STANDARDS FOR THE HAND HYGIENE OF FOOD HANDLERS

Sanette Klingenberg B Cur

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Supervisor: Prof H C Klopper
Co-supervisor: Ms A Marx

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SOLI DEO GLORIA

ABSTRACT

Globally, investigations into food-borne illnesses show that the majority of cases involve poor hand hygiene of the food handler. The challenge of providing safe food therefore requires new strategies for evaluating cross-contamination of pathogenic micro-organisms on the food handler's hands, which might be detrimental or hazardous to the health of the patient. Although food-borne diseases may be multifactorial in aetiology, no standards or evaluation systems, such as an occupational health surveillance programme, are available to monitor and ensure that food is free of pathogens. The formulation and implementation of standards may contribute to ensuring that food handlers comply with hand hygiene practices during food handling. Such practices guarantee that food reaching the patient is safe.

The objectives in this research project originated from the occupational health practice and gave direction of the empirical research project. The literature was reviewed to discover what is currently known concerning the food handlers' hand hygiene during food handling and food-borne illnesses and the theoretical framework gave direction and guidance to the survey design of the empirical research, which was quantitative, explorative, descriptive and contextual in nature. The food handlers from the food preparation sections of the four major healthcare services in Potchefstroom, in the North West Province, South Africa, were the target population and the sampling method was all-inclusive (n=110). Eighty (75.47%) food handlers participated in the research project.

The design entailed three steps. The first was conducted with a questionnaire, to identify the food handlers' compliance with hand hygiene during food handling. The second step involved determining the prevalence of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands. The results were used for the formulation of standards for the hand hygiene of food handlers.

Finally, recommendations for practice, education and research were made. The implementation of these recommendations could contribute knowledge to the body of nursing and promote good hand hygiene practices in the healthcare service.

KEY TERMS

Cross-contamination; Food-borne illnesses; Food handler; Health hazard; Hand hygiene; Occupational health; Occupational health surveillance; Pathogen micro-organisms; Standards.

ACRONYMS

ABET	Adult Basic Education and Training
CDC	The Centres for Disease Control and Prevention
DOH	Department of Health
FDA	Food and Drug Administration
FAO	Food and Agricultural Organization
HACCP	Hazard Analysis Critical Control Point
HAT	Verklarende Handwoordeboek van die Afrikaanse Taal
HIRA	Hazard Identification and Risk Assessment
ICN	International Council of Nurses
NIAID	National Institute of Allergy and Infectious Disease
OHP	Occupational Health Practitioner
SABS	South African Bureau of Standards
SASOH	South African Society of Occupational Health
USA	United States of America
USDA	United States Department of Agriculture
WHO	World Health Organization

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1.1 INTRODUCTION AND RATIONALE FOR THE STUDY

Challenges to quality and safety in the food supply chain require new strategies for the evaluation of cross-contamination of pathogenic micro-organisms on the food handler's hands, which may be transmitted onto the work surfaces and hand wash basins, creating an environment for the multiplying of pathogens. These pathogenic micro-organisms might be harmful or hazardous to the health of the consumer and/or to patients in the healthcare service. The Department of Health (SA, 2003:2) points out that contamination includes any condition, act or omission that may spoil food and that consumption of contaminated food is likely to be dangerous or detrimental to health.

Changes in the pathogens, as well as the lifestyles of the general population require a new approach to improve and ensure the safety of food the patient receives (DOH, 2005:12; South African Society of Occupational Medicine, SASOM, 1996:2). People have the right to expect that the food they eat is safe and suitable for consumption. A food-borne illness is at best unpleasant; at worst, it can be fatal. There are also other consequences to outbreaks of food-borne illnesses, such as an adverse effect on the recovery of patients and damage to trade and tourism, lead to loss of earnings, unemployment and litigation. Food spoilage is wasteful, costly and can have a negative impact on trade and the consumer's confidence (Codex Alimentarius Commission, 2003:3; DOH, 2005:11). In this research project, the consumers are the patients in the healthcare service that depends that the food they receive are free of pathogens.

Although food-borne illnesses may be multifactorial in aetiology, food handlers are an essential part of the food processing industry, especially in the healthcare service. In the food industry, the food handlers' hands are not included in occupational health surveillance for any pathogen micro-organisms (SASOM, 1996:2; DOH, 2000a:153). Globally, food-borne illnesses are still among the most widespread (DOH, 2002:1) and when investigated, poor hand hygiene of the food handler is most often identified as the cause of the incidence (Redman, 2000:1; Van Tonder, 2004:1).

In South Africa, as in many other developing countries, westernisation created a revolution of fast-food production, with an accompanying increase in the health risks associated with poor hand hygiene (DOH, 2005:12). According to the Codex Alimentarius Commission (2003:3), eating habits have also undergone major changes in many countries over the last two decades. For this reason, effective hand and surface hygiene control is vital to avoid the adverse health and economic consequences of food-borne illnesses.

The Centre for Disease Control and Prevention (CDC, 2005:12; DOH, 2005:14; Codex Alimentarius Commission, 2003:17) point out that the food handler, as possible carrier, can transmit food-borne micro-pathogen organisms from one product to another, including surfaces, and in the end, the consumer. According to the food and safety inspection section of the United States Department of Agriculture (2003:1), neglected hand washing is a prime cause of food poisoning and cross-contamination can be eliminated if hands are frequently washed with soap.

One of the micro-pathogen organisms, *Escherichia coli*, was first recognised as a pathogen that causes food-borne illnesses in 1982 during an outbreak investigation in the USA. The CDC pointed out that a relationship between contamination and food-borne illnesses involves *Escherichia coli* (cited in Ayçiçek *et al.*, 2004:254). *Escherichia coli*, as an emerging cause of food-borne illnesses, causes 73,000 infections annually (CDC, 2003b:1).

Another pathogen, *Staphylococcus aureus*, the only bacteria that is present on the human skin, can produce seven different toxins and is frequently responsible for food poisoning. According to the CDC (cited in Ayçiçek *et al.*, 2004:254) and the Food and Drug Administration (FDA, 2001:1), *Staphylococcus aureus* is the most common bacteria associated with food-borne illnesses, and may be detected in identified in 70% of cases. Van Tonder (2004:6) agrees, stating that *Staphylococcus aureus* has been indicated as the bacteria predominantly involved in food-borne illnesses and is a leading cause of gastroenteritis. Poor hand hygiene was identified as one of the reasons for this prevalence (DOH, 2005:1). According to the DOH's guidelines for environmental health officers on the interpretation of microbiological analysis data of food, micro-pathogenic organisms

causing food-borne illnesses includes *Brucella, Bacillus cereus, Campylobacter jejuni, Closstridium Botulinum, Clostridium perfringens, Escherichia coli* 0157:H7, *Listeria monocytogenes, Salmonella, Shigella, Novovirus, Toxoplasma gondi, Vibro species, Yersinia enterocolytica* and *Staphylococcus aureus.* Based on the literature reviewed, the pathogenic micro-organisms predominantly associated with food-borne illnesses are *Escherichia coli* and *Staphylococcus aureus.* These two pathogens were therefore chosen as the focus of this research project.

According to the South African Department of Health's (2002:1; 2005:3) statistical notes, in South Africa, food-borne illnesses are underreported. The present disease notification system of the country does not include new emerging food-borne illnesses, such as *Escherichia coli*, 0157:H7 and *Shigellosis*, which are at present not notifiable. The DOH statistical notes (DOH, 2002:4) show that during the period 1999 to 2004, 136,331 confirmed cases of food-borne related illnesses were reported and the reported deaths totalled 530. This supports the need to research the prevalence rate of *Escherichia coli* and *Staphylococcus aureus,* which affects the quality and safety of food reaching patients.

The Department of Health's (2000a:2) food control guideline requirements (Appendix 1) concerning occupational health surveillance of food-borne illnesses in the food processing industry concentrate on the identification of pathogenic micro-organisms on the working surfaces and utensils. They ignore the possible role of the food handlers' hands in the cross-contamination process. The DOH guidelines are regulated by public health legislation, namely, Health Act 63 of 1977. The DOH guidelines (2000a:2, see Appendix 1) conclude that surveillance of the food handler's hand hygiene is not an important factor or concern in the transmission of food-borne pathogens in the food handling process, although all the information reviewed indicates the opposite (DOH, 2005:14). To confirm this, the DOH's viewpoint and reasons for the exclusion of direct occupational health surveillance on food handlers are as follows:

- High employee turnover
- Costly medical examinations
- No guarantee exists for the detection of more than a small proportion of carriers of pathogenic organisms
- Results may lead to a false sense of safety

- Pre-employment and routine occupational health surveillance is not cost-effective and is unreliable (DOH, 2000a:2).

Dr. Makubalo, Chief Director of Health Information, Evaluation and Research opposes the above decision, urging the need for strengthening legislation and developing a code of conduct on food handling and excellent personal hygiene of the food handler (DOH, 2005:14). The lack of attention to hygiene could turn a quick meal into a nasty bout of food poisoning. No food handler can be involved in the food processing industry without using their hands, and so the exclusion of handlers in health care policies is questionable. Food poisoning represents a serious threat to health, can impose a substantial strain on healthcare systems and reduce economical productivity (DOH, 2005:11).

The possibility of transmitting pathogens from the food handler's hands to the consumer is undisputed (DOH, 2005:14). Dr. Makubalo suggests that research is needed to improve the diagnosis, clinical management, and treatment of food-borne illnesses, and to improve our understanding of the pathogenesis of new and emerging infections (DOH, 2005:12). Food-borne illnesses not only attract media attention, but the general public could also voice concern regarding the quality and safety of food they receive (DOH, 2002:14).

In South Africa, factors influencing the position on this issue include the absence of reliable data, lack of collaboration, underreporting of food-borne illnesses, the lack in the disease notification surveillance system and emerging food-borne illnesses such as *Escherichia coli*, 0157:H7 that are not yet notifiable (DOH, 2002:4). The food handler can be a disease carrier who can contaminate food and other surfaces with organisms like *Escherichia coli* and *Staphylococcus aureus* (to mention only two of the most common food-borne pathogens) directly through hand contact, or indirectly through sneezing, for example (CDC, 2005:12; Codex Alimentarius Commission, 2003:17; DOH, 2005:14).

Determining the prevalence rate of these two critical pathogenic micro-organisms would determine whether hand hygiene is maintained or whether the lack thereof contributes to cross-contamination during food handling. Decisions that address the possibility of the food handler transmitting food-borne pathogens through hand

contamination are hindered by our current inability to compare control strategies at different points of the food supply chain (DOH, 2005:3). In addition, and the absence of an integrated surveillance system is evidence of the need for standards for occupational health surveillance that will monitor the hand hygiene of the food handlers and improve food quality and safety.

In South Africa's healthcare services, food handlers form an essential part of the food provision service. Therefore, food handlers have a responsibility to comply with the DOH's guidelines (Directorate: Food control: July 2000a) (Appendix 1). Within this important food processing context, where patients is already in poor health and adherence to these guidelines is even more important. Patients must be sure that the foods they receive are free from micro-pathogens causing food-borne illnesses, and that such illnesses do not become a mitigating factor in their recovery process. Given the importance of food handling in this context, the healthcare services' food handlers were identified as a target population and as participants in this research project.

1.2 PROBLEM STATEMENT

It seems possible that occupational health and the Department of Health have not kept pace with the changing needs of the consumer to ensure that food is safe for human consumption. This refers especially to food handlers' compliance with hand hygiene. It seems that a gap may exist in occupational health evaluations of food-borne pathogens on the food handler's hands. As such, an evaluation of food handlers' hands hygiene may help to prevent cross-contamination of food-borne pathogens like *Escherichia coli* and *Staphylococcus aureus* in the food supply chain industry.

Food handlers are an essential link in the food processing industry; and by failing to institute occupational health evaluations of food handlers' hand hygiene, food handlers may increase the transmission of food-borne illnesses. The missing element, namely the surveillance of food handlers' hand hygiene, might have an impact on the quality and safety of the end product of food that reaches the consumer, who in this research project is the patient in the healthcare service.

The implementation of hand hygiene standards for food handlers may improve evidence-based practice in occupational health nursing in the food supply industry. This can be achieved in the form of structure, process or outcome standards to ensure compliance with the DOH's guidelines (Directorate: Food control: July 2000a; see Appendix 1). To achieve this, occupational health practitioners must have key knowledge, namely, information gained through research and data gathering, for the best evidence-based practice in providing clinical expertise that addresses the consumers' expectations (Brink, 2006:14). Evidence-based practice aims to deliver appropriate care in doing the right things correctly and in an efficient manner (Brink, 2006:13).

From the above background and rationale, the following research questions were raised:

1. What is the food handler's compliance with hand hygiene during food handling?
2. What is the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands?
3. What standards can be formulated for the hand hygiene of food handlers?

1.3 RESEARCH OBJECTIVES

Based on the research questions, the following research objectives were set:

1. To determine the food handler's compliance with hand hygiene during food handling
2. To identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands
3. To formulate standards for the hand hygiene of food handlers

1.4 PARADIGMATIC PERSPECTIVE

The paradigmatic perspective consists of three components, namely, meta-theoretical, theoretical and methodological assumptions.

1.4.1 Meta-theoretical assumptions

The meta-theoretical position refers to the belief statements of the researcher and is not meant to be tested. Nursing as a profession is based on the philosophy that all humans are unique; and therefore nursing has developed according to the

health needs of the individual, family and community. In occupational health practice (the focus of this research project), we commit ourselves to providing a service that is evidence-based. The human being, in this case the food handler, needs to be approached and valued in a holistic way. Occupational health is not only concerned with the employee in the work environment, but also with those patients in the healthcare service who receive our services. Each individual, family and community is diverse in their own sociological setup, and has their own beliefs, values and perceptions. As healthcare professionals we have to acknowledge this and take cognisance of these facets within each individual.

By definition, food handlers refers to persons who in the course of their normal routine work on the food premises come into contact with food not intended for their personal use (DOH, 2000a:2). The Codex Alimentarius Commission (2003:6) describes a food hander as follows: "Any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements". A food handler is thus any person involved in the processing, production, manufacturing, packaging, preparation, sale or serving of any foodstuff, including water and beverages (DOH, 2000a:1).

1.4.2 Theoretical assumptions

Theoretical assumptions include models and theoretical definitions. Specific theoretical concepts that will be used in this research project are the following:

- **Bacteria**

Bacterial pathogens are the most commonly identified cause of food-borne illnesses. They are easily transmitted and can multiply rapidly in food, making them difficult to control. Pathogenic bacteria are infectious disease-causing agents, which feed on nutrients in potentially hazardous foods and multiply very rapidly at favorable temperatures. Examples of pathogenic bacteria include *Salmonella, Shigella, Listeria, Monocytogenes,* and *Staphylococcus aureus.*

♠ Compliance

Compliance in this research project implies the awareness, knowledge, adherence to rules and responsibility of the food handler regarding basic food handling and hand hygiene practices, training, personal medical examinations and occupational surveillance of their hands (DOH, 2000a:164-166). Compliance with the DOH's guidelines (Directorate: Food control: July 2000a, see Appendix 1) is an essential aspect of food handling practice.

♠ Cross-contamination

Cross-contamination in food handling involves the transmission of pathogens through hands that are not clean to food, surfaces, sponges, towels, utensils, and ready-to-eat food (FDA, 2004:1). According to the Codex Alimentarius Commission (2003:24), people who do not maintain an appropriate degree of personal hygiene, or who have illnesses or other conditions, can contaminate food and surfaces through contact, transmitting food-borne illnesses to consumers.

♠ *Escherichia coli*

Escherichia coli are a bacterium that can produce a deadly toxin. It has been accepted as an indicator of faecal contamination, and suggests a general lack of cleanliness in handling and improper storage (DOH, 2006:5).

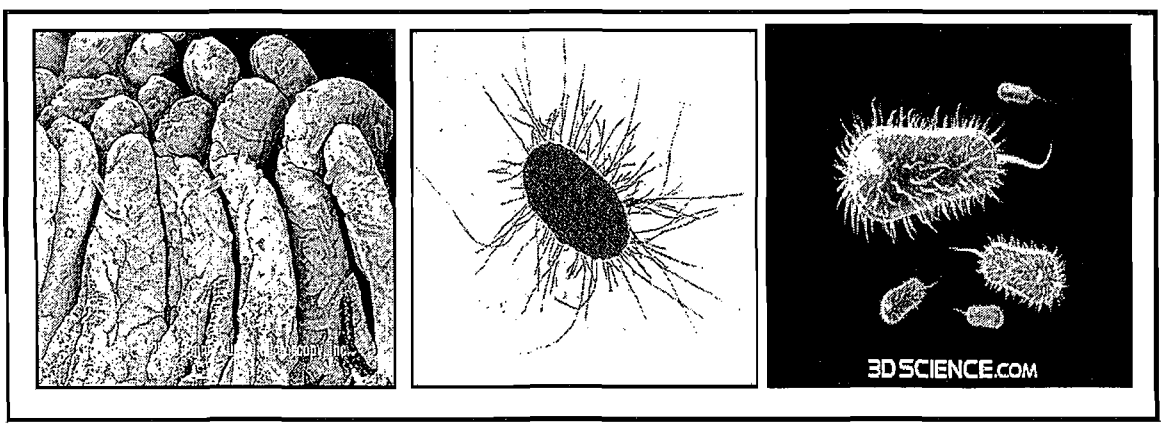

Figure **1.1**. *Escherichia coli* are commonly encountered rod-shaped bacterium, found in typical human bacterial flora. It can cause urinary tract infections, traveller's diarrhoea and no-socomial infections that can be severe and even life-threatening. Images of *Escherichia coli* with courtesy from 3DScience.com and Kunkel (2007).

♠ **Food-borne illness**

Food-borne illness, also referred to as food poisoning or food-borne disease, is transmitted to a human through food that contains unsound material and is detrimental for human health. Unsound material implies unwholesome, sick, polluted, infected, contaminated, decayed or spoiled food, or food that is unfit for human consumption for any reason whatsoever (SA, 2003:1). Food-borne illnesses arise from eating food contaminated by bacteria, viruses, environmental or food toxins (DOH, 2002:1). Some of the pathogenic micro-organisms identified in food as the culprits of food-borne illnesses, either because of the severity of the sickness or the number of cases of illness they cause, include the *Escherichia coli* group (DOH, 2002:1).

♠ **Food hygiene**

Food hygiene includes all the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food supply chain, from its growth, production or manufacture until its final consumption, with the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (Codex Alimentarius Commission, 2003:7).

♠ **Hand hygiene**

Hand hygiene is a condition promoting sanitary practices that minimise the spread of infectious micro-organisms between people or between other living organisms and people. One of the core fundamentals of hygiene is hand washing and the recognition of the link between hand washing and reduction in food-borne illness. Food handlers' hands are not only in contact with food but also with work surfaces where they handle and prepare food. For food handlers this implies the maintenance of hygiene practices such as washing their hands before and after food handling, to prevent contamination of food (CDC, 2002:3; CDC, 2005:8; Codex Alimentarius Commission, 2003:25).

♠ **Microbiological hazard**

When food becomes dangerous to the consumer because principles of hygiene and sanitation are not met, when it becomes contaminated by micro-pathogens from humans or the environment during production, processing or preparation, or

when it originates from a sick animal (DOH, 2006:1), a microbiological hazard exists.

♠ **Occupational hygiene**

According the Occupational Health and Safety Act 85 of 1993, occupational hygiene refers the anticipation, recognition, evaluation and control of situations that may develop in or from the workplace, and which can have a negative or detrimental effect on the health of people.

♠ **Occupational health**

Occupational health implies the creation of a state of physical and mental well-being within the occupational environment, while taking into consideration factors relating to the social and domestic life of each individual (Kotze, 1997:2). The components of occupational health make provision for occupational medicine, nursing and occupational hygiene.

♠ **Pathogenic micro-organisms**

Pathogenic micro-organisms refer to bacteria that cause disease, like *Escherichia coli* and *Staphylococcus aureus*, to mention those bacteria relevant to this research project. These bacteria can cause food-borne illnesses and are a microbiological hazard that is detrimental to human health (SA, 2003:2).

♠ **Prevalence rate**

Prevalence rate is the total number of times a specific occurrence appears within a certain phenomenon (HAT, 1994:1233). In this research project, it refers to the rate that *Staphylococcus aureus* and *Escherichia coli* are present or absent from the food handlers' hands.

♠ ***Staphylococcus aureus***

Staphylococcus aureus is a bacterium that produces seven different toxins that are frequently responsible for food poisoning that causes vomiting shortly after ingestion (CDC, 2005:1). Humans are the main reservoir for *Staphylococci aureus* involved in food-borne diseases. Human contamination of food can occur through direct contact, or indirectly through skin fragments or respiratory tract droplets.

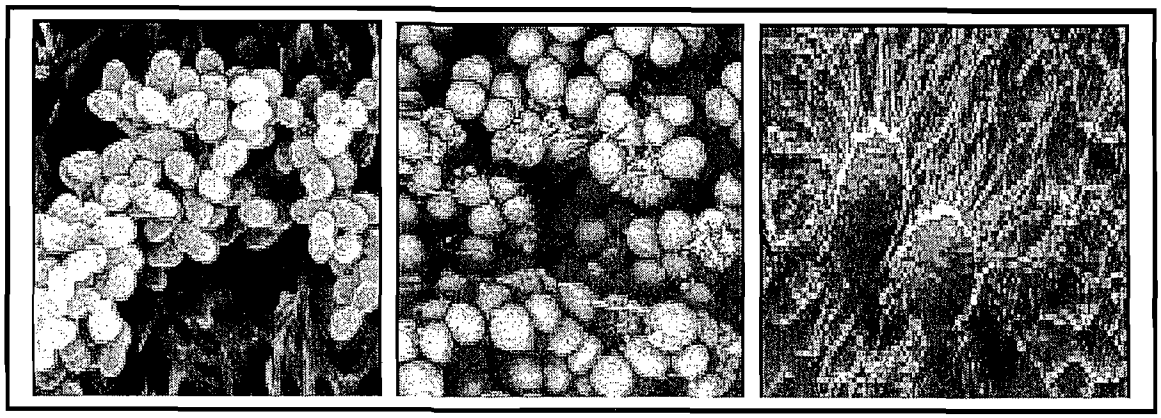

Figure **1.2.** Images of *Staphylococcus aureus* (FDA, 2001:2; McKee, 2007:1). *Staphylococcus aureus* is a Gram-positive coccus, which appears as grape-like clusters when viewed through a microscope and has large, round, golden-yellow colonies, often with β-hemolysis, when grown on blood agar plates. The golden appearance is the etymological root of the bacteria's name: *aureus* means "golden" in Latin.

♠ Standards

According to Muller (1998:242), Donabedian (2003:46, 60) and Bezuidenhout (2005:76), a standard is described as a specified quantitative measure of degree or frequency that specifies what is desired and achievable for excellent performance. It is the means by which general concepts and attributes are maintained and improved. Bezuidenhout (2005:76) emphasises that standards must be defined clearly to ensure that the evaluation of compliance with the set standards is clear and achievable. These standards include the following, of which one or more may be used:

- *Structure standards* describe what is required for the performance of an activity or support system for the organisation, for example, material and human resources
- *Process standards* describe step-by-step how an activity should be performed according to a technical procedure manual, education and training
- *Outcome standards* refer to the expected end result, output or change to attribute. In this research project, these would be improved compliance of the food handler with hand hygiene. An outcome standard is the measurement of the effect of the performance of an activity, and reflects not only how the activity has been done but also how skilfully it was conducted. Outcome

standards should be measurable, and so refer to how the objective or goal must be achieved, and the evaluation thereof.

In this research project, standards for occupational health surveillance are to measure the compliance of the food handler with hand hygiene in the form of structure, process or outcome standards. These are formulated from the findings of the research project and should be practical and applicable.

1.4.3 Methodological assumptions

As point of departure in this research project, the researcher interacted with the practical and empirical world of the research domain, namely, the food handler in the healthcare service. The relationship was practice-orientated and aimed to improve our understanding of the phenomenon and to reflect closely as possible the true state of affairs. Results could generate, provide and contribute knowledge to the existing body of knowledge and theory on which efficient evidence-based practice of quality care could be implemented. This would be done in an ethical manner with respect for the patient, family and community in need.

Burns and Grove (2005:2, 634) point out that research in the nursing discipline is based on the human needs; it focus, directs, determines and guides our decisions to implement the best practices based on scientific evidence to the benefit of our patients. Nursing research must be a process in which we give meaning to reality and gain a clearer insight into this reality. Muller (1998:32, 116-119) supports the notion that nursing research is an essential part for the development of scientific knowledge that enables us to provide evidence-based practice in occupational health practice, using the knowledge to make an impact on existing practices in society, and to promote the worker's health in the food industry. According to Brink (2006:4,12), we must accept research as a integral part of healthcare practice, and apply it in our practice to care for persons in health and illness and deliver an effective and efficient service to improve healthcare. According to the International Council of Nurses (ICN):

> nursing research focuses on developing knowledge of the care of persons in health and illness... It also emphasises the generation of knowledge of policies and systems that effectively and efficiently deliver nursing care; the profession and its historical development; ethical guidelines for the delivery

of nursing services and systems that effectively and efficiently prepare nurses to fulfil the profession's current and future social mandate (Brink, 2006:4).

The aim was not only to understand the phenomenon but also to generate valid and reliable findings through the exploration and survey of the phenomenon. In addition, the study aimed to provide evidence-based results that could be used to improve the standard of hygiene of food handler's hands.

1.5 RESEARCH DESIGN AND METHOD

1.5.1 Research design

The design of this research project is quantitative, explorative, descriptive and contextual in nature. Quantitative research is defined as a formal, objective, systematic process to describe and test relationships and to examine cause-and-effect interactions among variables (Burns & Grove, 2005:747). This was used inductively and deductively to explore and describe the food handlers' compliance with hand hygiene during food handling, as well as to identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers.

According to Burns and Grove (2005:44), the rationale for the design is to gain an overall picture through the exploration and description of a phenomenon. In this research project, the phenomenon described is the food handler's compliance with hand hygiene during food handling and the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers. The context of the research project included the four major healthcare services in Potchefstroom in the North-West Province (see chapter 3, section 3.2).

1.5.2 Research method

The research methods included a description of the population, sampling, data collection, and ensuring rigour in the data gathering and analysis. A summary of the research project method is presented in the table below. Details of the research method are described fully in chapter 3.

Table **1.1.** Summary of the research method

STEPS	DATA COLLECTION	POPULATION AND SAMPLE	DATA ANALYSIS
Step 1: Determine the food handler's compliance with hand hygiene during food handling.	**Questionnaire:** · Based on DOH guidelines (Appendix 1) · Standardised format. **Pilot study** · Prior to research project. · Conducted in similar setup not included in actual research project in Klerksdorp, one private and one provincial.	**Target population:** · All food handlers from the four healthcare services in Potchefstroom in the southern district of the North-west Province. · Provides curative services. **Sampling method and size:** · 100% representative, all inclusive. · Participants (N= 110)	**Process:** · Preparation of data for analysis. · Description of the sample. · Testing the reliability of the measurements. · Exploratory analysis of the data. · Confirmatory analysis guided by the research questions and objectives.
Step 2: To identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers.	**Scientific sampling:** · Accredited occupational health laboratory (Appendix 10). · Protocol procedure of sampling method. · Sampling from the food handlers' hand surfaces.	**Target population:** · Same as in step 1 **Sampling method and size:** · Same as in step 1	**Process:** · Same as in step 1
Step 3: Formulation of standards for hand hygiene of food handlers.	· Conclusions from theoretical framework. · Results from step 1 and step 2.	· Conclusion statements based on all the results from the research project.	**Standards** · Inductive and deductive logic. · Formulate standards based on findings. · Standards - structured, process and/or outcome. · Congruent with DOH's guidelines.

1.6 RIGOUR

Rigour (Burns & Grove, 2005: 176 & 735) requires that the researcher recognise and discuss the ethical implications of the research project with the participants. This requires not only expertise and diligence, but also honesty and integrity. To reduce errors and ensure that the findings were an accurate reflection of the reality, the research project involved specific steps requiring discipline, scrupulous adherence to detail, and strict accuracy in precise measurement methods, representative samples, and a well-developed study design. The researcher's

objectivity was required to minimise bias that might distort the findings. Rigour comprised the following elements: internal validity, external validity and reliability (discussed in chapter 3, section 3.4).

1.7 ETHICAL CONSIDERATIONS

Ethical research is essential to generate sound knowledge for nursing practice, including the protection of food handlers' rights, balancing benefits and risks, as well as obtaining informed consent (Burns & Grove, 2005:83,180-193; Brink, 2006:30-40). The researcher is responsible for conducting research in an ethical manner (Brink, 2006:30).

The application for conducting the research project was granted by the North-West University's ethical committee (certificate number: 07M05; see Appendix 2). The Department of Health of the North-West Province (Appendix 3) approved the research project and the Department of Health, Southern District (Appendix 4) was informed about the research project. The four healthcare services were provided with an application to conduct the research project (Appendix 5) and consent was received, in person, to perform the research project. The healthcare services required that the results from the research project be anonymous during the data collection and report writing phase to protect their food handlers' privacy.

The local Department of Health authorities gave permission for an inspector to accompany the accredited laboratory assistant to monitor the screening. However, this was not necessary as all the healthcare services supported and approved the research project. Reports of the findings were forwarded to all the healthcare services as requested.

The researcher established rapport with the participants, displayed honesty and integrity, and ensured them of their anonymity and privacy. Informed consent from participants was obtained after the research project was communicated verbally and explained in detail in such a way that the literacy level of each participant was acknowledged. The goal and benefits of the study, not only for themselves but also for the community and general public as a whole, was explained, along with the goal of gaining personal knowledge in food handling hygiene. The participants

were given the opportunity to ask questions and were given the option of receiving personal feedback regarding the research project results.

The research project was conducted competently and accurately, resources were managed honestly, those who contributed guidance or assistance were acknowledged, results were communicated accurately, and the consequences were considered in terms of the specific research field. Rigour is fully discussed in chapter 3, section 3.4.

1.8 RESEARCH PLAN OUTLINE

CHAPTER 1: Overview of the research
CHAPTER 2: Theoretical framework
CHAPTER 3: Research design and method
CHAPTER 4: Discussion of research results
CHAPTER 5: Standards for the hand hygiene of food handlers
CHAPTER 6: Evaluation of the study, limitations, recommendations for practice, education and research

1.9 SUMMARY

The chapter presented an overview of the research project. Food-borne illnesses may be multifactorial in aetiology and the food handlers' hands, as an essential part in the food processing industry, are not included in occupational health surveillance for pathogenic micro-organisms (SASOM, 1996:2).

Food-borne illnesses are still among the most widespread of illnesses throughout the world and the food handler, as carrier, can transmit these food-borne micro-pathogens from one product to another, and to the patient. The reason is usually inadequate or poor habits of hand washing and neglected personal hygiene during food handling. The food handler can contaminate food with organisms like *Escherichia coli* and *Staphylococcus aureus* (CDC, 2005:12; Codex Alimentarius Commission, 2003:17; DOH, 2005:14). Such contamination may be especially detrimental to the health of the patients in the healthcare services.

In South Africa, as in many other developing countries, westernisation has created a revolution of fast-food production, with a concurrent multiplication of health risks associated with poor food hygiene. The Department of Health's guidelines

(2000a:2; see Appendix 1) conclude that occupational health surveillance of the food handler is unnecessary, and ignores the possibility that the food handler can contribute to cross-contamination and food-borne illnesses.

The design of this research project was quantitative, explorative, descriptive and contextual in nature and included the four major healthcare services in Potchefstroom. The rationale for the design was to gain an overall picture through exploration and description, using a questionnaire and scientific sampling of the food handlers' hands. The aim of this was to investigate handlers' compliance with hand hygiene and to determine whether poor compliance contributes to cross-contamination during food handling.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 INTRODUCTION

The theoretical framework provides a basis for gathering information to build on, confirm, transcend and contribute knowledge in the field of nursing (Wilson, 1993:13). In this research project, the theoretical framework was intended to contribute to the existing knowledge on occupational health nursing. A theoretical framework is a structure of the collection of interrelated concepts that guide a research project. The theoretical framework establishes and defines the concepts (see chapter 1, section 1.3.2) in the research design relating to the compliance of the food handler with hand hygiene during food handling that might influence the prevalence rate of micro-pathogens like *Escherichia coli* and *Staphylococcus aureus,* which causes food-borne illnesses.

The literature comprises international and national research findings, journals, articles, books and national legislation, in addition to existing guidelines relevant to the research project. A study of the literature aimed to identify what is known about food handlers' compliance with hand hygiene during food handling. Seventy-eight, (78) literature sources (refer to Bibliography, p 151) and four (4) search engines were used to gather data, namely Google, MedLine, PubMed and OmniMedicalSearch.

Food-borne illnesses, due to contaminated food, are perhaps the most widespread health problem globally and are an important cause of reduced economic productivity. There is disagreement over whether food is safer today than in the past, but ensuring safe food every day has become more complex (Redman, 2000:1).

By definition, a food handler means a person who, in the course of their normal work, comes into contact with food not intended for his or her personal use (DOH, 2000a:1). The Codex Alimentarius Commission (2003:6) describes a food handler as "any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements". A food handler is thus any person involved in the processing, production, manufacturing, packaging, preparation,

sale and/or serving of any foodstuff, including water and beverages (DOH, 2000a:1).

Many countries have established inspection agencies concerning food processes. For example, the United States created the Food and Drug Administration (FDA), and the World Health Organisation (WHO, 1999:8) formed the Food and Agricultural Organisation (FAO). Countless challenges in food safety have been solved, yet new health threats develop continuously as a result of poor hand hygiene during food handling.

In South Africa, the food supply industry employs 10 to 15% of the workforce in the country. As such, the food handler forms an essential part in the food supply industry and food handling is integral to the food handler's job responsibility. It is inevitable that the food handler's hands come into contact with food, thus hand hygiene is vital to prevent food and surface contamination. This is especially important when working with food destined for ill people, as it may be a mitigating factor for the patient's recovery. Consequently, the food handler also forms part of the occupational health service. Through either structure, process or outcome standards in occupational health surveillance, occupational health practitioners can improve the standard of food quality and safety in the healthcare service.

Food contamination implies the effect exerted by an external agent on food such as contaminated hands which causes food to be unfit for human consumption. The most common way for food to be contaminated is through contact with food handlers who carry food-borne micro-pathogens (CDC, 2005:1). According to the FDA (2003a:1), careless food handling sets the stage for growth of disease-causing germs. The CDC (cited in Ayçiçek *et al.*, 2004:254) points out that most common bacteria identified in food poisoning (comprising 70% of cases) is *Staphylococcus aureus.* According to Van Tonder (2004:6), *Staphylococcus aureus* has been indicated as the bacteria predominantly involved in food-borne illnesses, the consequence of consuming contaminated food.

Escherichia coli is a bacteria present in our intestine, the purpose of which is to digest food. It was first recognised as a pathogen in 1982 during an outbreak investigation in the USA. In 1994, *Escherichia coli* became notifiable as a source

of food-borne illness, and in 2000, mandatory notification was introduced in 48 states in the USA (Rangel *et al.,* 2005:1). *Escherichia coli* are thought to give a good indication of faecal contamination and general lack of hand hygiene during food handling. A few strains release deadly toxins that can cause great discomfort and even death (FDA, 2003a:1). *Escherichia coli* can be transmitted in faeces from cattle and humans to edible foods. When these toxins are released in our bloodstream, they invade the lining of the intestine, causing severe damage to the intestinal lining, and shredding cells that clog the kidneys. Thereafter other organs start to fail in their ability to function. The presence of *Escherichia coli* are an alarming indication of contamination and food poisoning, as preparation of meals are handled by the contaminated hands of food handlers (CDC, cited in Ayçiçek *et al.*, 2004:254). There is no cure for food-borne illnesses and treatment with antibiotics is thought to exacerbate the condition as they kill other beneficial bacteria, leaving more resources for the *Escherichia coli* to thrive on (Redman, 2000: 14).

As an emerging source of food-borne diseases, *Escherichia coli* causes 73,000 infections annually in the United States of America (CDC, 2003:1). According to Rangel *et al.* (2005:606), from 1982 to 2002, 350 *Escherichia coli* food-borne illness outbreaks were reported in 49 states of the United States of America. Investigations into these outbreaks provided information about inadequacy of food processing methods, for example, half of the produce-associated outbreaks were due to kitchen-level cross-contamination. Consequently, Baş *et al.* (2006:317) proclaimed that food poisoning outbreaks of *Salmonella* and *Escherichia coli* have made the public more sceptical of the food they consume, and statistical evidence proves that the incidence of food poisoning caused by food handlers is greater than in any other food sector, accounting for 70% of all bacterial food poisoning outbreaks.

Staphylococcus aureus is the only pathogen in the permanent bacteria group that is present on the human skin (Ayçiçek *et al.*, 2004:253). Trickett (2000:19) points out that *Staphylococcus aureus* is present on the hands, under fingernails, in the nose and throat, and can survive in the air, in dust, sewage, water, milk, as well as on food equipment and surfaces. In normal circumstances, *Staphylococcus aureus* is not a health risk; however, it can cause food-borne illness shortly after ingestion

with acute vomiting and discomfort when the toxins they produce arrive in the intestinal tract in large numbers. *Staphylococcus aureus* has the ability to produce seven different toxins that are frequently responsible for food poisoning (CDC, 2005:1). The prevalence rate of *Staphylococcus aureus* is lower than *Escherichia coli*, the duration of the illness is very short and it is less frequently reported (Redman, 2000:14).

As a cause of food-borne illness, bacteria like *Escherichia coli* and *Staphylococcus aureus* are microbiological hazards that are detrimental to human health. A microbiological hazard is when food becomes unsafe to the consumer; when principles of hygiene and sanitation are not met; when food becomes contaminated by pathogens from humans or the environment during production, processing or preparation; or when food originates from a sick animal (DOH, 2002:1). The food handler can be a disease carrier and can contaminate food and surfaces with micro-pathogens like *Escherichia coli* and *Staphylococcus aureus*, to mention only two of the most common variety of pathogens causing food-borne illness. Pathogen micro-organisms, means bacteria that causes disease (SA, 2003:2), like *Escherichia coli* and *Staphylococcus aureus.* Although these two pathogens represent only a fraction of pathogens causing food-borne illnesses, they form the focus of this research project.

The Department of Health's (2000a:2; see Appendix 1) food control requirements on the surveillance of food-borne illnesses in the food processing industry concentrate on working surfaces, utensils, reporting of diseases and health education of food handlers, and ignore the possible role of the food handler's hands in the cross-contamination process. Trickett (2000:22) explains cross-contamination as:

> the transfer of bacteria from a contaminated source to an uncontaminated food via a non-food vehicle and involves usually one of the following: hands of the food handler, utensils, chopping boards, cloths, droplets of moisture from sneezing or coughing or drops of liquid from a contaminated food.

2.1.1 Concluding statements on the introduction to the theoretical framework

As a vital link in the food supply chain, food handlers are not included in occupational health surveillance programmes for ensuring compliance with hand hygiene to provide pathogen-free food, especially to patients in the healthcare service.

Food-borne illnesses occur worldwide; because of this, standards must be identified and implemented to eliminate cross-contamination during food handling.

To establish and implement standards for occupational health surveillance for the food handlers' hand hygiene, a number of aspects must be considered. This implies the recognition of the international and national information available, the current national guidelines for hand hygiene practices, the food handler as link in the food handling processes, and the right of the patient in the healthcare service to receive food that is free from food-borne pathogens.

The conceptual map below provides a gestalt of the phenomenon under investigation and indicates the interrelationships of the concepts.

