hospital X	Hospital Y	Hospital Z	
Nutritionist/dietetics	3(3%)	2(2%)	5(5%)	10 (10%)
Nutrition Educator	3(3%)	1(1%)	4(4%)	8 (8%)
Cooks	15(15%)	9(9%)	18(18%)	42(42%)
Waiters	8(6%)	4(4%)	10(10%)	22(22%)
Catering officer	2(2%)	1(1%)	3(3%)	6(6%)
Kitchen manager and storekeepers	1(1%)	1(1%)	1(1%)	3(3%)
Quality control officer	3(3%)	2(2%)	4(4%)	9(9%)
Total	35(35%)	20(20%)	45(45%)	100(100%)

4.2 Knowledge towards food safety among food handlers.

4.2.1 Participants' Knowledge Scores

Participants' knowledge scores in this study indicated that only 46.4% of respondents had adequate knowledge, as shown in Table 4.3. This suggests an overall inadequate level of knowledge, with cut-off points categorized as poor (≤ 53%), fair (54%–79%), and good (≥ 80%). The majority of participants (96.0%) demonstrated an understanding of the concept of personal hygiene. However, despite more than three-quarters (79.0%) knowing that skin diseases can lead to food contamination, only 22.0% were aware of the recommended duration for effective handwashing with soap to remove bacteria. Knowledge of the safest method for thawing frozen meat was also inadequate, as only 46.0% of participants knew the correct method. Furthermore, only 24.7% were aware that Salmonella bacteria are commonly associated with poultry products.

Table 4.3: Participants' knowledge score toward food safety.

Knowledge Variables	Response	Frequency (N=100)	Proportion (%)	Knowledge score
Should different food categories be	YES	16	16.0**	16.0
stored at different temperature?	NO	84	84.0	
Do you know what personal Hygiene Is?	YES	96	96.0**	96.0
	NO	4	4.0	
Can you define Cross Contamination	YES	32	32.0**	32.0
	NO	68	68.	
Do you know the Effective Way	YES	86	86.0**	86.0
Of storing different food	NO	14	14.0	
Do you know the best way of thawing	YES	46	46.0**	46.0
Frozen Meat	NO	54	54.0	
Can Skin infection Contaminate food?	YES	79	79.0**	79.0
	NO	21	21.0	
Do you know the chemicals used for	YES	32	32.0**	32.0
Cleaning and sanitizing Equipment	NO	68	68	
Are you familiar with FIFO Protocol in	YES	30	30.0**	30.0
food hygiene and safety	NO	70	70.0	
Do you know the duration one has	YES	22	22.0**	22.0
To take effectively wash the hands	NO	78	78.4	
Is Salmonella bacteria pathogens	YES	25	25.0**	25.0
associated with poultry products?	NO	75	75.0	
Participants' average knowledge scores %			(464/10)	46.4

n=Number of participants **= Percentage for knowledge scores
Note: The cut-off point was considered as Poor (less than and equal to 53%) fair (54%-79%) and good (80% and above).

4.2.2 Participants' Mean Knowledge Scores across the three hospitals

The findings in table 4.4 reveal the level of knowledge among food handlers across three hospitals. The cut-off points were considered as Poor (less than and equal to 5.3), fair (5.4-7.9) and good (8.0 and above). The findings indicate that respondents in Hospitals X, Y, and Z had good knowledge of personal hygiene, with a mean score of 8.91, 10.00, and 9.81, respectively. Overall, respondents demonstrated a good understanding of personal hygiene, reflected in an inter-hospital mean score of 9.57.

In terms of effective food storage, Hospital X exhibited fair knowledge with a mean score of 6.09, while Hospitals Y and Z demonstrated good level of knowledge, with mean score of 10.00 and 9.62, respectively. Overall, knowledge of effective food storage was rated good, with an inter-hospital mean score of 8.26. However, there was a significant gap in knowledge regarding temperature control. Hospitals X, Y, and Z demonstrated low levels of knowledge, with a mean score of 1.35, 1.88, and 1.58, respectively. Overall, the inter-hospital mean score for temperature control was low at 1.59.

In terms of understanding cross-contamination, respondents from Hospital Y demonstrated a fair level of knowledge, with a mean score of 5.31. In contrast, Hospitals X and Z exhibited low levels of knowledge, with mean scores of 1.52 and 2.69, respectively. Overall, the knowledge level regarding cross-contamination was low, as indicated by an inter-hospital mean score of 3.17. Regarding proper thawing methods for frozen meat, Hospital Y showed a fair level of knowledge, with a mean rank of 7.17, while Hospitals X and Z demonstrated low levels of knowledge, with mean scores of

3.13 and 3.46, respectively. Overall, knowledge about the best methods for thawing frozen meat was low, reflected in an inter-hospital mean score of 4.57.

Table 4.4: Mean Score of food safety knowledge performance across three hospitals

Food Safety Knowledge	**Correct Response (№ of respondent)**			
	Hospitals X	**Hospital Y**	**Hospital Z**	**Inter-Hospital Mean**
Temperature Control	1.35* (35)	1.88* (20)	1.58* (45)	1.59* (100)
Personal Hygiene (Definition)	8.91* (35)	10.00* (20)	9.81* (45)	9.57* (100)
Cross Contamination	1.52* (35)	5.31* (20)	2.69* (45)	3.17* (100)
Effective Storage (Food storage)	6.09* (35)	10.00* (20)	9.62* (45)	8.57* (100)
Thawing of Frozen Meat (Safest method)	3.13* (35)	7.17* (20)	3.46 (45)	4.57* (100)
Skin infection Contaminate food	8.74* (35)	9.69* (20)	5.19* (45)	7.87* (100)
Cleaning and sanitizing Equipment	2.13* (35)	4.17* (20)	3.46* (45)	3.25* (100)
FIFO Protocol	1.35* (35)	2.67* (20)	4.85 (45)	2.96* (100)
Duration of Hand wash	1.02* (35)	3.11* (20)	2.35* (45)	2.16* (100)
Food Borne Pathogen (Salmonella)	1.02* (35)	5.04* (20)	1.35* (45)	2.47* (100)

* mean for answers.
Note: Questions were multiple-choice options"yes,"no" that required justification for the selected answer.
Note: The cut-off points were considered as Poor (less than and equal to 5.3) fair (5.4-7.9) and good (8.0 and above). The range was (1 - 10)

4.2.3 Participants' Mean Knowledge Scores across all the independent variables

The findings in (table 4.5) reveal the Variations of knowledge, study hospital, age, gender and profession categories of food handlers. The scores among respondents were observed through a comparison of mean scores and/or mean differences. Independent two sampled t-test was run to compare the mean scores and mean differences of the study hospitals and sex of respondents, meanwhile, analysis of variance (ANOVA, Post Hoc Tests using the Tukey method) was used to compare mean scores and/or mean differences of other independent factors.

The mean scores for knowledge in Hospital X,Yand Z were statistically significant (p=0.000**)**. Respondents from Hospital Y were more knowledgeable to engage in food safety practices than participants from hospital X and hospital Z. (OR: 1.926, 95% CI: 1.046–3.545; p-value<0.05). Further, increasing the age of respondents was statistically significantly associated with better knowledge towards good handling practices (P-value=0.05).

Additionally, based on the professional category of the respondents, the mean knowledge scores were statistically significant (p=0.000. On education level, Respondents who attained tertiary education were significantly associated with better knowledge towards food safety practices compared to respondents who attained other education levels (p=0.035).