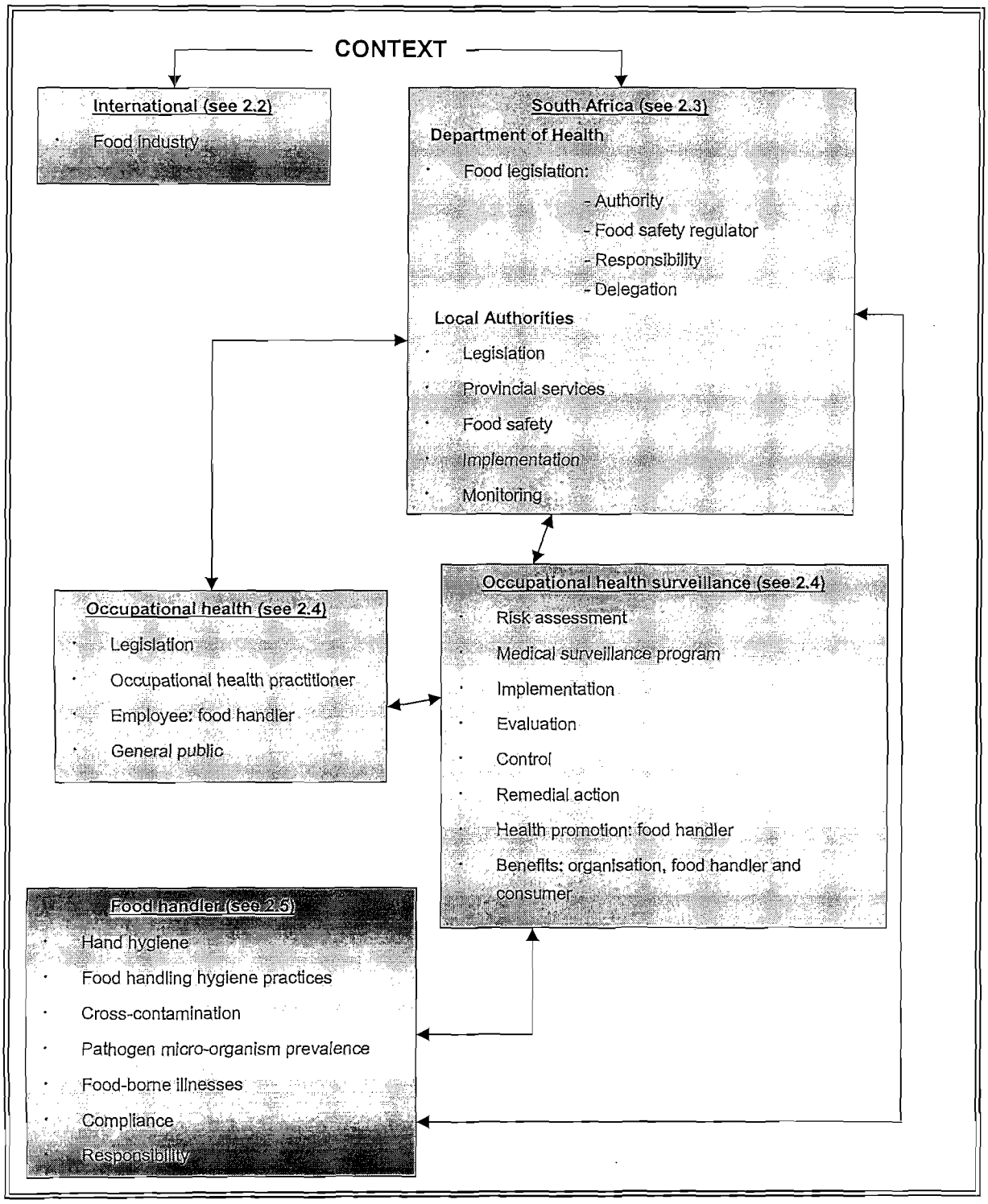

Figure **2.1.** Conceptual framework proposing the relationships between concepts

2.2 INTERNATIONAL PERSPECTIVE

According to Legnani (cited in Van Tonder, 2004:13), consideration is seldom given to food-borne illnesses and their results, which are often mild and self-treated. The author argues that this has resulted in the general under-estimation of the importance of food-borne illnesses and the consequences thereof for the

industry and general public at large. To protect consumers from food-borne illnesses, efforts must focus on each point in the farm-to-table chain to better predict and prevent food-borne hazards, and to monitor and rapidly react to outbreaks of food-borne illnesses. According to Dahl (2007:1), a food-service establishment should have an effective food-safety programme to prevent hazards before they occur. For example, the Hazard Analysis Critical Control Point (HACCP) programme was a proactive programme initiated by the FDA to ensure food safety for the astronauts in the space programme. The HACCP starts by reviewing a food service's standard operating procedures to be sure that food hazards are controlled during receiving, storage, preparation, service, and cooling of foods for later use. An examination of sanitation, food handlers' personal hygiene and work practices is also important (Dahl, 2007:1).

As Trickett (2000:1) points out, there has been an alarming increase in the number of food-borne illnesses in the past few years and it is therefore important that people preparing and serving food in a commercial environment should understand how food poisoning arises and how to prevent it. Trickett (2000:25), Redman (2000:1) and Van Tonder (2004:1) indicate that poor hand hygiene of the food handlers could spread food-borne pathogens to the food they are preparing. According to the National Institute of Allergy and Infectious Diseases (NIAID, 2005:1), the Codex Alimentarius Commission (2003:3) and the DOH (2005:11), food-borne illnesses are a common, distressing and sometimes life-threatening problem for millions of people around the world.

Trickett (2000:20) points out that *Staphylococcus aureus* is found in water, dust and the air, although food handlers are the main source of food contamination. According to the author, at least 30% of healthy people have *Staphylococcus aureus* present in their nasal passages, on their hair and skin. Without high-quality personal and hand hygiene, these bacteria can easily end up in the foods we eat and given the right environment, *Staphylococcus aureus* can multiply rapidly at room temperature, producing a toxin that is responsible for the condition known as *Staphylococcal* food poisoning. Trickett points out that these pathogenic bacteria are likely to be transferred to the carrier's hands and food if hand hygiene is neglected, resulting in the contamination of the food and surfaces. As a possible source of cross-contamination, the food handler has to prevent this through the

implementation and maintenance of a high-quality of hand hygiene during food handling. This includes hand washing after visiting the rest room, using serving tongs for handling food, avoiding sneezing or coughing, covering open cuts or boils, or recovering from food poisoning.

According to the Food Safety and Inspection service of the United States Department of Agriculture, (USDA, 2003:92), food handlers may carry disease which can contaminate food. This finding is supported by the CDC (2005:12), DOH (2005:14) and Codex Alimentarius Commission (2003:17). According to Allwood *et al.* (cited in Shojaei *et al.*, 2006:525), it is generally accepted that food-borne illnesses are linked to poor personal and hand hygiene of the food handler, which can be a reservoir and vehicle for the transmission of pathogens to food and work surfaces.

In a study done by Vollaard *et al.* (2004:863) of the Department of Infectious Diseases at Leiden University's Medical Centre, risk factors for the transmission of food-borne illnesses in restaurants and street vendors were identified in Jakarta, Indonesia. In a cross-sectional study, the hands of 128 street vendors and 74 food handlers from restaurants were analysed. The results showed that poor hand washing hygiene standards and direct hand contact with food caused contamination; and that the contaminant was identified as faecal. In 1999, in Toledo, Ohio, viral gastroenteritis occurred amongst people that attended a dinner prepared by a local caterer. Ninety-three of 137 attendees (67.9%), reported ill; and one food handler was identified as the transmitter of the pathogen (Kassa, 2001:9). As shown by Saryghad *et al.* (2005:647), the food-borne group A *Streptococcus* (GAS), caused an outbreak of tonsillo-pharingitis among residents of a dormitory in the Islamic Republic of Iran. Food handlers were identified as the reason for the cross-contamination. In an article by Khuri-Bulos *et al.* (1994:311), *Salmonella* food poisoning resulted in the hospitalisation of 84 out of 183 individuals who had lunch at the Jordan University Hospital in Amman. The outbreak was caused by massive contamination due to contaminated hands, in all probability of one food handler.

As reported by the United States Food and Drug Administration (FDA, 2003a:1), 76 million illnesses in the United States can be traced to food-borne pathogens. Of

these, 325,000 are hospitalised and more than 5,000 deaths occur. These findings are supported by the Department of Health and Human Services (2007:1). The spread of illnesses through food or beverages is a common, distressing and sometimes life-threatening problem for millions of people in the United States of America and around the world. As shown by the CDC (2005:1), food-borne illnesses are costly, and annual costs escalate between five and six billion dollars in direct medical costs and productivity loss. *Salmonella* alone accounts for $l billion annually. The people who represent these statistics are the public and patients of the same food industry which caused their food-borne illnesses (CDC, 2003:1). According to the CDC (cited in Ayçiçek *et al.*, 2004:254), for the period 1988 to 1992 the rate of food poisoning caused by poor personal hygiene was 22%. From 1975 to 1998, this figure was 42%. Thirty–four out of 81 food-borne illness outbreaks have been caused by poor hand hygiene of food handlers. Hygiene training was not given to guarantee safe food handling and this resulted in poor hand hygiene during food handling.

A study done by Howes *et al.* (cited in Baş *et al.*, 2006:317) in the USA suggested that improper food handler practices contribute to approximately 97% of food-borne illnesses in food service establishments and homes. Poor sanitary practices, food storage, handling and preparation, along with poor food safety knowledge of the food handlers, can create an environment in which food-borne pathogens are more easily transmitted. Baş *et al.* (2006:321) also indicate that the limited research related to food safety knowledge, practices and attitudes of food handlers in Turkey indicates that food-handling problems need to be addressed. For example, only 21.2% of food handlers out of 764 participants identified they need to wash their hands after using the toilet.

Allwood *et al.* (cited in Shojaei *et al.*, 2006:525) point out that improved personal hygiene and hand washing would limit faeces-to-hand-to-mouth spread of potentially pathogenic micro-organisms. However, in spite of showing food handlers that their hands are contaminated with large numbers of pathogenic organisms and that food safety can be improved by hand washing; food handlers may be reluctant to comply. Consequently, persistent surveillance is needed to evaluate compliance through standards and to enhance food safety for those in poor health. The USDA (2003:93) indicates that unwashed hands are a prime

cause of food poisoning; it emphasises that hand washing is an important practice in a food-processing environment and that food handlers should keep their hands clean to prevent cross-contamination of pathogens. Maintaining a high standard of hand hygiene is an important factor for food handlers when preparing or handling food (Trickett, 2000:26). Belton and Belton (2002:55) point out that members of the public have become increasingly concerned about risk management practices, particularly in the context of food and its production.

Decisions to formulate policy depend on the following aspects: perceiving if a problem exists, identifying concerns from the public, media or international settings, and motivation to eliminate the problem in human interest (Belton & Belton, 2002:76). According to Belton and Belton (2002:55), an increased understanding of food hazards will provide a basis from which decision-making on food safety and the needs of the wider public can be addressed and, based on this, through which quality of life and environmental sustainability may be promoted.

The World Health Organisation (WHO, 1999:8) emphasises that food safety and risk analysis are inherently essential to all food production processes as well as to all human activities that consist of risks that may aversely affect people's health. Determination of their relevance for health is only achievable through risk analysis, which is a recently emerging discipline. As a fundamental methodology, risk analysis underlines food safety standards that provide and facilitate adequate health protection. The Codex Alimentarius Commission (2003:62) points out that surveillance programmes can provide an ongoing opportunity to reassess public health risks associated with pathogens in foods if new relevant information and data become available.

As a point of departure, responsibility should be shared by governments, the food industry and the consumers, each playing an important role in the protection of human health. The WHO (1999:47) suggests that safety assurance should therefore form an integral part of the farm-to-table food safety continuum.

2.2.1 Concluding statements on international perspectives

The importance of food-borne illnesses and their consequences for the food industry, the general public at large and the patients, should be seen as a important factor in the alarming increase in the number of food-borne illnesses.

Food-borne illnesses are a common, distressing and sometimes life-threatening problem for millions of people around the world and should be addressed so as to eliminate cross-contamination.

The food handler as a vehicle for the contamination of food and surfaces during preparation and serving in a commercial environment, and especially in the healthcare service, should understand how food-borne illnesses arise, and how to comply with hand hygiene. In addition, a surveillance system should be in place.

2.3 SOUTH AFRICAN PERSPECTIVE

"Part of the secret of success in life is to eat what you like and let the food fight it out inside" (Mark Twain). This quote, written a hundred years ago, gave no thought to the changes that would occur in the food industry and consumer lifestyles in the following decades (Van Tonder, 2004:106). Clayton *et al.* (cited in Lues & Van Tonder, 2007:326) indicates that data on risk factors for food-borne illnesses result in the majority of cases from faulty food handling practices, and that the lack of personal hygiene amongst food handlers is one of the most commonly reported practices contributing to food-borne illnesses. According to the same article, bacteria such as *Escherichia coli* and *Staphylococcus aureus* can survive on hands and surfaces for hours or even days if not cleaned and properly maintained. This contributes to the increase in food-borne illnesses and even death of many people each year, at immeasurable cost in economic terms and in human suffering. *Escherichia coli* should normally be absent from hands and surfaces, and if present, indicates faecal contamination through poor hygiene practices. As Lues and Van Tonder (2007:330) point out, *Staphylococcus aureus* is the predominant species involved in food poisoning outbreaks.

According to the Official Gazette Extraordinary of Transvaal (1972:2374), which is still in use in Potchefstroom, in the southern district of the North-West Province, the only requirement for personal hygiene of the food handler is washing their

hands before beginning their work, after any break, and after visiting the toilet. No formal standards are available to evaluate the food handler's compliance with any of these requirements, nor for the identification of the prevalence rate of food-borne pathogen micro-organisms like *Escherichia coli* and *Staphylococcus aureus.*

The South African Bureau of Standards User's Code for Food Hygiene Management (SABS, 2001:27-28) confirms that food handlers shall be considered sources of pathogenic micro-organisms and potential carriers of food-borne illnesses. It remarks that it is generally accepted that the medical surveillance of the food handler, as a source of cross-contamination, is not a reliable method. In contrast, it requires management to ensure that all staff members are medically fit before employment as well as during work. Medical examinations must only be done if considered necessary, based on medical history, or indicated for epidemiological considerations. The SABS (2001:3-4) explains that management must commit themselves, paraphrase and document a hygiene policy and goals, and ascertain that all employees understand and implement the policy, over and above maintaining it. Management shall identify, monitor and record all critical parameters in the process to guarantee that all finished products are microbiologically safe in addition to establishing procedures for keeping food safe at all stages during handling (SABS, 2001:6-7). Management has to appoint an employee that, aside from their normal responsibilities and with the necessary authority, ensures that adherence to the user's code for hygiene is maintained. Furthermore, the SABS (2001:34) proposes that emphasis be placed on prevention rather than detection of contamination by implementing a tracking system to recognise microbiological contamination in the production processes, based on environmental sampling and testing. No standards for the food handler's hand hygiene are mentioned in the SABS user's code.

According to the SABS (2001:6), to prevent contamination of food, training and retraining must be provided for all personnel involved in food handling. Training should be implemented, documented and maintained over and above keeping records for statistical purposes to ensure that the process of hygiene is efficient and acceptable. The SABS guidelines recommend supplying change rooms, clothing, toilets and washing facilities with applicable soap and hand wash procedure notices as the only other requirements for hygiene (SABS, 2001:17).

This user's code also requires food handlers to undergo medical examinations before commencing the job where the medical history of the potential employee or epidemiological considerations justifies it. Hands should be washed as frequently as possible before commencing the daily work, directly after using the toilet and after coming into contact with contaminated material. Personal sanitation should be supervised: for example, no jewellery or long nails should be worn, while hair coverings, protective clothes and gloves should be used during food handling. Personal practices that might cause contamination of food, such as eating, smoking, chewing bubblegum or unhygienic practices like spitting, are forbidden. Each person working in the food handling area must adhere to these stipulations and maintain them while on duty (SABS, 2001:27-29).

The South African National Department of Health (DOH, 2000b:2) is responsible for the regulation of all matters related to food safety on national level. This body delegates this responsibility to provincial authorities for implementation and monitoring. In addition, the DOH is responsible for occupational health and approving the occupational health service (by means of a license), which includes the occupational health practitioner.

According to the South African Department of Health's (2002:1) statistical notes, food-borne illnesses are underreported in South Africa. One reason may be the lack of an efficient and integrated surveillance and notification system. Apart from not providing an effective mechanism to determine the role of food handlers in the spread of food-borne illnesses, the country's present disease notification system does not take cognisance of new emerging food-borne infections, such as *Escherichia coli*, 0157:H7 and *Shigellosis*, which are at present not notifiable. The statistical notes (DOH, 2005:4) show that during the period 1999 to 2004, 136,331 cases of food-borne related illnesses and 530 deaths were reported.

A study done by Van Tonder (2004:59-61) tested for, and results showed the presence of *Escherichia coli* and *Staphylococcus aureus* among 300 participants in 35 outlets in a retail group in the Western Cape, South Africa. The South African newspaper, Beeld, published research findings from The Lancet (cited in Pienaar, 2005:13), stating that if a more hygienic lifestyle were followed, the incidence of diarrhoea and pneumonia in children could be decreased by 50%.

The Chief Director of Health, Dr. Makubalo, stated that screening for food-borne illnesses is becoming an increasingly high priority on the public health agenda and should be integrated in the entire food supply chain (DOH, 2005:3). Integrating such data would result in robust surveillance information and allow appropriate priority setting and public interventions, such as reporting incidents to the health authorities, physician's responsibility to identify, confirming the causative agent and reporting suspected cases of food poisoning to the Department of Health. The Director further states that South Africa needs an efficient food-borne illness surveillance system (DOH, 2005:4).

The Department of Health's (2000a:2, see Appendix 1) food control guideline requirements on the surveillance for food-borne illnesses in the food processing industry concentrate on the surfaces and utensils, suggesting that the implementation of a surveillance system for the food handler's hands are not an important factor or concern in the transmission of food-borne pathogens. Rather, the DOH (2000a:3) relies on a mutual understanding and trust between management and food handling employees as the basis of a food handling strategy. The DOH guidelines (2000a:2, see Appendix 1) propose the following principles to promote a high standard of safe food handling:

- Management commitment
- Education and training
- Health interviews
- Reporting illness to management
- Applying basic food handling practices
- Applying basic personal hygiene practices

♠ Management commitment

Food hygiene is the responsibility of management, who need to implement a quality control programme of optimum hygiene covering all aspects of food handling, create optimum hygiene conditions and practices with vigilant and competent supervision, and promote open discussion and reporting of hygiene problems by employees. Management should employ a technical expert to advise on hygiene as well as the implementation of an occupational health programme for improving working conditions and increase product reliability.

♠ **Education and training**

Health authorities must accept that education and training of food handlers is also part of their responsibilities and therefore should ensure that appropriate programmes receive their attention. Practical and functional educational methods and aids should be used in such a way that all the employees know and understand the basic principles of food safety and personal hygiene, and their own responsibility in this regard. In addition, employees should undergo an assessment to monitor their knowledge of all the aspects involved in food handling. Refresher courses should be given periodically and conducted by properly trained personnel. The food handler should also understand the importance of reporting illnesses as soon as they occur.

♠ **Health interview**

This involves the completion of a questionnaire by the employee before commencing employment. It is aimed at a general assessment of a person's suitability for work as a food handler in terms of appearance and cleanliness. Aspects that should be included in the questionnaire are the identification of excretes and micro-organisms of importance in food safety. Medical advice need only be sought if the interviewer considers that a detailed examination would be desirable, in cases of suspicion of special conditions which might disqualify the appointment. Examples include otitis media with perforation, chronic bronchitis with purulent sputum and widespread skin conditions of secondary nature.

♠ **Reporting illness to management**

Management should encourage employees to report whenever they have any illness that might influence or contaminate the food they are handling. These illnesses include diarrhoea, open skin lesions, boils, eye infections, fever, cold and jaundice. Management should use discretion as to whether these employees should be subjected to certain work restrictions or suspended from their normal work. Management should have a general knowledge of food-borne illnesses so that they may identify them early and relocate the employee where no task involves the handling of food. This minimises cross-contamination to food or surfaces. Returning to work should take place after consultation and consent with both management and a medical doctor. These measures are aimed at protecting co-workers and consumers from becoming infected. The question arises to what

extent these measures have been implemented in the food industry, and the costs involved. The DOH points out that these measures must be applied in a practical way, so as not to exclude a person unnecessarily from work, while maintaining the safety of co-workers and consumers.

♠ **Applying basic food handling hygiene practices**

These are aimed at food handling and preparation, the maintenance of clean surfaces, utensils and equipment, along with the protection of food from insects and dust. Food must be obtained from a health-approved source, cooked properly, covered and stored carefully. Contact between raw and cooked food should be avoided.

♠ **Applying basic personal hygiene practices**

Managers should ensure that the food handlers adhere to the following aspects, which should be part of the customary norms and values during food handling: hands should be washed before and between handling different types of foods, after using the bathroom, after blowing one's nose, after smoking and eating and handling the refuse bin. Food handlers must wash their hands and scrub their nails in warm soapy water throughout the day to ensure that they are hygienically clean. Food handlers should dry their hands with paper towels or dry air and never use a communal towel unless it is of the revolving type. Nails should be kept short, not licked, and kept away from the face; hair should be covered; cuts and sores covered with waterproof dressing; handlers should never cough, sneeze or blow their nose over food. No jewellery should be worn and handlers should ensure that they are at all times clean of person. It is also recommended that a hot shower/bath be taken daily before commencing work. In the workplace, soap and clean towels should be available, as well as clean protective clothing.

In a circulation letter addressed to the health departments regarding pre-employment and routine medical examinations of the food handler, the DOH (2000a:10-11, see Appendix 1) again questions the cost-effectiveness of some of the abovementioned procedures in minimising contamination. For instance, DOH argues that pre-employment and routine medical examinations of food handlers are not cost-effective in the prevention of food-borne illnesses and recommends that health authorities should therefore not require it. According to the DOH, the

element of concern is the rapid turnover of employees given the cost of examinations that do not guarantee the detection of any but a small proportion of carriers of pathogenic organisms. Rather, the DOH emphasises education in hygienic practices. The DOH (2000a:10-11) states: "for these reasons the Department considers pre-employment and routine medical examinations of food handlers as not being cost-effective and unreliable in the prevention of food-borne diseases and recommends that it should therefore not be required by health authorities". However, later in the same text the DOH suggests that regular monitoring and surveillance by health authorities and management on the food handling processing is crucial, which seems to contradict the previous sentence.

2.3.1 Concluding statements on the South African perspective

It has been accepted that food handlers are potential carriers of food-borne illness and should be considered sources of pathogenic micro-organisms. However, no method exists to confirm if they adhere to hand hygiene during food handling.

Hygiene practices should be monitored and maintained to guarantee that food is safe for patients in the healthcare service.

Food handlers have to understand and master hygiene practices and be assessed. On this education and training is therefore a core element in the food handlers' mastery of this knowledge.

An efficient and integrated occupational health surveillance and notification system should be implemented to determine the role of food handlers in the spread of food-borne illnesses.

Financial costs should not be the chief consideration in determining food quality and safety. Rather, the chief factor should be assurance that the food reaching consumers (in this case, patients in the healthcare service) does not pose a threat to their health and recovery.

Managers in food preparation section must take responsibility for enforcing food safety rules through the training and retraining of all food handlers and regulating their compliance with hand hygiene.

2.4 OCCUPATIONAL HEALTH

The American Association of Occupational Health Nurses defines occupational health and establishes the responsibility of the OHP as: "the application of nursing principles in concerning the health of workers in all occupations, the prevention, recognition and treatment of illness and injury, and requires special skills and knowledge in the fields of health" (cited in Kotze, 1992:137).

Occupational health in South Africa is regulated by legislation and guidelines such as the Constitution of the RSA, Act 200 of 1993, and within the act, The Bill of Rights. The Health Act 63 of 1977, The Occupational Health and Safety Act 85 of 1993, The Mine Health and Safety Act 29 of 1996 and the Compensation for Occupational Injuries and Diseases Act 30 of 1993 are part of the OHP's compliance responsibilities. Other legislation relevant to occupational health are the Occupational Diseases in Mine and Works Act 78 of 1973, The Labour Relations Act 66 of 1995, The Medicines and Related Substances Act 90 of 1997 and the Foodstuffs, Cosmetics and Disinfectants Act 54 of 1972. All these acts govern the protection of the employee's health and safety in all industries with defined scopes, aims, duties and purposes (Hattingh & Acutt, 2003:25-80).
According to Labuschagne (2001:44), occupational health is client based. The client in this research project is the food handler. These employees are the first and most important client; and the company has to provide the entire infrastructure for occupational health to operate in. According to Hattingh and Acutt (2003:18), the scope of occupational health nursing is based on company policy and is directly responsible for this. As such, it requires their full commitment to the services offered in the industry. Not only is the worker affected, but also all the stakeholders are involved and interrelated: the employer, co-workers, family of the worker and the community. As such, occupational health does not end at the food industry's gate but includes multiple stakeholders (Labuschagne, 2001:36; Hattingh & Acutt, 2003:18). The stakeholders are displayed graphically in figure 2.2.

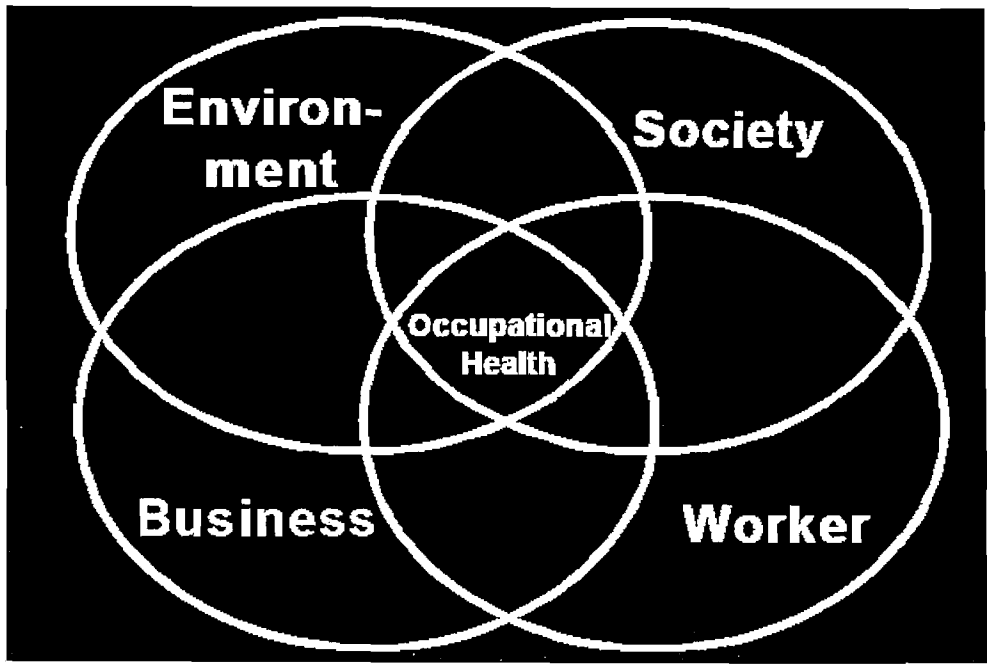

Figure **2.2.** Stakeholders in occupational health (Labuschagne, 2001:36)

Occupational medicine and occupational hygiene structures the occupational health system. Neither can hope to function effectively if they do not interact (Labuschagne, 2001:59). Occupational hygiene is defined by the Occupational Health and Safety Act 85 of 1993 as the anticipation, recognition, evaluation and control of circumstances that may develop in, or from the workplace, and which can have a negative or detrimental effect on the health of people. Although the Act refers to the employee in the workplace, it does not specify the food handler in particular. Neither mentions the health surveillance requirements or the negative influence the food handlers might have in cross-contamination of food that leaves the industry for the market and the patients in the healthcare service.

Furthermore, the occupational health system consists of five (5) pillars, namely HIRA risk profiling, surveillance, analysis, feedback and curative services to ensure the employees' well-being. Labuschagne (2001:80) illustrates the pillars of occupational health in figure 2.3.

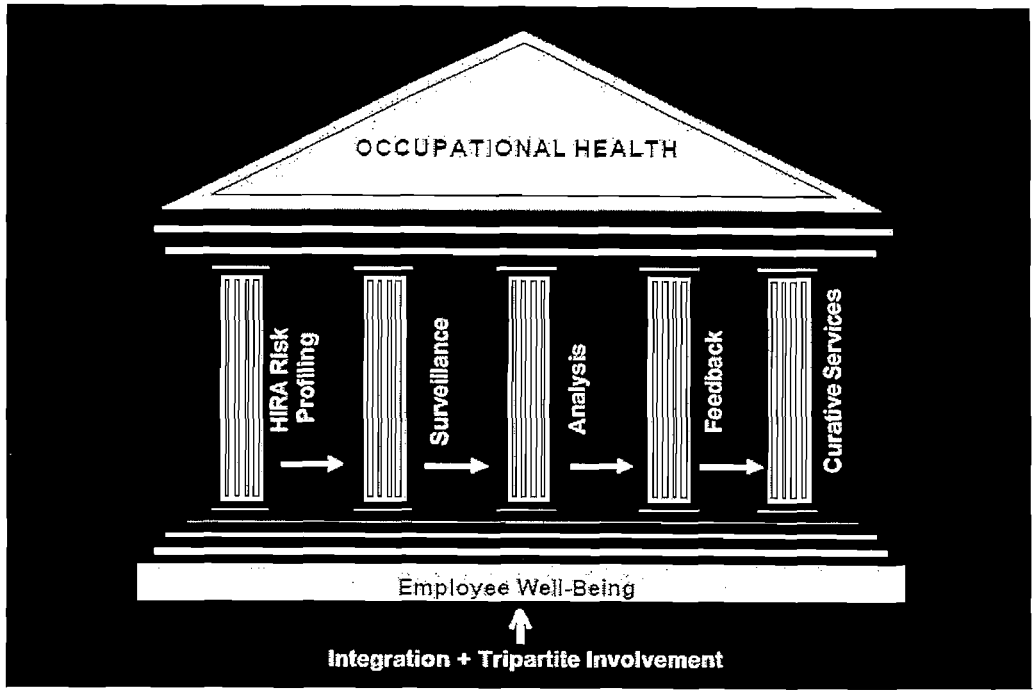

Figure **2.3**. The pillars of occupational health (Labuschagne, 2001:80)

The aim of the hazard identification and risk assessment (HIRA) is to implement measures to protect the health of employees that might be at risk. HIRA risk profiling takes into consideration all the hazards and risks present under a specific set of circumstances or in a specific setting. The hazard identification implies the process implemented to discover all the possible situations in the workplace where people may be exposed to injury, illness or disease, and the risk assessment involves the process to determine the likelihood that people may be exposed to injury, illness or disease in the workplace. The health surveillance system follows upon the risk profiling and relies heavily, if not totally on the information gathered. Based on the results and findings, an occupational health surveillance program is developed that encompasses all actions necessary to establish the state of employees' health to ensure optimal well-being. The purpose of occupational health surveillance is to ensure ongoing compatibility between the employee and their work environment (Labuschagne, 2001:80). Therefore, occupational health aims to monitor the employees' health in the organisation, is implemented and managed by the occupational health practitioner in collaboration with the occupational health medicine practitioner.

Labuschagne (2001:81) further states that the analysis of data accumulated during the occupational health surveillance process is converted into strategically useful

information to identify health trends as early as possible to implement remedial actions to protect the employee; preventing long term detrimental health effects and improves the general well-being of the work force. The same author points out that feedback to the employees provides them with information of their status of well-being. The curative service involves all activities that are aimed at repairing or reversing injuries or conditions that have already occurred, such as treatment of injuries or diseases, co-ordination of the multi-disciplinary services for rehabilitation, resuming of normal duties and stock control. The occupational health system is implemented and aims to monitor and sustain the employees' health in the organisation. It is implemented and managed by the occupational health practitioner in collaboration with the occupational health medicine practitioner.

2.4.1 Occupational health practitioner (OHP)

Historically, the primary function of the occupational health practitioner in South Africa was aimed at public health, protecting the health of the workers in the industry, commerce or other types of services which employ large numbers of workers (Kotze, 1997:40). Due to the expanding South African economy and the relative shortage of skilled labour, the work of the occupational health practitioner (OHP) is of considerable economic significance to the employer, the community as a whole, and the national welfare of the country (Kotze, 1997:39). In addition to this, the OHP is also a front-line community health nurse whose sphere of responsibilities extends beyond the care of the worker, in this regard the food handler, to include the family, community and the consumer (Kotze, 1997:40). In relation to this, Hattingh and Acutt (2003:15) verify that occupational health nursing and medicine consist of the following components: human factors, legislation, health surveillance and placement, health promotion and protection, emergency care, primary health care, treatment of diseases, administration and recordkeeping, rehabilitation, epidemiology and research. In this research project all of these elements are essential to guarantee and maintain hand hygiene of the food handlers in the food preparation sections.

Occupational health nursing is not an entity on its own, but is a comprehensive approach in rendering a health service to the employee. Simultaneously, the employee is part of a family and part of the community; these entities may

influence one another (Kotze, 1997:40). Occupational health nursing is therefore grounded in the belief that the OHP must render a service that is holistic, to improve and strengthen the health and welfare of all the employees, family and community (Kotze, 1997:60). The company and the occupational health service together must examine both the current and desired positioning of the two fields against each other, providing a service to the business environment that functions to extract optimum benefits for all parties involved (Labuschagne, 2001:279). The following figure displays these relationships (refer to figure 2.4).

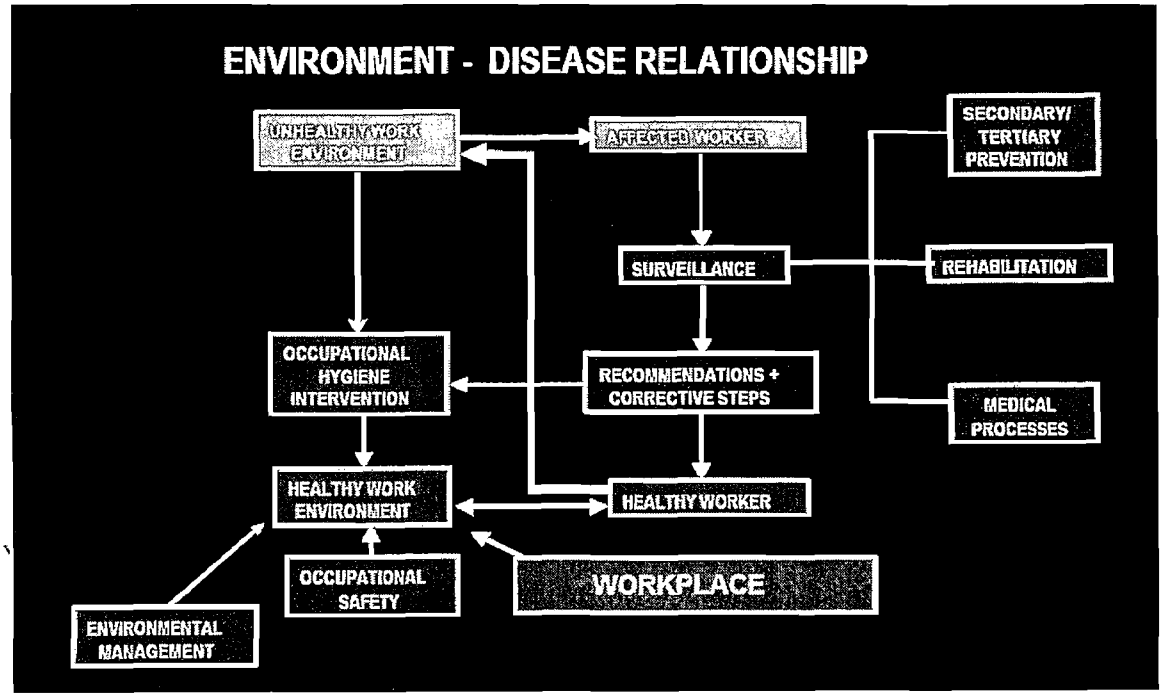

Figure **2.4.** Correlations between the worker, environment and occupational health system (Labuschagne, 2001:78)

Occupational health nursing is a postgraduate nursing speciality, requiring a wide scope of skills in providing healthcare to employees, aiming to optimise health, preventing illnesses and reducing health hazards based on governing legislation and prescribed guidelines. This structure includes the employer, employee and community in protecting their interests (Hattingh & Acutt, 2003:19). Hattingh and Acutt (2003:226) point out that the OHP functions independently, and as a professional must adhere to the provisions of the Nursing Act 33 of 2005, as well as the professional code of ethics which dictates their behaviour. Hattingh and Acutt (2003:221) emphasises that the OHP must have a wide field of knowledge

and experience in order to provide an effective health service. This knowledge and experience entails the following:

- General and occupational health nursing
- Ethical and legal compliance
- Emergency and trauma care
- Primary healthcare
- Health promotion and health education for the employees
- Toxicology and medicine
- Pharmacology
- Social and behavioural sciences
- Management of a health service
- Environmental hygiene, risk management and safety

Labuschagne (2001:188) explains that occupational health surveillance is possibly the most important element in the overall occupational health system. Not only does it produce essential facts, but the findings that this system delivers are of the utmost importance to ensure the employee's well-being. The health surveillance system uses risk profiling and relies on the information gathered in this way. According to Labuschagne (2001:280), a well-designed and correctly implemented and conducted occupational health surveillance system enables deliverables that provide considerable strategic information about the well-being of the workforce and add value to the company. The purpose of occupational health surveillance is to ensure ongoing compatibility between employees and their work environment, and therefore should be comprehensive in its approach (Labuschagne, 2001:152). The following framework outlines this (refer to figure 2.5).

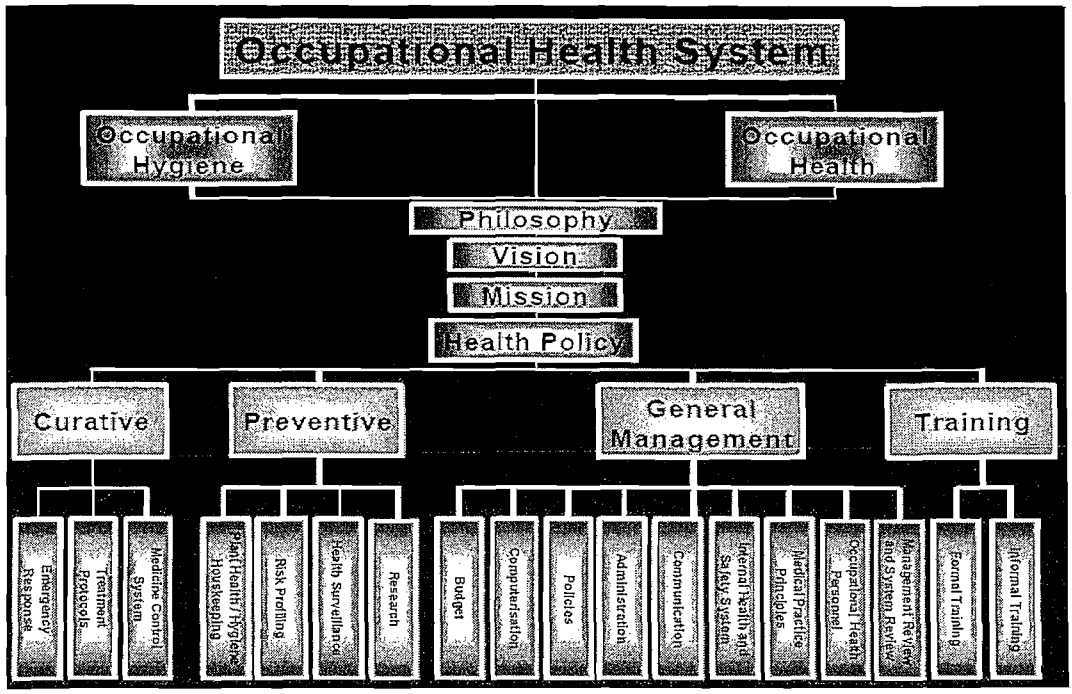

Figure **2.5.** Occupational health system (Labuschagne, 2001:152)

According to Kotze (1997:363), occupational health surveillance done on new appointees should be according the specifications and requirements of the job to employ the right person for the right job. The OHP's role in occupational health surveillance is a vital factor which relies upon the positive attitudes, participation and responsibility of both the employee and the employer to ensure a high standard of health and safety. In this research project, the employee refers to the food handler, the employer the healthcare service and the consumer, the patient in the healthcare service. The nature of the food handler's work environment requires that the OHP design a comprehensive occupational health surveillance programme (Kotze, 1992:65). The OHP has to implement the following aspects:

- Continuous data collection and evaluation for the identification and assessment of hazards in the work place
- Periodic reviewing of the employee's records to detect health changes
- Maintenance of a record and data storage system for retrieval of medical history to maintain optimal health
- Ensuring that all gathered data of employees are relevant for the work they are executing
- Development of a programme to enhance appropriate control for immediate remedial actions when needed

According to Labuschagne (2001:189), occupational health surveillance results deliver a framework for further decisions and remedial actions. Figure 2.6 illustrate the occupational health surveillance process.

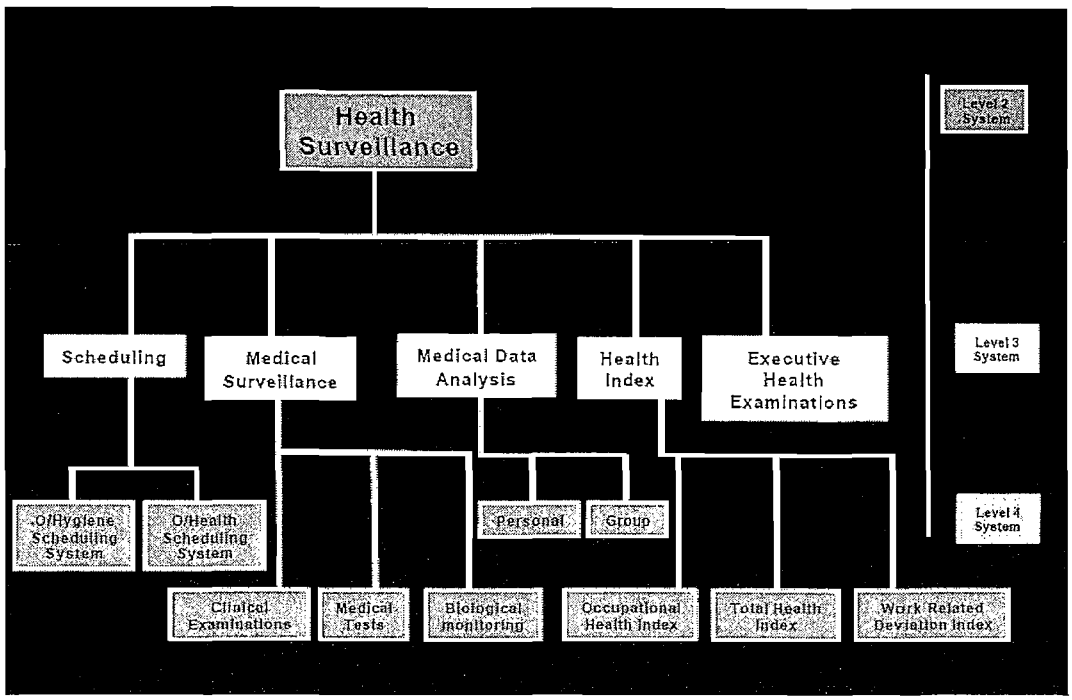

Figure **2.6.** The occupational health surveillance process

Disease prevention goes hand in hand with the promotion and maintenance of health. Health refers to the promotion and maintenance of the highest degree of physical, mental and social well-being of all individuals. According to Kotze (1992:146-47), the OHP has to assess the work methods and factors that might affect the employee's health. In this way, the OHP can recognise new or unusual hazards, as well as consider the consequences of applicable risks not only for the worker, but for the family and community alike. Occupational health surveillance encompasses all actions necessary to establish the health and long-term well-being of the employees (Labuschagne, 2001:194). Thus, as an employee in the food industry and possible disease carrier, the food handler must be included in an occupational health surveillance program, to prevent cross-contamination of micro-pathogens that cause food-borne illnesses.

At present, the OHP has no means to identify, confirm or evaluate the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers. As a result, the OHP cannot conduct a comprehensive and effective occupational

health surveillance regarding the food handler's compliance with hand hygiene to improve the standard in quality and safety of the food reaching the patients in the healthcare service.

2.4.1.1 Concluding statements on the occupational health practitioner

Health promotion and maintenance is part of the OHP's role. This important factor relies upon the positive attitudes, participation and responsibility of both the employee and the employer to guarantee that the food that receives is safe and free from food-borne pathogens.

Occupational health aims not only to protect and maintain the employee's health, but also to protect the family, community and patient. As such, standards for occupational health surveillance must be available to ensure that the food handler complies with hand hygiene during food handling.

If standards are available to evaluate the food handler's compliance with hand hygiene on a regular and continuous basis, the OHP is better equipped to achieve this goal.

2.5 THE FOOD HANDLER

Food handlers are persons who, in the course of their normal work, come into contact with food not intended for their personal use (Codex Alimentarius Commission, 2003:6; DOH, 2003:2). A food handler is thus any person involved in the processing, production, manufacturing, packaging, preparation, sale or serving of any foodstuff, including water and beverages (DOH, 2000a:1). According to the South African Society of Occupational Medicine (SASOM, 1996:2), food handlers are an indispensable part in the food processing industry, which employs 10 - 15% of the working population in South Africa. In a complexity of industrial activities, from farm-to-table and consequently to patients in the healthcare service, food handlers are an essential link in the whole food industry. The food handler's hands are in constant contact with food and surfaces, through the processing, preserving, packing, dissemination and preparing thereof (SASOM, 1996:2).

The Australian Food Standards code (2001:1) mentions that food handlers have an overall responsibility for doing whatever is reasonable to make sure that they

do not make food unsafe or unsuitable for people to eat. Food handlers also have specific responsibilities related to their health and hygiene. It is therefore essential that food handlers receive training and retraining to understand why compliance with basic food and hand hygiene practices is important, as well as occupational health surveillance. Food handlers have a responsibility to report any personal health problems where there is a chance that they might contribute to unsafe or unsuitable food as a result of their illness and digressions in the work place (Australian Food Standards Code, 2001:2; Codex Alimentarius Commission, 2003:24).

The Multnomah County Health Department (2005:3) argues that safe food is important in our daily lives whether the food is a prepared meal in the healthcare service or a restaurant meal. Improperly handled foods may cause food-borne illness, disability or even death. The food handler has responsibilities and liabilities when preparing and serving food to other people. According to the Australian Food Standards Code (2001:2), the most important information for food handlers is that they must do whatever is reasonable to prevent their body, anything from their body or anything they are wearing from coming into contact with food or surfaces, do whatever is reasonable to stop unnecessary contact with ready-to-eat food, and wear clean outer clothing. Furthermore, the food handler has to make sure that any open lesion is covered with a waterproof covering, not eat, sneeze, blow or cough while handling food or over surfaces, and not smoke or use tobacco or similar preparations where food is handled. It is therefore the food handler's responsibility to maintain personal hygiene practices and sanitation to minimise the risk of food and surface contamination (Multnomah County Health Department, 2005:4).

The Codex Alimentarius Commission (2003:25) states that food handlers who come into contact with food should operate in an appropriate manner to ensure that they are not likely to contaminate food. People who do not maintain an appropriate degree of personal hygiene can contaminate food and transmit food-borne illnesses to consumers.

Every food handler must be motivated and encouraged to participate in the occupational health surveillance of hand hygiene to guarantee long-term benefits

to patients and community members who depend on receiving pathogen-free food. If standards in the form of structure, process or outcomes are available to monitor the food handlers' compliance with hand hygiene, the quality and safety of the food they handle will be ensured.

2.5.1 Concluding statements on the food handler

Food handlers are found in every process in the food industry. They are a crucial and irreplaceable link in the farm-to-table process. As such, they must take responsibility to prevent cross-contamination through complying with hand hygiene during food handling.

Food handlers have to be informed of the consequences of poor hand hygiene compliance and their role in cross-contamination, food-borne illness outbreaks and statistics.

The food handler's inclusion in occupational health surveillance can contribute to safer and pathogen-free food reaching patients in the healthcare service.

2.6 SUMMARY

The literature reviewed acknowledges that the food handler is a key element in the transmission of pathogens that cause food-borne illnesses due to inadequate and poor compliance with hand hygiene. Another contributor may be the absence of a comprehensive occupational health surveillance programme in South Africa. The Department of Health's (2002:5) statistical notes recognise that food-borne illnesses are by far the most prevalent food-borne illness in South Africa.

Based on legislation and recommendations, the food industry has established and implemented a diversity of monitoring and control points in the food handling industry to guarantee food safety for the consumer. However, although this has improved the safety and quality of food, poor hand hygiene is still ignored in occupational health surveillance, despite its identification as an important aspect in food safety. The current food guidelines in South Africa consider this monitoring of hand hygiene to be unnecessary and unrealistic, although all the information available suggests the opposite.

In the absence of standards for hand hygiene of the food handler, no base line indicator is available to evaluate the level of the prevalence rate of pathogenic on the hands of the food handlers. Therefore, there is no proof of a high quality and safety of the food that reaches the patients in the healthcare service. The formulation and implementation of standards may establish and ensure the compulsory adherence of the food handlers with hand hygiene during food handling, helping to guarantee that food reaching the patients is safe. There is therefore an urgent need to develop, formulate and implement standards, based on solid scientific grounds, to allow the food industry to prove to the patients that the supplied food has no detrimental health effects.

Being accountable to the society in providing quality, cost-effective and efficient care, the OHP is responsible for the identification and elimination of all possible aspects that might have a detrimental effect on any individual's health. For that reason, research in this regard is crucial to enable the OHP to provide a comprehensive occupational health service not only to the food handler, but also to patients in the healthcare service who have the right to safe food. This will extend the development of scientific knowledge and theory in the discipline of occupational health nursing.

CHAPTER 3: RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

Occupational health practice and the theoretical framework presented in chapter 2 directed and guided the establishment of the research project. The information gathered during the literature review indicated that poor hand hygiene practices by food handlers could transmit food-borne micro-pathogens to food and surfaces, and eventually to patients in the healthcare service. Internationally, the United States Food and Drug Administration (FDA, 2003a:1) has proclaimed that *Escherichia coli* are a bacterium that can produce a deadly toxin, and is an indicator of faecal contamination. The presence of this bacterium on food suggests a general lack of hand hygiene during food handling.

Nationally, the DOH's guidelines for the management and occupational health surveillance of food handlers (Directorate: Food control: July 2000a, see Appendix 1) concentrates on surfaces and utensils. The DOH ignores the food handler as a medium in the transmission of pathogens to food and surfaces, which reach patients in the healthcare service. The DOH has suggested that implementing occupational health surveillance for the food handler's hands is not an important concern in the transmission of food-borne pathogens. The only requirement relating to the personal hygiene of food handlers is that they wash their hands before beginning work, after breaks and going to the bathroom. In occupational health and in the food industry, the food handler's hands are not included for the evaluation for pathogenic micro-organisms (SASOM, 1996:2). This research project aimed to determine the food handler's compliance with hand hygiene during food handling, and to identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers. A further aim was to use this information to formulate standards for the hand hygiene of food handlers.

3.2 RESEARCH DESIGN

The research questions were stated explicitly, giving direction to a quantitative, explorative, descriptive and contextual design. This **quantitative** design is a formal, objective, systematic, and scientific inquiry process that uses numerical data to obtain information about the world (Burns & Grove, 2005:23). The design involved the selection of participants from the defined target population, namely,

food handlers from the food preparation sections of four major healthcare services. The questionnaire (see Appendix 9) determined the compliance of the food handler with hand hygiene during food handling, while the scientific sampling identified the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands.

The design of the research project was **contextual.** The context included the four major healthcare services in Potchefstroom, both private and provincial, that provide curative services to the southern district of the North-West Province. The survey involved the collection and quantification of the gathered data. The context was specified in its purpose, the population identified, the sample selected, and the data collection methods and results analysis established. The rationale of the design was to gain an overall picture of the research problem, maximise the possibility of obtaining accurate information and present unbiased results.

According to De Vos *et al.* (2005:106), **exploration** is to gain insight, and become familiar with facts in a specific new area. In this project, the field of inquiry refers to food handlers' compliance with hand hygiene. The exploration involved gathering information to gain insight and knowledge about whether food handlers complied with hand hygiene during food handling, and to determine the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers. Ultimately, the goal was to establish whether food handlers might be a vehicle in cross-contamination during food handling and preparation.

The exploration and **description** entailed a complete and accurate portrayal of the literature in the description of the theoretical framework and the results from the empirical research. Inductive and deductive reasoning were used to arrive at the formulation of standards for the occupational health surveillance of food handlers' hands in the food preparation sections of the healthcare services.

3.3 RESEARCH METHOD

The **survey** followed a quantitative, formal, objective and systematic scientific inquiry process. This was done to obtain the relevant information on food handler's hand hygiene during food handling.

According to Fink (1995:1), a survey is a system or technique for collecting information to describe awareness, in the form of data collection in which questionnaires are used. Surveys have the following features: they have specific, measurable objectives, a sound research design and a sound choice of sample, reliable and valid instruments, appropriate analysis and accurate reporting of results (Fink, 1995:1). Surveys involve setting objectives for information collection, designing the research project, preparing a reliable and valid data collection instrument, analysing data and reporting results.

The objectives in this research project originated from the occupational health practice and literature investigation, as well as current knowledge on hand hygiene during food handling and consequently, food-borne illnesses. The design focused directly on obtaining information through a questionnaire completed by the food handlers (Appendix 9) concerning their compliance with hand hygiene during food handling. The questionnaire and scientific samples were done in sequence due to the time constraints of the both the food handlers and the laboratory consultant. The questionnaire was based on the Department of Health's guidelines for the management and health surveillance of food handlers (Directorate: Food control: July 2000a; see Appendix 1).

3.3.1 Step one: Determining the food handlers' compliance with hand hygiene during food handling

To determine the food handlers' compliance with hand hygiene, a questionnaire was designed and developed to obtain facts about each food handler's compliance with hand hygiene during food handling. This was done to establish whether the food handlers, as they operate, might be a vehicle in the cross-contamination of food-borne pathogens to food and surfaces, causing food-borne illnesses.

3.3.1.1 Questionnaire development

The questionnaire's content was an essential component in gathering the information needed to determine the food handlers' compliance with hand hygiene during food handling. The questionnaire created consistency in the data collection as all the participants answered the same questions, thereby preventing the opportunity for bias.

The questionnaire was compiled in both Afrikaans and English and consisted of 49 questions, comprising 39 closed-ended questions and 10 open-ended questions. The questionnaire was divided into six sections. The wording of the questions was understandable and acknowledged the literacy level of the food handlers. The questions were presented in such a way that the food handler had a choice of response in answering the closed-end questions and the opportunity to give their own response to the open-ended questions. The questions were clear and to the point. Some entailed a yes/no answer while others presented the participant with a choice between four alternatives. To eliminate ambiguous answers, the food handlers did not have the option of "I don't know", forcing them to decide what was applicable for them in their own food handling environment. The order of the questionnaire was based on the DOH's guidelines (see Appendix 1) which form the base of the food handler's food handling practices. Table 3.1 presents a summary of the DOH's guidelines and the questions that were developed from this data.

A pilot study was done after consultation with the statistical department at the North-West University and before the actual research project was conducted. An informative letter (see Appendix 8) accompanied the questionnaire explaining the rationale of the research project, the researcher's information and contact details, along with how the questionnaire should be answered. The food handlers answered the questionnaire in their natural work environment.

The Department of Health and the various healthcare services confirmed and approved participation for the research project to improve the quality and safety of the food they provide to patients. Conformation from the healthcare services regarding the total number of food handlers employed was done during the design phase of the research project. The total received was 110 (N = 110).

The sampling method was **all-inclusive** as the focus was the food handlers in the four major healthcare services' food preparation sections. According to Burns and Grove (2005:343), the term *inclusive* means that the participants who possess all the relevant characteristics are included in the sampling and target population, and therefore in the research project. The sampling method meant that a group of individuals that were representative of the population being studied was selected

(Burns & Grove, 2005:750). The sampling criterion was established on the basis of an all-inclusive sampling of the food handlers working in the food preparation sections of the healthcare services. Since the food handlers had to complete the questionnaire themselves, a further criterion was basic literacy (reading and writing). Although a basic literacy level was a participation requirement, some food handlers who had difficulty with this, requested to be included in the research project as they felt that they wanted to contribute to the improvement of their hand hygiene during food handling. To prevent excluding them from the opportunity to be part of the research project, the researcher accepted their request and assisted those participants to complete the questionnaire. Table 3.1 provides the DOH's guidelines and questions on which the questionnaire was based.

Table **3.1.** DOH's guidelines and questions developed

DOH's GUIDELINES (Directorate: Food control: July 2000a) (Appendix 1)	QUESTIONS BASED ON THE DIFFERENT ELEMENTS IN THE DOH's GUIDELINES
1. **Demographic data**	· Involved data regarding the food handlers' employer, age, gender, time of employment and highest school grade completed
2. **Education and training of the food handlers:** · A vital element in food safety and done by a trained person · It must be practical and functional · All employees must understand the basic principals of food safety · They should receive instructions in food safety, personal hygiene and their knowledge should be tested · Retraining should be done periodically · Illnesses and open lesions must be reported and addressed and reason thereof given	· Are there training sessions for the employees? · Are you shown how to do the job? · How often are you shown? · What is involved in these training lessons? · How is your knowledge tested? · What is involved in the retraining?
3. **Basic food handling hygiene practices and health monitoring through management responsibility:** · Handling of cooked and raw food · Protection, storing and covering of food · Maintenance and explanations of clean surfaces, utensils and water · Disposal of waste foods · Sources of contamination · Reporting illnesses – reasons for and purpose of restrictions · Occupational health monitoring – scientific sampling and special medical examinations	· Do you handle raw and cooked food together? · How many times per day are the work surfaces and equipment cleaned? · How many times are clean utensils used when food is handled? · How many times is clean water used to clean equipment? · In what way is food protected against dust, insects, etc? · What is done with the spoiled and waste food? · What is your responsibility regarding hygiene during food handling? · What does food contamination mean? · When you have an open sore, what happens? · Is it necessary to scrub your hands and nails between food handlings? · Why?

	· Do you undergo medical examinations? · Did they take swabs from your hands? · Did you receive any feedback?
4. Basic personal hygiene practices: · Hand washing and scrubbing – when, why and how · Hand washing – drying methods · Open sores – reporting and covering · Hand contact with hair, nose or other body parts · Reasons and availability of clean personal protective equipment – overalls, gloves and hair coverings every day · Reasons for not coughing, sneezing or nose blowing over food · Wearing of jewellery while handling food · Reason for personal cleanliness, availability of washing facilities, daily showering, using of soap and clean towels	· Do you always wear overalls during work? · Are you allowed to wear jewellery on your fingers? · Do you receive clean hair coverings, overalls and gloves every day before you start work (PPE)? · Do you wear clean hair coverings, overalls and gloves every day? · Are there facilities to shower? · Do you use these facilities every day? · Why? · Is there soap available to wash your hands during the day? · Are there clean towels available every day? · How do you dry your hands after washing them? · Are you allowed to work with an open sore/cut on your hands? · What is the reason why you are not allowed to blow your nose or sneeze at your workplace?
5. Department of Health (DOH): · Knowledge of the DOH · Visits, reason for this and feedback after visits	· Do you know who the Department of Health is? · Has one of Department of Health's inspectors been here? · What did they do?
6. Management commitment: · Food hygiene and inspections are management's responsibility · Implement a programme addressing hygiene in all food handling · Necessity of supervision · Discussion and reporting of hygiene problems must be encouraged · Creating optimum hygiene conditions · Encourage reporting of illnesses or skin lesions · Implement occupational health programme for improving working conditions · Employ technical experts to give advice on hygiene · Maximise hygiene levels through employee empowerment	· Does the supervisor do hygiene inspections daily? · Does another person do hygiene inspections in the work area/s? · How are hygiene standards maintained? · Are you encouraged to report hygiene problems to the supervisor? · If hygiene problems are reported, are discussions held to address it? · Are problems corrected after reporting/s? · Is it compulsory to report when you are sick, e.g. with diarrhoea or flu? · Why?

The following table (table 3.2) indicates the food handlers from the major four healthcare services who participated in the research project.

Table **3.2.** Total of food handlers in the research project, N=110

Institution	Total: food handlers	Total
Healthcare 1	57	
Healthcare 2	17	
Healthcare 3	13	
Healthcare 4	23	
Total		**N=110**

♠ Pilot study

Data collection refers to the process of precise, systematic gathering of information relevant to the research purpose, objectives or questions of a research project (Burns & Grove, 2005:733). Before the pilot study was conducted, a personal interview with an expert from the statistical consultation department at the North-West University was held to evaluate the original questionnaire for its readability. On suggestion, some of the wording and sentences were changed into laymen's terms for easier comprehension, to ensure a higher percentage of completion and to limit discouragement of the participants.

The pilot study was conducted in two similar curative healthcare services prior to the actual research project. These represented a private and provincial healthcare service in Klerksdorp, and reflected the same target population included in the actual research project. The questionnaire was used to identify and refine the data collection and sampling procedures, as well as to improve the quality of the research project.

After the reason for the pilot study had been explained, participants were selected on a voluntary participation basis. The pilot study consisted of twenty-one food handlers, twelve participants from the private healthcare and nine from the provincial healthcare service. The researcher encouraged them to ask questions during the completion of the questionnaire. This was necessary to scrutinise the overall integration and feasibility of the instrument.

The results indicated that the participants from the private healthcare service needed no guidance to complete the questionnaire, while the food handlers from the provincial healthcare service had some difficulty understanding even the most

basic wording and questions. This was because the literacy level of the majority of the food handlers was low, with most having an education level ranging between no schooling and Grade 8. The assistance of a translator did not seem to make much difference, and all the questions had to be explained numerous times in Tswana, English and Afrikaans until they were clear to the participants. The pilot study indicated that after the explanations, the majority of participants did not have trouble completing the questionnaire, but more time had to be allocated to those food handlers with lower literacy levels.

3.3.1.2 Data collection

The process of recruiting the participants was pleasant, positive, informative and non-aggressive, as this was essential to retain them during the research project. The researcher collected the data and care was taken to ensure consistency in the approach. The researcher explained and rephrased ambiguous questions. Of the total participants, 80 (75.47%) completed the questionnaire.

Originally, it was planned that the data collection, namely, the questionnaire and scientific sampling, would take place simultaneously. However, both the food handlers and the laboratory consultant had constraints on their time. Therefore, the questionnaires were done after the scientific sampling later on the same day.

3.3.1.3 Data analysis

The purpose of the analysis was to reduce and organise the data to an intelligible and interpretable form so that the relations of the research problems could be studied and tested, and conclusions drawn.

Descriptive statistics were used to organise and summarise the numerical data from the questionnaires. According to Brink (2006:171), descriptive statistics are used to describe, summarise and synthesise data, to convert and condense a collection of data into an organised, visual representation so that they have meaning. The statistician from the North-West University's, statistical service, confirmed that power analysis was not necessary as the sample was all-inclusive, including all the food handlers from the four major food preparation sections. The aim was to identify and calculate the total of scores and percentages of the responses the food handlers presented in the different categories of the

questionnaire. This consisted of: the food handlers' demographical data, training, basic food and personal hygiene practices, including occupational health surveillance, knowledge of the DOH and their management's commitment in maintaining hygiene standards in the food preparation sections. The gathered data were statistically analysed manually using Microsoft Excel, as this was the most appropriate procedure to derive the significance of the findings.

The process of data analysis was based on Burns and Grove's (2005:452 - 455) aspects of data analysis. This process consists of the following stages: (1) preparation of the data for analysis; (2) description of the sample; (3) testing the reliability of the measurements; (4) exploratory analysis of the data and (5) confirmatory analysis guided by the research questions and objectives.

♠ Preparation of data for analysis

Managing the data involved coding, which is the process of transforming the data into numerical symbols that may be entered into the computer, for example, the participant's gender (male/female), age and time employed within the food preparation section, and so on. A codebook was developed to ensure consistency for all the items in the questionnaire. The coding categories were mutually exclusive and exhaustive. Burns and Grove (2005:372) explain the terms *exclusive* and *exhaustive* as meaning that each element of the data must fit into only one of the categories and that all the data must fit into the established categories.

The information gathered through the questionnaire (Appendix 9) was explored to become familiar with the contents, to identify if any data were missing, to identify outliers, and to identify if spoiled data were present. Thereafter, the information was classified into categories. According to Burns and Grove (2005:384), outliers are those exceptions in the findings which provide a way to test the generalisation of the findings. Scrutinising the data was essential to evaluate all the data for accuracy and to correct errors found during cross-checking.

♠ Description of the sample

The description of the sample was aimed at describing and summarising the basic features of the date collected. This was essential to obtain as complete a picture of

the sample as possible to identify the compliance of the food handlers with hand hygiene within the different healthcare services.

Calculation of errors and spoiled data took place to eliminate incorrect findings and ensure valid and reliable results. The sample was described in the comparison of employer, gender, age, educational level and time of employment in the specific healthcare service to ensure that the samples were representative of the target population.

♠ **Testing reliability of measurements/instruments**

Examining the reliability of the methods of measurement in the research project focuses on stability, equivalence and homogeneity (Burns & Grove, 2005:454). This refers to the ability of the measuring instrument to show consistency in the numerical results each time it is applied; it does not vary and measures precisely what has been indicated. In this research project the food handlers' compliance to with hand hygiene, was examined.

Homogeneity examines the extent to which all the items in the instrument consistently measure the construct, and is a test of internal consistency. Equivalence was established when the questionnaires were analysed by the North-West University's statistical service.

♠ **Exploratory analysis**

According to Burns and Grove (2005:465) this is done to obtain insight and to detect any unexpected information that might have been in the data. It aims to detect crucial patterns that might exist in the data, to confirm that all the important data was included for a comprehensive analysis, and ensure that no valuable information (such as outliers) was missed. The data were organised and assessed to obtain meaning and facilitate insight into the phenomenon of food handler's compliance with hand hygiene during food handling. The data from each healthcare service was kept separate and coded to ensure that the results were applicable and relevant to the specific service, preventing misinterpretations and incorrect conclusions. All the data were examined with the intent to become as familiar as possible with the nature of the data, to organise them, as well as to facilitate insight into and meaning of the food handler's compliance with hand

hygiene during food handling. Searching for unexpected information in the data, such as serendipity, could be critical to theory and practice as this could generate further theory or research.

♠ **Confirmatory analysis guided by the questions and objectives**

According to Burns and Grove (2005:731), confirmatory analysis is done to confirm if the expectations expressed in the research questions and objectives were fulfilled.

Nominal data were used to identify the level of measurement and ensure adequacy, quality and validity of the results. The nominal data, which included gender, age, years of employment and education level, were organised into categories and each category was exclusive and exhaustive. According to Burns and Grove (2005:372), nominal scale measurement implies that all the data can be organised into categories, but cannot be compared, ranked or ordered. The term *exclusive* indicates that the categories must be established in such a way that each element of data will fit into only one of the categories, while *exhaustive* implies that all the data must fit into the established categories.

The data processing, both computerised and manual was designed to facilitate description, logical flow and consistency. Re-examining the analysis was done to ensure the appropriateness, practical significance, professionalism and quality of the statistical procedures. Interpretation of the results from the analysis was necessary to synthesise all the information. The interpretation was used to draw conclusions, and use these to make predictions about the usefulness and practical significance thereof for the field of nursing, both in terms of theory and practical implications for food handlers in occupational health nursing.

3.3.2 Step two: Identifying the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers in the food preparation section

This step involved the systematic and precise procedure of gathering information through the scientific sampling of the food handlers' hands. These results were needed to build and establish a base for improving occupational health nursing in the food preparation sections of the healthcare services. The population and

sample were the same as in step 1 (see section 3.3.1). The participants were valuable resources who were treated with respect. Open communication with them promoted a positive attitude, ensured involvement and guaranteed participation in the research project.

All the data collection procedures were clearly explained to the participants prior to obtaining informed consent. This was important in ensuring that the results of the information gathered were objective, reliable and valid. Misconceptions were clarified during the informed consent phase to avoid false interpretations and conclusions that would create irrelevant or spurious findings.

3.3.2.1 Data collection

The scientific hand samples were collected from each food preparation section of the four healthcare services involved. Eighty, 75.47%, food handlers participated in the scientific sampling and fourteen surface samples were collected. The data collection was conducted on the days that the food handlers were present on shift, to accommodate all of them. This process was repeated on a follow-up visit the following week to include those food handlers who were on a changed shift or had been absent during the first visit. The population and sample size was the same as in step 1 (refer 3.3.1).

- **Laboratory sampling method**

Logistical problems occurred with the transport of the scientific samples. The laboratory initially approached to do the analysis required the samples to be in Johannesburg two hours after they were taken. This was impractical and impossible given the time needed to conduct the sampling at all the healthcare service venues, the different shift times of the food handlers, and their location in Potchefstroom. As a result, a laboratory in Potchefstroom was appointed to conduct the scientific sampling.

The laboratory in Potchefstroom took responsibility for transporting the microbiological samples to the laboratory. The lab's accreditation certificate (see Appendix 10) was obtained before sampling commenced to certify their competency as an occupational health laboratory. The laboratory was informed that the microbiological analysis procedure must be anonymous and confidential

for all parties involved (i.e., the healthcare services, their food handlers and surfaces monitored), but only reported in the arranged coded format.

The laboratory assistant who collected the data was informed in advance of the research project, the applicable instrument identified, the participants involved, the settings, possible problem situations that might affect and interfere with consistency and how to control and minimise this. The integrity and validity of the research project depended on the correct procedures. It was ensured that all the necessary instruments were available to perform the sampling. Before the sampling took place, each healthcare service, food handler was coded to ensure the correct labelling and anonymity.

♠ **Scientific sampling procedure**

- The occupational health laboratory was contacted to confirm the date when the scientific sampling would commence.
- The laboratory supplied all the equipment to conduct the sampling: the standardised sterile swabs, sterile water, labels and containers.
- Each instrument received was sealed separately to maintain sterility.
- Approximately 30 seconds was needed to collect a sample from each food handler and surface.
- Each tube was coded according the prescribed category for each healthcare service, food handler and surface. The same code was then entered onto the laboratory's analysis request document, ensuring that the data were congruent with the information on each tube, to prevent errors.
- After the sampling had been conducted, each set of collected data was then placed in a coded container for each healthcare service, sealed to certify valid findings, and
- The samples were transported to the laboratory situated in Potchefstroom.

The microbiological procedure for analysis was done according to the laboratory's formulated protocol and set standards, and identified the presence or absence of *Escherichia coli* and *Staphylococcus aureus*. The direct evaluation technique was necessary to determine food handler's compliance with hand hygiene during food handling.

The results of the microbiological procedure were received electronically and on hard copy. As an accredited occupational health laboratory, the results can be considered to be consistent and credible. The validity and reliability of the research project is thus enhanced, and the formulation of standards is thus more likely to be based on sound findings. Formulated standards may help ensure the compliance of the food handler with hand hygiene, and may promote food safety for patients in the healthcare service.

The technique used for the identification of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands was chosen according to the standardised procedure of the laboratory's microbiological analytical protocol. It can be assumed, therefore, that an accurate measurement was taken. The procedure for the data collection was consistent for all the food handlers throughout the process in accordance with the research objectives and questions.

3.3.2.2 Data analysis

The purpose of the analysis was to reduce the data to an intelligible and interpretable form so that the prevalence rate could be studied. The analysis was aimed at identifying the presence or absence of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands. The numerical data from the scientific samples were transcribed verbatim, analysed manually and statistically. MS Excel was used to arrive at the significance within the findings. This was important to conclude if the sample was indicative of the target population, and to predict if the evidence from the findings could be generalised to similar situations elsewhere in the food handling industry or healthcare services.

The data set for each healthcare service was kept separate and coded to ensure that the results were anonymous, applicable and relevant to the specific service. This was done to prevent misinterpretations and incorrect conclusions. The data analysis process ensured that all the results fitted with the correct healthcare service and concurred with the coding assigned for each healthcare service before the scientific sampling was conducted. The results were calculated, organised and prepared manually for capturing to provide a meaningful visual presentation. The presentation was designed to represent the results for each healthcare service to reach conclusions that were a reflection of the reality.

The method was the most appropriate for the research project, as it contributed to and maximised meaningful findings and ensured objectivity of the findings. The combination of the methods enhanced each other to achieve the research project objectives.

3.3.3 Step three: Formulation of standards for the hand hygiene of food handlers

The concluding statements from the theoretical framework and results from steps one and two provided direction for formulating standards for the hand hygiene of food handlers. The structure, process and outcome of the standards formulation were based on the findings of the empirical data. The aim was to establish standards for the occupational health surveillance of food handlers' hand hygiene to prevent cross-contamination through poor hand hygiene that can cause food-borne illnesses.

A standard is a written description of the expected level of work performance and is a formal process outlining the procedures for a specified quantitative measure for quality improvement (Muller, 1998:242). Setting standards requires adherence to a logical process; it must be acceptable, realistic and applicable. It should correspond as faithfully as possible to the concepts of the required aspects they are intended to measure (Donabedian, 2003:61). Bezuidenhout (2005:76) indicates that a standard is the intended achievable level of output corresponding with a preset criterion against which actual performance is assessed. The same author points out that a standard must be used to determine whether an expectation is met and to encourage and motivate improvement to achieve the standard. According to Muller (1998:246-253), standards not only have to include scientific monitoring and evaluation methods, but must provide methods for feedback in relation to the results in the scientific evaluation procedure as well as written remedial steps to enhance cooperation of all the participants in the particular setup. The standards should include an infrastructure of monitoring strategies for compliance levels (e.g., questionnaires and scientific sampling), the instrument, policy regarding the relevant instrument, an identified occupational health laboratory to analyse the samples, a system for data analysis, data storage, a reference base of previous results and a feedback system to management.

The objective of the formulation of standards in this research project was to promote hand hygiene of the food handler to ensure quality and safety in food. A secondary objective was to establish a baseline for the occupational health surveillance of the food handler's hands against the set standards. According to Muller (1998:242) and Donabedian (2003:60), standards consist of the following types:

- *Structure* standards describe what is **required** for the performance or outputs. This may include a specified measure of an activity or support system for the organisation or food provider, for example, material and human resources. In this research project, this refers to a system to ensure the food handler's compliance with hand hygiene to prevent or minimise cross-contamination of pathogens during food handling.

- *Process* standards provide step-by-step descriptions of how an **action** should be performed. This is based on a technical procedure manual/s and training. In this case, this refers to a description of how food handlers in the healthcare service must comply with hand hygiene during food handling to prevent cross-contamination of pathogens to the food and surfaces. In clinical occupational health nursing, process standards involve a process assessment of the food handler in the handling of food, deciding what goal is to be achieved, deciding on best practice for compliance with the set standards, identifying possible obstacles, charting the regular implementation of scientific methods and procedures to monitor adherence to the standards, plans to evaluate results and achievements according the to set standards and to apply remedial actions for improving compliance.

- *Outcome* standards refer to the expected result or output and change in behaviour of the individual to adhere and achieve the required expectations. Outcome standards should be measurable; they should refer to the **objective** or **goal** that is to be achieved, and should include methods of evaluation for the improved compliance with hand hygiene.

3.4 ETHICAL CONSIDERATIONS

Ethical considerations requires honesty and integrity of the researcher, as well as the protection of the human rights of the participants such as self-determination, privacy, anonymity and confidentiality, fair treatment and the protection from discomfort and harm (Burns & Grove, 2005:207). In addition to the mentioned ethical considerations, the research has to be reviewed and approved by the applicable ethical committees.

Approval for the research project was obtained from the following authorities:

- Ethical Committee from the North-West University, certificate number: 07M05 (Appendix 2)
- Department of Health, North-West province (Appendix 3) and informed the Department of Health, Southern District of the North-West province (Appendix 4), concerning the research project
- The four healthcare services in Potchefstroom

The healthcare services were provided with an informative letter (Appendix 5) concerning all the aspects of the research project. The only requirements that the healthcare services made were that they should remain anonymous when reporting results and that they should receive a report of the findings upon completion of the project. Progress communication with the healthcare services was maintained during the data collection process.

An interpreter was not necessary as the food handlers understood their role as participants in the project and as an essential link in the food processing industry. All the details of the research project were clearly explained and communicated both verbally and in an invitation letter (Appendix 6) that was given to each participant. The food handlers were encouraged to ask questions related to the research project and these were explained in layman's terms to ensure that all the participants understood all the aspects. This included voluntary participation, the purpose and long-term goal of the project, and the formulation of standards for the occupational health surveillance of hand hygiene. It was explained that the project aimed to ensure that the food reaching patients in the healthcare service is pathogen-free.

The participants were also informed that there were no personal risks involved to them as individuals and they had the option to receive personal feedback regarding their results. Self-determination was ensured as the food handlers were treated fairly, with respect and dignity. The participants' privacy was protected, as they remained anonymous and were guaranteed that the gathered data would be kept confidential and secured in a locked place. An informed consent form was signed by each participant (Appendix 7). Some of the handlers approached choose not to participate. No participants withdrew during the project. Guidelines on how to complete the questionnaire were clearly stated in a cover leaflet (Appendix 8) that accompanied the questionnaire (Appendix 9). It is likely that the knowledge that they would remain anonymous allowed the food handlers a greater sense of security and encouraged them to provide honest answers.

The research project was conducted ethically and honestly; and those who contributed guidance and assistance were acknowledged. The results were communicated accurately to the parties involved.

3.5 RIGOUR

Rigour involves the striving for excellence in research with discipline, scrupulous adherence to detail and strict accuracy (Burns & Grove, 2005:750). The same authors further states that a controlled study design with specific steps, precise measurement methods, representative samples and statistical analysis is necessary to ensure that the research findings are an accurate reflection of the reality.

3.5.1 Validity and reliability

According to Burns and Grove (2005:376 & 754) and Brink (2006:207 & 208), validity is the ability of an instrument to measure the construct that it is intended to measure, and reflects the accuracy of the claim. Reliability refers to the consistency and dependability of the research instrument to measure the construct, which includes stability, equivalence and homogeneity (Burns & Grove, 2005:374 & 749). Burns and Grove (2005: 376, 735 & 752) define stability as the aspect concerned with the consistency of repeated measures, while equivalence involves comparing two versions of the same paper-and-pencil instrument measuring the same event. Homogeneity validates the paper-and-pencil test and

examines the extent to which all the items within the instrument consistently measure the construct.

3.5.1.1 Validity

- **Internal validity**

Internal validity is the extent to which the effects detected in the research project are a true reflection of reality rather than the result of extraneous variables, history, maturation, testing, instrumentation, selection and mortality (Burns & Grove, 2005:215). Burns and Grove (2005:755) state that instrument validity determines the extent to which the instrument actually reflects the construct being examined, while content validity examines the extent to which the method of measurement includes all the major elements relevant to the construct being measured (Burns & Grove, 2005:732). According to Brink (2006:200), content validity is the degree to which an instrument covers the scope and range of information that is sought, including all the major elements in the construct. In this research project, content validity was ensured by using the Department of Health's guidelines for the management and health surveillance of food handlers (Directorate: Food control: July 2000a, see Appendix 1) as the foundation for the questionnaire and theoretical framework. Therefore, the questionnaire (Appendix 9) reflected all the major elements of the construct being examined. The instrument appropriately and accurately measured what it intended to measure, namely, the food handler's compliance with hand hygiene during food handling. This confirmed both the measure's face and content validity.

Construct validity examines the fit between the conceptual and operational definitions and determines whether the instrument actually measured the theoretical construct that it was suppose to measure (Burns & Grove, 2005:731). The method of measurement, namely the scientific sampling, was designed to identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers in the food preparation section. This was undertaken according to the analysis protocol and procedures of the accredited occupational health laboratory (Appendix 10). The instrument measured what it was supposed to measure, namely, the presence or absence of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers in the food preparation section. The evidence for the construct validity was obtained from the literature

reviewed and from the representativeness of the target population, which was tapped through an all-inclusive sampling process.

- **External validity**

Generalisability of the findings may be limited, although the application and transferability to different groups under different sets of circumstances, or to other food suppliers and food processing industries may be possible. Replication of the study in a similar setup and using a similar sample would add value to the development of theory.

3.5.1.2 Reliability

Burns and Grove (2005:41 & 374) state that reliability is concerned with how consistently the instrument and measurement technique measures what they are supposed to measure. Important concepts here include stability, equivalence and homogeneity.

The questionnaire was scrutinised and assessed through a pilot study conducted in contexts similar to the final settings prior to the actual research project. A codebook was established which identified the different healthcare services and their food handlers. The questionnaires and samples were coded for each of the healthcare services and food handlers to maintain anonymity. The data were accurately assigned, coded and categorised. The categories did not overlap as the coding sets were only applicable to the specific healthcare service and its food handlers. The relationship between the conceptual concepts, namely, the literature, occupational health and the food handler's hand hygiene, along with the operational concepts, namely, the questionnaire and the scientific sampling, confirmed that the instruments used meaningfully measured the compliance of the food handlers with hand hygiene during food handling.

The measuring instruments were consistent as all the food handlers completed the same questionnaire, and the scientific sampling was conducted according to the prescribed protocol and procedures of the accredited occupational health laboratory. The data were scrutinised and synthesised to eliminate errors and to guarantee that the data were accurately assigned to the applicable healthcare service and food handlers. In addition, the results and reports were verified to

ensure the data were applicable to the healthcare services and their food handlers. Reliability was established through ensuring that the data were consistent for each healthcare service and food handler during the collection and analysis phase.

The food handlers who participated in the research project were assured of anonymity. This helped to promote honesty in completing the questionnaire. The information gathered can therefore be considered to have measured and tested accurately what it was supposed to, which constitutes consistency in measurement. It can be accepted therefore that the research questions and objectives provided an accurate reflection of the reality.

To prevent threats to validity and reliability, which include the Hawthorne effect, maturation of the participants and mortality, and to ensure a true reflection of the reality, the data collection, the questionnaire and samples were conducted concurrently and without notice of arrival. The researcher remained objective and implemented the needed level of control over the participants and environment.

Through the premises, propositions and conclusion evidence was provided in support of the objectives in a structured logical form that included all the relevant data and literature reviewed. The results of the questionnaire and scientific sampling provided the information needed for the formulation of standards for the occupational health surveillance of food handlers' compliance with hand hygiene.

3.6 SUMMARY

The main purpose of the research design and methodology employed was to objectively explore and describe food handlers' compliance with hand hygiene during food handling, and to determine the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers in the food preparation sections of four healthcare services.

The literature review and quantitative survey design guided the steps followed to define and select the representative sample and size, methods of measurements and data collection, as well as select the analytical procedures of the numerical data.

CHAPTER 4: DISCUSSION OF RESEARCH RESULTS

4.1 INTRODUCTION

The purpose of this chapter is to present the facts, knowledge and findings as effectively as possible. The intention is that the results will have a lasting impact, in such a way that the food handlers will maintain a high level of hand hygiene and consequently prevent cross-contamination during food handling. The information was obtained from the use of the questionnaire and scientific sampling of the food handlers' hands.