Table 4.5: Participants' Mean Knowledge Scores across all the independent variables

Variables	Frequency (n=100)	Mean	Knowledge score Std dev	95% CI
Study Hospitals				
Hospital X	35	3.52	2.25	2.76-4.28
Hospital Y	20	5.90	1.77	5.12-6.68
Hospital Z	45	3.47	1.21	2.91-4.03
			P-value=0.000**	
Sex				
Males	45	3.20	1.93	2.18-4.22
Females	55	6.80	2.03	5.81-7.79
			P-value=0.000**	
Age				
18-20	11	5.27	2.19	4.84-5.71
21-26	32	5.33	2.03	4.74-5.92
Above 26	56	6.22	1.57	5.66-6.78
			P-value=0.05**	
Education Level				
None	2	5.00	1.55	4.77-5.33
Primary	29	5.28	1.68	4.63-5.93
Secondary	37	5.66	2.08	5.07-5.65
Tertiary	32	6.52	1.68	5.77-7.27
			P-value= 0.058	
Professional Categories				
Quality control officer	9	4.10	1.43	2.87-5.33
Nutritionist/dietetics	10	5.56	0.76	1.65-3.47
Nutrition Educator	8	6.10	1.83	4.79-7.41
Cooks	42	3.09	0.92	2.36-3.82
Waiters	22	4.07	1.22	3.13-5.01
Catering officer	6	7.09	2.12	4.46-9.72
Kitchen managers	3	5.00	2.00	-2.45-12.45
			P-value=0.000**	

**=Indicates significance statistics at p-value < 0.05; Std dev= Standard deviation CI=Confidence interval at α=0.05

4.2.4 Variation of knowledge scores among respondents in sampled hospitals

The findings presented in Figure 4.1 show the variation in knowledge among respondents in three sampled hospitals. The data reveal that only 45.7% of respondents from Hospital X possess adequate knowledge, indicating insufficient food safety knowledge, with cutoff points defined as poor (≤ 53%), fair (54%-79%), and good (≥ 80%). Furthermore, only 55% of respondents in Hospital Y exhibited adequate knowledge, reflecting a fair level of knowledge based on the same cutoff points. Additionally, only 42.2% of respondents from Hospital Z demonstrated adequate knowledge, indicating inadequate knowledge according to the specified cutoff points of poor (≤ 53%), fair (54%-79%), and good (≥ 80%).

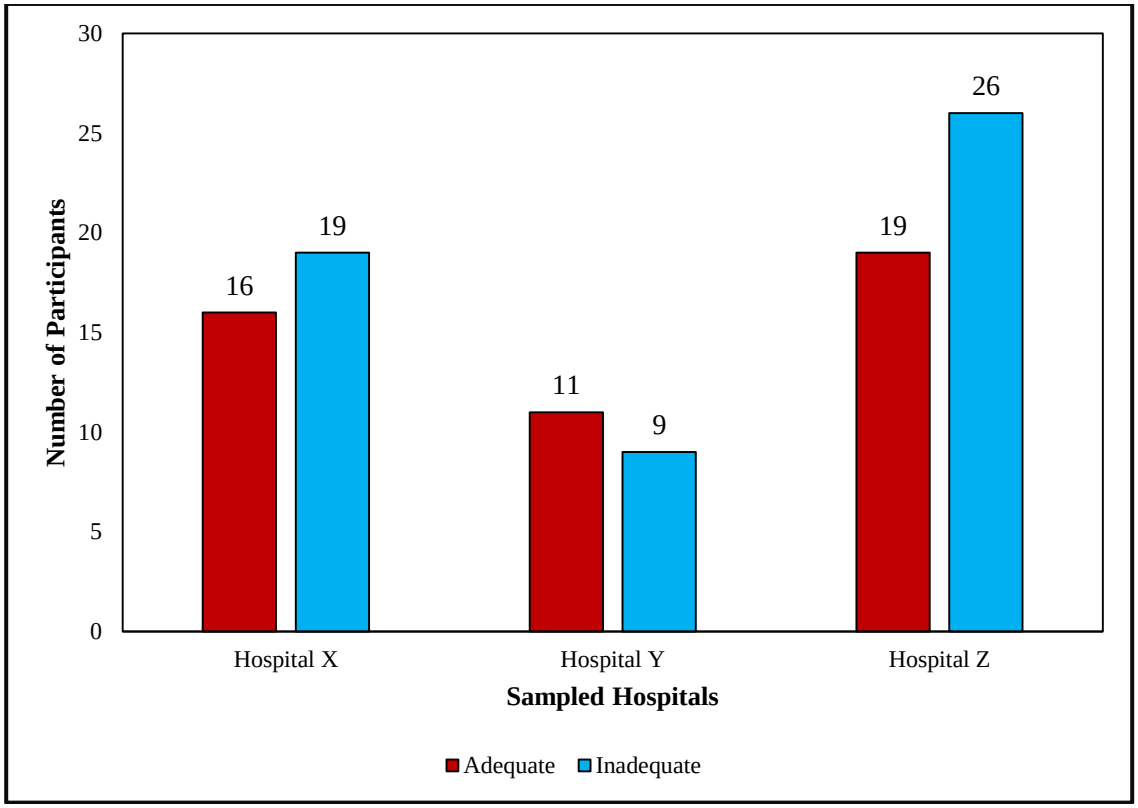

Figure 4.1: Variation of knowledge scores among respondents in three hospitals

4.3 Attitudes towards food safety

4.3.1 Participants' Attitude Mean Scores

The participants' mean attitude score was 94.0%, indicating a positive attitude towards food safety. The cut-off points were categorized as follows: poor (≤ 53%), fair (54%-79%), and good (≥ 80%). Of the respondents, 89.0% expressed concern about improving hygiene practices to reduce the risk of food borne diseases, and 97.0% believed that it is the responsibility of food handlers to prevent food borne illnesses. Additionally, all food handlers (100%) were willing to attend regular food safety training sessions in hospitals (Table 4.6).

Table 4.6: Participant Attitude score toward food safety.

Attitude Variables	Response	Frequency (N=100)	Proportion (%)	Attitude score
Are you concern about improving hygiene practices to reduce the risk of food-borne diseases?	YES	88	88.0**	88.0
	NO	12	12.0	
Do you believe that responsibility of food handlers in preventing foodborne illnesses?	YES	97	97.0**	97.0
	NO	3	3.0	
Do you think there is a need for regular food safety training sessions in this hospital?	YES	100	100.0**	100.0
	NO	0	0	
Do you believe that thorough handwashing can prevent foodborne illnesses?	YES	97	97.0**	97.0
	NO	3	3	
Do you immediately seek medical attention when you accidentally cut yourself when handling food or when ill?	YES	88	88.0**	88.0
	NO	12	11.7	
Participants' average knowledge scores %			(470/5)	94.0

n=Number of participants **= Percentage for knowledge scores
Note: The cut-off point were considered as Poor (less than and equal to 53%) fair (54%-79%) and good (80% and above).

4.3.2 Participants' Attitude Mean Scores across sampled hospitals

Table 4.7 presents the mean scores of attitudes toward food safety among food handlers in sampled hospitals. The cut-off points were considered as Poor (less than and equal to 5.3) fair (5.4-7.9) and good (8.0 and above). Respondents from Hospitals X, Y, and Z demonstrated a positive attitude toward enhancing food hygiene to prevent foodborne illnesses, with mean scores of 9.35, 8.13, and 8.85, respectively. Overall, attitudes toward improving food hygiene across the hospitals were positive, as reflected in an inter-hospital mean score of 8.78.

Attitudes toward preventing food poisoning were favorable in all facilities, with Hospitals Y and Z achieving a mean score of 10.00, while Hospital X had a mean score of 9.13. Overall, respondents demonstrated good attitude toward preventing food poisoning, reflected in an inter-institutional mean score of 9.71.

Additionally, regarding food safety training programs, Hospitals X, Y, and Z had a mean score of 10.00. This indicates a widespread positive attitude toward food hygiene training, with an inter-hospital mean score of 10.00. Attitudes toward handwashing before food handling were positive across all hospitals, with mean scores of 9.13, 10.00, and 10.00 for Hospitals X, Y, and Z, respectively. Overall, respondents exhibited a positive attitude toward hand washing, as indicated by an inter-hospital mean score of 8.83.

Additionally, respondents from Hospitals X, Y, and Z demonstrated positive attitudes toward avoiding working while sick, with mean scores of 7.83, 10.00, and 8.65,

respectively. Generally, respondents exhibited a good level of attitudes in this area, reflected by an inter-hospital mean score of 8.83.

Table 4.7: Mean Score of Attitude toward food safety across the hospitals

Attitudes toward food safety	**Positive Response (№ of respondent)**			
	Hospitals X	**Hospital Y**	**Hospital Z**	**Inter-Hospital Mean**
Improving hygiene	9.35* (35)	8.13* (20)	8.85* (45)	8.78* (100)
Preventing food poisoning	9.13* (35)	10.00* (20)	10.00* (45)	9.71* (100)
Food Safety Training	10.00* (35)	10.00* (20)	10.00* (45)	10.00* (100)
Cleaning hands	9.13.* (35)	10.00* (20)	10.00* (45)	9.71* (100)
Avoid working when sick	7.83* (35)	10.00* (20)	8.65* (45)	8.83* (100)

* Mean for answers.
Note: Questions were multiple-choice options that required justification for the selected answer.
Note: The cutoff- point were considered as Poor (less than and equal to 5.3) fair (5.4-7.9) and good (8.0 and above).

4.3.3 Participants' Mean Attitude Scores across all the independent variables

Respondents from Hospital Y demonstrated more positive attitudes toward food safety (mean score = 9.62 ± 10.59; p = 0.000) compared to those from Hospitals X and Z (Table 4.8). Additionally, a statistically significant correlation was found between increasing respondent age and more favorable attitudes toward food safety practices (p = 0.009). Regarding professional categories, there were no significant differences in mean attitude scores (p = 0.191). Respondents with tertiary education were notably more likely to exhibit better attitudes toward food safety practices (p = 0.0002).

Table 4.8: Participants' Mean Attitude Scores across all the independent variables

Variables	Frequency (n=100)	Attitude score Mean	Std dev	95% CI
Study Hospitals				
Hospital X	35	9.08	2.13	8.35-9.81
Hospital Y	20	9.62	2.17	8.65-10.59
Hospital Z	45	9.50	2.25	8.83-10.17
		P-value= 0.598		
Sex				
Males	45	9.33	14.91	7.50- 5.60
Females	55	9.43	1.49	5.17- 5.69
		P- value= 0.965		
Age				
18-20	11	8.27	2.19	4.84-5.71
21-26	32	9.20	2.03	4.74-5.92
Above 26	56	9.98	1.57	5.66-6.78
		P-value= 0.009**		
Education Level				
None	2	5.00	2.25	-4.51-14.51
Primary	29	7.28	2.25	6.35-8.21
Secondary	37	8.66	1.79	7.90-9.42
Tertiary	32	9.52	1.87	8.78-10.26
		P-value= 0.0002**		
Profession Categories				
Cooks	42	8.09	1.83	7.41-8.75
Waiters	22	8.67	2.04	7.73-9.61
Catering officer	6	9.09	2.65	6.86-11.32
Quality control officer	9	9. 41	2.39	5.88- 8.95
Kitchen managers	3	9.00	3.00	4.09-13.91
Nutritionist/dietetics	10	9.50	2.14	8.22-10.78
Nutrition Educator	8	9.90	2.54	8.23-11.57
		P-value= 0.191		

**=Indicates significance statistics at p-value < 0.05; Std dev= Standard deviation CI=Confidence interval at α=0.05

4.3.4 Variation of attitude scores among respondents in three hospitals

The findings illustrate the variation in attitude scores across the three hospitals (Figure 4.2). Respondents from Hospital X achieved a score of 94%, indicating a positive attitude, based on the cutoff points of poor (≤ 53%), fair (54%-79%), and good (≥ 80%). Similarly, respondents from Hospital Y attained a score of 95%, also reflecting a positive attitude. Respondents from Hospital Z had a mean score of 93%, which likewise indicates a positive attitude according to the same cutoff points.

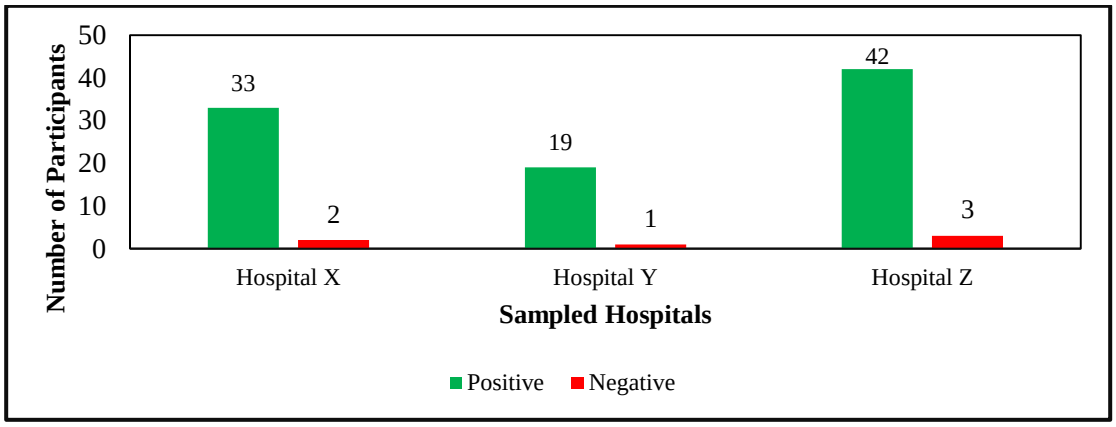

Figure 4.2: Variation of attitude scores among Respondents in sampled hospitals

4.4 Practices towards Food Safety

4.4.1 Participants' Practice Mean Scores

In this study, the average practice score of participants was 45.0% (Table 4.9), indicating poor food safety practices at cut point of (poor ≤ 53%), fair practices (54–79%), and good practices (≥ 80%). Among the respondents, 66.0% reported not wearing gloves when handling cooked food, and only 49.0% dried their hands with a clean towel or hand dryer after washing. Furthermore, just 20.0% indicated that they were provided with a changing room. Additionally, only 45.0% of participants reported consistently separating raw and cooked food during storage.

Table 4.9: Participants' Practice score toward food safety.

practices Variables	Response	Frequency (N=100)	Proportion (%)	Practice score
Do you wear Gloves when handling food/ready to eat food	YES	34	34.0**	34.0
	NO	66	66.0	
Do you avoid working when you are sick with a cold or diarrhea?	YES	75	75.0**	75.0
	NO	25	25.0	
Do you wash your hands with water and soap before handling food?	YES	84	83.0**	83.0
	NO	16	16.0	
Are you provided with Change room	YES	20	20.0**	20.0
	NO	80	80.0	
Do you separate raw and cooked food during storage?	YES	45	45.0**	45.0
	NO	55	55.0.	
Do you dry your hands with a dry cloth or a hand dryer after a hand wash?	YES	49	49.0**	49.0
	NO	51	51.0	
Are you provided with shower room	YES	20	20.0**	20.0
	NO	80	80.0	
Do you know the importance of hand drying after hand wash	YES	17	17.0**	17.0
	NO	83	83.0	
Do you know how often you Should cut your nails?	YES	37	37.0**	37.0
	NO	63	63.0	
Do you clean the contact surfaces, such as cutting boards or tables, before handling food?"	YES	70	70.0**	70.0
	NO	30	30.0	
Participants' mean average Practice scores %			(450/10)	45

n=Number of participants **= Percentage for knowledge scores

Note: The percentage cut-off points were considered as Poor (less than and equal to 53%) fair (54%-79%) and good (80% and above).

4.4.2 Participants' Practice Mean Scores across sampled hospitals.

Table 4.10 presents the level of practices among food handlers in Hospitals X, Y, and Z. The cut-off points were considered as Poor (less than and equal to 5.3) fair (5.4-7.9) and good (8.0 and above). The findings revealed that respondents in Hospitals X, Y, and Z exhibited good hand washing practices with soap before handling food, with a mean score of 8.13, 8.13, and 8.85, respectively. Overall, respondents across the hospitals demonstrated good level of hand washing practices, as indicated by an inter-hospital mean score of 8.37.

Regarding the avoidance of work while ill with diarrhea or a cold, the findings revealed that Hospitals X and Z exhibited good levels of practice, with a mean score of 10.00 for both, while Hospital Y showed a low level of practice with a mean score of 2.50. Overall, respondents across the hospitals demonstrated a fair level of practice concerning this issue, as indicated by an inter-hospital mean score of 7.50.

In terms of glove use when handling ready-to-eat foods, Hospital Y exhibited a fair level of practice with a mean score of 6.88, while Hospitals X and Z demonstrated low levels with mean scores of 1.52 and 1.92, respectively. Overall, glove use when handling ready-to-eat food was low across the hospitals, as indicated by an inter-hospital mean score of 3.44.

Regarding hand-drying practices after hand washing, Hospital Y exhibited a fair level of practice with a mean score of 6.88, while Hospitals X and Z showed low levels with mean scores of 4.48 and 3.26, respectively. Overall, the practice of hand drying with a towel or hand dryer was low across the hospitals, as indicated by an inter-hospital mean

score of 4.87. Additionally, regarding the cleaning of contact surfaces before handling food, Hospitals Y and Z demonstrated good handling practices, with mean scores of 8.33 and 8.85, respectively. In contrast, Hospital X showed fair level of handling practices, with a mean score of 5.65. Overall, the practices in this area were fair across the hospitals, as indicated by an inter-hospital mean score of 7.61.