Department of Health Directorate: Food Control Guidelines for the Management and Health Surveillance of Food handlers (2000a) (Appendix 1) is the basis for the food handlers' food handling practices during food handling and therefore was the point of departure for this research project to confirm if the food handlers' comply with hand hygiene during food handling. The guidelines provided the development and the content of the questionnaire and the literature reviewed the pathogens for the scientific sampling. The literature reviewed, acknowledged that the food handler is a key element in the transmission of pathogens that causes food-borne illnesses due to inadequate and poor compliance with hand hygiene. The identification of the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of the food handlers within the food preparation sections was to confirm if the food handlers' may transmit pathogens causing food-borne illnesses. In the absence of a comprehensive occupational health surveillance program to evaluate this, the food handlers' may contribute to the statistics in food-borne illnesses. The results from the empirical research and literature review formed the basis for the formulation of standards for the hand hygiene of food handlers.

The healthcare services required that the results from the scientific sampling on the food handlers' hands had to be anonymous during the data collection and report writing phase, to protect their food handlers', as well as the healthcare services privacy. This was in line with the ethical principles the researcher adheres with.

4.2 REALIZATION OF DATA COLLECTION

The survey design of this research project was quantitative, explorative, descriptive and contextual in nature. The context was defined and concise to generate scientific knowledge. The rationale for the design was to gain an overall picture through the exploration and description of the food handler's compliance with hand hygiene during food handling and the identification of the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands. The purpose for the data analysis was to reduce and organise the data to an interpretable form so that the relations of research problems can be studied, tested and conclusions drawn. The gathered data was statistically analysed according to the most appropriate procedure, in this research project, manually and with the excel computer program, to contrive the significance within the findings. Scientific representations are significant in relation to a relevant body of theory, in this research project, occupational health surveillance of the hand hygiene of the food handlers in the healthcare services' food preparation sections. This quantitative survey design was therefore the most suitable to gather accurate information from the all-inclusive sample of the target population (N=110), the food handlers within the food preparation sections, from the four major healthcare services. The food handlers participated in the research project were eighty (n=80) or 75.47% and the food handlers that completed the questionnaire were the same participants during the scientific sampling.

The Hawthorne effect was experienced during the first scientific sampling process when the data collection team entered the food preparation sections, the majority of food handlers scattered to wash their hands, as well as to spray disinfectant on their hands. The data collection was abandoned and the sampling process was repeated at an unnotified follow-up visit, to ensure valid results. The supervisors were requested to assist the data collection team to prevent the food handlers cleaning their hands with no prevail. However, the supervisors disappeared as soon as the team made their appearance. According to Burns and Grove (2005:738), the Hawthorne effect is a psychological response in which participants change their behaviour simply because they are participants in a research project.

The second visit to conduct the scientific sampling was undertaken without notice of arrival. This was possible as prior informed consent was obtained from the

healthcare services and participants. The scientific sampling was conducted by the researcher and research assistants. On arrival, all participants were asked to remain at their work stations. The process conducting the data collection was done according to the laboratory's procedure (see chapter 3, section 3.3.2.1).

4.3. QUESTIONNAIRE RESULTS

The development of the questionnaire was based on the Department of Health's guidelines for the management and health surveillance of food handlers (Directorate: Food control: July 2000a) (Appendix 1; see chapter 3, section 3.3.1 for the detailed discussion). The objective of the questionnaire was to determine the food handler's compliance with hand hygiene during food handling. A total of eighty (n=80) food handlers participated in the research project and completed the questionnaire. This represents a participation rate of 75.47%, the statistician confirmed, provides a solid basis for valid interpretations. The questionnaire consisted of the following six sections (with 49 questions in total):

Section 1: Demographic data

Section 2: Education and training

Section 3: Basic food handling hygiene practices

Section 4: Basic personal hygiene practices

Section 5: Department of Health

Section 6: Management commitment

The results of each of the sections are discussed below.

4.3.1 Section 1: Demographic data

The demographic data collected from the food handlers included (i) their place of employment, (ii) period employed in the food preparation section, (iii) age, (iv) gender, and (v) highest school grade completed. Each of these is discussed here.

4.3.1.1 Place of employment

Four healthcare services were used in the research project. They employ a total of 110 food handlers. The distribution of the food handlers among the four healthcare services is as follows: Healthcare 1 employs 47.5% (n=38); Healthcare 2 employs 21.25% (n=17); Healthcare 3 employs 15% (n=12) and Healthcare 4 employs 16.25% (n=13). Figure 4.1 graphically represents the distribution.

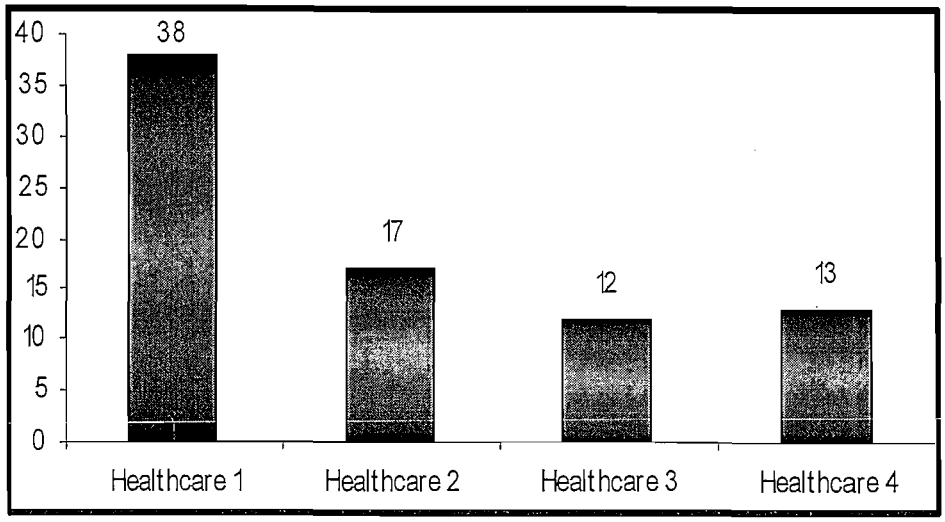

Figure **4.1.** The food handlers' distribution.

4.3.1.2 Age

Data pertaining the **age** of the food handlers in the four healthcare services were indicated with intervals reflecting the age group 20–29 years, 30–39 years, 40–49 years and 50–59 years. The indicated age intervals are indicated for each healthcare service in table 4.1. The intervals are graphically displayed in figure 4.2.

Table **4.1.** Age distribution of the food handlers in the four healthcare services

	20-29 yrs	**30-39 yrs**	**40-49 yrs**	**50-59 yrs**
Healthcare 1 (n=38)	n=6 (15.79%)	n=8 (21.05%)	n=16 (42.11%)	n=8 (21.05%)
Healthcare 2 (n=17)	n=2 (11.77%)	n=10 (62.50%)	n=5 (31.25%)	n=0 (0.00%)
Healthcare 3 (n=12)	n=4 (33.33%)	n=2 (16.67%)	n=5 (41.67%)	n=1 (8.33%)
Healthcare 4 (n=13)	n=2 (15.38%)	n=2 (15.38%)	n=7 (53.85%)	n=2 (15.38%)
TOTAL (n=80)	n=14 (17.50%)	n=22 (27.50%)	n=33 (41.25%)	n=11 (13.75%)

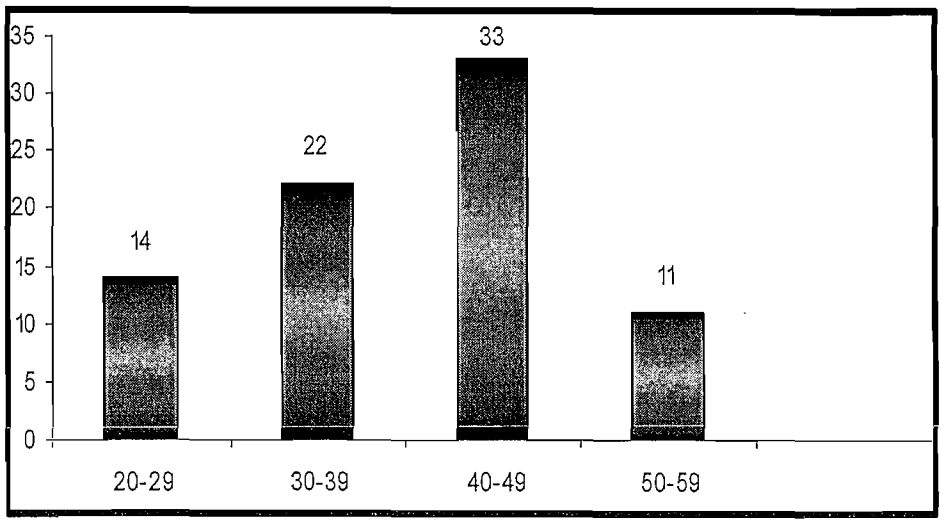

Figure **4.2.** The age distribution of the food handlers.

4.3.1.3 Gender

The gender distribution for the four healthcare services is indicated in table 4.2 and graphically represented in figure 4.3.

Table **4.2.** Gender distribution of food handlers in the four healthcare services

	Male	**Female**
Healthcare 1 (n=38)	n=23 (60.53%)	n=15 (39.47%)
Healthcare 2 (n=17)	n=2 (11.76%)	n=15 (88.24%)
Healthcare 3 (n=12)	n=0 (0.00%)	n=12 (100.00%)
Healthcare 4 (n=13)	n=6 (46.15%)	n=7 (53.85%)
TOTAL (n=80)	n=31 (38.75%)	n=49 (61.25%)

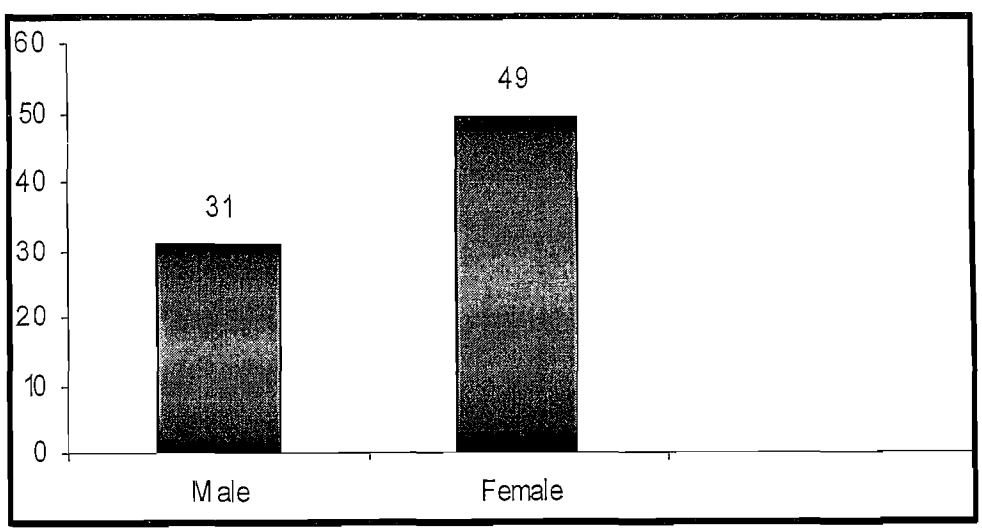

Figure **4.3.** The gender distribution of the food handlers.

4.3.1.4 Highest school grade completed

As part of the demographic data the highest school grade that the participants completed was needed to conclude if level of schooling may influence food handlers' compliance. Table 4.3 summarises the handlers' educational levels and figure 4.4 provides a graphic representation of this.

Table **4.3.** Food handlers' highest completed level of schooling

	No schooling	Gr 1-7	Gr 8-10	Gr 11-12
Healthcare 1 (n=38)	n=2 (5.26%)	n=8 (21.05%)	n=14 (36.84%)	n=14 (36.84%)
Healthcare 2 (n=17)	n=0 (0.00%)	n=2 (11.77%)	n=2 (11.77%)	n=13 (76.47%)
Healthcare 3 (n=12)	n=0 (0.00%)	n=3 (25.00%)	n=5 (41.67%)	n=4 (33.33%)
Healthcare 4 (n=13)	n=1 (7.69%)	n=3 (23.08%)	n=5 (38.46%)	n=4 (30.77%)
TOTAL (n=80)	n=3 (3.75%)	n=16 (20.00%)	n=26 (32.50%)	n=35 (43.75%)

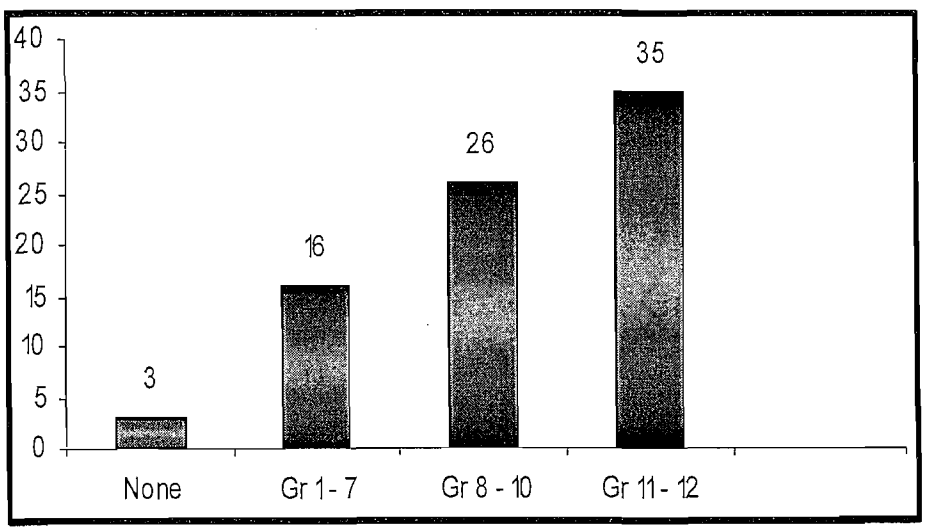

Figure **4.4.** The highest school grade completed by the food handlers.

4.3.1.5 Period of employment

The period of employment in the four healthcare services was indicated with intervals of 0-5 years, 6-10 years, 11-15 years, 16-20 years and > 21 years. The indicated intervals are indicated for each healthcare service in table 4.4 and figure 4.5.

Table **4.4.** Food handlers' period of employment

	0-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	>20 yrs
Healthcare 1 (n=38)	n=13 (34.21%)	n=3 (7.90%)	n=7 (18.42%)	n=13 (34.21%)	n=2 (5.26%)
Healthcare 2 (n=17)	n=9 (52.94%)	n=1 (5.88%)	n=2 (11.77%)	n=5 (29.41%)	n=0 (0.00%)
Healthcare 3 (n=12)	n=7 (58.33%)	n=3 (25.00%)	n=2 (16.67%)	n=0 (0.00%)	n=0 (0.00%)
Healthcare 4 (n=13)	n=5 (38.46%)	n=2 (15.39%)	n=3 (23.08%)	n=3 (23.08%)	n=0 (0.00%)
TOTAL (n=80)	n=34 (42.50%)	n=9 (11.25%)	n=14 (17.50%)	n=21 (26.25%)	n=2 (2.50%)

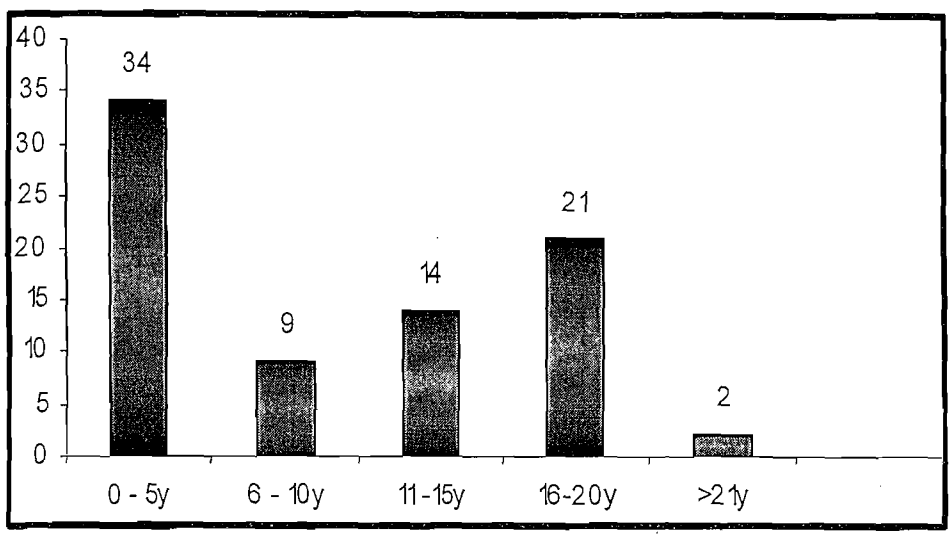

Figure **4.5.** The intervals in terms of the period the food handlers' have been employed.

4.3.1.6 Discussion of demographic data

The different healthcare services showed a participation rate from healthcare service 1 of 66.67%, healthcare service 2 was 100%, healthcare service 3 was 92.31% and healthcare service 4 was 56.52%. The age of the food handlers is as follows: 41.25% (n=33) is between 40 and 49 years of age, 13.75% (n=11) are between 50 – 59 years, and the majority, 68.75% (n=55) are between 30 and 49 years. These data show that the age group 50 – 59 is likely to have the most experience in food handling, although they are in the minority in the group as a whole.

Healthcare service 1 was the only one where more males than females are employed, while the other three healthcare services employ more females than

males, indicating that the females outnumber the males. Most of the food handlers from the four healthcare services (76.25%, n=61) have completed schooling between the grades 8 – 12 and should have no difficulty in comprehending any training or retraining. For the 23.75% (n=19) of food handlers that might have difficulty in understanding the training, alternative ways must be implemented to accommodate them in achieving compliance with the DOH guidelines.

The majority of food handlers (42.50% or n=34) have worked for less than five years, while the remainder (57.50%, n=46) have more than eleven years of experience.

4.3.1.7 Conclusions drawn from demographic data

The results from the demographic data collected indicate that nearly a third of the participants in the research project had difficulty in comprehending the questions and required assistance in completing the questionnaire. The conclusion is drawn that they may not only experience difficulty if training and retraining includes written learning material, but may struggle to understand what basic food and hand hygiene entails.

Training programmes should take into consideration that the majority of food handlers have completed Grade 10 or below.

Should the training structure include an increase in schooling level, the handlers may be better able to understand the basics of food hygiene, including compliance with hand and surface hygiene and standards.

4.3.2 Section 2: Education and training

The aim of collecting data regarding education and training was to determine whether the food handlers receive education and training as required by the DOH guidelines (Directorate: Food control: July 2000a, see Appendix 1. Refer to chapter 3, section 3.3.1 for the detailed discussion). Any lack in this important aspect might contribute to the inability of food handlers to understand the basic principles of hand hygiene during food handling. This section includes (i) training lessons, (ii) demonstrations and (iii) structure of training lessons. Each of these is discussed below.

4.3.2.1 Training lessons

It was important to determine whether the food handlers receive training to ensure compliance with hand hygiene. The results were for practical training as no written or formal training were received. Table 4.5 summarises the food handlers' responses to this enquiry (table 4.5) and figure 4.6 provides a graphic presentation of this data.

Table **4.5.** Food handlers' exposure to practical training

	Practical training received	No training received
Healthcare 1 (n=38)	n=37 (97.37%)	n=1 (2.63%)
Healthcare 2 (n=17)	n=16 (94.12%)	n=1 (5.88%)
Healthcare 3 (n=12)	n=3 (25.00%)	n=9 (75.00%)
Healthcare 4 (n=13)	n=12 (92.31%)	n=1 (7.69%)
TOTAL (n=80)	n=68 (85.00%)	n=12 (15.00%)

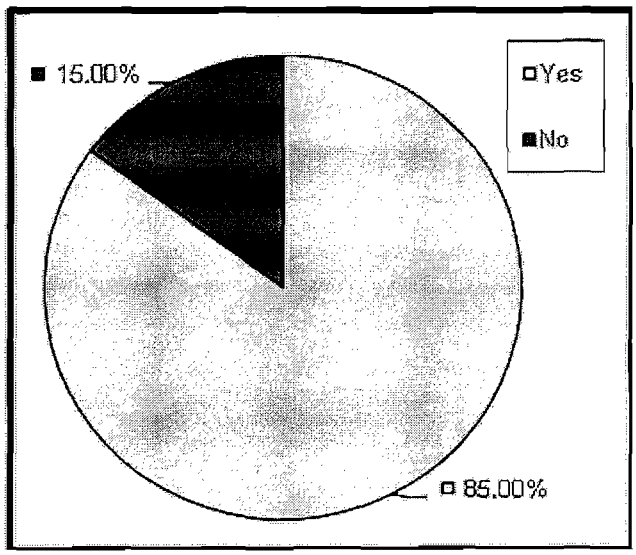

Figure **4.6.** Food handlers' practical training exposure

4.3.2.2 Demonstrations

The data collected regarding the regularity of practical demonstrations was important to determine if the absence thereof might have an influence on the food handlers' understanding of and compliance with hand hygiene. The following table summarises the data collected for the demonstrations during training (see table 4.6) and figure 4.7 presents a graphic display of the data.

Table **4.6.** Demonstrations and regularity of training

	Regular practical demonstrations	No practical demonstrations
Healthcare 1 (n=38)	n=36 (94.74%)	n=2 (5.26%)
Healthcare 2 (n=17)	n=14 (82.35%)	n=3 (17.65%)
Healthcare 3 (n=12)	n=6 (50.00%)	n=6 (50.00%)
Healthcare 4 (n=13)	n=10 (76.92%)	n=3 (23.08%)
TOTAL (n=80)	n=66 (82.50%)	n=14 (17.50%)

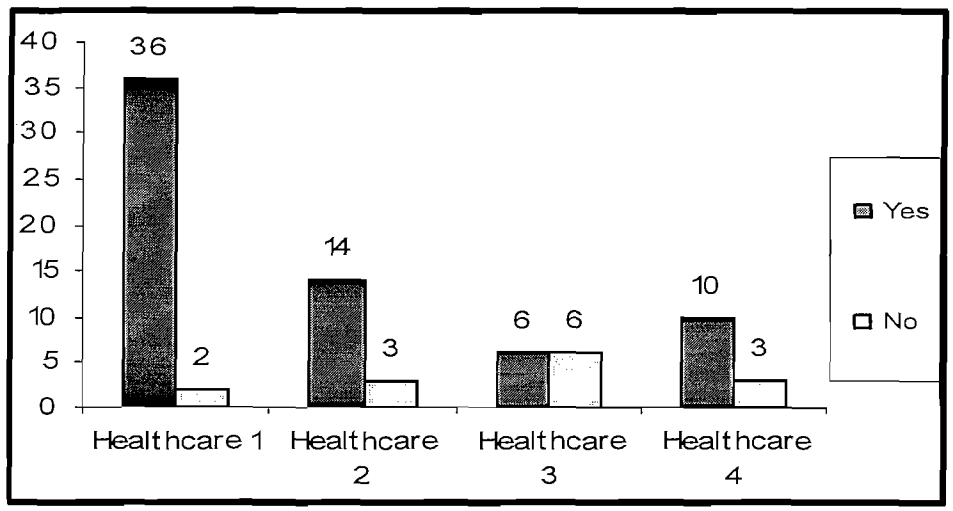

Figure **4.7.** Training demonstrations and regularity

4.3.2.3 Structure of training lessons

The structure of training refers to the content of the retraining lessons along with the assessment thereof. It is important to evaluate the congruency between the structures of training, compliance with hand hygiene and the possibility that the food handler might be a vehicle in the transmission of pathogens. Table 4.7 provides the results of this investigation and figure 4.8 illustrates these findings.

Table **4.7**. The structure of training the food handlers receive

	Written training		Practical training		
	Yes	No	Yes	No	No training
Healthcare 1 (n=38)	n=1 (2.63%)	n=37 (97.37%)	n=33 (86.84%)	n=2 (5.26%)	n=3 (7.90%)
Healthcare 2 (n=17)	n=8 (47.06%)	n=9 (52.94%)	n=15 (88.24%)	n=2 (11.77%)	n=0
Healthcare 3 (n=12)	n=1 (8.33%)	n=6 (50.00%)	n=9 (75.00%)	n=3 (25.00%)	n=5 (41.67%)
Healthcare 4 (n=13)	n=0	n=13 (100.00%)	n=12 (92.31%)	n=0	n=1 (7.69%)
TOTAL (n=80)	n=10 (12.25%)	n=65 (81.25%)	n=69 (86.25%)	n=7 (8.75%)	n=9 (11.25%)

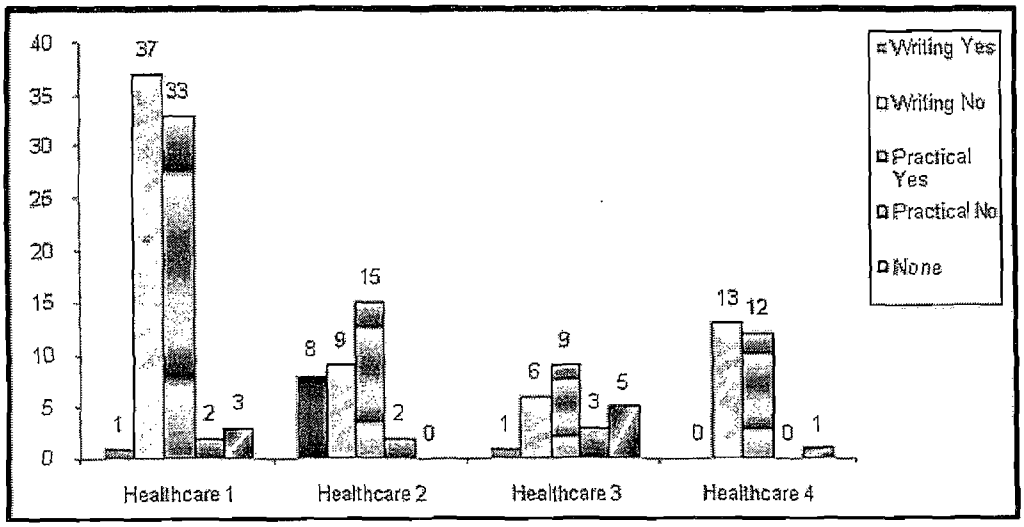

Figure **4.8.** The training structure of the food handlers.

4.3.2.4 Discussion of results of education and training

The results from this section indicated that 12.25% (n=10) of the food handlers do receive written training material during formal training and retraining lessons. The remaining 81.25% (n=65), indicated the opposite. They only training they receive is practical lessons and demonstrations. Food handlers should receive training and retraining, including written learning material to ensure that they comprehend and understand hand hygiene practices, which form the basis for the prevention of cross-contamination. Most of the food handlers indicated that they receive only practical demonstrations to conduct their work, and it is a concern that 17.50% (n=14) indicated that they have received no training of any kind. Education and training is a requirement according to the DOH guidelines (Directorate: Food control: July 2000a, see Appendix 1). The SABS (2001:6) affirms that training and

retraining must be provided for all personnel involved in food handling, to prevent the contamination of food. The same SABS code stipulates that training and retraining should be implemented, documented and maintained. In addition, records must be kept for statistical purposes to evaluate whether the process of hygiene is efficient and acceptable.

4.3.2.5 Conclusions drawn from results of education and training

When food handlers do not receive training and retraining, it may be deduced that they will not comprehend how, where or when pathogens might be present or be transmitted to patients.

It is important that food handlers receive written training material and practical demonstrations that provide them with knowledge that can be assessed regularly to monitor their compliance and non-compliance with hand hygiene. Only in this case may the handlers accept liability and responsibility for ensuring that food that they handle is safe for patients.

Work experience does not guarantee compliance with hand hygiene during food handling.

The Department of Health's guidelines for the management and health surveillance of food handlers should be included in the structure of lessons as a reference for compliance with hand hygiene.

All food handlers should receive induction and training to develop their knowledge. Management is responsible for providing training to comply with the DOH's guidelines. Failure to educate and communicate is likely to result in non-compliance with hand hygiene.

Standards to evaluate and confirm food handlers' compliance with hand hygiene during food handling should be available to ensure that food is pathogen-free and safe for patients in the healthcare service.

4.3.3 Section 3: Basic food handling hygiene practices

These data were important to determine whether the food handlers understand why they must comply with hand hygiene during food handling. The aspects addressed in this section include (i) food handling, (ii) frequency of cleaning, (iii) food protection and disposal, (iv) responsibility, (v) open lesions, (vi) hand hygiene practices and (vii) occupational health surveillance. Each of these topics is discussed below.

4.3.3.1 Food handling

As part of basic food handling hygiene practices it was imperative to establish the food handlers' knowledge of the correct handling of raw and cooked food. A lack of knowledge may result in the increased transmission of pathogens from one product to another and thus to patients. All the food handlers from the four healthcare services understood this important aspect.

4.3.3.2 Frequency of cleaning

It was important to determine whether the food handlers understand the reasons for regular cleaning of all work surfaces and utensils and the use of clean water, and whether they comply with these practices. Table 4.8 summarises the data and figure 4.9 provides a visual representation.

Table **4.8**. Handlers' understanding of need for surface hygiene

	After each task	1-2/day	3-4/day
Healthcare 1 (n=38)	n=36 (94.74%)	n=1 (2.63%)	n=1 (2.63%)
Healthcare 2 (n=17)	n=17 (100.00%)	n=0	n=0
Healthcare 3 (n=12)	n=12 (100.00%)	n=0	n=0
Healthcare 4 (n=13)	n=13 (100.00%)	n=0	n=0
TOTAL (n=80)	n=78 (97.50%)	n=1 (1.25%)	n=1 (1.25%)

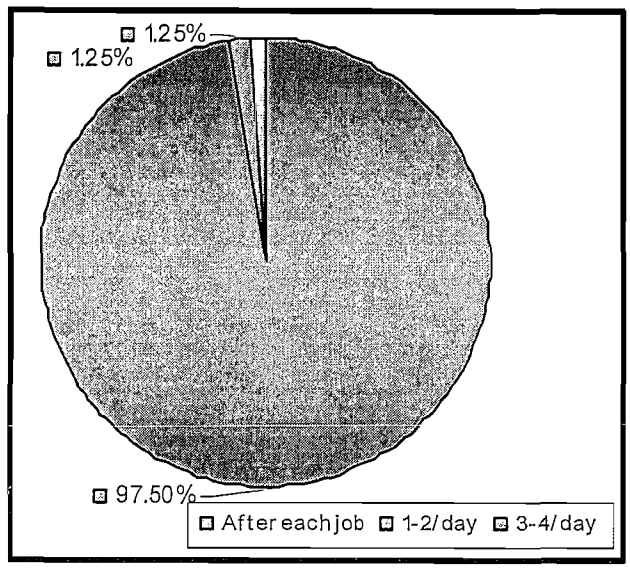

Figure **4.9.** Food handlers' understanding of need for surface hygiene

4.3.3.3 Food protection and disposal

This section investigated whether the food handlers understand the importance of protecting food after handling. Unprotected and waste food can attract insects, flies and rodents if not handled properly. Protection refers to taking measures to prevent access to food by insects, birds, and so on, as well as covering and refrigerating food. Protection and disposal of waste food should be consistent with the healthcare service procedures. The food handlers must know what happens to the waste food and why. Table 4.9 summaries the food handlers' comprehension of these aspects and figure 4.10 presents the findings graphically.

Table **4.9.** Knowledge of the protection and disposal of food

	Protection		Disposal	
	Cover & left	**Cover & fridge**	**Waste bins**	**Pig farm**
Healthcare 1 (n=38)	n=18 (47.38%)	n=20 (52.63%)	n=21 (55.26%)	n=17 (44.74%)
Healthcare 2 (n=17)	n=2 (11.76%)	n=15 (88.24%)	n=8 (47.06%)	n=9 (52.94%)
Healthcare 3 (n=12)	n=0	n=12 (100.00%)	n=5 (41.67%)	n=7 (58.33%)
Healthcare 4 (n=13)	n=5 (38.46%)	n=8 (61.54%)	n=9 (69.23%)	n=4 (30.77%)
TOTAL (n=80)	n=25 (31.25%)	n=55 (68.75%)	n=43 (53.75%)	n=37 (46.25%)

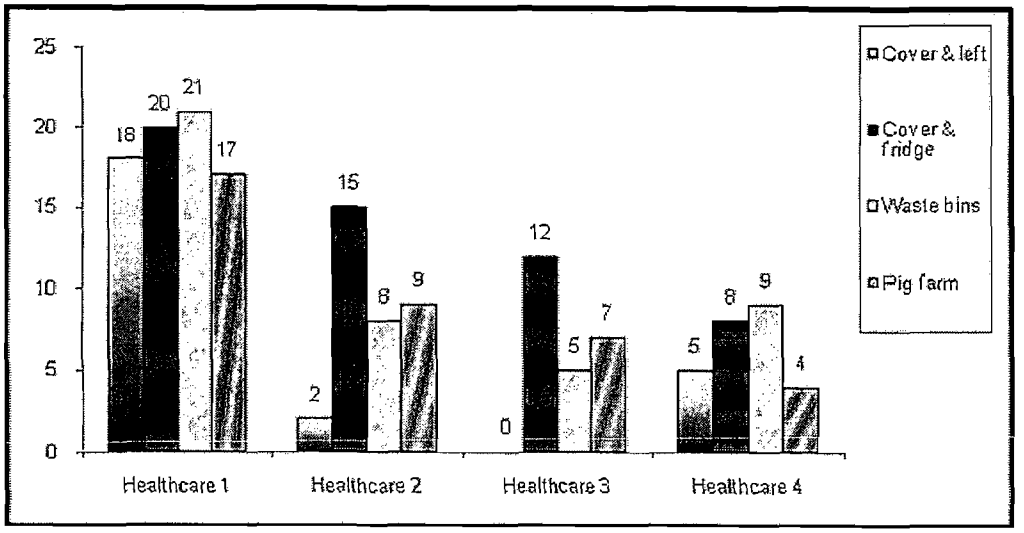

Figure **4.10.** Knowledge of food protection and disposal of food

4.3.3.4 Responsibility

The data collected were crucial to determine if handlers have been delegated or assigned responsibility that may influence the degree of food contamination during handling. An absence of responsibility might promote non-compliance with hand hygiene and increase the transmission of pathogens to food. Table 4.10 summarises the data, which is graphically demonstrated in figure 4.11.

Table **4.10**. The food handlers' understanding of responsibility

	Hand wash only	Wearing gloves only	Hand washing & gloves	*Other	*Missing*	Cross-contamination by hands	
						Yes	No
Healthcare 1 (n=38)	n=17 (44.74%)	n=6 (15.79%)	n=5 (13.16%)	n=9 (23.68%)	n=1 (2.63%)	n=21 (55.26%)	n=17 (44.74%)
Healthcare 2 (n=17)	n=5 (29.41%)	n=0	n=0	n=12 (70.59%)	n=0	n=12 (70.59%)	n=5 (29.41%)
Healthcare 3 (n=12)	n=4 (33.33%)	n=0	n=7 (58.33%)	n=1 (8.33%)	n=0	n=12 (100.00%)	n=0
Healthcare 4 (n=13)	n=7 (53.85%)	n=3 (23.08%)	n=3 (23.08%)	N=0	n=0	n=12 (92.31%)	n=1 (7.69%)
TOTAL (n=80)	n=33 (41.25%)	n=9 (11.25)	n=15 (18.75%)	n=22 (27.50%)	n=1 (1.25%)	n=57 (71.25%)	n=23 (28.75%)

*Other included: food protection, tidiness, training, hygiene and cleanliness.

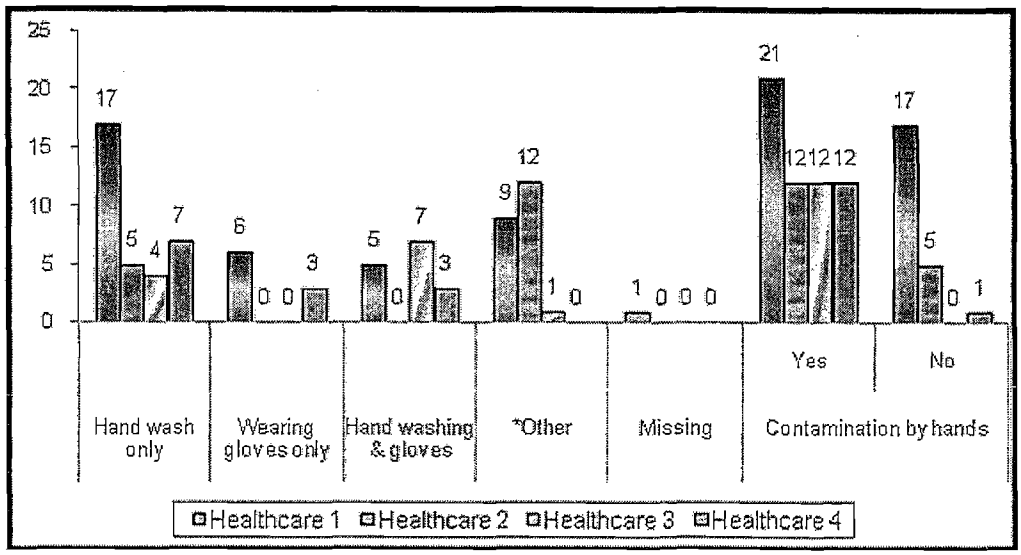

Figure **4.11.** The food handlers' understanding of responsibility.

4.3.3.5 Open lesions

This section aimed to establish whether the food handlers understand how open lesions should be handled during food handling. Neglected open lesions increase the likelihood for the transmission of pathogens to food and surfaces. Open lesions must be covered properly to prevent cross-contamination of pathogens from hands to work surfaces, food and so also to patients. Depending on the extent of the lesion, actions may include one of the following: withdrawal from work, covering with plaster and continuing work, or conducting other work. The results of this investigation are shown in table 4.11 and figure 4.12.

Table **4.11.** Actions taken during open lesions.

	Withdrawn from work	**Covered with plaster and continue work**	**Other work**
Healthcare 1 (n=38)	n=7 (18.42%)	n=30 (78.95%)	n=1 (2.63%)
Healthcare 2 (n=17)	n=0	n=16 (94.12%)	n=1 (5.88%)
Healthcare 3 (n=12)	n=7 (58.33%)	n=5 (41.67%)	n=0
Healthcare 4 (n=13)	n=0	n=10 (76.93%)	n=3 (23.08%)
TOTAL (n=80)	n=14 (17.50%)	n=61 (76.25%)	n=5 (6.25%)

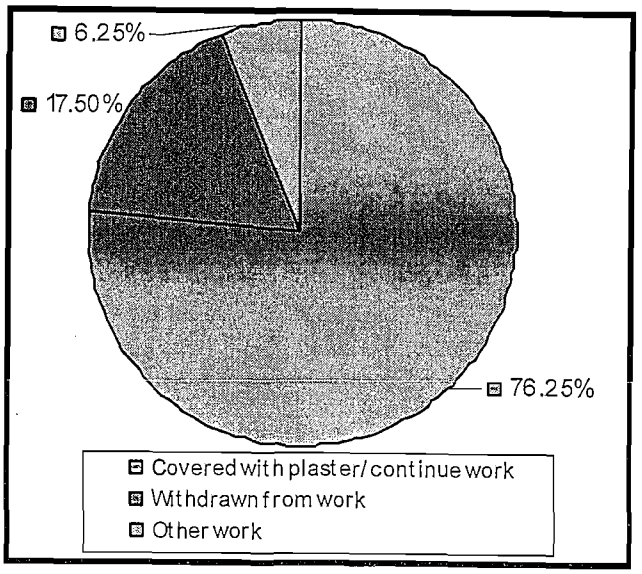

Figure **4.12.** The food handlers' understanding of lesions.

4.3.3.6 Hand hygiene practices

The foremost element in preventing the cross-contamination of pathogens like *Escherichia coli* and *Staphylococcus aureus* during food handling is the maintenance of hygienically clean hands. This can only be achieved if food handlers wash and scrub their hands and nails before and between handling different foods. Therefore it was vital to identify whether food handlers adhere to this practice. Table 4.12 summarises this aspect and figure 4.13 gives a graphical representation of the results.

Table **4.12.** A summary of the food handlers' understanding of hand hygiene practices.

	Necessity to scrub hands & nails	**No scrubbing of hands & nails necessary**
Healthcare 1 (n=38)	n=26 (68.42%)	n=12 (31.58%)
Healthcare 2 (n=17)	n=13 (76.47%)	n=4 (23.53%)
Healthcare 3 (n=12)	n=12 (100.00%)	n=0
Healthcare 4 (n=13)	n=10 (76.92%)	n=3 (23.08%)
TOTAL (n=80)	n=61 (76.92%)	n=19 (23.75%)

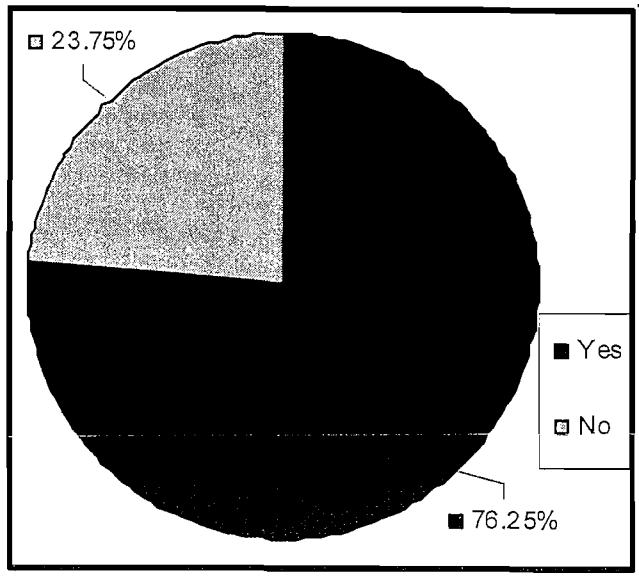

Figure **4.13.** The food handlers' understanding of hand hygiene practices.