Table 4.10: Mean Score of Practices toward food safety among the participants

Practices toward food safety	**Correct Response (№ of respondent)**			
	Hospitals X	**Hospital Y**	**Hospital Z**	**Inter-Hospital Mean**
Hand Wash with Soap	8.13* (35)	8.13* (20)	8.85* (45)	8.37* (100)
Wearing of Gloves (When handing cooked food)	1.52* (35)	6.88* (20)	1.92* (45)	3.44* (100)
Draying of hands after (Hand wash)	4.48* (35)	6.88* (20)	3.26* (45)	4.87* (100)
Avoid working when sick	10.00* (35)	2.50* (20)	10.00* (45)	7.50* (100)
How often do you cut? Your finger nails	3.65* (35)	4.63* (20)	2.77* (45)	3.68 (100)
Change room provided	1.52* (35)	10.00* (20)	1.69* (45)	4.40* (100)
Cleaning contact Surface before handling food	5.65* (35)	8.33* (20)	8.85* (45)	7.61* (100)
Importance of hand drying after hand wash.	1.00* (35)	2.45* (20)	1.56* (45)	1.67* (100)
Shower rooms provided?	0* (35)	10.00* (20)	0* (45)	3.33* (100)
Do you separate raw and Cooked food during storage	4.67* (35)	4.89* (20)	3.87* (45)	4.47* (100)

* Mean for answers.

Note: Questions were multiple-choice options (yes or no) that required justification for the answer.

Note: The Mean Rank scores were considered as Poor (less than and equal to 5.3) fair (5.4-7.9) and good (8.0 and above). The range score was (1-10)

4.4.3 Participants' Mean Practice Scores across all the independent variables

A higher level of education was significantly associated with better food safety practices ($p = 0.001$) among respondents. Regarding professional categories, mean practice scores were statistically higher among nutritional educators/nutritionists (5.894 ± 1.2887; $p = (0.003)$ compared to cooks, waiters, catering officers, and quality controllers (Table 4.11). Additionally, an increase in the age of respondents was significantly associated with improved food safety practices ($p = 0.001$). However, no significant association was found between the independent factors (education level, sex, age) and practice scores when considered together ($p > 0.05$).

Table 4.11: Participants' Mean Practice Scores across all the independent variables

Variables	Frequency (n=100)	Practices score Mean	Std dev	95% CI
Study Hospitals				
Hospital X	35	4.06	1.13	3.38-4.78
Hospital Y	20	6.46	1.10	5.52-7.40
Hospital Z	45	4.27	1.09	3.64-4.90
		P-value= 0.000**		
Sex				
Males	45	4.77	1.71	4.69-5.29
Females	55	4.99	1.57	4.48-5.05
		P-value= 0.512		
Age				
18-20	11	4.73	1.65	4.34-5.12
21-26	32	5.035	1.54	4.59-5.47
Above 26	56	5.06	1.73	4.44-5.67
		P-value=0.832		
Education Level				
None	2	3. 16	1.22	3.68-4.64
Primary	29	7.28	2.25	6.35-8.21
Secondary	37	4.87	1.69	4.64-5.11
Tertiary	32	5.87	1.16	5.35-6.39
		P-value= 0.0001**		
Professional Categories				
Cooks	42	3.09	1.83	7.41-8.75
Waiters	22	3.82	1.62	4.44- 5.26
Catering officer	6	4.11	1.22	3.65-4.56
Quality control officer	9	4.92	1.65	4.65-5.20
Kitchen managers	3	4.28	1.88	3.31-5.25
Nutritionist/dietetics	10	5.12	1.63	4.63-5.62
Nutrition Educator	8	5.89	1.28	5.21-6.58
		P-value= 0.0003**		

**=Indicates significance statistics at p-value < 0.05; Std dev= Standard deviation CI=Confidence interval at α=0.05

4.4.4 Variation of practices scores among participants in sampled hospitals

The findings presented in Figure 4.3 reveal variations in handling practices among respondents in the three hospitals. Specifically, 48.6% of respondents in Hospital X demonstrated good handling practices, indicating that the remaining respondents exhibited inappropriate handling practices according to the cutoff points: poor (≤ 53%), fair (54–79%), and good (≥ 80%). Additionally, respondents in Hospital Y achieved a mean score of 50%, which also reflects inappropriate handling practices. Similarly, respondents in Hospital Z exhibited inappropriate practices, with a mean score of 42.2%, falling within the cutoff points of poor (≤ 53%), fair (54–79%), and good (≥ 80%).

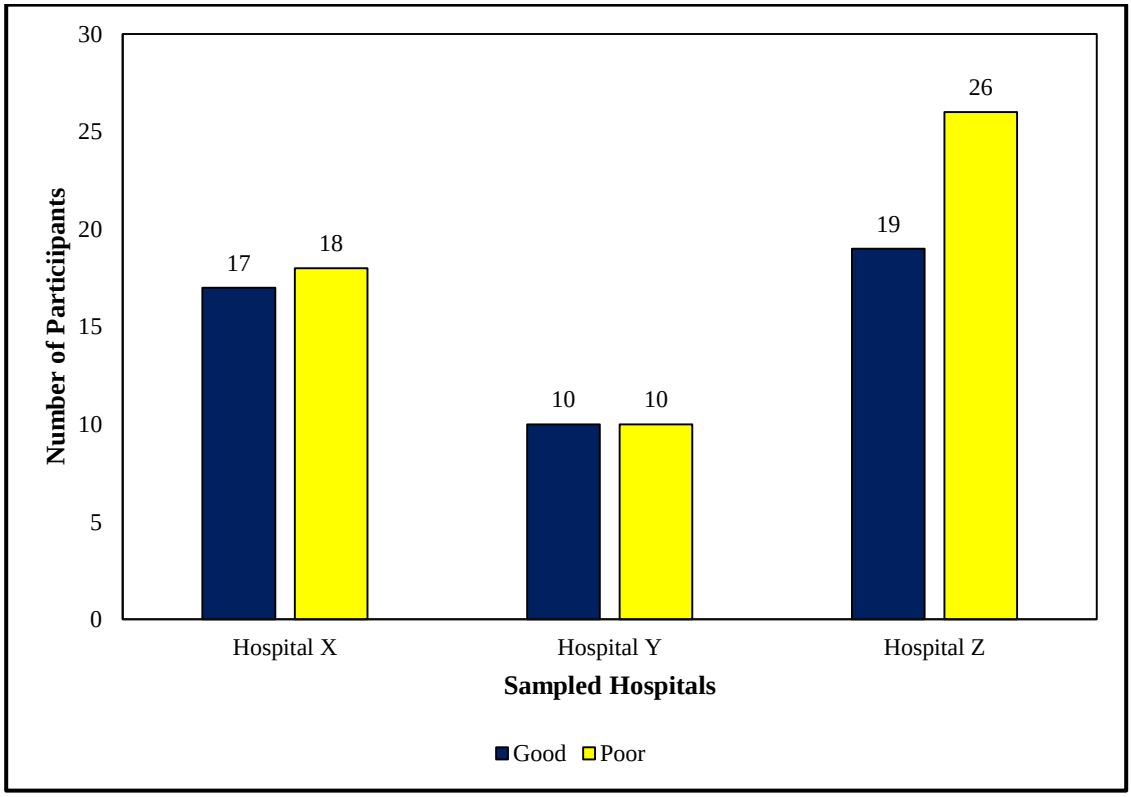

Figure 4.3: Variation of practices scores among Respondents in sampled hospitals

4.5 Participants' KAP performance scores towards Food Safety.

Table 4.12 presents the respondents' Knowledge, Attitudes, and Practices (KAP) performance scores towards food safety. The levels of knowledge, attitudes, and practices were categorized based on individual mean scores, with cut-off points for poor (≤ 53), fair (54–79), and good (≥ 80) performance. Among the respondents, only 46.4% demonstrated adequate knowledge, 94.0% exhibited positive attitudes, and 45.0% demonstrated good food safety practices.

Table 4.12: KAP performance scores among respondents towards Food safety in three hospitals

Outcome Variable	Score	cut-point	Proportion %	95% CI
Knowledge				
Adequate knowledge	46.4	≥ 8.0	46.4%	36.6-56.2
Inadequate knowledge	**53.6**	≤ 79 ≤ 53	**53.6%**	43.8-63.4
Attitudes				
Positive attitudes	**94.0**	≥80	**94.0%**	89.4-98.7
Negative attitudes	6.0	≤79 ≤ 53	6.0%	1.35-10.65
Practices				
Good practices	45	≥ 80	45.0%	35.3-54.7
Poor practices	**55**	≤ 79 ≤ 53	**55.0%**	45.2-64.7

4.6 Association between knowledge, attitudes, and practices towards Food Safety

The level of practice was defined as the outcome variable, with scores ≥80% classified as 'good knowledge', scores ≤53% classified as 'low knowledge', and scores between 54–79% classified as 'fair knowledge'. Knowledge and attitudes were considered predictor variables. A Pearson Chi-square test was performed to assess the associations

between good knowledge, good practices, and positive attitudes. A statistically significant association was found between good knowledge and good practice ($\chi 2$=60.70;p=0.000), whereas no statistically significant association was observed between positive attitudes and good handling practices ($\chi 2$=0.0202; p=0.03). Additionally, a stepwise binary logistic regression analysis was conducted to evaluate the strength of the associations between good knowledge, good practices, and positive attitudes. The results revealed that respondents with good knowledge were three (3) times more likely to possess good knowledge of food handling practices in the study area (p = 0.000) (Table 4.13)

Table 4.13: Association between the level of knowledge, attitudes, and practices

Factor	Frequency (n=100)	Cut-point	OR	95% CI	P-value
Knowledge score					
Adequate knowledge	46 (46.4%)	≥ 8.0	0.34	36.6-56.2	0.000
Inadequate knowledge	54 (53.6%)	≤ 79 ≤ 53	Ref		
Attitudes score					
Positive attitudes	94 (94.0%)	≥80%	0.1	0.57-1.747	0.1
Negative attitudes	6 (6.0%)		Ref		

Ref: Reference category OR: Odds Ration n= Total number of respondents

4.7 Checklist Observations

This section presents the observations from the checklist used to assess various aspects of food safety practices among food handlers, as well as record-keeping and documentation. The checklist was developed following a thorough literature review and an iterative process of revision and testing by a group of experienced ethics consultants.

Table 4.14 presents the results from the observation checklist. It was noted that only 26 respondents had completed food hygiene training. Additionally, none of the three hospitals had established kitchen standard operating procedures (SOPs) regarding food safety. In terms of sanitary facilities, only Hospital Y had a designated changing room and bathing area specifically for food handlers, while the other hospitals lacked these facilities. Health permits were present in all three hospitals.

Table 4.14: The checklist observation for participants' in three sample hospitals involved systematically evaluating food safety practices across different categories.

Documents	Hospitals X	Hospital Y	Hospital Z
Medical Examination (Evidence)	• Yes=10 • No=25	• Yes=15 • No=5	• Yes=15 • No=30
Training in food hygiene (Certificate)	• Yes= 5 • No=30	• Yes=8 • No=12	• Yes=15 • No=30
Waste Management Record	• Poor	• Poor	• Poor
Kitchen SOP	• SOPs absent	• SOPs absent	• SOPs absent
Sanitary Facilities	• No Change Room	• Change Room present	• No change Room
Health Permit	• Present	• Present	• Present

4.8 Key Informants Interview

The qualitative results analyzed from the key informants. Key informants were interviewed regarding food safety and the following major themes emerged from interviews; food storage and safety, Management of leftover food, sources of food, special consideration, Pest control, and hand washing with soap (Table 4.15). The

findings from revealed a generally positive approach, with good practices in food storage, hand washing, and pest control. Perishable items are refrigerated, and leftover food is either discarded or stored for re-cooking. Pest issues, particularly with cockroaches, are addressed through chemical treatments. However, inconsistencies exist, particularly in leftover food management and pest control

Table 4.15: Results for qualitative thematic analysis of key informants' perspective on food safety in selected Hospitals.

Major Theme	Sub Themes
Food storage and Safety	• Store meat product in a refrigerator • Store Perishable Vegetables in a refrigerator • Keeps dry food in a storeroom • It is very important to refrigerate food • Microorganisms cannot survive in low temperature
Leftover food management	• Discard leftover food if not fit for human consumption • Store Leftover food in the refrigerator • Give leftover food to bedsitters. • Re-cooking the following day • Store in the fridge and cook the following day
Sources of food	• Buy meat products from supermarkets • Purchasing vegetables from the Local farmers
Food Serving Process	• Serve food using a trolley
Pest Control	• Encountered pests, such as cockroaches, in the hospital kitchens. • Environmental Health department control pests • Spray Chemicals to control pests
Hand washing practice	• Wash hands often • Wash with soap water After visiting toilet • Before preparing food • When changing tasks

4.8.1 Food storage and Safety

Participants were asked about how food is stored and the importance of food storage to which most of them indicated that it was very important to store food in refrigerator because food cannot be spoiled or cannot go bad. They believe that refrigeration can prevent food spoilage and that some microorganisms cannot survive at very low temperature. They further expressed the goodness of a freezer or fridge though most.

*Yes, it is very important as it is one way to avoid spoilage of food stuff and it can even be kept in the fridge for some time if it is not for immediate use and we also have the storage room to store dry foods (***Hospital Y***).*

4.8.2. Leftover food Management

When asked how they kept and preserved leftover food after a long working day, some key informants said they give the food to the bedsitter who usually come far, while others mentioned that they kept the food in the fridge and it is re-cooked the following morning and others said that whatever remains, it is always thrown away.

*When there is leftovers food, we examine the leftovers carefully. If the leftovers are suitable for consumption, we select a group of individuals (patients' bedsitter) who come from far areas and offer them the food to eat but if the food is not fit for consumption, we throw way (***Hospital Z***)*

4.8.3 Sources of food

When asked about where they source food products, some key informants said they buy food from local farmers while others said they buy from the supermarkets,

We have local suppliers who we trust when it comes to food sourcing and certain types of food such as vegetables, eggs and tomatoes from local farmers (**Hospital X)**.

4.8.4 Human health and safety

When asked about how they ensure human health and safety, key informants said that they ensure that all food handlers undergo medical examination. Additionally, some mentioned that hospitals supply appropriate clothing such as hair nets, aprons, uniforms, and gloves.

We take our food handlers for medical examinations every six months, the medical examinations are done within our hospital, and we also provide protective clothing such as aprons, gloves, hair net. **(Institution X)**.

4.8.5 Food serving process.

When asked on how what they use to serve food to patients. Key informants said they have had a designed trolley dedicated to transport and deliver meals to patients.

After food is cooked, we have trolleys that we use for transporting and delivering meals to patients in patient's wards, food handlers are responsible for serving food **(Hospital Z).**

4.8.6 Pests in Kitchen

When asked if they have issues with pests in the kitchen hospital and what methods they use to control the pests. Some key informants said they usually encounter pests, especially cockroaches and others said they don't have issues with pests in their hospital kitchen.

We often encounter the issue of pests, particularly cockroaches. We have an environmental health department which regularly applies chemical sprays to eliminate these pests, with treatments occurring every one month, **(Hospital X)**

4.8.7 Hand washing practice

When asked to describe how and when they washed their hands, some key informants said they wash their hands so often especially after visiting the restroom, before preparing food and when changing tasks, workstation or items they were handling. Others said they wash their hands periodically with soap, warm water and wipe with clean tower. To lesser extent others said they washed their hands after sneezing, coughing or torching their face, hair or clothes.

*It is very important because it is one of the ways designed to avoid food contamination while handling food, preparing and serving patients. It is also important to dry hands with a hygienically clean towel, to avoid dripping of water in the food. Hand washing in hospital kitchen is practiced and done every time you handle anything as you are preparing or serving patients, as well after sneezing, using restrooms, coughing or torching hair (***Hospital Y***).*

CHAPTER FIVE

5.0 DISCUSSION

This is the first study on food handlers' knowledge, attitudes, and practices (KAP) related to food safety in Mufulira District. The findings revealed that food handlers had generally inadequate knowledge, positive attitudes, and poor practices regarding food safety in the selected hospital facilities. Regarding the key informants, the findings revealed that while the hospitals generally try to follow good hygiene protocols, there are inconsistencies in food storage, handling of leftovers, pest control, and waste management

5.1 Knowledge of Food Safety among food handlers

This study found that the majority of respondents (53.6%) had inadequate knowledge of food safety. Approximately 46.0% of respondents were aware of the best and safest methods for thawing frozen meat. However, the majority mistakenly believed that thawing meat at room temperature was the safest method, unaware that the safest approach is to thaw it in a refrigerator at 40°F or below to prevent bacterial growth. These results are consistent with studies conducted in northern Ethiopia, eastern Ethiopia, and India, but fall significantly below the findings reported by Yared, which indicated that 70% of respondents had adequate knowledge. The difference in results was due to regional variations in food safety education and awareness.

The fact that over half of the respondents (54.0%) demonstrated inadequate knowledge of the best method for thawing frozen meat indicates a fundamental lack of understanding of basic food safety knowledge. Inadequate knowledge can lead to

improper handling of food at various stages of preparation, storage, and cooking, increasing the risk of contamination with harmful pathogens, such as *Salmonella, E. coli, and Listeria*. These pathogens can cause foodborne illnesses, posing significant risks to consumers. Furthermore, if meat continues to be thawed improperly at room temperature, it creates an ongoing risk of contamination and the spread of foodborne pathogens. Given that thawing is a critical point in the food handling process, failure to follow proper methods increases the likelihood of cross-contamination, where harmful bacteria can spread to other foods, kitchen surfaces, and utensils.