4.3.3.7 Occupational health surveillance

Ensuring compliance with basic food handling hygiene practices to prevent the cross-contamination of pathogens during food handling, may be achieved through the implementation of an occupational health surveillance programme. For this reason, it was important to discover if the food handlers' health is monitored and if they receive feedback of the results. If a regular occupational health surveillance programme is absent, there is no method of evaluating whether food handlers comply with hand hygiene. An occupational health surveillance programme can help ensure that food handlers do not become vehicles in the transmission of pathogens that can cause food-borne illnesses. Table 4.13 summarises the findings relating to this aspect and figure 4.14 provides a graphic presentation of the data.

Table **4.13.** Occupational health surveillance and feedback

	Occupational health surveillance done	**No occupational health surveillance done**
Healthcare 1 (n=38)	n=3 (7.90%)	n=35 (92.11%)
Healthcare 2 (n=17)	n=4 (23.53%)	n=13 (76.47%)
Healthcare 3 (n=12)	n=1 (8.33%)	n=11 (91.67%)
Healthcare 4 (n=13)	n=1 (7.69%)	n=12 (92.31%)
TOTAL (n=80)	n=9 (11.25%)	n=71 (88.75%)

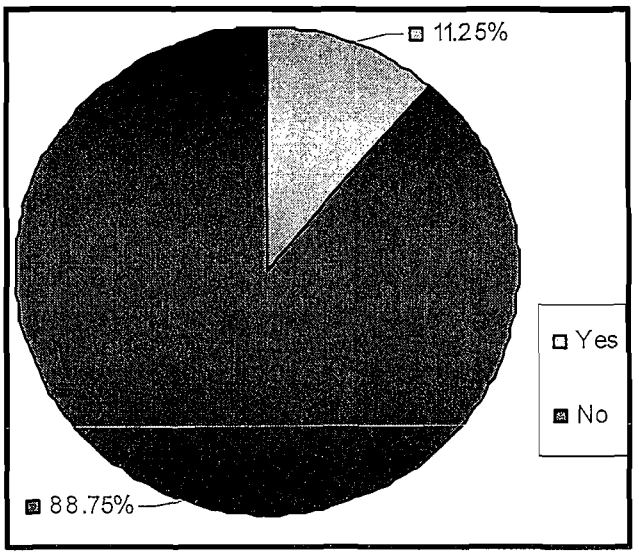

Figure **4.14.** Occupational health surveillance and feedback.

4.3.3.8 Discussion the results of basic food handling hygiene practices

According to the DOH's guidelines for the management and health surveillance of food handlers (Directorate: Food control, July 2000a; see Appendix 1), raw and cooked food should not be handled at the same time. Doing so is a direct cause of cross-contamination between different foods, especially when raw chicken is handled. Raw chicken has been recognised as a source of pathogens and should never be in contact with any other food. It is essential that surfaces and utensils be scrupulously cleaned every time a different food item is handled, and that clean water is used frequently to guarantee the prevention of cross-contamination between different foods. The food handlers from the four healthcare services indicated that most of them knew about the importance of the abovementioned aspects during food handling. Even if only one food handler fails to clean the surface or utensil after a single piece of food (such as raw chicken) has been handled, cross-contamination may take place, causing a food-borne illness to occur, which may affect patients whose health is already compromised.

As for hand washing, the majority of food handlers indicated that the only responsibility they have concerning basic food handling hygiene is to wash their hands, while 18.75% (n=15) stated that their responsibility included both hand washing and wearing gloves. Of the total number of food handlers, 27.50% (n=22) listed food protection, tidiness, training, hygiene and cleanliness as their responsibility, and 11.25%% (n=9) of the food handlers stated that they are

responsible for wearing gloves. Although the majority of food handlers (71.25%, n=57), indicated that they understood what food contamination meant, they described the concept in the broader sense in person to the researcher. Of the total, 28.75% (n=23) of the food handlers did not know what food contamination means, a mitigating factor and critical aspect of hand hygiene. Most of the food handlers (76.25%, n=61) indicated that if they has an open lesion, they would cover it with a plaster and continue with their normal work. The balance (23.75%, n=19) indicated that they were either given alternative work or were withdrawn from their normal duties. In any food preparation section there must be consistency in how open sores or lesions are treated to prevent the transmission of pathogens to food and surfaces. Most of the food handlers indicated that it is necessary to wash and scrub their hands and nails when handling different food, but it is alarming that 23.75% (n=19) of the food handlers did not seem to know the importance of this essential action. This should be a serious concern for the managers in the food preparation sections as well as the healthcare services.

The majority of food handlers, 88.75% (n=71) stated that they are not medically screened. It is uncertain whether managers only include a section of the food handlers in occupational health surveillance programmes or if the minority of food handlers that indicated that they are included in such a programme misunderstood what occupational health surveillance entails. During the process of completing the consent forms, questionnaires and scientific sampling phases, it was noticed that not a single food handler from all four healthcare services wore gloves during food handling. It is obvious that the food handlers have no clear understanding of or insight into what their involvement or responsibility is in terms of basic food handling hygiene practices. It is essential that the food handlers realise what food contamination entails, including the complete epidemiology cycle, how it occurs, and the handlers' role in transmission, the consequences thereof and how it must be avoided. There is also no uniformity within the food preparation sections of how open sores or lesions should be handled to prevent cross-contamination. It seems clear that management must be more consistent in this regard.

Washing and scrubbing hands and nails between handling different food is essential to prevent cross-contamination. This includes not only the transmission of pathogens like *Escherichia coli* and *Staphylococcus aureus,* but also an

assortment of other pathogens, like *Brucella, Bacillus cereus, Campylobacter jejuni, Closstridium Botulinum, Clostridium perfringens, Listeria monocytogenes, Salmonella, Shigella, Novovirus, Toxoplasma Gondi, Vibro species* and *Yersinia enterocolytica.* Patients in the healthcare service have the right to receive food that is pathogen-free. Fully a quarter (25%) of the food handlers did not know the importance of clean hands. The absence of hand hygiene may aggravate the illness and recovery of hospitalised patients. This serious lack of knowledge of hand hygiene during food handling is a cause of concern for all the healthcare services as they are responsible for the care and recovery of patients. Managers have the responsibility to ensure that all food handlers comply with this essential aspect of food handling.

The most common way for food to be contaminated with pathogens like *Escherichia coli* and *Staphylococcus aureus* is through food handlers who might carry and transmit pathogens to food and surfaces. Occupational health surveillance of food handlers' hands can contribute to the prevention of the transmission of pathogenic micro-organisms to food and surfaces. The implementation of such a programme could contribute to the improvement and maintenance of the food handlers' compliance with hand hygiene, food quality and safety.

All the areas of investigation explored above reveal a shortcoming in one or other form. These shortcomings should be addressed, clarified and understood by all the food handlers through the implementation of training and retraining. The relevant principles should be clarified and emphasised on an ongoing basis, not only during training and retraining, but also during practical demonstrations. In addition, food handlers' knowledge must be assessed to make certain that they comply at all times with hand hygiene during food handling. According to the Department of Health's guidelines, food handlers have a responsibility in basic food handling hygiene practices, and managers should make certain that their employees comply with these guidelines. When one food handler neglects to adhere to these principles, many patients may be affected, with dangerous consequences.

4.3.3.9 Conclusions drawn from results of basic food handling hygiene practices

When food handlers doesn't understand the basics of food handling hygiene, they will not comprehend nor understand why cleaning of surfaces, utensils and usage of clean water is important during food handling and the consequences thereof for patients.

Practical work experience does not seem to guarantee compliance with hand hygiene.

The lack of responsibility and empowerment may limit improvements and participation.

Non-adherence to hygiene practices can create opportunities for pathogens to multiply during food handling. Although equipment seems clean to the eye, it may harbour pathogens, as it has not been cleaned properly.

Consistency is needed in the way food is protected and disposed of and food handlers must know and comply with the healthcare service's procedures regarding the protection, disposal and destination of waste food.

4.3.4 Section 4: Basic personal hygiene practices

The data collected aimed to verify whether the lack of compliance with hand hygiene may influence the presence or absence of pathogens like *Escherichia coli* and *Staphylococcus aureus.* Basic personal hygiene practices are one of the sections in the DOH's guidelines (Directorate: Food control: July 2000a, see Appendix 1). Basic personal hygiene practices include (i) personal protective clothing, (ii) jewellery, (iii) sanitation, and (iv) airborne pathogens. Each of these is discussed below.

4.3.4.1 Personal protective clothing

To prevent the transmission of pathogens, every food handler should wear clean personal protective clothing (overalls, hair coverings and gloves) every day (DOH, 2000a:9). Management has to provide and make certain that all food handlers

adhere to this requirement. Table 4.14 and figure 4.15 summarise the current compliance of food handlers with this requirement.

Table **4.14.** Wearing of personal protective clothing

	Clean protective clothing and worn	No availability of personal protective clothing
Healthcare 1 (n=38)	n=37 (97.37%)	n=1 (2.63%)
Healthcare 2 (n=17)	n=17 (100.00%)	n=0
Healthcare 3 (n=12)	n=12 (100.00%)	n=0
Healthcare 4 (n=13)	n=13 (100.00%)	n=0
TOTAL (n=80)	n=79 (98.75%)	n=1 (1.25%)

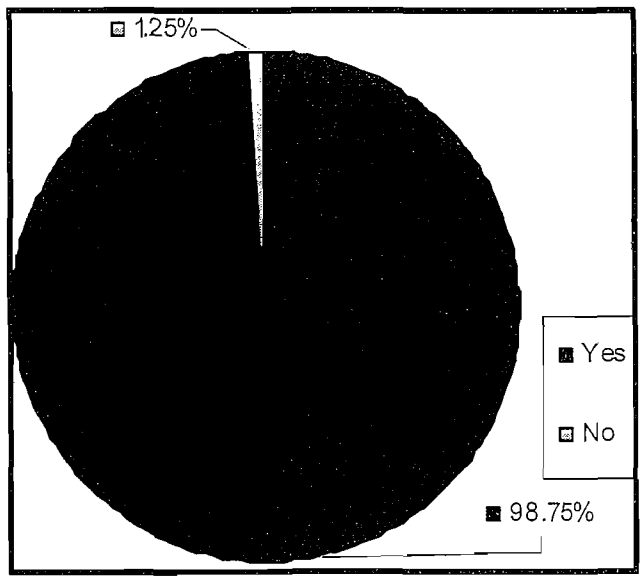

Figure **4.15.** Personal protective clothing.

4.3.4.2 Jewellery

According to the DOH's guidelines (Directorate: Food control: July 2000a), no food handler is allowed to wear any jewellery during food handling. Since jewellery can contribute to the transmission of micro-pathogens, it was therefore important to establish whether the food handlers comply with and understand the reason for this guideline. Figure 4.16 gives a graphical display of this finding.

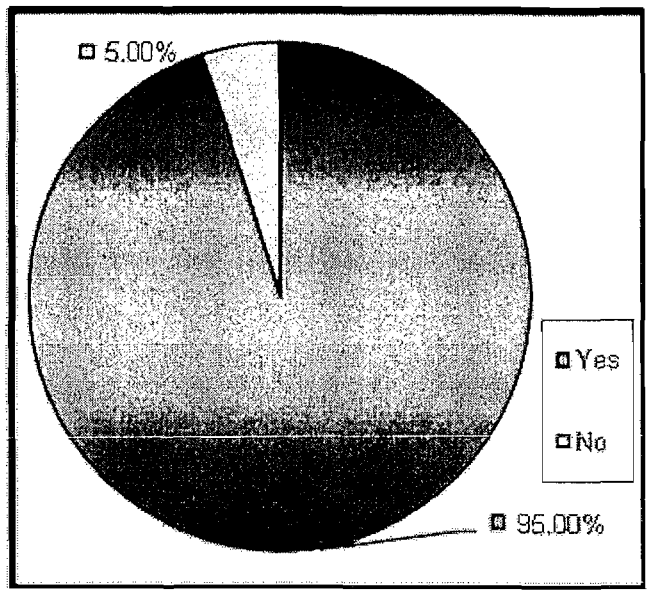

Figure **4.16.** Wearing of jewellery.

4.3.4.3 Sanitation

A fundamental aspect in the maintenance of food handlers' personal hygiene depends on the availability of sanitation facilities and equipment. The latter is therefore an essential part of any food preparation section. Managers must ensure that all the food handlers use these facilities and that they understand the reason for the compliance. Showers, soap, towels and hand-drying devices are essential in preventing the transmission of pathogens from hands to surfaces and eventually to patients. As part of basic personal hygiene practices, it was important to identify whether the mentioned aspects were available and used by the food handlers (table 4.15 and figure 4.17 summarise these data).

Table **4.15**. Availability and usage of sanitation facilities and equipment

	Sanitation available & used	**No sanitation available or used**
Healthcare 1 (n=38)	n=29 (76.32)	n=9 (23.68%)
Healthcare 2 (n=17)	n=13 (76.47%)	n=4 (23.53%)
Healthcare 3 (n=12)	n=6 (50.00%)	n=6 (50.00%)
Healthcare 4 (n=13)	n=10 (76.92%)	n=3 23.08%)
TOTAL (n=80)	n=58 (72.50%)	n=22 (27.50%)

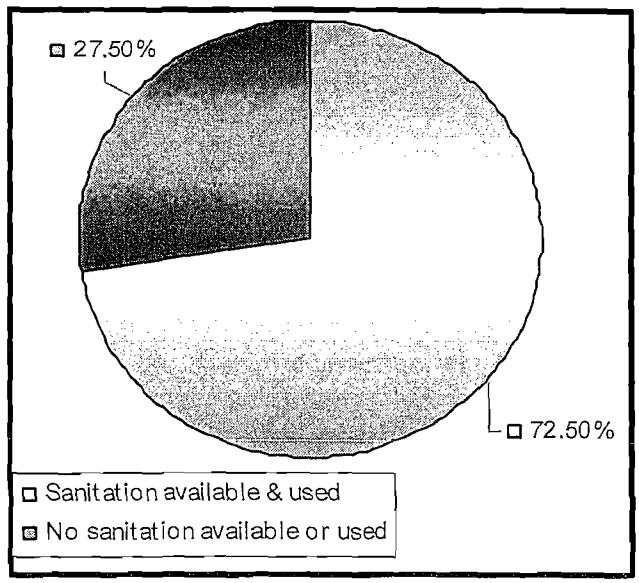

Figure **4.17.** Availability and usage of sanitation facilities and equipment.

4.3.4.4 Air-borne pathogens

It was of value to establish whether the food handlers understand that they may influence the presence or absence of pathogens on their hands. Air-borne pathogens like *Staphylococcus aureus* can be transmitted when food handlers blow their noses or sneeze near food or during food handling. Such actions promote the spread of air-borne pathogens. Table 4.16 summarises and figure 4.18 graphically demonstrates these data.

Table **4.16.** Understanding of methods of spreading air-borne pathogens

	Spreading of germs	**Doesn't know**
Healthcare 1 (n=38)	n=36 (94.74%)	n=2 (5.26%)
Healthcare 2 (n=17)	n=16 (94.12%)	n=1 (5.88%)
Healthcare 3 (n=12)	n=12 (100.00%)	n=0
Healthcare 4 (n=13)	n=13 (100.00%)	n=0
TOTAL (n=80)	n=77 (96.25%)	n=3 (3.75%)

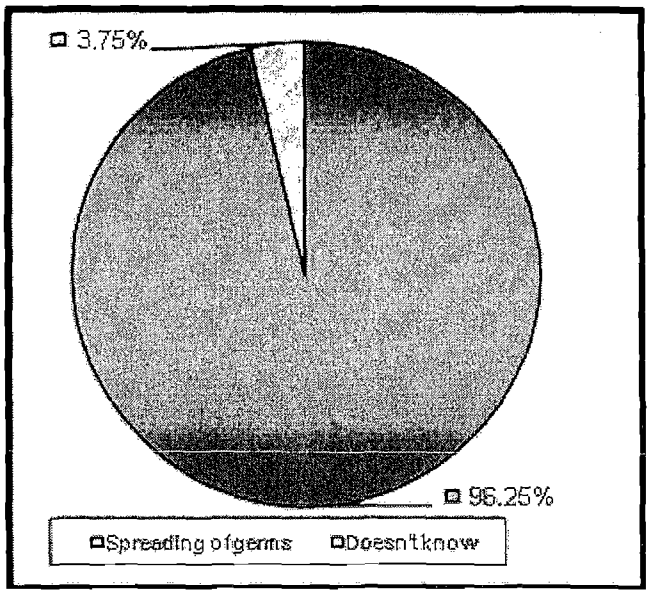

Figure **4.18.** Understanding of air-borne pathogens.

4.3.4.5 Discussion of the results of basic personal hygiene practices

Basic personal hygiene requires a number of practices to ensure that pathogens are not transmitted to work surfaces and food. Protective clothing, no jewellery, no sneezing or coughing and sanitation facilities and equipment are factors indicated by the DOH (2000a:9). Adherence to these guidelines should be part of food handlers' daily practice.

Protective clothing should include overalls, head coverings, gloves and aprons. The results from this section indicate that 98.75% (n=79) of the food handlers stated that they receive clean protective clothing daily. As for jewellery, 95.00% (n=76) know that jewellery may not be worn handling food. Management should ensure that all food handlers understand the reasons for this and the consequences of cross-contamination from wearing jewellery.

According to the Regulations governing general hygiene requirements for food premises and the transport of food (SA, 2003:22) where less than eighty (80) food handlers are employed, there should be three (3) wash basins for men and five (5) for woman. At one healthcare service, which employs a large number of food handlers, there was only one hand-washing facility available in the food handling area, 1 (one) in the men's' and women's' change rooms, indicating that the ratio between food handlers and washing facilities are too low. As the food preparation section was very large, this hand wash basin was not within reach of all the food

handlers. Since the food handlers had to make an effort to reach it, this discouraged them from using it. At two of the participant services, there was no soap or any hand-drying devices available for the food handlers to wash and dry their hands. Sanitation facilities and equipment (showers, soap, towels and hand drying devices) are fundamental to the maintenance of personal hygiene during food handling. Drying appliances are a requirement in the DOH guidelines, section 3.6 (Directorate: Food control: July 2000a). Hand drying devices are essential, as wet hands provide a rich breeding ground for *Escherichia coli* and *Staphylococcus aureus*. In the absence of these important elements, pathogens may be more easily transmitted to food. Only 72.50% (n=58) of the food handlers indicated that sanitation facilities were available and used, while 27.50% (n=22), indicated that this was not the case. Some of the food handlers preferred not use the shower facilities provided, and by doing this, run the risk of exposing their co-workers, families, communities and patients to pathogens. *Escherichia coli* and *Staphylococcus aureus* are not the only pathogens that can be transmitted in this way. Food handlers should be required to use the facilities to prevent the transmission of pathogens.

The majority of food handlers, 96.25% (n=77), knew that blowing their noses or sneezing can contaminate food and surfaces with airborne pathogens, such as *Staphylococcus aureus*. However, every food handler ought to know and understand how countless micro-organisms can be transmitted, not only to the food they are handling or onto the work surfaces, but also to their co-workers and patients, causing numerous diseases and even death.

During site visits that took place during the consent phase, data collection and various other visits, the researcher noticed that at some of the food preparation sections, the majority of the food handlers did not wear overalls, hair coverings or gloves during food handling, despite their questionnaire responses to the contrary. Some food handlers from all four healthcare services did not comply, know or understand the most important aspects of basic personal hygiene and therefore did not comply with the DOH guidelines. The question arises of why management fails to enforce these important aspects as they are finally responsible for the hygiene standards in their food preparation sections. Employers and managers cannot expect their food handlers' hands to be pathogen-free if sanitation facilities

and equipment are absent. These findings suggest that management does not ensure that food handlers comply with basic personal hygiene. Managers in the food preparation sections are responsible for ensuring that all food handlers comply with DOH guidelines. These findings should be of concern to the healthcare services as food-borne illnesses can have disastrous consequences for patients.

4.3.4.6 Conclusions drawn from results of basic personal hygiene practices

Food handlers should be acquainted with the items and facilities available for them to maintain a high level of personal hygiene. Employers must provide personal protective clothing (overalls, head coverings, gloves and aprons), sanitation facilities and equipment (showers, soap, towels and hand drying devices) for food handlers.

Food handlers who are not informed or familiar with their responsibilities regarding the maintenance of personal hygiene during food handling are less likely to understand why they must comply with hand hygiene.

Food handlers have to be motivated to comply with hand hygiene. It should become the norm to establish a culture to provide food that is safe for patients.

When even one food handler is not fully informed and knowledgeable about all the aspects of hand hygiene, it can have disastrous consequences for many patients in the healthcare service.

Standards for establishing an occupational health surveillance programme may assist in identifying and monitoring the presence or absence of pathogens like *Escherichia coli* and *Staphylococcus aureus.* It may also help to ensure that the food is pathogen-free and safe for consumers.

4.3.5 Section 5: Department of Health

This section was included to assess the food handlers' knowledge of the DOH as governing body, as well as to determine if inspectors visit the healthcare services' food preparation sections for hygiene inspections and if they give feedback to the

food handlers on the results of their investigations. The National Department of Health (DOH) is responsible for the regulation of all matters related to food safety. The DOH delegates this responsibility to the provincial authorities for implementation and monitoring. The DOH (2000a:3) states that they rely on mutual understanding and trust between managers and their food handling employees as the basis for a food handling strategy. Included in this section are the results of the study pertaining to (i) knowledge of the DOH, and (ii) inspector visits and actions.

4.3.5.1 Knowledge of Department of Health

Management has the responsibility of informing the food handlers about the Department of Health, and the role they play as decision maker regarding all food handling practices in South Africa. The DOH's guidelines (Directorate: Food control: July 2000a), requires that all food handlers comply with their guidelines. Figure 4.19 summarises the findings relating to food handlers' knowledge of the DOH.

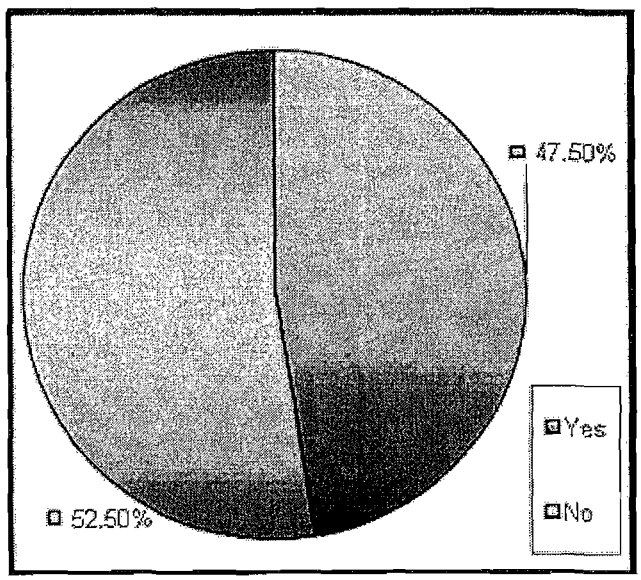

Figure **4.19.** Knowledge of the DOH.

4.3.5.2 Inspector visits

To ensure compliance with the DOH guidelines, it is important that DOH inspectors visit the food preparation sections of both provincial and private healthcare services. The food handlers must be informed of when and why the inspectors are visiting, as should receive feedback from these visits as an

indication of their level of compliance with hand hygiene. Table 4.17 and figure 4.20 summarise and graphically depict these results.

Table **4.17**. Knowledge of the inspector's visits, actions and feedback

	Ask about food and inspected walls/units	Doesn't know
Healthcare 1 (n=38)	n=13 (34.21%)	n=25 (65.79%)
Healthcare 2 (n=17)	n=7 (41.18%)	n=10 (58.82%)
Healthcare 3 (n=12)	n=1 (8.33%)	n=11 (91.67%)
Healthcare 4 (n=13)	n=4 (30.77%)	n=9 (69.23%)
TOTAL (n=80)	n=25 (31.25%)	n=55 (68.75%)

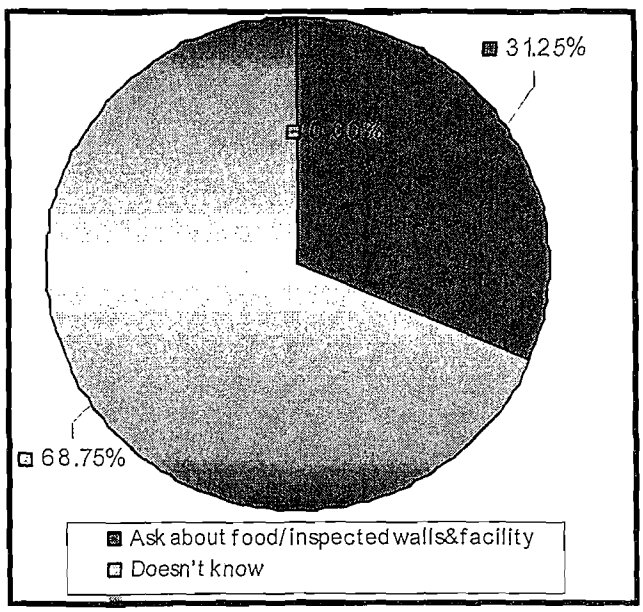

Figure **4.20.** Knowledge of the DOH's inspectors' visits, actions and feedback.

4.3.5.3 Discussion the results of the DOH

It is interesting to note that more than half of the food handlers 52.50%, (n=42) did not know who their governing body is. Management is responsible for informing all the food handlers about the organisations who guide their food handling practices. This information should be included in training and retraining programmes. Information must be presented in such a manner that all the food handlers, irrespective of their literacy level, understand all the facets of hand hygiene.

4.3.5.4 Conclusions drawn from results of the DOH

The conclusion is drawn that the majority of food handlers do not know and have not seen any DOH inspector visiting their food preparation section. It appears that the private healthcare services are excluded in the inspections, and that the food handlers in some healthcare services are not informed if or when the inspectors are visiting.

The DOH must consider all healthcare services equal, irrespective of the type of healthcare they provide to the general public. The private sector should not be ignored or excluded from visits as this may contribute to the prevalence of food-borne illnesses.

All the food handlers should know who their governing body is and why the inspectors visit their facilities.

Food handlers are not able to neither recognise or deduce what gaps exist in their basic food handling hygiene practices, nor know how to correct them, if they are not informed of the guidelines that govern their hygiene practices.

4.3.6 Section 6: Management commitment

This data was included to investigate whether management was actively involved in and committed to maintaining hand hygiene during food handling. Aspects investigated in this section are (i) inspections, (ii) appointment of an employee to conduct inspections, (iii) hygiene standards, (iv) reporting, discussions and corrections, and (v) reporting of illness.

4.3.6.1 Inspections

Part of the managers' responsibility (DOH, 2000a:3) in the food preparation section is to conduct daily hygiene inspections to ensure that the handlers comply with hand hygiene principles. This section investigated whether the food handlers had seen their managers perform hygiene inspections. The following table (table 4.18) summarises the information gathered and figure 4.21 provides a graphic presentation thereof.

Table **4.18.** Handlers' perception of managers' inspections

	Knowledge of inspections	No knowledge of inspections
Healthcare 1 (n=38)	n=32 (84.21%)	n=6 (15.79%)
Healthcare 2 (n=17)	n=15 (88.24%)	n=2 (11.77%)
Healthcare 3 (n=12)	n=4 (33.33%)	n=8 (66.67%)
Healthcare 4 (n=13)	n=12 (92.31%)	n=1 (7.69%)
TOTAL (n=80)	n=63 (78.75%)	n=17 (21.25%)

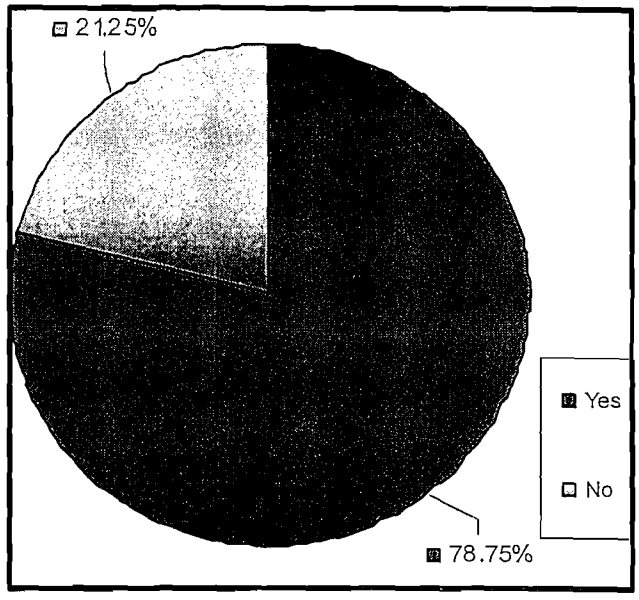

Figure **4.21.** Handlers' perception of managers' inspections

4.3.6.2 Appointment of an employee to conduct inspections

According to the DOH's guidelines (Directorate: Food control: July 2000a), an employee can be appointed to conduct daily hygiene inspections in the food preparation section in addition to his or her normal duties. This was investigated in this section, and the data summarised in table 4.19 and figure 4.22.

Table **4.19.** Appointment of employee to conduct inspections

	Another person seen doing hygiene inspections	No other person seen doing hygiene inspections
Healthcare 1 (n=38)	n=30 (78.95%)	n=8 (21.08%)
Healthcare 2 (n=17)	n=14 (82.35%)	n=3 (17.95%)
Healthcare 3 (n=12)	n=1 (8.33%)	n=11 (91.67%)
Healthcare 4 (n=13)	n=10 (76.92%)	n=3 (23.08%)
TOTAL (n=80)	n=55 (68.75%)	n=25 (31.25%)

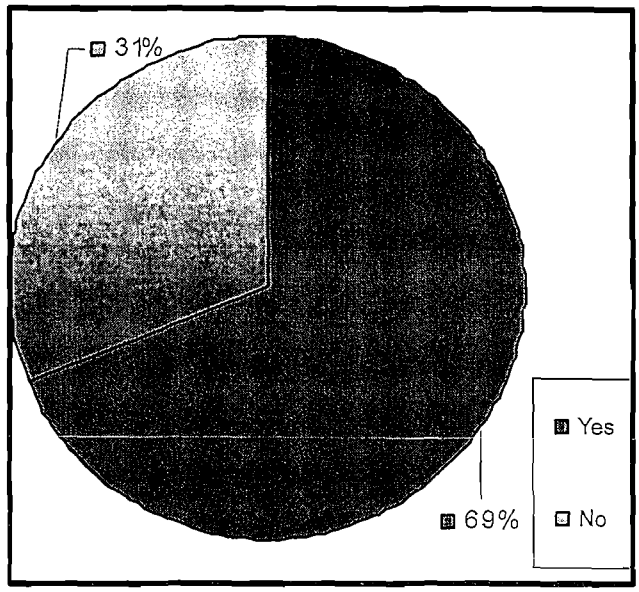

Figure **4.22.** Hygiene inspections done by another employee

4.3.6.3 Hygiene standards

It was important to establish management's commitment to maintaining hygiene standards in the food preparation section. Management's attitude may influence the prevalence rate of pathogens like *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands. Maintaining hygiene standards is the starting point for the prevention of transmission of pathogens hands and surfaces to food. Table 4.20 provides a summary and figure 4.23 demonstrates the data relating to this finding.

Table **4.20.** Maintenance of hygiene standards

	Special equipment *	**Cleaning**	**Hand washing**	**Doesn't know**	***Missing***
Healthcare 1 (n=38)	n=20 (52.63%)	n=12 (31.58%)	n=0	n=6 (15.80%)	n=0
Healthcare 2 (n=17)	n=5 (29.41%)	n=7 (41.18%)	n=2 (11.77%)	n=3 (17.65%)	n=0
Healthcare 3 (n=12)	n=11 (91.67%)	n=1 (8.33%)	n=0	n=0	n=0
Healthcare 4 (n=13)	n=6 (46.15%)	n=3 (23.08%)	n=2 (15.39%)	n=1 (7.69%)	n=1 (7.69%)
TOTAL (n=80)	n=42 (52.50%)	n=23 (28.75%)	n=4 (5.00%)	n=10 (12.50%)	n=1 (1.25%)

*Special equipment included chemicals and tools

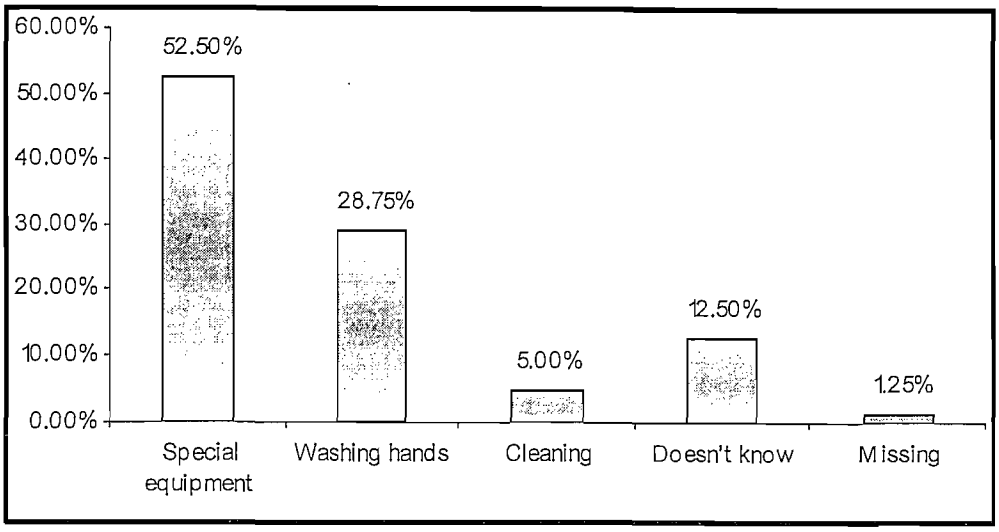

Figure **4.23.** Maintenance of hygiene standards

4.3.6.4 Hygiene problems reported, discussed and corrected

As part of the data collected on management's commitment to maintaining hygiene standards in the food preparation sections, it was important to determine if reported hygiene problems are discussed and corrected. Table 4.21 and figure 4.24 summarise these findings.

Table **4.21.** Action taken in response to hygiene problems

	Hygiene problems reported		Hygiene problems discussed		Hygiene problems corrected	
	Yes	No	Yes	No	Yes	No
Healthcare 1 (n=38)	n=36 (94.74%)	n=2 (5.26%)	n=31 (81.58%)	n=7 (18.42%)	n=25 (65.79%)	n=13 (34.21%)
Healthcare 2 (n=17)	n=17 (100.00%)	n=0	n=17 (100.00%)	n=0	n=17 (100.00%)	N=0
0Healthcare 3 (n=12)	n=12 (100.00%)	n=0	n=12 (100.00%)	n=0	n=12 (100.00%)	N=0
Healthcare 4 (n=13)	n=13 (100.00%)	n=0	n=9 (69.23%)	n=4 (30.77%)	n=10 (76.92%)	n=3 (23.08%)
TOTAL (n=80)	n=78 (97.50%)	n=2 (2.50%)	n=69 (86.25%)	n=11 (13.75%)	n=64 (80.00%)	n=16 (20.00%)

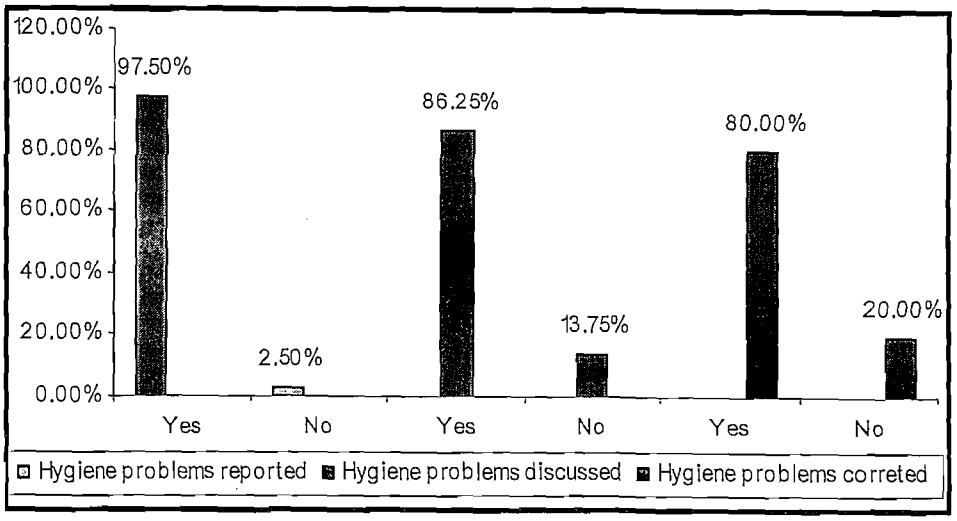

Figure **4.24**. Action taken in response to hygiene problems

4.3.6.5 Reporting when ill

The DOH guidelines (Directorate: Food control: July 2000a) state that it is compulsory for food handlers to report to their managers when they are sick. This is essential to guarantee that no disease-causing pathogens are transmitted to work surfaces, co-workers and customers or patients. This part of the research project investigated whether the food handlers comply with and understand the reason for this requirement. The results are shown in table 4.22 and figure 4.25.

Table **4.22.** Mandatory reporting of illness

		Reasons for compulsory reporting when ill		
	Compulsory to report when ill	**Prevent transmission of germs/diseases**	**Doesn't know**	***Missing***
Healthcare 1 (n=38)	n=38 (100.00%)	n=37 (97.37%)	n=1 (2.63%)	n=0
Healthcare 2 (n=17)	n=17 (100.00%)	n=16 (94.12%)	n=1 (5.88%)	n=0
Healthcare 3 (n=12)	n=12 (100.00%)	n=11 (91.67%)	n=0	n=1 (8.33%)
Healthcare 4 (n=13)	n=13 (100.00%	n=13 (100.00%)	n=0	n=0
TOTAL (n=80)	n=80 (100.00%)	n=77 (96.25%)	n=2 (2.50%)	n=1 (1.25%)

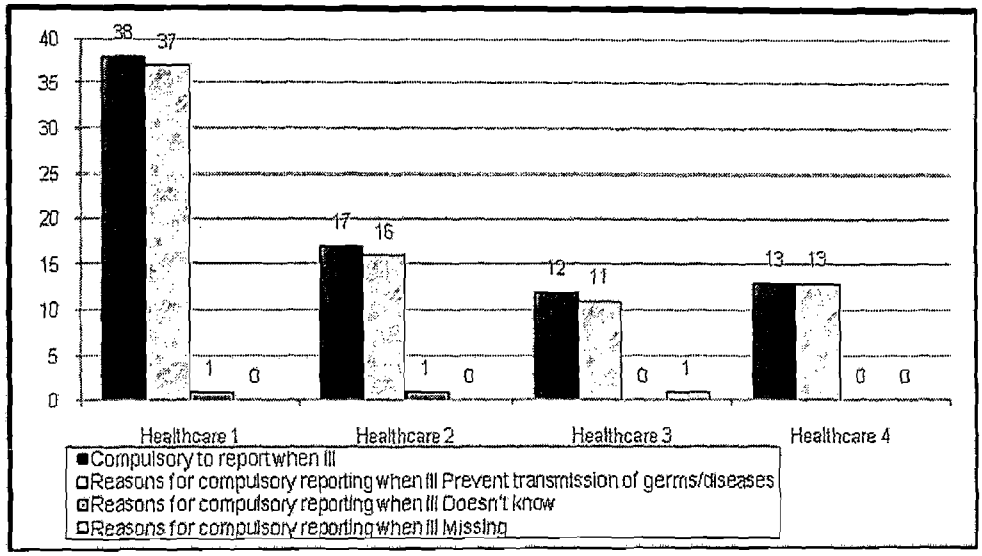

Figure **4.25.** Compulsory reporting of illnesses.

4.3.6.6 Discussion of results of managements' involvement in maintaining hygiene standards

The maintenance of hygiene standards is essential in any food preparation section. If management fails to promote adherence to these standards, it is likely that the prevalence of pathogens in the food preparation section will increase. Although the majority of food handlers (78.75%, n=63) indicated that their managers conduct daily hygiene inspections, it is of concern that 21.25% (n=17) of the food handlers are either not aware of the inspections, or fail to understand the reasons for the inspections. In the outsourced food provider's food preparation section, the food handlers indicated that the manager does not conduct hygiene inspections, although the manager contested this. Transparency and communication between managers and staff seems to be lacking. This could contribute to the handlers' poor compliance with hand hygiene.