Additionally, only 24.0% of respondents demonstrated good knowledge regarding the duration of handwashing. Most were unaware that effective handwashing requires at least 20 seconds. This finding agrees with studies by *Martins et al*. (2012), Gomez-Neves and Garcia (2023), and Biruk *et al.* (2019), which reported that only 25% of food handlers knew the appropriate duration for washing their hands. A related study conducted in South Africa assessed food handlers' knowledge of food hygiene in similar settings and found an average correct response rate of 28.0%. Proper hand hygiene is crucial in preventing foodborne illnesses; this lack of awareness among food handlers increases the risk of contamination, particularly if hands are not washed for the recommended 20 seconds. This could lead to the transmission of harmful pathogens, such as bacteria and viruses, to food, thus raising the potential for foodborne outbreaks.

Regarding temperature control, only 16.0% of respondents had good knowledge. The majority believed that food is safe as long as it is stored in a refrigerator, regardless of the temperature, failing to recognize that different food categories require storage at different recommended temperatures. This result is similar with studies conducted in

Gondar, Ethiopia (20.3%) and Arba-Minch (32.6%). It also agrees with the study by Zhang *et al*. (2015) in China, which concluded that most food handlers were unaware of proper temperature control. However, these results are lower than those reported in studies conducted in Jordan, Northwest Ethiopia, and Malaysia. The differences in findings may reflect the varying institutional settings and geographical locations. For example, studies conducted in regions with more formalized food safety training programs, such as Jordan and Malaysia, typically report higher knowledge levels. In contrast, studies in regions with less structured food safety systems, such as parts of Ethiopia, china and Zambia, tend to show lower knowledge levels.

Regional differences in the availability and effectiveness of food safety education programs further explain the disparities in knowledge. Countries like Jordan and Malaysia, with well-established public health systems and regulatory frameworks, typically have better access to food safety training and a more rigorous approach to food safety regulation. On the other hand, in countries with less developed food safety infrastructure, such as parts of Ethiopia, China and Zambia, food handlers may lack formal training, which contributes to lower levels of food safety awareness.

The misconception that all food is safe as long as it is stored in a refrigerator, regardless of the specific temperature, can lead to improper storage. Many pathogens such as *Salmonella, Listeria,* and *E. coli*) thrive at temperatures that are not cold enough to prevent their growth. For instance, while most perishable foods should be kept at temperatures below 40°F (4°C), some foods like certain meats, dairy, or eggs may require lower temperatures to stay safe. If the temperature is not maintained correctly,

harmful bacteria can proliferate, increasing the risk of cross-contamination in both the refrigerator and when food is prepared or served.

Almost all food handlers (96.0%) were aware of the concept of personal hygiene, with the majority recognizing that good personal hygiene involves maintaining cleanliness. This finding is similar to that of Osaili *et al*. (2011). However, this study revealed inadequate knowledge in areas related to cross-contamination, with only 38.0% of respondents able to define cross-contamination. The majority did not understand the concept. This finding is similar with a study conducted in Malaysia by Zailani (2020), which reported a low level of knowledge regarding cross-contamination (35%). Cross-contamination is one of the primary mechanisms by which harmful pathogens, such as *Salmonella, E. coli,* and *Listeria*, are transferred from one surface or food item to another. Without a proper understanding of cross-contamination, food handlers are more likely to engage in unsafe practices, such as using the same cutting board for raw meat and vegetables or failing to properly sanitize utensils and hands. This increases the risk of contamination, which can lead to foodborne illnesses.

5.2 Attitudes towards Food Safety

This study found that the majority of respondents (94.0%) had positive attitudes toward food safety. Attitudes play a crucial role in shaping individuals' perceptions, beliefs, and behaviors, and positive attitudes are often associated with positive outcomes, while negative attitudes may lead to undesirable results (Kabir, 2018; Kainga *et al.*, 2022). Attitudes toward food safety training programs were also positive, the majority of respondents (89.0%) expressed eagerness and willingness to participate in food hygiene training, believing it would enhance their knowledge of food safety practices.

Previous studies have reported that, although training may not always result in behavioral changes, it can lead to improvements in both knowledge and attitudes among staff (Pilling *et al.,* 2008). Additionally, attitudes toward improving food hygiene to prevent food poisoning were found to be positive, with 97.0%. This result is similar with a study conducted by Tajul Ariffin (2016) in Malaysia, which found that 95.68% of food handlers had positive attitudes toward the prevention of food poisoning. The positive attitudes expressed by the majority of respondents suggest that food handlers recognize the importance of food hygiene and are likely motivated to adopt safe food handling practices. This presents a favorable foundation for food safety interventions and training programs, as food handlers' positive attitudes can facilitate the adoption of hygienic practices in food establishments. If food handlers are inclined to improve hygiene practices, there is potential for these attitudes to translate into better adherence to food safety standards and protocols.

Despite the prevalence of positive attitudes, the study also identified specific challenges that hinder the consistent translation of these attitudes into action. One of the key barriers mentioned by respondents was the inadequacy of resources and tools necessary for maintaining food safety. They expressed frustration over the scarcity of sanitizers, gloves, and cleaning agents, which occasionally led to lapses in adherence to food safety practices, particularly during peak hours. These findings are similar with observations made by Nghiem *et al.* (2018), who highlighted the significant impact of resource availability on the relationship between attitudes and food safety practices. Adequate resourcing is a fundamental factor in ensuring that food handlers can effectively translate their positive attitudes into practice.

The scarcity of sanitizers, gloves, and cleaning agents directly increases the risk of contamination and the spread of foodborne illnesses. Without proper hygiene materials, food handlers may be unable to maintain essential cleanliness standards, particularly during peak hours when the volume of food preparation and handling is higher. This lapse in adherence to food safety practices heightens the likelihood of cross-contamination, improper food storage, and exposure to harmful pathogens, ultimately compromising public health and safety.

5.3 Practices towards Food Safety among food handlers

The present study revealed that few respondents (45.0%) had good handling practices toward food safety. Regarding wearing gloves, few food handlers (34.0%) in this study reported of wearing gloves when touching cooked food and 49.0% of respondents said they always dry their hands after hand wash. These findings are significantly lower than those of food handlers in Dubai, where 92.2% confirmed they always used gloves and 90.1% dry their hands. However, our finding are comparable to a study conducted in Malaysia, where 44.4% of participants reported always wearing gloves and 33.4% stated they always dried their hands after hand wash.

The variation in results was due to regions having varying levels of awareness and prioritization of food safety practices. In some cultures, food safety might not be as highly emphasized in daily operations, whereas in other places, such as Dubai, there may be a stronger cultural focus on hygiene and cleanliness, which can lead to higher adherence to food safety practices like wearing gloves or drying hands.

Gloves are an important barrier against cross-contamination, especially when handling ready-to-eat foods like cooked items. The low percentage of food handlers (34.0%)

using gloves when touching cooked food indicates a significant gap in hygiene practices. Without gloves, food handlers are more likely to transfer harmful pathogens from their hands to food, particularly if they have touched raw food or surfaces contaminated with bacteria. This increases the risk of contamination and the potential for foodborne illnesses. Additionally, inadequate hand drying (with only 49.0% of respondents always drying their hands after washing) further contributes to the spread of bacteria. Wet hands can more easily transfer bacteria to food, utensils, and surfaces. Proper hand drying is an essential step in ensuring that pathogens are removed from the hands and that surfaces and food are not exposed to potential contaminants.

Additionally, regarding the practice of refraining from work when ill, the majority of food handlers (75%) indicated that they never worked while sick. They recognized that working while ill, especially with a cold or diarrhea, can contaminate food, prompting many to seek leave or medical attention. This finding contrasts with a study which was conducted in the United States, where only 11.9% of food handlers refrained from working when sick. However, our study agrees with a study in Saudi Arabia, where 74.4% reported they stopped handling food when ill.

The finding that 75% of food handlers in this study refrained from working while ill indicates a strong awareness of the risks contamination from illnesses such as colds or diarrhea. This proactive approach helps reduce the likelihood of foodborne illnesses, as sick food handlers are more likely to contaminate food and surfaces with harmful pathogens, such as *norovirus*, *Salmonella,* or *E. coli*, which can be transmitted through food handling.

Regarding changing rooms and shower facilities, the study revealed that only 20% of respondents had access to designated changing rooms, while 80% lacked such facilities. This finding agrees with a study by Chipabika (2012) in Kabwe, Zambia, which reported that 85% of food handlers did not have access to changing rooms. However, it contrasts with an earlier study by Safee (2010), which found that all participants had access to changing rooms and engaged in daily bathing and clothing changes before beginning their work duties.

The absence of separate changing facilities for food handlers can lead to unsafe practices, such as using the kitchen or related areas as changing spaces. When food handlers change in these environments, there is a significant risk of contaminating food preparation surfaces, utensils, and equipment with contaminants from personal clothing, including dirt, bacteria, or viruses. This issue is especially concerning in hospital kitchens, where the consequences of contamination can be severe, particularly for immunocompromised patients. Without a designated changing area, food handlers may unintentionally introduce harmful microorganisms into areas that should remain sterile or, at a minimum, free from contamination.

None of the hospitals implemented kitchen standard operating procedures (SOPs), This finding is similar with a study conducted in South Korea in 2017 by Kim. Without kitchen SOPs in place, there is no standardized approach to food safety, which increases the likelihood of food contamination during food preparation, handling, or serving. Inadequate food handling procedures may lead to the transfer of harmful pathogens, such as *Salmonella, E. coli,* or *Listeria,* from raw to cooked foods or from contaminated

surfaces to food. Cross-contamination poses a particular risk in hospitals, where patients are more susceptible to infections.

Additionally, the study revealed a positive trend in medical examinations for food handlers; however, there was poor record-keeping in waste management, which is crucial for ensuring compliance and accountability. Poor record-keeping in waste management undermines the ability to trace and identify sources of contamination. Effective waste management records are essential for understanding waste disposal patterns and ensuring that waste, particularly food waste or hazardous materials, is handled appropriately. Without proper documentation, it becomes difficult to track whether waste is being disposed of in a safe and sanitary manner, which increases the risk of cross-contamination. This lack of documentation can also delay corrective actions and increase the risk of foodborne outbreaks.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The research findings generally indicate that food handlers displayed inadequate knowledge and poor handling practice. For example, food handlers demonstrated low knowledge level in aspects such as cross contamination, food-borne pathogens, temperature controls, and correct thawing of frozen meat products.

Additionally, food handlers generally exhibited positive attitudes toward food safety, motivated by a sense of duty towards patient welfare. However positive attitudes exhibited by majority of food handlers did not transmit into good handling practice. Furthermore, the study found a relationship between knowledge level, food handling practices, and attitudes of food handlers. Educational attainment was shown to influence food safety levels, as indicated by logistic regression analysis. Furthermore, key informants highlighted some of obstacles which lead to poor food handling practices such as, lack of SOPs and lack of resources.

6.2 Recommendations

Based on the findings, the following recommendations are proposed to enhance food safety practices in Mufulira District hospitals:

1. It is recommended that food handlers be subjected to food safety education and trainings based on on-going intervals to ensure food safety practices are adhering to.

2. Food Handlers is to be encouraged to practice good temperature monitoring to ensure food safety.
3. It is also recommended that all kitchen' managers undergo basic training on food storage and services to impart knowledge to their working teams to constantly implement sound food safety systems and improve implementation and compliance.
4. Hospitals should be employing food handlers who are well trained in food hygiene.
5. Hospital management should provide protective clothing (PPE) to food handlers also develop kitchen SOPs

6.3 Study Limitations

1. The data supplied by some government hospitals was limited due to bureaucratic nature of government departments and also due to concealment of facts on perceived government failures.
2. The study employed a cross-sectional study design; therefore, the findings can only be interpreted in terms of associations but cannot claim causality among the variables studied.
3. The hospitals and participants included in this study were selected from one major District, so the findings cannot be generalized across the country. Further studies, particularly incorporating food handlers from other districts, are highly recommended.

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APPENDICES

Appendix I: A checklist of food safety knowledge, handling practices and attitudes among food handlers in hospitals

THEME	LOGISTICS	YES	NO	VERIFIABLE	REMARKS
1. PERSONEL	Is there evidence of medical examination for handler			❖ Certificate ❖ Register of handlers	
	Is there evidence of training in food safety			❖ Certificate of completion or attendance ❖ Training plan/strategy	
	Do food handlers wear Personal Protective clothing			❖ Gloves ❖ Aprons ❖ Washable footwear or covering ❖ Face masks ❖ Lab coats or other uniform ❖ Head wear	
	Cutting of finger nails			❖ Observe finger	
	Behavior and attitude of food handlers toward patients when serving the food			❖ Observe food transportation, manner of storage, waste disposal options, cleanliness and hygiene, observance of clothing rules inside and outside preparation areas	

2. HAND WASHING FACILITIES	Running water (Hot and Cold)	• Number of stations Presence of all needed items (running water, soap/handwash etc)
	Hand dryer	
	Soap	
3. WATER SUPPLY	Running water	❖ No. of sources ❖ Functional taps
	Water	
	storage facilities	
5. WASTE MANAGEMENT	Record on the amount of waste generated.	❖ Disposal of dirty/used water
	How waste is disposed off	
6. SANITARY FACILITIES	Records on waste collection	
	Sanitary facilities (male and female)	
	Change rooms	

	Wall, floor	
	Lighting	
	Hand washing facilities	
7.DOCUMENTATION	Is there a policy for maintaining food safety documents	Presence of policies
	Documentation on trainings	
8. FOOD HANDLING PRACTICES	Handler wipes off sweat during the food production process or when serving food.	
	Handler picks his ear(s) during the food production process or when serving food.	

Appendix II: Questionnaire: Assessment of Food Safety Knowledge, Handling Practices, and Attitudes among Food Handlers in Hospital facilities of Mufulira District, Zambia.

Date of Interview:

Place of Interview:

Serial Number:

Instructions for the Interviewer:

- Introduce yourself to the respondent.
- Explain the reason for the interview.
- Assure the respondent of confidentiality and anonymity.
- Do not write the name of the respondent on the interview schedule.

Based on your personal knowledge and experience, rate your level of knowledge by select yes or no about the following principles of food safety.

Section A: Demographic Data

1. Sex of respondent:
    - (a) Male ( )
    - (b) Female ( )
2. Age at last birthday:
    - (a) 18 to 20 years ( )
    - (b) 21 to 26 years ( )
    - (c) Above 26 years ( )
3. Education level:
    - (a) None

- (b) Primary
- (c) Secondary
- (d) College

4. Responsibilities/occupation……

1. Do Washing hands before work reduces the risk of food contamination

- Yes
- No
- Justify your answer……..

2. Do you know what Personal Hygiene is?

- Yes
- No
- Justify your answer……..

3. Should different food categories be stored at different temperature?

- Yes
- No
- Justify your answer……..

4. Can skin infection contaminate food?

- Yes
- No
- Justify your answer……..

5. Do you know what Cross contamination is?

- Yes
- No
- Justify your answer……..

7. Do you know the chemicals utilized for cleaning kitchen surfaces such as the floor?

- Yes
- No
- Justify your answer……..

8. Can using different cutting board prevent cross contamination

- Yes
- No
- Justify your answer……..

9. Do you know that Salmonella bacteria pathogens are associated with poultry product?

- Yes
- No
- Justify your answer……..

10. Do you know the best way of thawing frozen meat?

- Yes
- No
- Justify your answer……..

11. Do you have knowledge on how long you should take to wash your hands to remove bacterial?

- Yes
- No
- Justify your answer……..

12. Do you understand what the FIFO Protocol is in food safety?

- Yes
- No
- Justify your answer……..

13. Do you know the refrigeration temperature?

- Yes
- No
- Justify your answer……..

15. Do you know at what temperature ready-to-eat foods should be maintained?

- Yes
- No
- Justify your answer……..……..

Practices

Choose between yes or no for the following food safety handling food questions.

1. Do you wear Gloves when handling food/ready to eat food

- Yes
- No
- Justify your answer……..

2. Do you Wash your hands with water and soap before handling food

- Yes
- No
- Justify your answer……..

3. Do you dry your hands after washing them?

- Yes
- No
- Justify your answer……..

4.Do you Clean Food contact Surface before and after handling food

- Yes
- No
- Justify your answer……..

5. Do you avoid working when you have a cold/diarrheal?

- Yes
- No
- Justify your answer……..

6. Are you provided with Change room?

- Yes
- No
- Justify your answer……..

7. Do you know the importance of hand drying after hand wash before handling food?

- Yes
- No
- Justify your answer……..

8. Are you provided with a shower room?

- Yes
- No

9. Do you Avoid Working when you have lesion on your hand

- Yes
- No

10. Do you wash utensils (knives, spoons etc.) in warm water?

- Yes

- No
- Justify your answer……..