In terms of the appointment of an employee to conduct hygiene inspections in the section, 68.75% (n=55) of the food handlers indicated that they has seen another person perform hygiene inspections, although 31.25% (n=25) were unaware of such an appointment. This suggests that not all the food handlers are involved or participate in hygiene matters that concern themselves. This may discourage food handlers from reporting hygiene deviations. In terms of the use of special hygiene equipment, 52.50% (n=42) of the food handlers stated that special equipment is used to maintain hygiene standards, 28.75% (n=23) listed cleaning as the manner in which they maintain hygiene standards, and 5% (n=4) considered hand washing

to be sufficient. Of the total, 12.50% (n=10) did not know how hygiene standards are maintained. These results suggest that there is little consistency within and between the food preparation sections in terms of the maintenance of hygiene standards.

When food handlers report hygiene problems, managers must respond positively by recognising such inputs. This may motivate the food handlers to participate in and improve the level of hand hygiene standards. However, merely reporting problems is insufficient. The reported hygiene deviations must be corrected as soon as possible. Compliance, motivation and standards will diminish in the absence of corrective action. Of the total participants, 2.5% (n=2) revealed that hygiene deviations are not reported, 86.25% (n=69) indicated that hygiene problems are discussed and 80% revealed that they are corrected. The balance of 13.75% (n=11) felt that problems are not discussed, while 20% (n=16) reported that reported hygiene problems are not corrected.

It seems that while all the food handlers are encouraged to report hygiene problems, sometimes no discussions are held to address hygiene problems. It is likely that this could discourage the food handlers from reporting any hygiene problems, which may influence their compliance with hand hygiene and encourage the growth of pathogens like *Escherichia coli* and *Staphylococcus* aureus. This is an indication that a gap exists in the communication system. It is therefore recommended that managers involve every food handler in providing pathogen-free food. Managers should take cognisance of these gaps and should be transparent in their expectation that their employees maintain hand hygiene. Managers should be concerned that some of their food handlers do not believe that hygiene problems that have been reported will be corrected. This might discourage food handlers from reporting hygiene problems, and might further discourage compliance with hand hygiene.

All of the food handlers knew that it was important to report any illness to management. However, 2.5% (n=2) food handlers did not know why it was mandatory. Lack of knowledge and insight may be linked to non-compliance, creating the possibility that pathogens may be transmitted to food, causing food-borne illnesses.

4.3.6.7 Conclusions drawn from the results of managements' commitment to maintain hygiene

Leadership commitment and follow-through is necessary for long-term change and compliance with hand hygiene.

To avoid the contamination of food during handling, managers must conduct daily hygiene inspections to ensure that food handlers comply with hygiene standards. The reason for these daily inspections must be communicated to the food handlers.

Hygiene practices must be defined and clarified to ensure that the food handlers understand how to maintain hand hygiene. All the food handlers must be included in discussion, implementation, evaluation and corrective actions taken to improve and sustain positive participation and hygiene standards.

Food safety is the responsibility of the managers. This is a responsibility that may not be delegated; therefore, managers have to guarantee that the food handlers understand that food safety and quality is a priority throughout the whole handling process. Managers ought to provide vigilant and competent supervision to ensure optimum hygiene conditions and practices, and establish an environment conducive to open discussion and reporting of hygiene problems by employees, based on a relationship of mutual trust.

Management should employ a technical expert to advise on all hygiene aspects. In addition, they should implement an occupational health system for the improvement of compliance with hand hygiene. This may promote product reliability and safety.

If standards are available to monitor food handlers' compliance with hand hygiene, food is more likely to be free of pathogens like *Escherichia coli or Staphylococcus aureus,* which causes food-borne illnesses.

4.4 SCIENTIFIC SAMPLING RESULTS

The second step in the data collection process was to determine the food handler's compliance with hand hygiene during food handling through scientific

sampling of hands and work surfaces. A total of 80 food handlers participated in the scientific sampling and 14 scientific samples were collected from different surfaces in the food preparation sections. A statistician confirmed that the participation rate of 75.47% provided a basis for valid interpretations. The scientific sampling concentrated on the identification of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands.

The scientific sampling consisted of two sections:
Section 1: Scientific hand sampling
Section 2: Scientific surface sampling

4.4.1 Scientific hand sampling

The presence of *Escherichia coli* and *Staphylococcus aureus* on hands is an indication of poor hand hygiene. The results from the scientific hand sampling, which are given only in percentages, are anonymous to protect the healthcare services and their food handlers, as requested. The data are presented in table 4.23 and figure 4.26.

Table **4.23.** The prevalence rate of *Escherichia coli* and *Staphylococcus aureus*

	Escherichia coli		*Staphylococcus aureus*	
	Positive	**Negative**	**Positive**	**Negative**
Healthcare 1	0%	100.00%	7.69%	92.31%
Healthcare 2	9.09%	90.91%	0%	100.00%
Healthcare 3	12.50%	87.50%	5.88%	94.12%
Healthcare 4	0%	100.00%	3.57%	96.43%

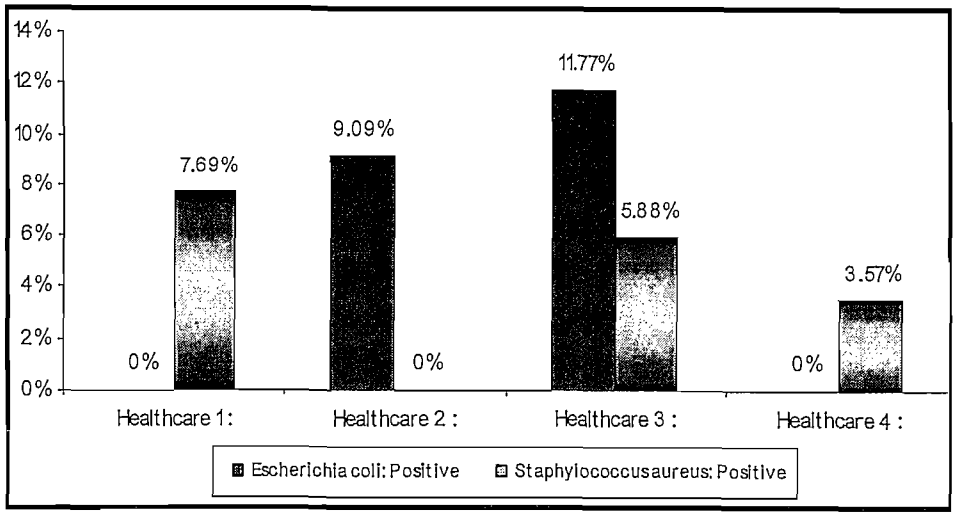

Figure **4.26.** The prevalence rate of *Escherichia coli* and *Staphylococcus aureus.*

Images of the different pathogens that can cause food-borne illnesses are provided to enhance insight and clarity.

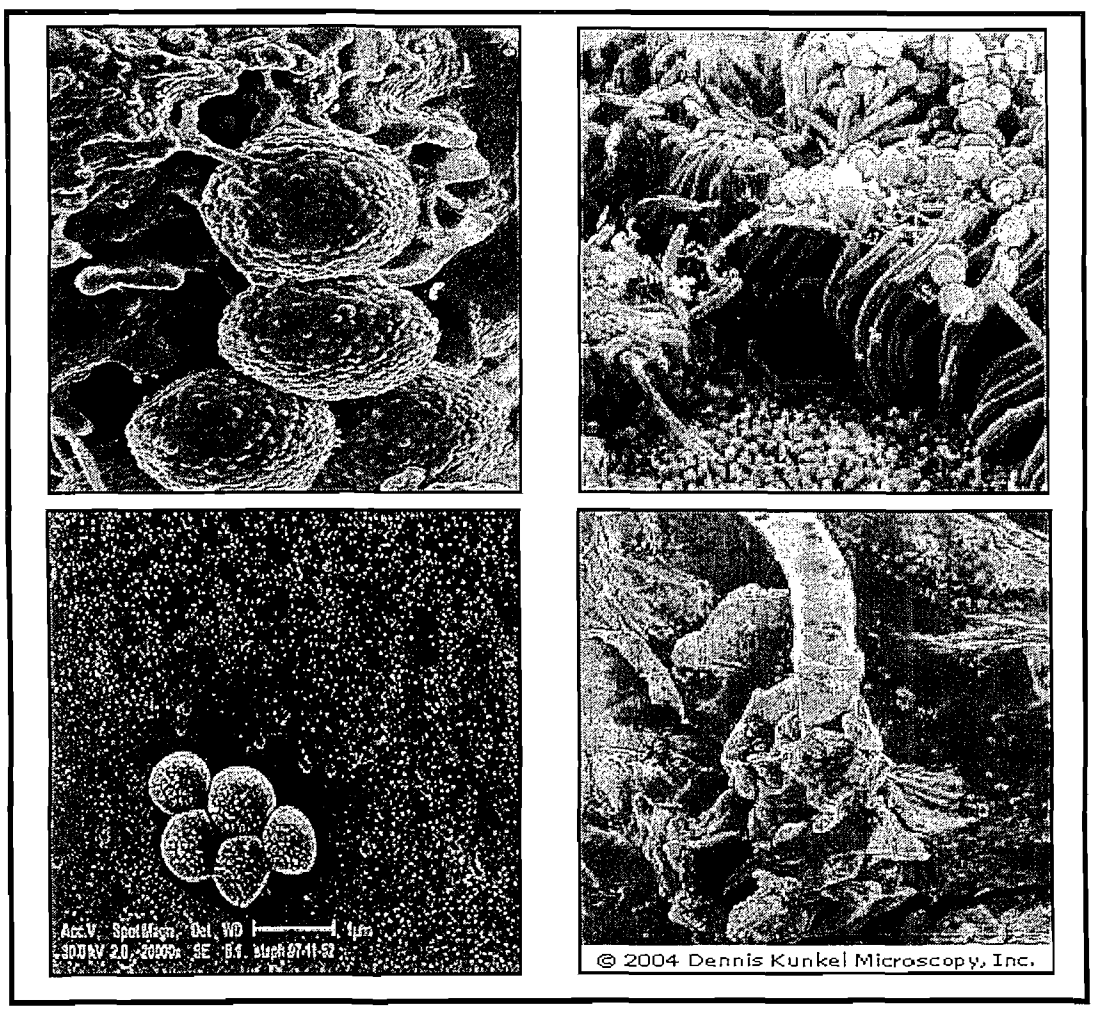

Figure **4.27**. Staphylococcus aureus is a gram positive bacterium that usually emerges under the microscope as spherical (coccus) organisms appearing in pairs, short chains, or

bunched, grape-like clusters. The round, pea-like objects are mesithillin-resistant Staphylococcus aureus and the darker objects are human white blood cells. At least 30% of healthy people have Staphylococcus aureus bacteria living in their nasal passages, hair and skin. Without good hygiene, these bacteria can easily end up in the foods we eat. Given the right environment, Staphylococcus aureus can multiply rapidly at room temperature, producing a toxin that is responsible for the condition known as Staphylococcal food poisoning. (FDA, 2001:2; Copyright Dennis Kunkel Microscopy, Inc., 2007).

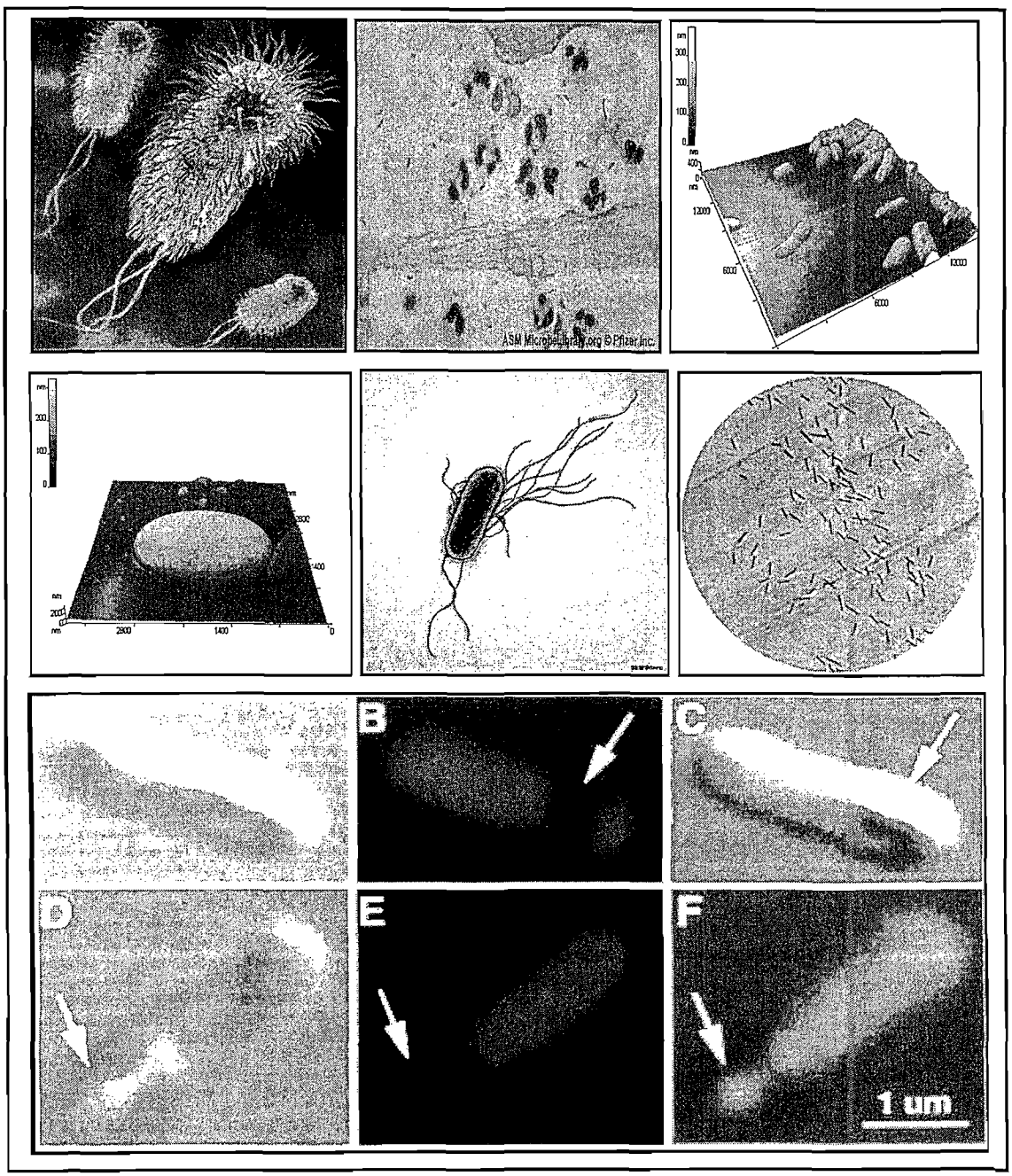

Figure **4.28.** Images of *Escherichia coli* using single-particle x-ray diffraction. *Escherichia coli* are normal inhabitants of the intestines of all animals, including humans. When

aerobic culture methods are used, *Escherichia coli* is the dominant species found in faeces (FDA, 2001:1). Normally *Escherichia coli* serve a useful function in the body by suppressing the growth of harmful bacterial species and by synthesizing appreciable amounts of vitamins. A minority of *Escherichia coli* strains are capable of causing human illness by several different mechanisms (FDA, 2006:1). Every year, food-borne illnesses take a massive toll on human health (Pacific Ag Research, 2007; Copyright Dennis Kunkel Microscopy, Inc., 2007; Miao *et al.*, 2003:111).

4.4.2 Scientific surface sampling

Fourteen (n=14) scientific samples were taken from different surfaces in the four healthcare services' food preparation sections. This enabled the identification of the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the surfaces that the food handlers come into contact with during food handling. Food handlers are potential vehicles in the cross-contamination of pathogens. If food handlers comply with hand hygiene and cleaning is effective, no pathogens should be present on any surface. Table 4.24 illustrate the findings related to the prevalence of these pathogens on work surfaces.

Table **4.24.** Pathogens identified on work surfaces

	Work surface	**Hand wash basin**	**Utensil wash basin**	**Tables**
Healthcare 1	None	None	None	None
Healthcare 2	Moderate growth of **Gram Negative Bacilli* ..... Food supply contractor: Moderate growth of **Coliform bacillus*	Moderate growth of *Coliform bacillus* ..... Food supply contractor: Moderate growth of mixed bacteria including *Gram Negative Bacilli*	Moderate growth of mixed bacteria including *Gram Negative Bacilli* ..... None	..... Food supply contractor: Moderate growth of mixed bacteria and *Gram Negative Bacilli*
Healthcare 3	Moderate growth of *Coliform bacillus*	Moderate growth of bacteria included *Gram Negative Bacilli*	None	None
Healthcare 4	Mixed bacteria	Moderate growth of mixed bacteria and *Gram Negative Bacilli*	None	Mixed bacteria

* *Gram negative Bacilli*: includes bacteria such as *Escherichia coli, Klebsiella, Salmonella, Shigella* and *Pseudomonas.*

* *Coliform bacillus*: refers to a wider group of organisms normally found in the human's intestines', for example, *Escherichia coli.*

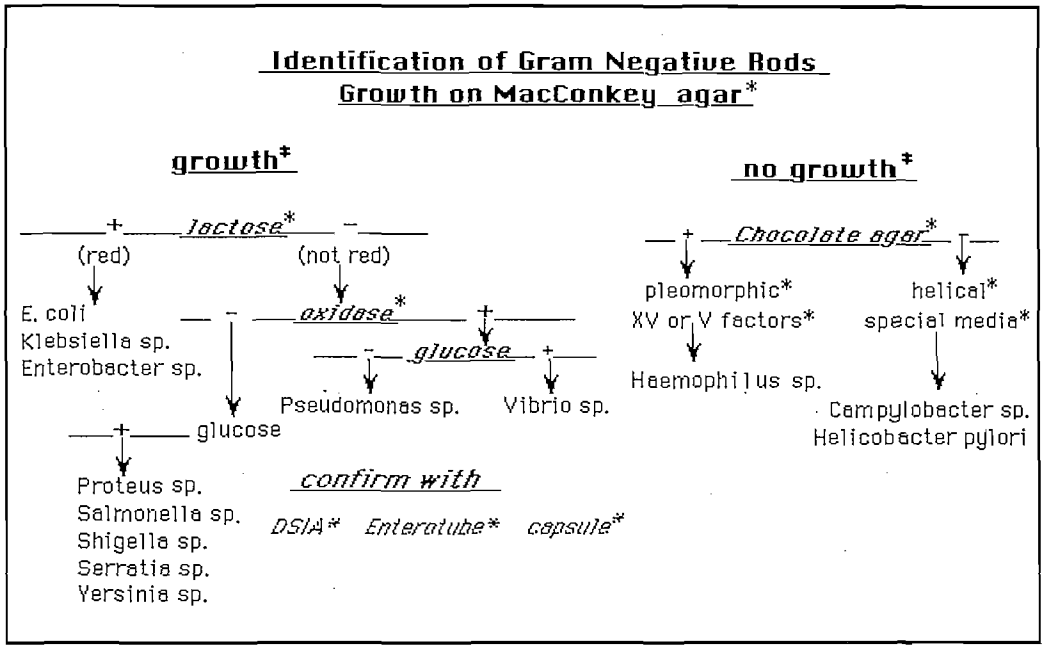

Figure **4.29.** *Gram Negative Bacilli* strain growth pattern.

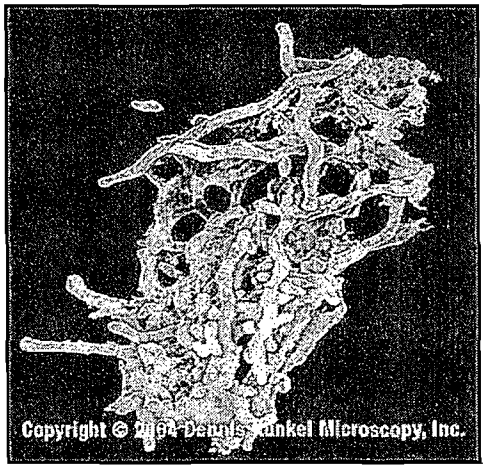

Figure **4.30.** *Coliform Bacillus* causes a food-borne illness similar to that of *Staphylococcus aureus.* In practice, isolated *Coliforms'* are almost always *Enterobacteriaceae* from the genera *Enterobacter, Klebsiella,* and *Escherichia coli.* Examples of Coliform bacteria are members in the genera *Escherichia* (e.g. *E. coli*), *Klebsiella* (e.g. *K. pneumoniae*), *Enterobacter* (e.g. *E. cloacae*), and *Citrobacter* (e.g. *C. ferundii*) (Copyright Dennis Kunkel Microscopy, Inc., 2007).

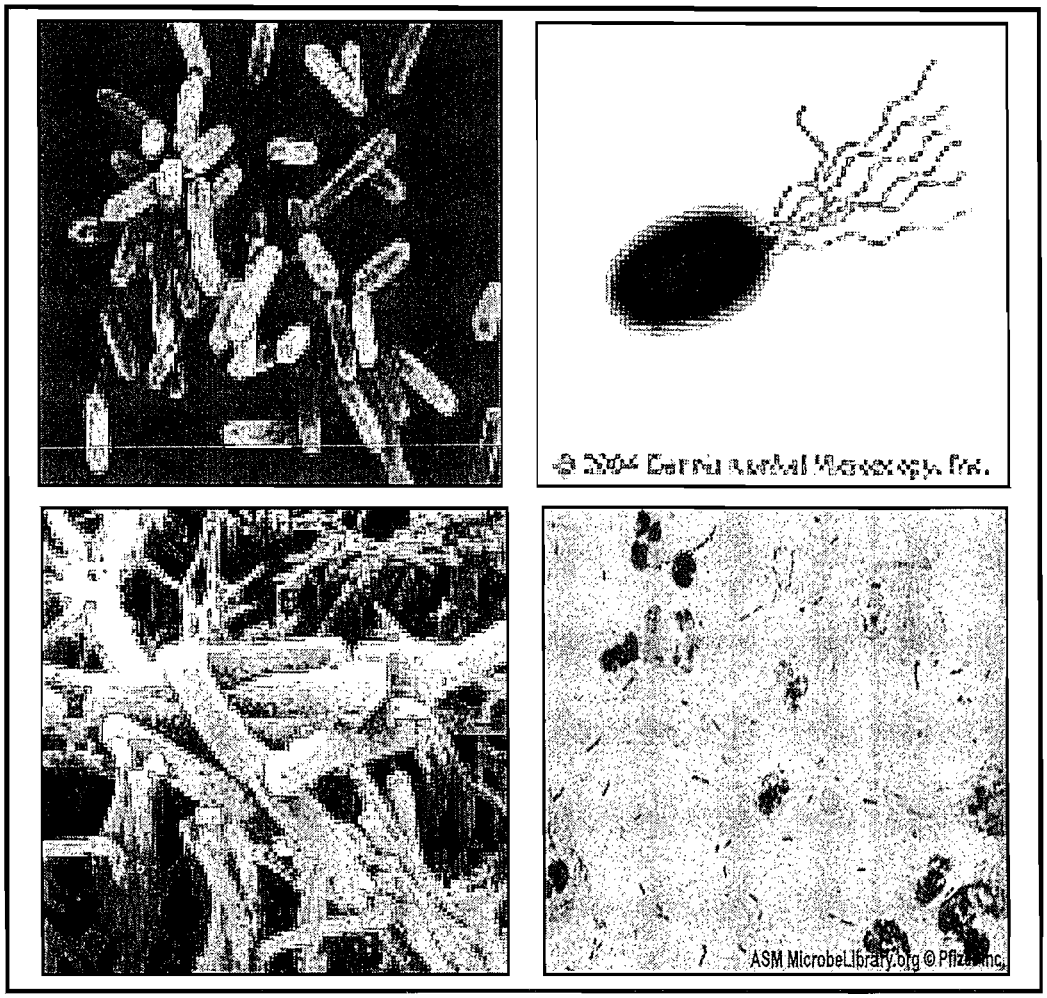

Figure **4.31**. *Pseudomonas*, a genus of gram-negative aerobic bacteria. Some species are pathogenic for plants and vertebrates (Copyright Dennis Kunkel Microscopy, Inc., 2007).

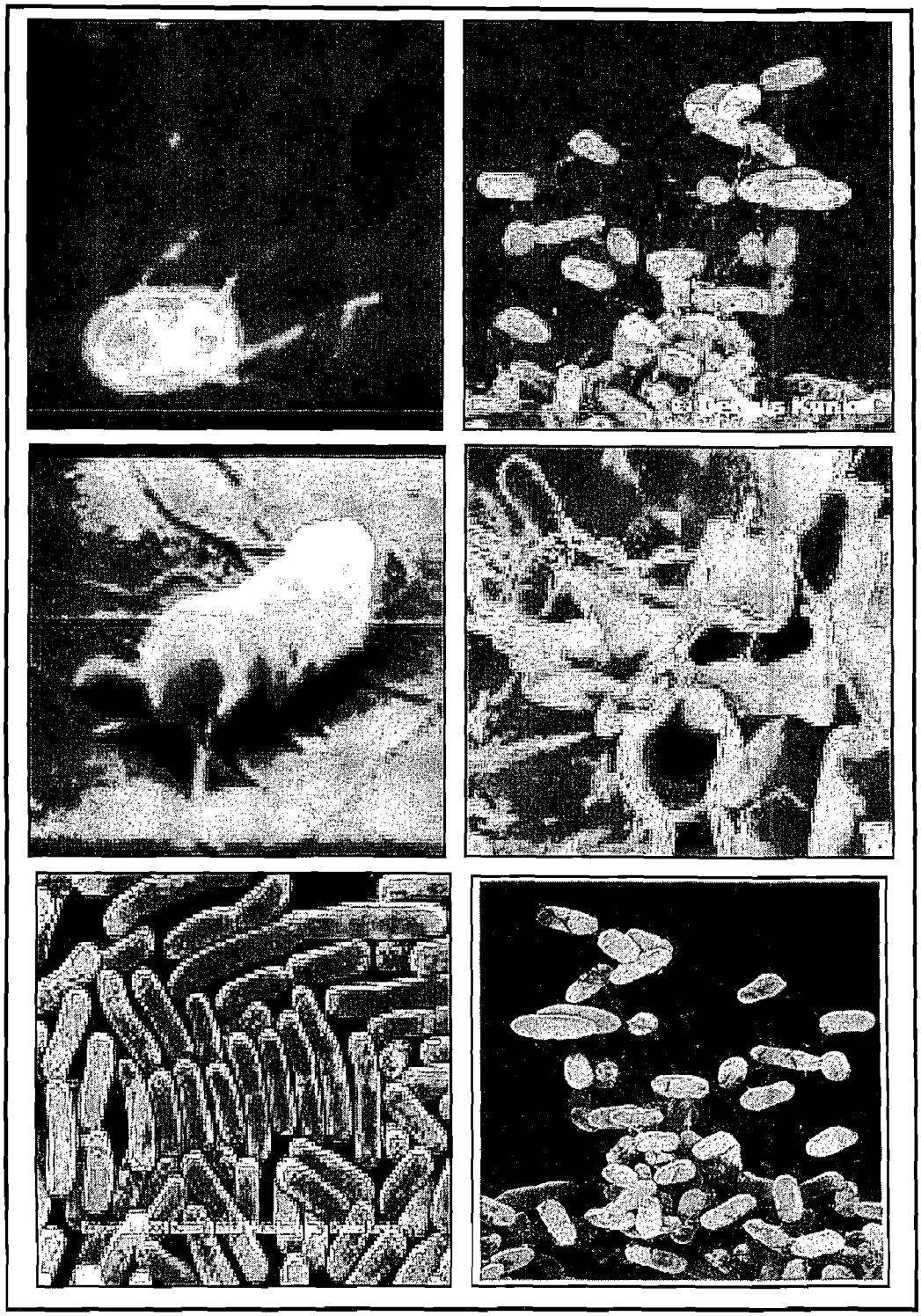

Figure **4.32.** *Salmonella* is the most frequently reported food-borne illness in the United States of America and one of the most common food-borne illnesses worldwide. *Salmonella* bacteria have been known to cause illnesses for more than 100 years when it was discovered by Dr. Daniel Salmon (USDA, 2005:1). (Images with courtesy from Wikipedia, the free encyclopedia, food-borne illness; USDA/Science Source/Photo Researchers, Inc.; Copyright Dennis Kunkel Microscopy, Inc., 2007).

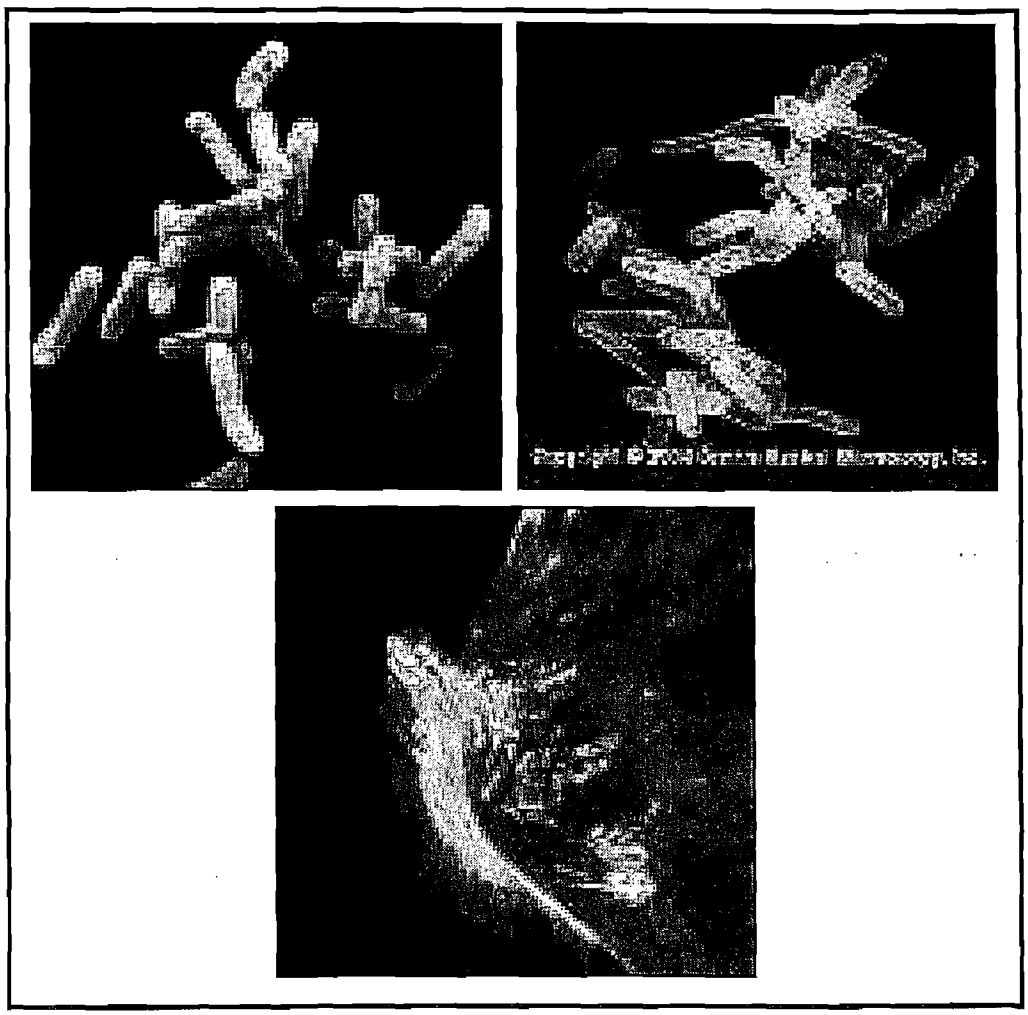

Figure **4.33.** *Shigella, a Gram Negative Bacilli* that can cause dysentery or shigellosis in humans and is usually spread among humans by food handlers with poor personal hygiene (FDA, 2001 and Fox, 2007).

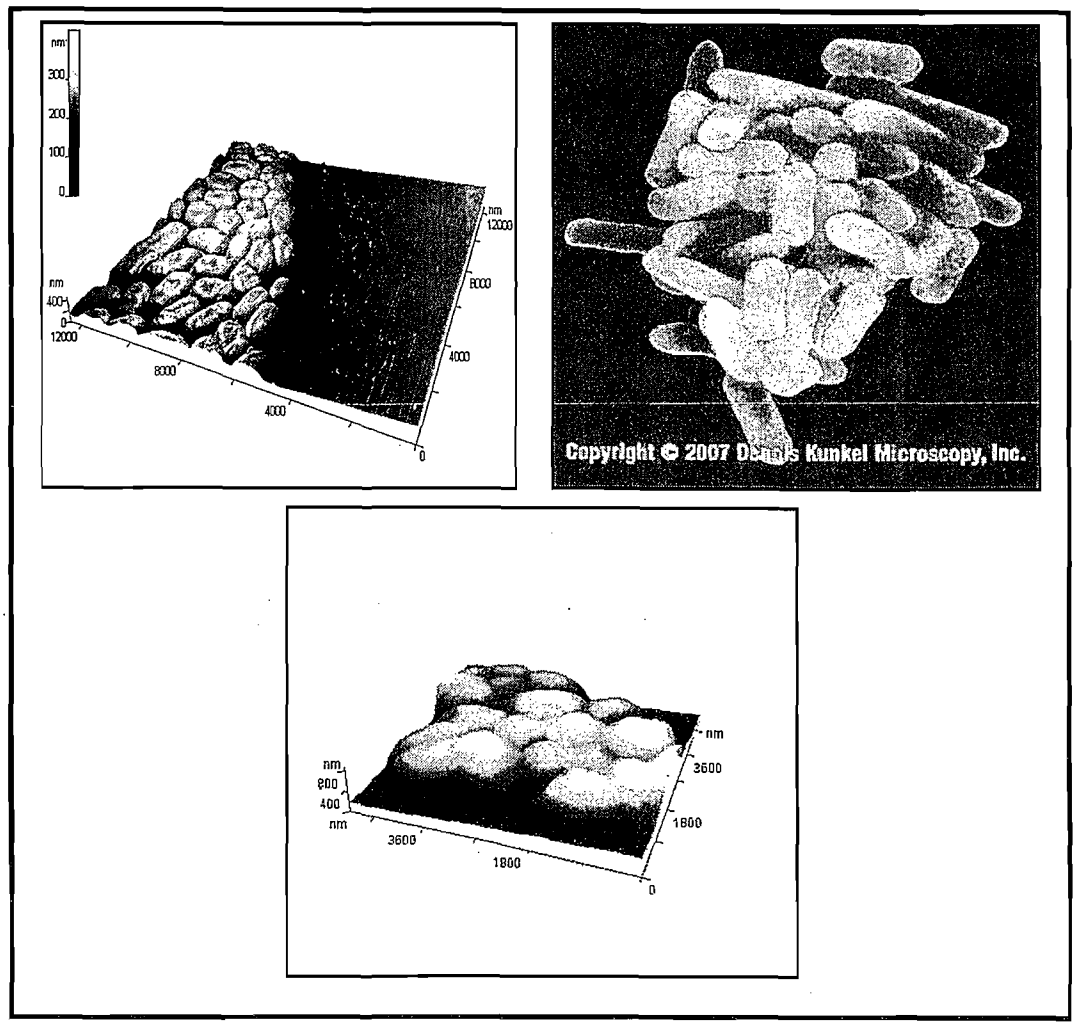

Figure **4.34.** *Klebsiella*. Any of the rod-shaped bacteria that makes up the genus *Klebsiella*. They are gram-negative and thrive better without oxygen than with it, and don't move. (Copyright Dennis Kunkel Microscopy, Inc., 2007).

4.4.3 Discussion of the results of the scientific sampling

The results from the scientific hand sampling reveal that both *Escherichia coli* and *Staphylococcus aureus* was found in healthcare facility 3. In healthcare 4 *Staphylococcus aureus* was found, in healthcare 2 *Escherichia coli* was found and in healthcare 1, *Staphylococcus aureus* was detected on some of the food handlers' hands. These findings should be a serious concern for management, as this indicates that food handlers do not comply with hand hygiene during food handling. When pathogens are present on the food handlers' hands and they touch any surface or food, these pathogens may be transmitted to food, contaminating it and causing food-borne illnesses.

There might be several reasons for this prevalence rate. As identified during the questionnaire phase of the data collection, some healthcare services do not provide the food handlers with soap, or devices to dry their hands. Some facilities are not ratio compatible; in other words there are not enough basins for all the handlers, and so they are unlikely to wash their hands as frequently as they should. In addition, not all the food handlers receive training or retraining, and not all have their knowledge of basic personal and hand hygiene, basic food handling practices, and cross-contamination assessed. This means that not all the handlers understand that these pathogens can be transmitted to patients. Such pathogens include not only *Escherichia coli* and *Staphylococcus aureus,* but also *Brucella, Bacillus cereus, Campylobacter jejuni, Closstridium Botulinum, Clostridium perfringens, Listeria monocytogenes, Salmonella, Shigella, Novovirus, Toxoplasma Gondi, Vibro species, Yersinia enterocolytica* and *Streptococcus.* Transmission of these pathogens to patients may worsen their health, delay recovery and may even cause unnecessary deaths. This issue has to be addressed and management is responsible for guaranteeing that the food leaving the food preparation section will not harm any individual.

The surfaces in the food preparation sections are part of the food handlers' work environment and should be hygienically clean and free of pathogens. The results for healthcare services 2, 3 and 4, plus the outsourced food supplier for healthcare 2 showed the presence of a variety of micro-organisms (see tables 4.23 and 4.24). The presence of such a numerous range of micro-organisms clearly indicates that food handlers do not adhere to the guidelines and requirements for personal hygiene. The presence of pathogens will create the basis for the growth and transmission of a multiplicity of pathogens to patients, causing their health to deteriorate rather than to improve. The poor standard of hygiene in the food preparation sections of these healthcare facilities is therefore cause for concern.

Managers must comply with the guidelines of the DOH (Directorate: Food control: July 2000a, see Appendix 1) and should regularly evaluate the hygiene standard of the food preparation sections, which include the food handlers. They must train, retrain and test the food handlers in terms of their knowledge, understanding of and compliance with basic food handling, personal and hand hygiene. Management must ensure that all the steps have been taken to prevent cross-

contamination of pathogens like *Escherichia coli* and *Staphylococcus aureus*. Standards are needed to monitor these important aspects. If standards are part of the occupational health surveillance, the statistics of food-borne illnesses might be reduced.

4.4.4 Conclusions from results of the scientific sampling

When personal and specifically hand hygiene is lacking, the transmission of pathogens like *Escherichia coli* and *Staphylococcus aureus* to the food will occur, resulting in cross-contamination that causes food-borne illnesses.

The presence of *Escherichia coli* is an indicator of faecal presence. It is a significant cause of food-borne illnesses. *Staphylococcus aureus* is normally present in people's nasal cavities, boils, pimples and throat infections. Given the right environment, this pathogen can multiply rapidly at room temperature producing a toxin that is responsible for the condition known as *Staphylococcal* food poisoning. The presence of these pathogens is an indication of poor hand hygiene.

When training and retraining is given, the structure of lessons must include written learning material. This will establish a basis from which the food handlers could improve their knowledge of maintaining hand hygiene, ensuring pathogen-free food.

Occupational health surveillance of the food handlers' hands is currently not included in the DOH's guidelines.

The conclusion drawn from the results revealed that standards are essential for the implementation, evaluation and control of hygiene practices to ensure that food handlers comply with and maintain hand hygiene during food handling. This may best be done through an occupational health surveillance program.

If occupational health surveillance is part of the standards, the statistics of food-borne illnesses might be lower.

4.5 SUMMARY

This chapter analysed the quantitative data gathered to establish a comprehensive reflection of the prevalence of pathogens in the food preparation sections of four healthcare services. The analyses were presented descriptively, making use of tables and figures. The questionnaire (Appendix 9) focused on the food handlers' compliance with hand hygiene during food handling, based on the DOH's guidelines (Directorate: Food control: July 2000a). The scientific sampling of the food handlers' hands and other surfaces was aimed at determining the prevalence rate of *Escherichia coli* and *Staphylococcus aureus.* The risk of food-borne illnesses due to contact with hands, surfaces and food, increases as the level of contamination increases. In addition, these micro-organisms can survive on hands and surfaces for hours or even days.

The results suggest that management's involvement in the food preparation sections is inadequate. Management should implement training and retraining on a regular basis to guarantee that all the food handlers understand the aspects involved in hand hygiene and contamination. Compliance with hand hygiene must be enforced, and management ought to involve their food handlers in all the aspects regarding hand hygiene. This is crucial in the prevention of cross-contamination and improvement of hand hygiene, food safety and quality. The DOH guidelines indicate that the above actions are the managers' responsibility, which may not be delegated to the food handlers.

When standards are available to evaluate the compliance of the food handlers with hand hygiene, the food that leaves the food preparation section is more likely to be free of pathogens that can cause food-borne illnesses and aggravate the already weakened health of patients in the healthcare service. Furthermore, if standards are available for the implementation of an occupational health surveillance programme, the OHP can assist managers in the food preparation section to evaluate the food handlers' compliance with hand hygiene on a continuous basis.