11. Do you know the importance of drying the hands after hand wash before you handle food?

- Low extent
- Moderate extent
- High extent

Justify your answer……..……

ATTITUDE

Based on your personal experience, rate your level of Attitude toward the following food safety practices by selecting YES or NO.

1. Do you believe that your role in ensuring food safety directly impacts the patients' health in the hospital?

- Yes
- No
- Justify your answer……..

2. Are you concerned about improving hygiene practices to reduce the risk of food-borne diseases?

- Yes
- No
- Justify your answer……..……..

3. is it your responsibility to prevent foodborne illnesses?

- Yes
- No
- Justify your answer……..

4. Do you hold the belief that thorough handwashing can prevent foodborne illnesses?

- Yes
- No
- Justify your answer……..

5. Do you think there is a need for regular food safety training sessions in this hospital?

- Yes
- No
- Justify your answer……..

6. Do you know that clean Cleaning of Food contact Surface before and after handling food.

- Yes
- No
- Justify your answer……..

7. do you use the same cloth to dry your hands, clean your hands, and wipe or dry the dishes.

- Yes
- No
- Justify your answer……..

8. Do you immediately seek medical attention when you accidentally cut yourself when handling food?

- Yes
- No
- Justify your answer……..

9. Do you believe that food stored at an incorrect temperature must be always discarded?

- Yes
- No
- Justify your answer……..

Thank you for sparing this time”

Appendix III: key information

1. How do you keep food safe?

2. What do you do with leftover food?

3. How do you store food and for how long?

4. What are your sources of your food?

6. What procedures are in place for human health and safety?

7. How is food served to patients and who is responsible for the processes?

8. Do you have issues with pests? If so, how are they controlled? Can you give some examples?

9. Have there been instances of food poisoning among patients attributed to food served from the hospital? What do you do in such instances?

10. Do you have haccp principals in place?

Appendix iv: Information for participants

Title of Study: Assessments of food safety Knowledge, attitude and practices among food handlers in Mufulira District, Zambia

Investigator: Charles Nyendwa

Principle investigator: Professor Andrew Phiri

Introduction

You are invited to take part in a questionnaire survey to assess knowledge, attitude, and practices towards food safety in mufulira district.

Aim of the study

The purpose of this study is to determine the levels of knowledge, attitude, and practices towards food safety among handlers in hospital facilities of Mufulira District, Zambia.

Procedures

If you agree to participate in this study, you will be asked to complete a questionnaire that will take approximately 15 minutes to complete. The questionnaire will include questions about your knowledge, attitudes and practices towards food safety in hospital facilities, and your socio-demographic information.

Risks

There are no known risk associated with participating in this study. Also, your decision to participate or not in the study will not affect your job and/or working conditions.

Benefits

The study will help to identify the knowledge gaps among healthcare workers on controlling and preventing food contamination in hospital facilities. The information generated from this survey will also help to improve the

management of food in health facilities and could ultimately lead to the development of better public health initiatives and policies.

Confidentiality

All information gathered throughout the study will be kept strictly confidential and will not be shared with anyone outside of the research team. Without your permission. Your responses will be coded into numbers only and not names. If you have questions, complaints ,or problems as a result of your participation in this survey, you may call (**CHARLES NYENDWA**, Mobile; +260979448689 or *Email*; charlesnyendwa13@gmail.com**)**

Participation

Your participation in this study is voluntary. You have the right to withdraw at any time without penalty or loss of job, and you will not be asked to provide a reason.

I have read and understand the information provided above, and that I voluntarily give or not, my agreement to participate in this study.

Agree ☐ Disagree ☐

Signature……...

Date……

Appendix V: Informed Consent Form

Greetings.

My name is **CHARLES NYENDWA,** a masters' student of the University of Zambia (UNZA). My investigation involves a questionnaire interview with food handlers working in health facilities of Mufulira District

Specifically, I would like to learn about your personal knowledge, attitudes, and practices towards food safety .This will help us generate information useful to improve food safety in health facilities and developing effective intervention strategies for the preventing food borne illnesses in hospital facilities.

Participation in this study is voluntary, and I would also like to inform you that there is no risk to participating in the study, and that everything that you share with me will be kept confidential. Also, your decision to participate or not in the study will not affect your job and/or working conditions

Do you agree to take part in this survey? YES ☐ NO ☐

Signature of the respondent _____

Date of interview _____

Appendix VI: Ethical Approval

UNIVERSITY OF ZAMBIA
BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: +260 977925304
Telegrams: UNZA, LUSAKA
Telex: UNZALU ZA 44370
Fax: + 260-1-250753
Federal Assurance No. FWA00000338

Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia
E-mail: unzarec@unza.zm
IRB00001131 of IORG0000774 **NHRAR-REC No 2021-05-0002**

8th November 2023

Your REF. No. 4544-2023

Mr. Charles Nyendwa,
University of Zambia,
School of Veterinary,
P.O Box 32379,
Lusaka.

Dear Mr. Nyendwa,

RE: ASSESSMENT OF THE FOOD SAFETY KNOWLEDGE, HANDLING PRACTICES AND ATTITUDE AMONG FOOD HANDLERS IN HOSPITAL ENVIRONMENTS OF MUFULIRA DISTRICT, ZAMBIA (REF. NO. 4544-2023)

The above-mentioned research proposal was presented to the Biomedical Research Ethics Committee on 8th November, 2023. The proposal is **approved**. The approval is based on the following documents that were submitted for review:

a) Study proposal
b) Questionnaires
c) Participant Consent Form

APPROVAL NUMBER : REF. No. 4544-2023

This number should be used on all correspondence, consent forms and documents as appropriate.

i. **APPROVAL DATE : 8th November 2023**
ii. **TYPE OF APPROVAL : Standard**
iii. **EXPIRATION DATE OF APPROVAL : 7th November 2024**
iv. After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the UNZABREC Offices should be submitted one month before the expiration date for continuing review.
v. **SERIOUS ADVERSE EVENT REPORTING**: All SAEs and any other serious challenges/problems having to do with participant welfare, participant safety and study integrity must be reported to UNZABREC within 3 working days using standard forms obtainable from UNZABREC.

vi. **MODIFICATIONS**: Prior UNZABREC approval using standard forms obtainable from the UNZABREC Offices is required before implementing any changes in the Protocol (including changes in the consent documents).

vii. **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the UNZABREC using standard forms obtainable from the UNZABREC Offices.

viii. **NHRA:** You are advised to obtain final study clearance and approval to conduct research in Zambia from the National Health Research Authority (NHRA) before commencing the research project.

ix. **QUESTIONS**: Please contact the UNZABREC on Telephone No. +260977925304 or by e-mail on unzarec@unza.zm.

x. **OTHER**: Please be reminded to send in copies of your research findings/results for our records. You are also required to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study. Use the online portal: unza.rhinno.net for further submissions.

Yours sincerely,

Munsaka.

Prof. Sody Mweetwa Munsaka, BSc., MSc., PhD
CHAIRPERSON
Tel: +260977925304
E-mail: s.munsaka@unza.zm

APPENDIX VII: Permission Letter for Data Collection from Mufulira District Health

In reply please quote No.....
All correspondence to be addressed to the
District Health Director
Tel: 411202 Fax: 410068

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
MUFULIRA DISTRICT HEALTH OFFICE

Finance Bank Chambers
Buteko Street,
P O Box 40055
MUFULIRA

27th June, 2023

REPUBLIC OF ZAMBIA MINISTRY OF HEALTH
28 JUN 2023
MEDICAL OFFICER-IN CHARGE
P.O. BOX 40055, MUFULIRA

The Dean
School of Veterinary Medicine
UNZA
LUSAKA.

Dear Sir/Madam,

RE: PERMISSION TO COLLECT DATA FOR A RESEARCH PROJECT FROM OUR FACILITY.

Reference is made to the above subject.

I acknowledge receipt of your correspondence. In which you were requesting for your student's permission to conduct his research on "**Assessment of the food safety knowledge, handling practices and attitudes among food handlers in hospital environments of Mufulira District, Zambia.**

I wish to inform you that permission has been granted for your student to carry out the research project at our facility.

However note that he is expected to provide the District Health Office with the findings from the Research Project prior to dissemination.

Yours faithfully,
MUFULIRA DISTRICT HEALTH OFFICE

Dr. Kambole Mpande
DISTRICT HEALTH DIRECTOR.

REPUBLIC OF ZAMBIA MINISTRY OF HEALTH MUFULIRA
27 JUN 2023
P.O. BOX 40055, MUFULIRA