CHAPTER 5: STANDARDS FOR THE HAND HYGIENE OF FOOD HANDLERS

5.1 INTRODUCTION

The purpose of this chapter is to formulate standards for the hand hygiene of food handlers. To formulate standards all the gathered data should be systematised in a meaningful manner and interpreted using an inductive and deductive strategy (Mouton & Marais, 1998:103). According to Brink (2006:5-6), and Mouton and Marais (1998:30) logical perplexing problems are solved through mental logical reasoning, either using inductive or deductive reasoning. The same authors point out that inductive reasoning involves finding a notation of numbers on the basis of which we can evaluate scientific theories, the assumption being that even if we cannot prove the final truth of a hypothesis, we can produce a set of rules which will allow us to determine the degree to which it is confirmed by the available evidence. An inductive strategy thus entails embarking upon a project without an explicit conceptual framework, merely using general and vague hypotheses to guide the research. This is done to discover patterns by means of close analysis of gathered data for generalisation. The result is therefore more systematic in the explanation, such as in exploratory and descriptive studies. Inductive reasoning merely lends gradual support to the conclusion; the genuine supporting evidence can only lead to highly probable conclusions, as more evidence establishes more support for the conclusion reached on the basis of new evidence (Mouton & Marais, 1998:110-113).

On the other hand, deductive reasoning is the process of developing specific observations about a particular situation from a greater portrait or from general principles (de Vos *et al.*, 2005:47). Mouton and Marais (1998:103) add that deductive reasoning is based upon a clear conceptual framework, which leads to a rigid manner of conceptualisation, operationalisation, data collection, analysis and interpretation. The truth of the conclusion is already either implicitly or explicitly contained in the truth of the argument. An explanation of the argument and therefore the supporting evidence is linked to the conclusion on the basis of the meaning of the central theory in the specific statements (Mouton & Marais, 1998:110-113).

In this chapter, a deductive reasoning approach was used to apply the results from the empirical research and the literature review to formulate standards for the health surveillance of food handlers. The research project was based upon a clear conceptual framework, which provided the interrelationships between the concepts to facilitate the design, data collection and the analysis methods. The concepts in the conceptual framework are the international perspective, the national perspective (Department of Health and local authorities), occupational health, occupational health surveillance, the food handler, and the formulation of standards for the hand hygiene of food handlers. Inductive reasoning was used to develop useful guidelines from the standards for the food handlers' compliance with hand hygiene within the preparation sections of the healthcare service as a whole. Thus, the findings of the research project may influence policy and generate knowledge in the field of nursing, and may thus become a useful tool for occupational health nursing in the food industry.

Figure 5.1 demonstrates the use of deductive and inductive approaches in this research project.

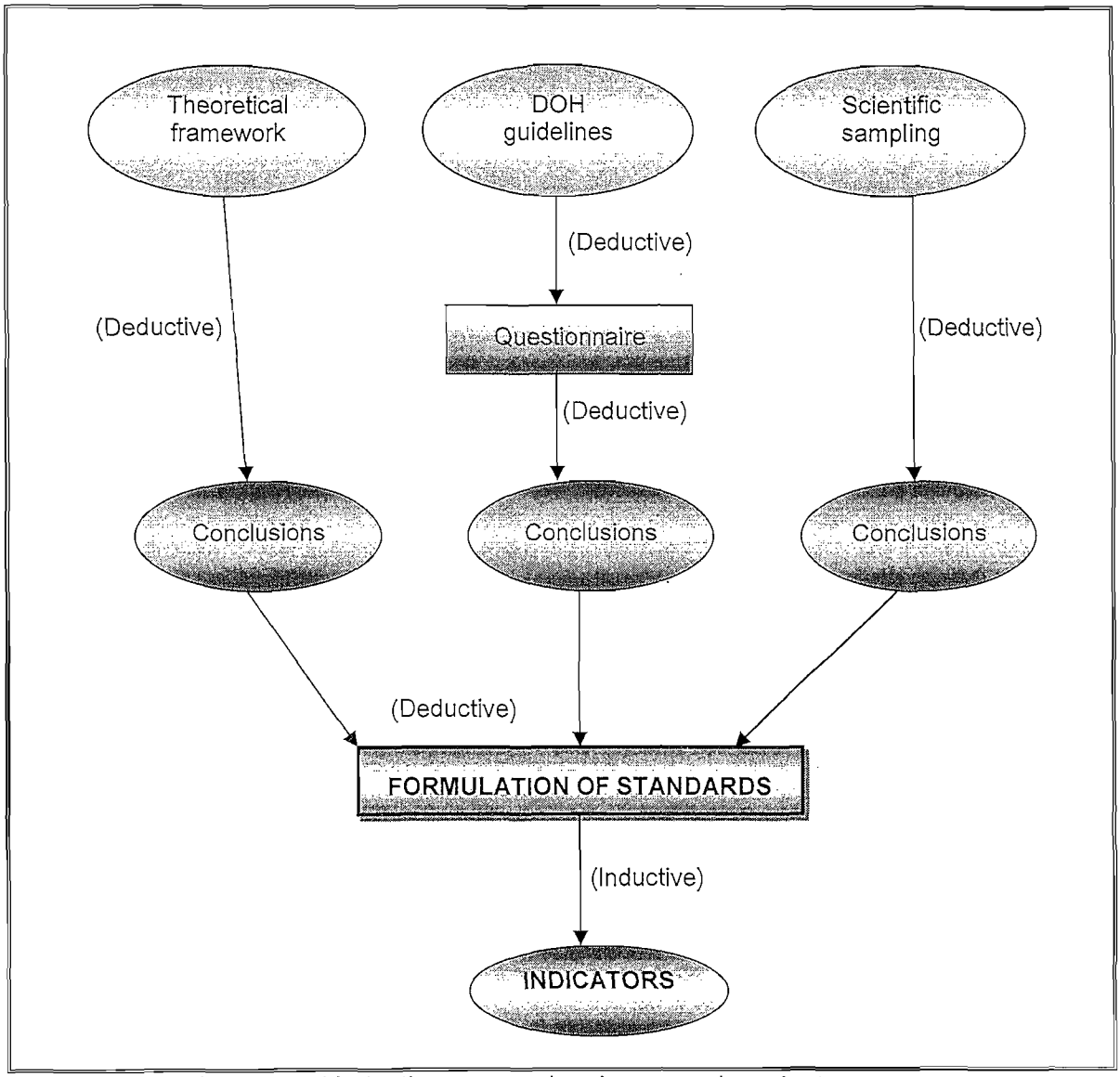

Figure **5.1.** Deductive and inductive approaches in research project

5.2 STANDARDS

According to Donabedian (2003:60) and Bezuidenhout (2005:9 & 78), a standard is a formal process of written procedures. It should describe and specify output performance, namely, what is supposed to be accomplished, achieved and measured within a specific activity. A standard is an intentional planned indicator that must be clearly defined, be relevant, meaningful, appropriate, measurable, and achievable. It should also be accepted by those who have to use it to ensure compliance. Muller (1998:242-245) states that a standard implies the development of knowledge and experience relevant to the required, specialised and related field. Donabedian (2003:61) indicates that a standard must include an infrastructure and resources; both material and human, to establish a solid

foundation for the surveillance and monitoring strategy for compliance that is lower than or level with the expected requirement.

5.2.1 Structure standards

A structure standard describes what is **required,** the action, key performance indicators and support system needed to achieve the expected prerequisites and objectives (Donabedian, 2003:50). Labuschagne (2001:49-50) indicates that the requirements should be definable in terms of a description, in other words, the stipulations that will be accepted as representing the attainment of a goal. The progress towards achieving the objective should be ascertainable so as to enable assessment of the effectiveness of the process as well as its pace. Structure standards serve as predetermined guidelines by which the progress, development and implementation of knowledge is judged. The size of the increments or steps towards the required objective will determine how many key performance indicators there should be within the required structure. Objectives should eventually lead to action to ensure that results are being achieved. In this research project, this refers to the healthcare service's requirements of the food handler's compliance with hand hygiene to prevent cross-contamination of pathogens during food handling. According to Donabedian (2003:46 & 52), structure standards, as a major determinant of quality, must include aspects such as the availability of material resources (facilities and equipment), human resources (number, variety and qualifications of professional support personnel), as well as organisational support (management commitment, training, retraining, supervision and performance monitoring) to achieve the required standards.

Based on the findings of the empirical research and literature review, the following structure standards were formulated. The rationale of this formulation is to reduce the likelihood of introducing a health hazard which may adversely affect the safety of food or its suitability for consumption, and to effectively maintain a high level of hand hygiene.

5.2.2 Process standards

Process standards systematically describe how an **action** should be performed. This takes the form of a technical procedure manual for the evaluation or assessment of the food handler's compliance with hand hygiene. In clinical

occupational health nursing, process standards involve the following: planning the goal to be achieved, deciding how to achieve the best practice for compliance, identifying possible problems, deciding how the process should be implemented, how regularly assessments are done, what monitoring facets should be used to ensure compliance with the set standards, evaluation methods, achievements, and choice of remedial actions for improving compliance. Donabedian (2003:52) states that process standards refer to the actions performed that provide an indication of the current level of quality. This author adds that process standards correspond to the activities that represent aspects such as prevention, education, monitoring and management (Donabedian, 2003:46). In this research project, the rationale for process standards is to ensure that food handlers will comply with hand hygiene practices to prevent cross-contamination of pathogens during food handling.

5.2.3 Outcome standards

Outcome standards refer not only to the expected result, output or indicator of the assessment concerning the achievement of the requirement, but also refer to how skilfully it was done, based on the information provided (Donabedian, 2003:54). It should be measurable, and should thus refer to the **objective** or **goal** that has been identified. According to Donabedian (2003:53), this implies that all the inputs of the requirements must be reflected during the measurement of the level of compliance, including what has been done, how useful and successful it was, and what the attitude of change was from the participants. According to the same author, how the outcome is measured must be decided during the planning stage (Donabedian, 2003:54). Donabedian (2003:55) adds that outcome standards should be relevant to the objectives decided upon; they must be achievable; the magnitude and duration needed to achieve the outcome should be taken into account; information for the compliance measurement must be provided, together with the relevant resources, literature, written training material and training.

The standard must adhere to the legal and regulatory framework, in addition to the company's mission and policies. The responsibility and accountability for the achievement thereof rests with both management and the relevant employees – in this case, the food handlers. Donabedian (2003:46) points out that an outcome standard implies the activity that constitutes a change in the company; in this case, the healthcare service. In this research project, outcome standards should include

changes in the food handlers' attitudes towards gaining knowledge and complying with hand hygiene. The outcome must state exactly what its aim is; it should list the steps taken towards achieving the goal; and state how the process will be evaluated. This process must involve planning the evaluation procedures, including regularity, implementation, and evaluation, as well as remedial steps to implement corrective actions. Indicators for outcome standards must include the following (Donabedian, 2003:55):

- The outcome selected should be relevant to the objective that has been identified
- It must be achievable
- It must be attributable to the goals that have been set
- The level of the outcome must be taken into account
- Information must be available concerning the expected compliance
- The performance and actions taken to correct compliance must be in congruence
- The resources must be available and relevant to achieve objectivity, and must be a true reflection of the measurement for compliance with the objective

Feedback must be valued as an intrinsic motivation force; it must be reliable, neutral, truthful and consistent with the set standards, reflecting the true state of affairs. Remedial steps are aimed at solving problems and instituting measures. For example, to achieve food handlers' compliance with hand hygiene to achieve quality in food safety, more regular retraining and practical evaluation of food handling hygiene should be applied. This should be done with consideration for the literacy level of the food handler and presented in such a way that the information is understandable and meaningful.

Donabedian (2003:56) recommends that the combination of a structure, process and an outcome standard can set a strategy for a comprehensive measurement for the achievement of and compliance with the set standards. This will create a platform for a more comprehensive assessment of what has been achieved, the activity involved and the goal set. This will identify if the method of assessment is appropriate and what aspects should be highlighted during retraining. The rationale for setting outcome standards is the prevention of cross-contamination of

micro-pathogens from the food handlers' hands during food handling to ensure that food is safe for patients in the healthcare service.

The conclusion statements from the theoretical framework and research project were each assigned a reference number, for e.g. C1, C2, etc that has been utilized to formulate standards for the hand hygiene of food handlers. Tables 5.1 and 5.2 summarise the concluding statements from the theoretical framework and empirical research used to formulate standards for the hand hygiene of food handlers.

Table **5.1.** Concluding statements (C) from the theoretical framework.

SECTION	CONCLUDING STATEMENTS
Introduction	· Food handlers, as a vital link in the food supply chain, are not included in occupational health surveillance programmes for ensuring compliance with hand hygiene to provide pathogen-free food to patients in the healthcare service (C1). · Food-borne illnesses occur worldwide and standards must be identified and implemented to eliminate cross-contamination during food handling (C2). · To establish and implement standards for the occupational health surveillance of food handlers' hand hygiene, a variety of aspects must be considered. These include acknowledging the international and national information available, the current national guidelines for hand hygiene practices, the role of the food handler as a vital link in the food handling processes, and the right of the patients to receive pathogen-free food (C3).
.....	.....
International Perspective	· The importance of food-borne illnesses and their consequences for the food industry, the general public at large and the patient should be emphasised, as an alarming increase in the number of food-borne illnesses have been documented (C4). · Food-borne illnesses are a common, distressing and sometimes life-threatening problem for millions of people around the world and should be addressed so as to eliminate cross-contamination (C5). · The food handler may be a vehicle for the contamination of food during preparation and serving in a commercial environment. This role is especially important in the healthcare service. Handlers should understand how food-borne illnesses arise, and how to comply with hand hygiene. An occupational health system should also be in place (C6).
.....	.....
National Perspective	· It has been accepted that food handlers are potential carriers and are considered sources of pathogenic micro-organisms. However, still no method exists to confirm if they adhere to hand hygiene during food handling (C7). · Hygiene practices must be monitored and maintained to guarantee that food is safe for patients in the healthcare service (C8). · Food handlers have to understand and master the principles of hand hygiene. Their knowledge of this should be assessed. Education and training is therefore essential in this process (C9). · An effective and integrated occupational health surveillance and notification system should be implemented to determine the role of food handlers in the spread of food-borne illnesses (C10). · Financial costs should not prevent action being taken when food quality and safety is at stake; rather, the assurance that the food patients receive poses no threat to their health and recovery should be paramount (C11). · Managers in food preparation sections are responsible for enforcing food safety through ensuring compliance with hand hygiene and providing training and retraining to food handlers (C12).
.....	.....

Occupational health practitioner	· Food handlers are found in every process in the food industry, and they are responsible for preventing cross-contamination through maintaining good hand hygiene (C13). · Food handlers have to be informed of the consequences of poor hand hygiene compliance and their role in cross-contamination, and outbreaks of food-borne illness (C14). · Food handlers' inclusion in occupational health surveillance can contribute to the provision of safer and pathogen-free food to patients (C15).
.....	.....
Food handler	· Food handlers are found in every process in the food industry; they are a crucial link from farm-to-table and cannot be replaced. It is therefore important that they take responsibility for preventing cross-contamination by maintaining good hand hygiene (C16). · Food handlers have to be informed of the consequences of poor hand hygiene compliance and their role in cross-contamination, and outbreaks of food-borne illness (C17). · Food handlers' inclusion in occupational health surveillance can contribute to the provision of safer and pathogen-free food to patients (C18).

Table **5.2.** *Concluding statements* (C) *from the empirical research results*

SECTION	CONCLUDING STATEMENTS
Demographic data	· The results from the demographic data collected indicate that nearly a third of the participants in the research project had difficulty in comprehending the questions and had to receive assistance in completing the questionnaire. The conclusion is that they may not only experience difficulty with written training material, but may struggle to understand what basic food and hand hygiene entails (C19). · Work experience does not guarantee compliance with hand hygiene during food handling (C20). · Training programmes should take into consideration that the majority of food handlers have completed Grade 10 or less (C21). · When the structure of training includes increasing the school level of handlers, they may be better able to understand the basics of food hygiene, including compliance with hand hygiene and standards (C22).
.....	.....
Education and training	· If food handlers do not receive training and retraining, it may be deduced that they will not comprehend how, where or when pathogens might be present or be transmitted to patients (C23). · It is important that food handlers receive written training material and practical demonstrations that provide them with knowledge that can be assessed regularly. In this way, their compliance with hand hygiene can be monitored. Only then can they be expected to take responsibility for ensuring that the food they handle is safe for patients (C24).

	· The Department of Health's guidelines for the management and health surveillance of food handlers should be included in the structure of lessons, as a reference for compliance with hand hygiene (C25). · All food handlers must receive induction and training to develop their knowledge. Management is responsible for providing training to ensure compliance with the DOH's guidelines. Failure to educate and communicate will likely result in handlers' non-compliance with hand hygiene (C26). · Standards to evaluate and confirm the food handlers' knowledge and compliance with hand hygiene should be available to ensure that food is pathogen-free and safe for patients (C27).
.....	.....
Basic food handling hygiene practices	· When food handlers fail to understand the basics of food handling hygiene, they will not understand why cleaning of surfaces, utensils and usage of clean water is important during food handling and the consequences thereof for patients (C28). · Practical work experience does not guarantee compliance with hand hygiene (C29). · The absence of responsibility and empowerment will limit improvements and participation (C30). · Non-adherence to hygiene practices can create a base for pathogens to multiply. Equipment may appear visibly clean but still harbour pathogens (C31). · Consistency is required in the way food is protected and disposed of. Food handlers must know and comply with the agreed procedure of the healthcare service regarding the protection and disposal of waste food (C32).
.....	.....
Basic personal hygiene practices	· Managers must provide personal protective clothing (overalls, head coverings, gloves and aprons), sanitation facilities and equipment (showers, soap, towels and hand drying devices) for the food handlers (C33). · Food handlers not familiar with their responsibilities regarding the maintenance of personal hygiene will not understand why they must comply with hand hygiene (C34). · Food handlers have to be motivated to maintain hand hygiene. This must become the norm to establish a culture for providing food that is safe for patients (C35). · The ignorance of even a single food handler can have disastrous consequences for patients (C36). · Creating standards will allow an occupational health surveillance programme to identify and monitor the presence pathogens like *Escherichia coli* and *Staphylococcus aureus,* as well as to ensure that the food is pathogen-free and safe for patients (C37).
.....	.....
Department of Health	· This research found that the majority of food handlers were unaware of DOH inspector visits to the food preparation section. The question arises of why the private healthcare services are excluded in the inspections, and why the food handlers in some are not informed of when the inspectors are visiting (C38). · The DOH must consider all equal, irrespective of the type of healthcare they provide to the general public. The private sector should not be ignored or excluded from visits (C39). · All the food handlers should know who their governing body is and why inspectors visit their facilities (C40). · Food handlers cannot recognise or deduce what gaps exist in their basic food handling hygiene practices or how

	to correct them if they are not informed of what these guidelines are (C41).
.....	.....
Management commitment	· Leadership commitment and follow-through is necessary for long-term attitude and behaviour change among food handlers (C42). · Managers must conduct daily hygiene inspections to ensure that food handlers comply with hand hygiene practices. The reasons for daily inspections must be communicated to food handlers (C43). · Hygiene aspects must be defined and clarified to ensure that the food handlers know how to maintain hand hygiene. All food handlers must be included during discussions, implementation, evaluation and corrective actions to improve and sustain positive participation (C44). · Food safety is the responsibility of the managers. Since they cannot delegate this task, they have to guarantee that the food handlers understand that food safety and quality is a priority throughout the whole handling process. Managers' supervision should be vigilant and competent to ensure optimum hygiene conditions and practices, and to establish an environment conducive to mutual trust, open discussion and reporting of hygiene problems (C45). · Management has to employ a technical expert to advise on all hygiene aspects, over and above, the implementation of an occupational health system for the improvement and compliance with hand hygiene and in the end increase product reliability and safety (C46). · If standards are available to monitor the compliance of the food handlers' with hand hygiene, food will be free of pathogens, like *Escherichia coli or Staphylococcus aureus,* which causes food-borne illnesses (C47).
.....	.....
Scientific hand sampling	· When personal hygiene, and specifically hand hygiene, is lacking, pathogens like *Escherichia coli* and *Staphylococcus aureus* may be transmitted to food, resulting in cross-contamination and food-borne illnesses (C48). · *Escherichia coli*, an indicator of faecal presence, is a significant cause of food-borne illnesses. *Staphylococcus aureus*, normally present in nasal cavities, boils, pimples and throat infections, can multiply rapidly at room temperature and produce a toxin that is responsible for *Staphylococcal* food poisoning. The presence of these pathogens is an indication of poor hand hygiene (C49). · The structure of lessons must include written training material. Training and retraining provides the basis for informing food handlers about hand hygiene (C50). · Occupational health surveillance of the food handlers' hands is currently not included in the DOH's guidelines (C51). · The results suggest that standards are essential for the implementation, evaluation and control of hand hygiene. Only through an occupational health surveillance programme can it be ensured that food handlers comply with and maintain hand hygiene (C52).

Standards are written procedures to provide measurable indicators to achieve an identified goal; this implies knowledge and experience development in a relevant and required field. In this research project, a solid foundation for the compliance of the food handlers with the DOH's guidelines for the management and health surveillance of food handlers: Directorate: Food control: July 2000a (Appendix 1), but in addition to, with hand hygiene during food handling, through a comprehensive occupational health surveillance system. The DOH guidelines are used as structure for the formulation of standards (refer to table 5.3).

Table **5.3.** The different DOH guideline sections and reference chapters.

DIFFERENT SECTIONS FROM THE DOH GUIDELINES USED AS BASIS FORMULATION OF STANDARDS	REFERENCE CHAPTERS
Demographic data	Chapter 2, 2.3; Chapter 3, 3.3; Chapter 4, 4.3.1
Education and training	Chapter 2, 2.3; Chapter 3, 3.3; Chapter 4, 4.3.2
Basic food handling hygiene practices	Chapter 2, 2.3; Chapter 3, 3.3; Chapter 4, 4.3.3
Basic personal hygiene practices	Chapter 2, 2.3; Chapter 3, 3.3; Chapter 4, 4.3.4
Knowledge of the DOH's guidelines	Chapter 2, 2.3; Chapter 3, 3.3; Chapter 4, 4.3.5
Management involvement and commitment	Chapter 2, 2.3; Chapter 3, 3.3; Chapter 4, 4.3.6

5.2.4 Standards for the hand hygiene of food handlers

Table **5.4.** Components of the different standards

STANDARD	INDICATORS FOR GENERALISATION	TYPE OF STANDARD
Demographic: The level of schooling should be increased to at least Grade 10 or above to ensure that the food handlers could be assessed for the compliance with basic food and personal hygiene during food handling. (Evidence from C9, C10, C12, C13, C14, C19, C20, C21, C22, C23, C24 and 45)	· Current employees with a lower literacy level than Grade 10 should be enrolled in a training development structure to understand written training material benefiting both themselves and their employer. Management should involve the Department of Education to conduct Adult basic education and training (ABET) (C9, C10, C12, C19, C21 and C22). · Food handlers should be encouraged and motivated to develop their literacy level to (C9, C10, C12, C13, C14, C19, C21, C22 and C45).	Structure
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Food handlers who can read and write should be enrolled for training in hygiene practices during food handling. (Evidence from C9, C10, C12, C13, C19, C20, C22, C23 and C29)	· Knowledge and experience can be developed if the literacy level is Grade 10 or above. Only thereafter can experience be achieved based on lesson content that has been derived from the DOH guidelines for the management and health surveillance of food handlers (2000) (C9, C10, 12, C13, C19, C20, C22 and C29). · When reading and writing has been successfully mastered and written training material is understood, food handlers can be enrolled for training aimed at compliance with hand hygiene during food handling (C9, C10, C12, C22 and C23).	Process
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All the food handlers employed, completed Grade 10 or above. (Evidence from C9, C10, C12, C22, C23 and C24)	· Food handlers who have completed Grade 10 or above have been enrolled for training on the compliance with food handling hygiene practices (C9, C10, C12, C22, C23 and C24).	Outcome
Education and training: Management must provide education and training to ensure that food handlers understand	· Induction (new employees and after annual leave), training (annually) and retraining (bi-annually) must include the Department of Heath's guidelines for the management and health surveillance of food handlers (2000) and all relevant national legislation.	Structure

written training material to ensure compliance with hand hygiene during food handling. (Evidence from C1, C2, C3, C4, C5, C7, C9, C12, C13, C14, C16, C17, C19, C21, C22, C23, C24, C25, C32, C33, C37, C40, C41, C47, C49, C50 and C52)	This will ensure that food handlers know who their governing body is, and who directs their hygiene practices during food handling (C2, C3, C4, C5, C12, C14, C22, C23, C24, C25, C40 and C41). · Compliance with hand hygiene assessment procedures must be determined during the training content planning: this comprises the 'what (understanding of what is involved in hand hygiene), when (annually and bi-annually) and how (through a questionnaire and scientific sampling)' of monitoring during assessment (C21, C22, C24, C25 and C47). · The written training material must be reviewed and updated annually so that it corresponds with new developments and requirements such as the Department of Health's guidelines for the management and health surveillance of food handlers: Directorate: Food control: July 2000 (C2, C24, C25 and C40). · Content of the written training material and demonstrations must include elements of basic food handling hygiene practices, personal hygiene practices, food safety, cross-contamination and prevention and food-borne illnesses (C3, C12, C13, C22, C23, C24, C25, C32, C33 and C49). · Training should be done annually and retraining bi-annually. It should include written training material and practical demonstrations to ensure continuous maintenance of basic hygiene during food handling (C1, C3, C4, C5, C12, C23, C24 and C50). · The content of the lessons must be relevant, adequate and functional for the literacy and comprehension level of the food handlers (C9, C14, C19, C21 and C22). · The training, retraining and demonstrations should be structured according to set standards. These standards should be explained to the food handlers as they have to adhere to them (C2, C7, C12, C14, C16, C17, C23, C24, C32, C37, C47 and C52).	
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Training and assessment criteria must close the gap between theory and practice. (Evidence from C3, C4, C5, C9, C12, C21, C24 and C44)	· The training lessons should be divided into sections to close the gap between theory and practice and improve understanding, increase compliance with hand hygiene, and minimise confusion and overloading (C3, C4, C5, C12, C21 and C24). · Each section must be completed before the next section is addressed and the annual pre-planned assessment and monitoring criteria for evaluation used (C9, C12 and C44).	Process
.....	.....	
Training and retraining must entail gaining knowledge in understanding the reasons for the compliance with hand hygiene during food handling.	· Guidelines for the assessment of the food handlers knowledge must be established during the annual planning phase of the training and must include aspects related to hand hygiene during handling (C4, C5, C6, C8, C9, C25, C26, C28, C35, C48, C49 and C50). · Food handlers must be told why training assessments are necessary, as well as when (annually) and how (with a questionnaire) they will be assessed (C9, C12 and	

(Evidence from C4, C5, C6, C8, C9, C12, C14, C19, C21, C25, C26, C28, C35, C48, C49 and C50)	C14).	
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An assessment program must be provided to the food handlers to prepare themselves for the evaluation of their knowledge. (Evidence from C9, C12, C14, C19 and C21)	· An annual programme must be established and provided to ensure that the food handlers receive adequate opportunity and time to prepare themselves for the assessment (C9, C12, C19 and C21). · The methods for assessing the food handlers' knowledge must be communicated before the assessment to ensure that they understand the process (C9, C12, C14, C19 and C21).	
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The outcome of the planned training should be aimed at developing food handlers' knowledge and providing practical demonstrations to implement such knowledge into practice. (Evidence from C1, C3, C4, C5, C6, C9, C10, C12, C13, C15, C16, C17, C22, C23, C24, C30, C31, C34, C35, C36, C48 C49, C50, C51 and C52)	· The aim of training and retraining is the food handlers' compliance with hand hygiene during food handling (C16, C17, C31, C34, C35, C36, C48 and C 49). · Assessments are based on the annual pre-planned syllabus requirements and practical demonstrations, as well as the results from the occupational health surveillance (C1, C3, C6, C9, C10, C12, C13, C15, C49, C51 and C52). · Food handlers have met these requirements and it has been confirmed that they understand the content of the written training material and practical demonstrations and liability and responsibility can be granted (C3, C4, C5, C6, C9, C12, C13, C16, C22, C23, C24, C30, C31, C34, C50 and C51). · After each training and retraining session has been successfully completed, food handlers have received detailed feedback and explanation of results (verbal and written) to ensure continued motivation and participation (C9, C12, C13, C14 and C48). · If results of the food handlers' assessments that have been evaluated against the questionnaire checklist indicate non-conformances and failures have resulted in retraining until it is confirmed that the food handler has met the requirements of the standards (C2, C9, C12, C13 and C48). · After each training session has been completed, written feedback to management of the assessment results has indicated whether or not the process has achieved the goal (C12 and C13). · The personal document file kept as reference, monitors the effectiveness of the training and resultant compliance with hand hygiene (C2, C3, C4, C5, C12, C13, C30, C48 and C50).	Outcome
Basic food handling hygiene practices: Basic food hygiene practices and procedures must be in congruence	· Basic food handling hygiene practices must be included in the written training material and demonstrations to ensure that the food handlers' knowledge base is	Structure

with the Department of Health's guidelines (2000) and should be consistent throughout the food handling process. (Evidence from C2, C3, C4, C5, C6, C7, C10, C12, C13, C14, C15, C16, C18, C19, C20, C22, C23, C24, C28, C29, C30, C31, C32, C33, C34, C36, C37, C49, C50, C51 and 52).	developed and sustained. Only this will allow the food handlers to accept liability and responsibility for hygiene practices during food handling (C3, C4, C5, C6, C12, C13, C16, C22, C23, C24, C30, C31, C34, C50, and C51). · A minimum of six (6) months of practical demonstrations, which is in congruence with the DOH's guidelines (2000), is required to develop experience in basic food handling hygiene practices (C2, C12, C19, C20, C29 and C37). · Emphasis must be placed on hygiene practices in all aspects of food handling, e.g. using sanitation facilities, washing hands, cleaning all work surfaces and utensils, and using clean water and appropriate materials (C3, C4, C5, C12, C28, C32 and C33). · To ensure the employee's well-being, an occupational health system, that includes occupational hygiene and occupational health (HIRA profiling, surveillance [knowledge and scientific sampling], analysis and interpretation of results, feedback and remedial actions) should be planned and reviewed annually. It must be based on the company's philosophy, vision, mission and health policy (curative, preventative, management and training) and the DOH's guidelines (2000) (C3, C4, C5, C6, C7, C10, C14, C15, C18, C22, C36, C49, C51 and C52).	
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Food handlers must demonstrate the information they receive to ensure that they comprehend all the aspects involved in basic food hygiene practices. (Evidence from C2, C3, C4, C5, C6, C7, C9, C10, C12, C14, C15, C18, C19, C20, C22, C29, C32, C35, C36, C49, C51 and C52)	· Food handlers should be informed and understand the reasons for the maintenance of basic food hygiene and results of non-compliance (C3, C4, C5, C6, C9, C12 and C14). · Practical work experience will not guarantee that food handlers comply with basic food handling hygiene practices. For this reason they must be able to demonstrate basic food handling hygiene practices after each practical demonstration have been completed (C3, C4, C5, C6, C9 and , C12, C19, C20, C29 and C32). · Practical demonstrations given and daily observations indicate consistency in the way the food handlers' apply basic food hygiene practices. This prevents confusion and inaccuracy that contributes to the transmission of pathogens (C3, C4, C5, C12, C18 and C32). · Food handlers must be motivated and encouraged to maintain a high standard of hygiene and inputs recognised during weekly discussions and meetings, bi-annual workshops and teambuilding sessions (C2, C3, C4, C5, C6, C14, C35 and C49). · The questionnaire developed (based on the DOH guidelines [2000]) to identify the food handlers' level of understanding of basic food hygiene practices, must be able to show whether the food handlers understand all the aspects. If they do not, retraining is necessary (C3, C4, C5, C7, C9, C10, C18, C32 and C36). · The annual planned occupational health surveillance system should be implemented to determine not only whether the food handlers understand the content of the training lessons, but also to confirm that they comply with basic food handling hygiene practices (C3, C4, C5, C6, C7, C10, C14, C15, C18, C22, C36, C49, C51	Process

.....	and C52).	.....
Compliance with basic food handling hygiene practices should be enforced and monitored to prevent multiplying and transmission of pathogens to food. (Evidence from C3, C4, C5, C6, C9, C10, C14, C15, C17, C18, C22, C32, C36, C47, C48 and C49).	· The results from the occupational health surveillance and the questionnaire indicate that food handlers understand why compliance with hand hygiene is necessary. If they have not, the principles of basic food handling and hygiene practices during food handling have been repeated as indicated by the DOH guidelines (C3, C4, C5, C6, C9, C10, C15, C18, C32, C36, C49 and C51). · The presence of pathogens *Escherichia coli* and *Staphylococcus aureus* suggest that food handlers are not adhering to basic food hygiene practices. If these pathogens are identified during inspections, retraining with the questionnaire and scientific sampling is repeated after confirming the following: - confirm understanding of basic food hygiene practices - review inspection processes and frequency (C3, C4, C5, C6, C9, C10, C15, C18, C22, C32, C36, C47, C48 and C49) · Food handlers are informed (written and verbally) in layman's terms of the results and interpretation of their tests, questionnaire and scientific sampling, to ensure that they fully understand the content of the information conveyed. Confidentiality of personal medical records is maintained (C6, C10, C14, C17, C18, C21 and C36). · Written and verbal feedback and explanation of non-conformance and consequences have been communicated positively to the food handlers to motivate continuous compliance (C3, C4, C5, C6, C10, C13, C14, C15, C18, C36 and C49). · Written feedback to management concerning the outcome of the training and retraining assessment results has been done after each training session have been completed, to ensure ongoing support for the programme (C10 and C13). · The established personal documentation system for each food handler have been established and implemented to create a reference base for the ongoing and analysis of the effectiveness of the food handlers' compliance (C3, C4, C5, C6, C10, C15, C36 and C49). · Food handlers have been empowered to implement the knowledge they have gained to take responsibility for their own actions (C6, C13, C16, C30 and C34).	Outcome
Basic personal hygiene practices: Basic personal hygiene practices and procedures must be in congruence with the Department of Health's guidelines (2000) and consistent throughout the whole food handling process. (Evidence from C2, C3, C4, C5, C6,	· To ensure compliance with hand hygiene during food handling that becomes a norm, management must establish a culture of transparency, through discussions, weekly meetings, workshops and team building sessions (C3, C12, C33, C42, C44 and C48). · The Department of Heath's guidelines and basic personal hygiene practices must be included in the written training material: - *Hands should be washed and fingernails scrubbed* in warm soapy water (before food is handled, after visiting the toilet, after blowing the nose,	Structure

C7, C10, C12, C15, C18, C22, C23, C24, C25, C33, C36, C37, C40, C42, C44, C47, C48, C50, C51 and C52).	after smoking and/or eating, between handling raw and cooked food, between handling unwashed vegetables and prepared food; and after handling any soiled objects, such as a refuse bin, etc.); - Hands should be dried with paper towels or a hot air drier and never a communal towel unless it is of the revolving type which is supervised properly, finger nails should be kept short and clean and not licked, keep hands away from the nose, mouth, eyes, ears, or hair during the time food is handled; - Keep all cuts and sores covered with a waterproof dressing, do not prepare or work with food while there are unhealed cuts or sores on the hands, unless rubber gloves are worn; - Clean protective clothing should be worn (clean washable overall or overcoat of a pale colour) which will show the dirt, should be worn; - Hair should be kept covered to prevent dust and bacteria it contains from falling into the food; - Never cough, sneeze or blow the nose over food; - Do not smoke, chew tobacco, etc. while handling food; - Do not wear rings and other jewellery which can come into contact with the food; and - Food handlers should ensure that they are at all times clean of person and it is recommended that a hot shower/bath be taken every day before commencing work. Soap and clean towels must be available (C3, C4, C5, C22, C23, C24, C25, C40 and C50). · Formulated standards and the annual HIRA risk profiling should be the basis for an annual planned occupational health surveillance programme for the identification of pathogens. This is done quarterly with the questionnaire and scientific sampling to confirm the understanding and compliance of the food handlers' with hand hygiene during food handling (C2, C3, C4, C5, C6, C7, C10, C15, C18, C36, C37, C47, C51 and C52).	
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Compliance with hand hygiene must be monitored against the set standards to ensure that food is pathogen free and safe. (Evidence from C2, C3, C4, C5, C6, C8, C12, C13, C14, C16, C22, C23, C24, C25, C28, C31, C32, C33, C34, C35, C36, C40, C48, C49 and C50).	· During annual training and bi-annual retraining, as well as practical demonstrations, food handlers must be familiarised with the content of the Department of Health's guidelines for the management and health surveillance of food handlers (2000) so that they understand the consequences of poor hand hygiene and the transmission of pathogens to food and in the end to patients, causing food-borne illnesses (C3, C4, C5, C6, C12, C13, C14, C22, C23, C24, C25, C36 and C40). · The reasons for daily hygiene inspections ought to be communicated to the food handlers, as they have to understand the necessity for maintaining basic hand hygiene standards throughout the food handling process (C2, C3, C4, C5, C6, C12, C14, C31, C32, C36 and C49).	Process

	· Compliance with hand hygiene must be monitored against the set standards to ensure that food is safe (C2, C3, C4, C5, C6, C8, C12, C31, C32, C36, C37 and C49). · Daily monitoring must be conducted to confirm if the food handlers comply with rules such as wearing the provided clothing (overalls, head coverings, gloves and aprons) and if they use the sanitation facilities and equipment (showers, soap, towels and hand drying devices) (C3, C4, C5, C6, C8, C12, C28, C31, C33 and C36). · Supervision of hygiene practices throughout the food handling process must be vigilant to ensure that knowledge is implemented correctly and according to the DOH's requirements (C3, C4, C5, C6, C8, C12, C13, C23, C28, C31, C32, C36, C48 and C49).	
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Food handlers should be knowledgeable concerning their responsibilities in the compliance and maintenance of personal and hand hygiene during food handling.	· Assessment results have indicated whether the food handlers are informed and knowledgeable about their responsibilities in the maintenance of basic personal hygiene during food handling (C3, C4, C5, C6, C9, C12, C13, C14, C17, C30, C34, C36, C49 and C50). · Daily follow-up monitoring is done to confirm if the food handlers are complying with rules such as wearing the provided clothing (overalls, head coverings, gloves and aprons) and using the sanitation facilities and equipment (showers, soap, towels and hand drying devices) (C3, C4, C5, C6, C8, C12, C13, C28, C31, C33, C36 and C48). · The implemented occupational health surveillance has indicated whether the food handlers have complied with basic personal hygiene practices during food handling. When analysis of the results indicated the presence of pathogens such as *Escherichia coli* and *Staphylococcus aureus,* retraining is conducted (C1, C3, C10, C12, C15, 18, C31, C36, C47, C48, C49, C51 and C52). · Occupational health surveillance of the food handlers' hands has been conducted quarterly. The following aspects have been considered: - Food handlers should have been informed during discussions, team building sessions and workshops of the reasons and benefits of the surveillance programme (protecting own well-being, patients, families and community) in the provision of food that is pathogen free - The surveillance procedures, questionnaire, scientific sampling, equipment used and frequency (quarterly) thereof have been explained and understanding verbally confirmed - Results and records kept as reference for the monitoring of the food handlers' future compliance with basic hygiene practices have been kept confidential (C1, C3, C4, C5, C8, C10, C12, C14, C15, C17, C18, C31, C32, C36, C49, C51 and C52). · An approved occupational health laboratory has conducted the scientific sampling and confirmed the micro-pathogens to be monitored for, area of the hand surface	Outcome

	that came into contact with food (finger tips and base and palms), micro-biological procedures, use of sterile instruments and the results reported (C10, C15, C18, C31 and C51). · All the results have been evaluated and analysed for written feedback and remedial actions (C4, C5, C12, C15, C18, C36 and C47). · Non-compliance with basic personal hygiene practices (presence of pathogens and failure in the completion of the questionnaire) has been assessed and resulted in retraining (C4, C5, C12, C22, C23, C24, C31, C32, C36, C48 and C49). · Procedures to identify the relevant non-compliances are: - confirm understanding of basic personal hygiene practices and monitoring procedure - review inspection processes and frequency - repeat the questionnaire and scientific sampling to confirm compliance with hand hygiene (C3, C4, C5, C10, C12, C15, C31, C32, C36 and C52) · Written and verbal feedback and explanations following non-adherence have been given positively to motivate continuous involvement in the maintenance of basic personal hygiene during food handling (C3, C10, C12, C13, C14, C36 and C48). · Quarterly written feedback to management concerning the results, not only of the food handlers' understanding and compliance with hand hygiene, but also of the occupational health surveillance, has indicated the success of the whole training, retraining and occupational health system (C1, C3, C4, C5, C10, C13, C18, C36 and C52).	
Knowledge of the DOH: Food handlers should be informed who their governing body is. (Evidence from C3, C4, C5, C12, C13, C14, C17, C25, C31, C32, C36, C38, C39, C40 and C48)	· Management must inform the food handlers when and why a DOH inspector is visiting, and give written and verbal feedback to food handlers of audit results (C4, C5, C12, C14, C31, C32, C36, C38 and C40). · Food handlers must be informed of all relevant DOH guidelines they must adhere to, to ensure that the gaps that exist in their hygiene knowledge and practices are corrected (C3, C12, C13, C14, C17, C25, C36, C38, C40, C41 and C48). · All healthcare services should be considered equal and the DOH's inspectors should visit (bi-annually) all that provide curative services to ensure consistency in the food handlers' compliance (C3, C4, C5, C36, C38 and C39).	Structure
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The food handlers should be familiar with the purpose and reasons why the inspectors are visiting the food preparation section.	· Knowledge of the DOH must be tested after the training lesson has been completed to confirm if the food handlers comprehend who guides their food handling practices (C12, C21, C22, C23, C24, C25, C36, C38 and C40). · Food handlers cannot recognise or deduce what gaps exist in their basic food handling hygiene practices or know how to correct them if they are not informed	Process

(Evidence from C3, C4, C5, C12, C13, C14, C17, C21, C22, C23, C24, C25, C36, C38, C40 C41and C48)	(written and verbally) of the DOH guidelines they have to adheres with (C3, C4, C5, C12, C13, C14, C17, C25, C36, C38, C41 and C48). · The food handlers' knowledge of the role of the DOH must be assessed (using a questionnaire) during training (C4, C5, C12, C22, C23, C24, C36 and C38).	
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The food handlers should be knowledgeable and acquainted who guides their hygiene practices during food handling. (Evidence from C4, C5, C10, C12, C14, C25, C31, C32, C36, C38, C40, C41 and C48)	· The food handlers recognise the DOH inspector and know why the visits are necessary (C4, C5, C14, C31, C32, C36 and C38). · Knowledge tested after the training lesson confirms whether the food handlers have understood who guides their food handling practices (C12, C13, C21, C22, C23, C24, C25, C36, C38 and C40). · When food handlers fail to provide the correct answers, retraining is conducted and assessed until success is achieved (C4, C5, C12, C21, C22, C23, C24, C25, C36, C38 and C40). · Written and verbal feedback and explanation of non-conformance is communicated positively to motivate continuous involvement (C10, C12, C14, C25, C36, C38 and C41). · The personal documentation system kept as reference base indicates whether the food handlers' knowledge of the DOH and its requirements has improved (C12, C25, C36, C40 and C48).	Outcome
Management commitment: Food safety is the responsibility of management, and may not be delegated. As such, management must provide training and retraining to guarantee that food handlers understand what food safety and quality implies throughout the handling process. (Evidence from C1, C3, C4, C5, C6, C7, C10, C11, C12, C15, C18, C22, C23, C24, C26, C28, C31, C32, C33, C36, C42, C45, C46, C47, C50, C51 and C52)	· Management must ensure that an annual budget is in place for: - Training (annual) and retraining (bi-annual) of food handlers - Competent trained people to conduct the training and retraining - Sanitation and personal protective equipment - Annual HIRA risk profiling - An occupational health surveillance system (C1, C3, C6, C7, C10, C11, C12, C15, C18, C22, C23, C24, C26, C28, C31, C33, C36, C46, C47, C50, C51 and C52) · Managers and supervisors should be knowledgeable and updated with new legislation relating to food hygiene principles and practices to be able to judge potential non-compliance and food contamination risks (C3, C4, C5, C12, C18, C31, C32, C42 and C45).	Structure
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Management must establish an environment that is conducive for	· Management must establish and maintain an environment that is conducive to open discussion and reporting of hygiene problems, during meetings, workshops and team	Process

learning. (Evidence from C1, C3, C10, C12, C15, C18, C23, C24, C28, C31, C33, C36, C42, C44, C48, C49, C51 and C52)	building sessions, based on mutual trust (C3, C12, C33, C42, C44 and C48). · Management must ensure that a personal documentation system is in place that will indicate all the food handlers' training, retraining, assessments and results. Occupational health surveillance must also be established to monitor the development, improvement and compliance with hand hygiene practices (C1, C3, C10, C12, C15, C18, C23, C24, C36, C48, C49, C51 and C52).	
Monitoring, assessments and occupational health surveillance results should indicate if the food handlers understand the content of the training lessons and to what extent. Managers must enforce food handlers to comply with the wearing of protective clothing as indicated by the Department of Health's guidelines (2000). (Evidence from C1, C2, C3, C4, C5, C8, C9, C10, C12, C14, C15, C18, C20, C22, C23, C24, C27, C31, C32, C36, C37, C42, C43, C44, C45, C46, C47, C48, C49, C51 and C52)	· Management must employ a technical expert to conduct annual HIRA risk profiling to identify and assess all possible hygiene and health risks, including pathogens like *Escherichia coli* and *Staphylococcus aureus* that cause food-borne illnesses (C3, C10, C31, C32, C46 and C51). · Managers must ensure that all the food handlers comply continuously with the standards that have been set and monitor this through an occupational health surveillance programme (C1, C2, C3, C4, C5, C8, C9, C10, C12, C15, C18, C27, C36, C37, C45, C47, C48, C49 and C52). · Management have to perform daily hygiene inspections and walk through and the reasons and necessity thereof must be communicated to the food handlers to understand the importance of compliance with hand hygiene (C3, C4, C5, C8, C14, C31, C32, C36, C42, C43, C44, C45 and C49). · Monitoring of the food handlers' food handling practices will indicate if training and demonstrations have been successful and that food handlers understand why hand hygiene is necessary to prevent cross-contamination (C3, C4, C5, C8, C9, C14, C18, C20, C22, C23, C24, C36, C43, C45, C48 and C49).	.....
Monitoring, evaluation and comparison of the audit and occupational health surveillance results should indicate if the training and practical demonstrations has been successful and to what extent. Empower food handlers to accept liability and responsibility in the compliance with hand hygiene during food handling.	· A technical expert has been employed to advise management of all possible hygiene and health risks, and to conduct sampling to identify pathogens like *Escherichia coli* and *Staphylococcus aureus* (C3, C4, C5, C10, C15, C18, C31, C32, C46, C48, C49, C51 and C52). · Managers have confirmed that the annual training included the DOH requirements (basic food handling hygiene practices and basic personal hygiene practices) and practical assessments have been conducted and the results scrutinised to evaluate the food handlers' level of understanding and compliance with hand hygiene (C3, C9, C12, C22, C23, C24, C33 and C36). · Managers have ensured that all the food handlers comply continuously with the standards that have been set through an occupational health surveillance programme (C1, C2, C3, C8, C9, C10, C12, C13, C15, C18, C36, C45, C47, C49,	Outcome

(Evidence from C1, C2, C3, C4, C5, C8, C9, C10, C12, C13, C14, C15, C18, C19, C22, C23, C24, C30, C31, C32, C33, C34, C36, C44, C45, C46, C47, C48, C49, C51 and C52)	C51 and C52). · The food handlers understand the reason why daily inspections are necessary (C4, C5, C31, C32 and C36). · The food handlers know how to maintain hand hygiene (C3, C9, C13, C19, C31, C32, C36 and C44). · All training, audits and scientific sampling results has been transparent and written and verbal feedback has been given to ensure motivation and participation (C3, C10, C13, C14, C15, C22, C23, C33, C36, C48, C49 and C52). · As recognition for their achievements, food handlers who comply well with hygiene practices have received a certificate to motivate them in the long-term (C30 and C34).	

5.3 SUMMARY

Standards are the process used to measure both the level of achievement of the goals that have been set, as well as the underperformances (Donabedian, 2003:60). This author adds that the best way to achieve a comprehensive result for quality assessment is to use all three standards or a combination thereof. The standards in this research project are aimed at increasing the compliance of food handlers with hand hygiene to prevent the transmission of pathogens to food consumed by patients in the healthcare service. Quarterly occupational health surveillance of the food handlers' hands can support the method of assessment. This may increase the level of compliance with hand hygiene and encourage remedial actions to improve the quality and safety of food consumed by patients in the healthcare service.

Furthermore, standards must include accurate specifications to represent what has to be achieved. Irrelevant measures or information should be excluded, for instance aspects that have no influence on or relevance to the outputs should not be measured. In this research project, the standards must be applicable to measuring the food handlers' compliance with hand hygiene during food handling.

Compliance with standards also includes activities that are conducive to reminding and maintaining the food handlers' adherence to the standards. These are that management must be continuously visible and should represent leadership in the food preparation section. It is management's responsibility to remind the food handlers to comply with hand hygiene and to convey and provide the food handlers with written and verbal feedback of evaluation results to establish a relationship of trust, participation, as well as positive involvement. Achievements should be recognised to maintain positive changes in behaviour and attitudes and non-conformance must be addressed in a positive manner to avoid demoralising the employees. Addressing problems must be rehabilitative rather that destructive (Donabedian, 2003:131). The goal here is to achieve and ensure the food handler's long-term commitment to complying with hand hygiene during food handling and providing food that is pathogen free.

CHAPTER 6: EVALUATION OF THE STUDY, LIMITATIONS, RECOMMONDATIONS FOR PRACTICE, EDUCATION AND RESEARCH.

6.1 INTRODUCTION

In this chapter, the concentration will be on the evaluation of the research project, discussion of the limitations identified during the research project and recommendations for practice, education and research.

6.2 EVALUATION OF THE STUDY

The objectives in this research project originated from occupational health practice and theory pertaining to the food handlers' hand hygiene during food handling and its link to food-borne illnesses. The research project and rationale was explorative and descriptive in nature, using a questionnaire and scientific sampling, aiming to gain insight, if the food handlers' compliance with hand hygiene during food handling may contribute to cross-contamination during food handling.

The goal of the research project was to formulate standards for the hand hygiene of food handlers. The first objective was to determine the food handlers' compliance with hand hygiene during food handling. This involved the use of a questionnaire that was developed from the Department of Health's guidelines for the management and health surveillance of food handlers: Directorate: Food control: July 2000a. The results indicated that a low level of schooling is a mitigating factor not only that some of the questions had to be explained in layman's terms for them to understand, but also influenced their understanding of basic food handling hygiene practices and the consequences of this proofs that training is essential to increase the literacy level to Grade 10 or above. The sections on basic food and hand hygiene practices indicated that aspects such as food protection, responsibility, hand washing, cleaning and usage of sanitation facilities lack in one or other form during food handling. The end result of this will cause pathogens being transmitted to food, causing food-borne illnesses. In addition to this, the responsibility and involvement of the managers in the food preparation sections, that they may not delegate, is inadequate in ensuring that food is pathogen free. They should ensure that annual training and bi-annual

retraining is conducted to guarantee that all the food handlers understand the aspects involved in hand hygiene and contamination.

The research project further investigated the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the food handlers' hands. The results confirmed the presence of both of these pathogens in most of the food preparation sections sampled. This is a further indication of the managers' lack of commitment; these results are an alarming sign that patients in the healthcare service are exposed to pathogens that may affect their recovery.

From the results from the questionnaire and scientific sampling, the researcher proofed that the Department of Health have to reconsider their opinion regarding food handlers not being an important factor in the transmission of food-borne pathogens. The fundamental approach is to ensure that food is pathogen free through the implementation of an occupational health surveillance system to evaluate the food handler's hand hygiene during food handling.

The exploration and description of this phenomenon entailed a complete and accurate portrayal of the current situation and the results from the empirical research emphasised the likelihood of transmission of pathogens from the food handlers' hands to the consumer, as stated by Dr. Makubalo. The research project further found that the Department of Health is not only ignoring the gap that exists in the prevention of food-borne illnesses, but also that occupational health surveillance of the food handlers' hands is needed to identify the presence of pathogens like *Escherichia coli* and *Staphylococcus aureus.*

Based on the outcome of the empirical research, standards were formulated for the food industry to implement, ensuring that the food reaching the public and especially the patient in the healthcare service will be pathogen free and safe. This was done to assist management in ensuring that food handlers comply with hand hygiene during food handling. It was recommended that the DOH inspectors monitor the implementation of these standards in all food preparation sections. This can be achieved through the implementation of a comprehensive occupational health surveillance system.

The researcher has developed knowledge and experience conducting a research project, as well as, in the field of occupational health nursing. Focusing on food handlers, ignored by the DOH as vehicles in the transmission of pathogens, the researcher proofed that food handlers have to be part and parcel of an occupational health surveillance program within the food preparation sections, contributing to ensure that the food the provide to the patients are pathogen free. Additionally, the researcher attained more knowledge and insight regarding not only, the food handlers' influence in the safety of food, but also how the food preparation sections operate within the healthcare service. As a result, a small booklet containing the standards and recommendations will be published and presented to the healthcare services to use as guidelines within the food preparation sections.

6.3 LIMITATIONS

The following limitations were identified based on the results from the research project:

- The inability of the majority of the food handlers to read and write meant that some of them experienced difficulty in comprehending the questionnaire. This might have had an influence on the results obtained during the data collection.
- Given the food handlers' lack of schooling, the length of the questionnaire meant that more time was used than originally planned. In addition, the food handlers had limited time to complete the questionnaire.
- *Escherichia coli* and *Staphylococcus aureus* represent only a fraction of the pathogens that cause food-borne illnesses. To include the other significant pathogens that cause food-borne illnesses can broaden the current knowledge we have, and by so doing, contribute to strategies designed to reduce the incidence of food-borne illnesses. However, given the limited scope of a master's degree it is not possible to include all the pathogens that cause food-borne illnesses.

6.4 RECOMMONDATIONS FOR PRACTICE, EDUCATION AND RESEARCH

The findings of the empirical research indicated the need to engage food handlers in a variety of activities to ensure their compliance with hand hygiene, such as the increase in the level of schooling to at least Grade 10 or above for the food

handlers to understand written training material and practical demonstrations. Training should include the DOH's guidelines (2000a), as these forms the basis that guides the food handlers' food and hand hygiene practices during food handling. Furthermore, the lack of commitment from management in certain areas of food handling has to be addressed, as managers are responsible for providing food that is pathogen free. Through the implementation of an occupational health surveillance system, based on standards, the food handlers' compliance with hand hygiene can be monitored, evaluated and maintained to improve the safety of food during food handling. Therefore, in the sections below, the following recommendations are suggested for practice, education and research.

6.4.1 Practice

♠ **Implementation of standards**

- Implementation of standards based, and in congruence with the DOH's guidelines (2000a), provides measurable indicators to develop and achieve knowledge and experience, a solid foundation for the compliance of the food handlers with hand hygiene during food handling.
- Standards form the basis and reference for the Approved Inspection Authority conducting the HIRA risk profiling in the food preparation section, to identify al possible health risks, including hygiene aspects, which can cause food-borne illnesses.
- Standards must be used as guideline for the establishment of an occupational health system to monitor and evaluate the food handlers' compliance with hand hygiene during food handling.

♠ **Collaboration between authorities**

- The Department of Health in South Africa, at national level, is overly responsible for the regulation of all matters related to food safety and delegates this to the provincial authorities for implementation and insurance that food is safe for consumption. For this reason, must translate the formulated standards into policies and action plans for the food industry to implement.
- Through collaboration between the different authorities involved in the provision of food: the food industry, food providers and the healthcare services,

a process for the implementation of the standards should be established to ensure that the food reaching the patient is pathogen free.

♠ **The Department of Health**

- Food handlers should be informed, knowledgeable and acquainted who their governing body is, as well as be familiar with the purpose and reasons why the DOH's inspectors are visiting the food preparation section.
- Occupational health surveillance of the food handlers' hands must be included in the DOH's guidelines.

♠ **Management**

- Management is responsible and liable to inform and ensure all the food handlers knowledgeable regarding who guide their food handling practices and these should be included in training and retraining.
- Food safety is the responsibility of management, which they can't delegate; therefore they have to provide training and retraining and guarantee that the food handlers comply with hand hygiene during food handling.
- Management must enforce compliance with hand hygiene through monitoring all the aspects regarding aspects relevant to hand hygiene to prevent multiplying and transmission of pathogens to food.

♠ **The implementation of training**

- The structure of training must include the increase in schooling level to Grade 10 or above, make use of ABET, for the food handlers to be able to understand written material and practical demonstrations.
- The structure of lessons must include written material when training and retraining is given, this will establish the basis from which the food handlers could receive their knowledge for the maintenance in hand hygiene, ensuring pathogen free food.
- The Department of Health's guidelines for the management and health surveillance of food handlers: Directorate: Food control: July 2000a (Appendix 1) should be part of the structure of lessons.
- All food handlers must receive induction (new employees and after annual leave), annual training and bi-annual retraining to develop their knowledge regarding the requirements of the DOH's guidelines (2000a).

- Assessments must be according the provided written training material and practical demonstrations to test the food handlers' compliance and non-conformances with hand hygiene, in addition to, cross-contamination during food handling.

♠ **Occupational health**

- Including the OHP's during the Approved inspection Authority's audits conducting the HIRA risk profile will enhance their comprehension of the audit, as OHP'S are the specialists who manages and co-ordinate the occupational health system for the employer.
- Based on standards and AIA audit results, an occupational health system must be planned and implemented as an indicator for ensuring that the food handlers are not vehicles in the transmission of pathogens that can cause food-borne illnesses.
- The purpose of health surveillance is to ensure the ongoing compatibility between the food handlers and their work environment and in the end ensure that food is pathogen free for the patient, the family and the community that receives the food.
- The value of a quarterly implemented occupational health surveillance program, guided by the standards available, could improve evidence-based practice, to identify, evaluate and monitor the food handlers' compliance with hand hygiene during food handling and for the maintenance of hygienically clean hands in the prevention of cross-contamination of pathogens, like *Escherichia coli* and *Staphylococcus aureus,* during food handling.
- An occupational health program is to monitor, evaluate and compare the audit and occupational health surveillance results to conclude if the training and practical demonstrations has been successful and to what extent.
- Analysis of data accumulated during the occupational health surveillance process must be converted into strategically useful information to identify health trends as early as possible to implement remedial actions, not only in the workplace, but for the food handler as well; preventing long-term detrimental health effects and improves the general well-being of the work force through early prevention, recognition and treatment of illness affecting the safety of food.

♠ **Participation, empowerment and ownership**

- Participation and empowerment is needed as the maintenance of high standards depends on how food handlers work together. What they believe to be true about their individual and collective purposes influences their willingness to comply with these standards in food hygiene practices.
- Acknowledgement of achievements have to be recognised to maintain a positive change in behaviour and attitudes and non-conformances must be addressed in a positive manner to avoid an environment in which demoralization is created, it must be rehabilitative rather that destructive.
- Empower food handlers to accept liability and responsibility in the compliance with hand hygiene during food handling.

6.4.2 Education

♠ **Occupational health practitioner**

- As the food industry employs 10 to 15 percent of the workforce in South Africa, it is important that occupational health practitioners receive the necessary knowledge and skills to conduct a comprehensive occupational health surveillance of the food handlers working in the food preparation section. This may be done through an additional course specialising in this area.
- Occupational health practitioners can be utilized to provide in-service training, not only for food handlers but also for nursing students conducting practicals, as well as post graduate students enrolled in an occupational health course.
- Through the development of a networking system between OHP's working in the food industry, experiences and skills can be updated and enhanced to improve the service they provide to the different sectors of the food industry.

6.4.3 Research

♠ **Generalisation**

- The sample size in this research project was all inclusive, with participants from the food preparation sections of the four healthcare services in Potchefstroom. The DOH provides only one definition for food handlers, and as result of this, the conclusion can be reached that food handlers in the food industry as a whole, may be classified and fit into this definition. Therefore, the research results can be generalised to other food preparation sections in the food industry and used as the basis for further research.

- **Data collection**

- To achieve more in depth data regarding the food handlers' understanding and compliance of hygiene practices, the questionnaire could be divided into several smaller sections. This could be administered on different occasions. This would overcome the limitations of administering one very long questionnaire and would allow the inclusion of additional questions to provide more data. In addition, such a series of questionnaires could include guidelines besides those provided by the DOH. This will also increase the likelihood of obtaining more in-depth data regarding the food handlers' understanding and compliance with hand hygiene practices.

- **Food industry**

- The possibility for further research in this field is immense. As a starting point, the food handlers from the curative services the North-West Province may be included. The research field may also be extended to other sectors that prepare and provide food, such as the South African Defence Force, Universities and school hostels and cafeterias and retirement homes in Potchefstroom and other regions in the North-West Province.
- It is recommended that throughout the food industry further research is needed, to achieve true value, by utilizing numerous food industries to participate in a comprehensive research project as this will add knowledge to the body of nursing.
- Therefore it is recommended that further research is conducted throughout the food industry. The participation of a variety of food industries in a comprehensive research project will add knowledge to the body of nursing.

6.5 CONCLUSION

Internationally and nationally, food handlers are a crucial link in the food industry from farm-to-table, and to patients in the healthcare service. In South Africa, food handlers have a responsibility to comply with the DOH's guidelines. Food handlers who prepare food for patients in the healthcare services' have more reason to adhere to the DOH's guidelines. If food is contaminated with pathogens like *Escherichia coli* and *Staphylococcus aureus*, food-borne illness may aggravate patients' recovery. Due to this important role, the healthcare services' food

handlers were identified as a target population for inclusion in this research project.

The empirical research results indicate that the food handlers do not comply with hand hygiene during practices food handling. This finding supports the need for the formulation of standards that can be translated into policies and action plans for the food industry, which must implement, monitor and ensure that food handlers comply with hand hygiene practices. This will ensure that food in the healthcare service is pathogen free and safe.

"Nursing is not only a service to the sick; it is also a service to the well.
We have to teach people how to live"

Florence Nightingale
1895

SOLI DEO GLORIA

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GUIDELINES FOR THE MANAGEMENT AND HEALTH SURVEILLANCE OF FOOD HANDLERS

DEPARTMENT OF HEALTH

DIRECTORATE: FOOD CONTROL

JULY 2000

TABLE OF CONTENTS

1. BACKGROUND

As in the rest of the world, the debate continues in the RSA amongst health professionals and public health authorities on the relative merits, costs and benefits of health surveillance of food handling personnel by means of routine medical examinations. There is no uniformity in the procedures adopted by authorities requiring surveillance. Universally there is still uncertainty as to whether, and under what circumstances, routine medical examinations are cost effective in preventing or at least minimizing food contamination.

In the RSA the aspect of routine medical examination of food handlers varies considerably amongst health authorities, especially at local government level. Some enforce it through legislation, which makes it compulsory, while others do not require it at all. This situation is not in the best interest of all concerned and the Department of Health has decided to issue the following guidelines in this regard.

For the purpose of this document the term **"food handler" means "Persons who in the course of their normal routine work come into contact with uncovered food not intended for their personal use."** Food includes water and any other liquid intended for human consumption. A food handler is thus any person involved in the processing, production, manufacturing, packaging, preparation, sale or serving of any foodstuff, including water and beverages.

It should be emphasized that the purpose of this document is not to elaborate on the statutory requirements of food handling and the places where it takes place, but to serve as a guide for persons involved in food handling with regard to practices which will contribute to safe food handling.

2. VIEWPOINT OF THE DEPARTMENT OF HEALTH REGARDING PRE-EMPLOYMENT- AND ROUTINE MEDICAL EXAMINATIONS OF FOOD HANDLERS

In accordance with the view of the Joint FAO/WHO Expert Committee on Food Safety, the Department accepts that it is not easy to maintain medical control over food handlers due to a rapid turnover which makes it difficult to keep track of them.
Medical examinations are costly and do not guarantee the detection of more than a small proportion of carriers of pathogenic organisms. Screening for pathogens in stool specimens from food handlers is not cost-beneficial and is not recommended, and the identification of a carrier is not likely to make a significant contribution to the control of food borne diseases. Infection may also occur after the examinations.

Routine medical examinations of food handlers may lead to a false sense of safety which can cause negligence with regard to general hygienic practices and personal hygiene. A much more effective preventative measure, the education of food handlers in hygienic practices, is often also neglected.

For these reasons the Department considers pre-employment and routine medical examinations of food handlers as not being cost-effective and unreliable in the prevention of food borne disease and recommends that it should therefore not be required by health authorities. Regular monitoring and surveillance by health authorities and management of the food handling process are, however, crucial elements in the prevention of food borne diseases.

3. A PROPOSED STRATEGY FOR HEALTH SURVEILLANCE OF FOOD HANDLERS

The following principles should be applied as part of a strategy:

- Management commitment;
- Education and training;
- Health interviews;
- Reporting illness to management;
- Applying basic food handling practices; and
- Applying basic personal hygiene practices.

These principles can only succeed in promoting a high standard of safe food handling if applied and accepted in an open and trusting manner by all the parties concerned, namely, employers and employees. Mutual understanding and trust between management and food handling employees form the basis of a safe food handling strategy.

3.1 MANAGEMENT COMMITMENT

The hygiene of food is the responsibility of management and can at no point be delegated to food handlers. Management commitment to the following is essential:

- A programme of optimum hygiene covering all aspects of food handling.
- Vigilant and competent supervision in this respect is vital;
- Open discussion and reporting of hygiene problems by employees and quick response with corrective measures;
- Reassurance that food handlers will not suffer loss of pay or their jobs if they report symptoms such as diarrhea or infected skin lesions;
- Employment of technical experts to advice on hygiene;
- creating optimum hygiene conditions and practices and the regular upgrading thereof;
- Responding to consumer complaints regarding hygiene in a professional and responsible manner;
- Implementation of an occupational health programme for improving working conditions and increasing product reliability; and
- Mutual trust should be developed amongst employees in order to support each other to maintain maximum hygiene levels. To create this, food handlers should be empowered to be part of the evaluation process regarding hygiene standards.

3.2 EDUCATION AND TRAINING

The following aspects are important:

- Health authorities must accept that the education and training of food handlers are also part of their responsibility and should ensure that appropriate programmes receive their attention;
- Education and training of food handlers are vital elements of food safety programmes;

- Practical and functional educational methods and aids should be used, especially with regard to street vendors. Language and other cultural factors should be taken into account;
- All employees must know and understand the basic principles of food safety and their own responsibility in this respect;
- Managers must be aware that employees who have gastroenteritis or open skin lesions must stay away from work or be prohibited from handling food while symptoms persist;
- Food handlers should receive instruction in food safety and personal hygiene and should be required to undergo a test of their knowledge of the subject;
- Refresher courses should be given periodically;
- Particular attention should be given to the need to report illness by food handlers as soon as it occurs;
- Education programmes must take literacy and educational standards of food handlers into consideration;
- Education and training programmes to be conducted by properly - trained personnel; and
- Education and training programmes must also be extended to management, cleaners and other personnel involved with food handling.

3.3 HEALTH INTERVIEW

Health interviews involve the completion of a questionnaire by the employee and are aimed at a general assessment of a person's suitability for work as a food handler in terms of demeanour, appearance and cleanliness.
All relevant aspects related to environmental health matters and practices of food handling should thus be included in the questionnaire.

The following aspects are important:
- Questions should be directed towards the identification of excretes, whether clinically well or symptomatic, of organisms of importance in food safety;
- The interview should take place before employment;
- The interview may be repeated under special circumstances, e.g. following a period of absence from work due to sickness or a holiday in a country or place in which an epidemic of gastroenteritis has been reported; and

- Medical advice need only be sought if the interviewer considers - that a more detailed examination would be desirable. Recruits suspected of suffering from the following conditions will require a medical examination and if confirmed, be disqualified from being appointed as a food handler:
    * Chronic supportive conditions, e.g. otitis media with drum perforation;
    * Chronic bronchitis with productive, purulent sputum, or
    * Widespread chronic skin conditions, such psoriasis or eczema which makes skin cleansing difficult and are often associated with secondary infection.

Leadership of existing personnel should where possible be involved during the interview stage to strengthen mutual trust amongst new and old staff members.

3.4 REPORTING ILLNESS TO MANAGEMENT

Managers should encourage employees to report to their supervisors whenever they have diarrhoea, sore throat, fever, a cold or open skin lesions, or are jaundiced. Discretion should then be used as to whether or not these persons should be subjected to certain restrictions or suspended from food handling duties. Management should have a general knowledge of food borne diseases and the symptoms thereof to ensure that food handlers suffering from it can be identified early. Management must thus be aware that employees who have for example gastroenteritis or open pus producing lesions (ear, teeth/gums, lungs, skin, etc.) must stay away from work or be relocated with tasks that do no involve the handling of food.

Questions often arise which medical conditions normally disqualify a person temporarily from food handling as well as what length of exclusion from work after illness must be applied. It must be kept in mind that health standards are applied in a practical way, so as not to exclude a person from work unnecessarily, while maintaining the safety of other employees and food.

The following conditions disqualify a person temporarily from food handling:

- Infection of the eyes or eyelids;
- Inflammation and/or discharge from ears;
- Oral sepsis;
- Staphylococcal conditions e.g. recurrent boils or open sores; or

- Recent history of gastrointestinal infection.

The following rule with regard to the length of exclusion from work after specific illnesses should be applied. (Return to work in these cases should, however, only take place after consultation with and consent of a medical doctor):

- Hepatitis A: six weeks from onset of jaundice;
- Salmonella food poisoning, cholera, dysentery and typhoid and paratyphoid: three consecutive negative stool specimens taken 48 hours apart;
- Parasite worms and other parasitic conditions: until successfully treated;
- Staphylococcal and streptococcal: until successfully treated;
- All other gastrointestinal illnesses (bacterial or viral): until symptom free: and
- Tuberculosis: seven days from onset of effective treatment.

These measures are aimed at protecting co-workers as well as the public from becoming infected through direct contact with an infected food handler or by means of contaminated food handled by such a person. The transmission of diseases such as
TB, STD's and AIDS is practically of very little consequence with regard to the handling of food, but steps taken should be aimed mainly at protecting co-workers and clientéle from becoming infected.

3.5 APPLYING BASIC FOOD HANDLING HYGIENE PRACTICES

With regard to basic food handling hygiene practices, the following golden rules should always apply:

- basic foodstuffs (meat, milk, etc.) must be obtained from a health approved source;
- cook food thoroughly;
- eat cooked foods immediately or within one hour after preparation;
- Store cooked foods carefully as temperature control is essential;
- Reheat cooked foods thoroughly and only once;
- Cover and/or seal cooked foods during storing and when displayed;
- Avoid contact between raw and cooked foods;
- Keep all kitchen surfaces, utensils and equipment meticulously clean;

- Protect foods from dust, insects, rodents, animals and other sources of contamination;
- Clean tongs, gloves, etc. should be used to handle prepared food where necessary;
- Use clean water, clean running water must continuously be available to ensure proper hygiene practices;
- Waste foods must be properly disposed of;
- Do not inflate food containers (plastic bags, paper bags, etc.) by means of blowing in them by mouth; and
- Do not thaw frozen foods in cold or warm water for more than six hours at room temperature.

3.6 APPLYING BASIC PERSONAL HYGIENE PRACTICES

Managers should ensure that food handlers at all times adhere to the following aspects, which should become part of the customary norms and values of these persons:

- Hands should be washed and fingernails scrubbed in warm soapy water:
  * before food is handled;
  * after visiting the toilet;
  * after blowing the nose;
  * after smoking and/or eating;
  * between handling raw and cooked food;
  * between handling unwashed vegetables and prepared food; and
  * after handling any soiled objects, such as a refuse bin, etc.

- Hands should be dried with paper towels or a hot air drier and never a communal towel unless it is of the revolving type which is supervised properly;
- Finger nails should be kept short and clean;
- Keep hands away from the nose, mouth, eyes, ears, or hair during the time food is handled.
- Fingers must not be licked when preparing food;
- Keep all cuts and sores covered with a waterproof dressing. Do not prepare or work with food while there are unhealed cuts or sores on the hands, unless rubber gloves are worn;
- A clean washable overall or overcoat of a pale colour, which will show the dirt, should be worn;

- *Hair should be kept covered to prevent dust and bacteria it contains from falling* into the food;
- Never cough, sneeze or blow the nose over food;
- Do not smoke, chew tobacco, etc. while handling food;
- Do not wear rings and other jewellery which can come into contact with the food; and
- Food handlers should ensure that they are at all times clean of person and it is recommended that a hot shower/bath be taken every day before commencing work. Soap and clean towels must be available.
- Clean protective clothing should be worn.

4. CONCLUSION

The main emphasis should fall on;

* personal hygiene (suitable washing facilities, etc.)
* clean protective clothing;
* effective supervision of the health of employees and appropriate action timely taken when indicated; and
* maintaining hygienic food handling practices.

Sound management with regard to hygiene and commitment from employers as well as employees holds the key to success.

5. REFERENCE

Health surveillance and management procedures for food handling personnel.
World Health Organisation (WHO), Geneva, 1989.

REPUBLIC OF SOUTH AFRICA

2011/B

DEPARTMENT OF HEALTH
PRIVATE BAG X 828
PRETORIA
0001

TEL: 3120364
DIRECTORATE: ENVIRONMENTAL HEALTH

TO ALL DEPARTMENTS, INSTITUTIONS, CHIEF DIRECTORATES AND REGIONAL OFFICES
CIRCULAR NO. OF 1994

VIEWPOINT OF THE DEPARTMENT OF HEALTH REGARDING PRE-EMPLOYMENT AND ROUTINE MEDICAL EXAMINATIONS OF FOOD HANDLERS

As in the rest of the world, the debate continues in South Africa among health professionals and public health authorities on the relative merits, costs and benefits of health surveillance of food handling personnel by means of pre-employment- and routine medical examinations, and there is no uniformity in the procedures adopted by authorities requiring surveillance. Universality there is still uncertainty as to whether, and under what circumstances, routine medical examinations are cost-effective in preventing or at least minimizing food contamination.

In South Africa the aspect of pre-employment- and routine medical examination of food handlers varies considerably among health authorities, especially at local government level, where some enforces it through legislation which makes it compulsory, while others do not require it at all. This situation is not in the best interest of all concerned and the Department of Health has therefore decided to express its viewpoint in this regard.

For the purpose of this circular the term "food handlers" means the following:
"Persons who in the course of their normal routine work come into contact with uncovered food not intended for their personal use. (Food includes water and any other liquid intended for human consumption). A food handler is thus any person involved in the processing, production, manufacturing, packaging, preparation, sale or serving of any foodstuff, including water and beverages.

In accordance with the viewpoint of the Joint FAO WHO Expert Committee on Food Safety, the Department accepts that it is not easy to maintain medical control over food handlers due to a rapid turnover which makes it difficult to keep track of them. Medical examinations are costly and do not guarantee the detection of more than a small proportion of carriers of pathogenic organisms. Screening for pathogens in stool specimens from food-handlers is not cost-beneficial and is not recommended, and the identification of a carrier is not likely to make a significant contribution to the control of food borne diseases. Infection of food handlers may also occur after the examinations.

Furthermore, routine medical examinations of food handlers may lead to a false sense of safety which can cause negligence with regard to general hygienic practices and personal hygiene. A much more effective preventive measure, the education of food handlers in hygienic practices, is often also neglected.

For these reasons the Department considers pre-employment and routine medical examinations of food handlers as not being cost-effective and unreliable in the prevention of food borne diseases and recommends that it should therefore not be required by health authorities. Regular monitoring and surveillance by health authorities and management of the food handling process is however a crucial element in the prevention of food borne diseases.

To assist health authorities, the Department of Health has also compiled a document entitled: "Guidelines for the management and health surveillance of food handlers", which includes amongst other the Department's policy as set out in this circular with regard to medical examination of food handlers. A copy of the guideline document can be obtained on request from the Department of Health, Directorate: Environmental Health.

DIRECTOR-GENERAL

APPENDIX 2

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Prof HC Klopper
Bussie 520

Etiekkomitee
Tel (018) 299 2564
Faks (018) 297 5308
E-pos Estelle.LeRoux@pnwu.ac.za

23 April 2007

Geagte prof Klopper

GOEDKEURING VIR EKSPERIMENTERING MET MENSE

Hiermee wens ek u in kennis te stel dat u projek getiteld *"Standards for the hand hygiene of the food handlers' hands "* goedgekeur is met nommer 07M05.

Gebruik asseblief die nommer genoem in paragraaf 1 in alle korrespondensie rakende bogenoemde projek en let daarop dat daar van projekleiers verwag word om jaarliks in Junie aan die Etiekkomitee verslag te doen insake etiese aspekte van hulle projekte asook van publikasies wat daaruit voortgespruit het. U sal in Mei vanjaar die dokumentasie hieroor ontvang.

Goedkeuring van die Etiekkomitee is vir 'n termyn van hoogstens 5 jaar geldig (volgens Senaatsbesluit van 4 November 1992, art 9.13.2). Vir die voortsetting van projekte na verstryking van hierdie tydperk moet opnuut goedkeuring verkry word.

Die Etiekkomitee wens u alle voorspoed met u werk toe.

Vriendelike groete

ESTELLE LE ROUX
SEKRETARIAAT

APPENDIX 3

HEALTH

DEPARTMENT:
HEALTH
NORTH WEST PROVINCE

2nd Floor Tirelo Building
Dr Albert Luthuli Drive
Mafikeng, 2745
Private Bag X2068
MMABATHO, 2735

Directorate: Policy, Planning & Research

Enq:S.Malakane
Tel: (018) 387 5947/6
Fax: (018) 387 5317
E-mail
smalakane@nwpg.gov.za

To : Ms S.Klingenberg
P.O Box 390
Potchefstroom
2520

Date: 8 Aug 2007

Subject: Approval for Research: **Standards for the hand hygiene of the food handler's**

Approval is granted to conduct the above study in the North West Province, kindly make relevant arrangements with the management for suitable dates and times. Detail at the bottom of this letter has to be completed by you and returned to Policy, Planning and Research Directorate before your study may commence.

Kind Regards

.....
Mr K.Rabenye
Director: Policy, Planning and Research
North West Dept of Health

The NWDoH will be furnished with final report by

END 2007
.....
Submission date of the final report

.....
Ms S.Klingenberg

APPENDIX 4

HEALTH

DEPARTMENT:
HEALTH
NORTH WEST PROVINCE

2nd Floor Tirelo Building
Dr Albert Luthuli Drive
Mafikeng, 2745
Private Bag X2068
MMABATHO, 2735

Directorate: Policy, Planning & Research

Enq: S Mak
Tel: (018) 387 5747/6
Tel: (018) 387 5780
Fax: (018) 387 5617
smakakane@nwpg.gov.za

TO : Mr M.SENNE
THE HOSPITAL CEO
KLERKSDORP/TSHEPONG COMPLEX
NORTH WEST DEPARTMENT OF HEALTH

FROM : MR B.P MABOE
ACTING- DIRECTOR: POLICY,PLANNING & RESEARCH

DATE : 10 SEPT 2007

SUBJECT: **APPROVALFOR RESEARCH PROJECT: STANDARDS FOR H AND HYGIENE FOOD HANDLERS' HANDS**

The above stated matter refers:

That permission has been granted by the Superintendent- General –Dr L.K Sebego for Ms S.Klingenberg to conduct a study on the above stated matter within hospitals in Southern District, including **Witrand Hospital**.

With reference to problems encountered by the researcher; to gain access to some health facilities in the district, your good office is kindly requested to inform the managers in this regard. Research outcomes are critical to inform the management about gaps and how to improve services to benefit our communities.

With kind regards

Mr B.P Maboe
Acting Director: Policy, Planning & Research
North West Dept of Health

APPENDIX 5

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Tel (018) 082 578 8151
Fax (018) 018 298 1148
Email maffie@naschem.denel.co.za

26 March 2007

HEALTHCARE MANAGEMENT

APPROVAL FOR RESEARCH

I am a M.CUR. (Health science) student at the North-West University, Potchefstroom campus. I am busy with research titled:

STANDARDS FOR THE HAND HYGIENE OF FOOD HANDLERS.

The Ethical Committee at the North West University, Potchefstroom has approved the research project.

The research will include all the food handlers in the food preparation sections within the context of the four major health care institutions in Potchefstroom in the North-West Province. The criteria for inclusion implies the food handler working in the health care service's food preparation section, literacy level of understanding and writing, as well as research project acceptance and voluntary participation. Except for the time to participate in the research project, there is no other known discomfort or inconvenience.

The data will be collected in the work environment but in a separated room from the physical working area, to protect the participants. The researcher will and if necessary through a translator, explain/rephrase the questions to participants when assistance is needed to collect the questionnaire data. The completion of the questionnaire will take approximately 10 – 15 minutes per food handler and the scientific sampling 30 seconds per food handler. Data will be collected, without

notice of arrival, in the work environment and at the visit; all participants will be asked to remain at their positions, this is to ensure valid and reliable results. As researcher, I will remain at a distance and be an observer during this time.

The rationale for the research project is to gain an overall picture through the exploration and description the food handler's compliance with hand hygiene during food handling and to identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers. Through evaluation of the surface of their hands, I can improve our understanding of the pathogenesis of new and emerging infections. Therefore, I can formulate standards for the hygiene of the food handler's hands.

The objectives of the research project are to:

- *Determine the food handler's compliance with hand hygiene during food handling.*
- *To identify the prevalence rate of Escherichia coli and Staphylococcus aureus on the hands of food handlers.*
- *Formulate standards for hand hygiene of food handlers.*

The methods will include the following procedures:

The first step consists of a questionnaire for gathering data that will be completed by the participant. The questionnaire is based on Department of Health's guidelines for the management and health surveillance of food handlers: Directorate: Food control: July 2000a.

The second step consists of a sterile swab, a standardized instrument that will be use to gather data from the food handler's hand surface. The instrument will be supplied by the laboratory and the procedure of collection of the sample will be based on their protocol and precise area of the hand surface. The analyzing of the scientific sample can only be conducted by an accredited occupational laboratory.

The third step will be the formulation of standards for the hand hygiene of food handlers.

My supervisor in this research project is Prof H C Klopper and co-supervisor is Ms A Marx from the North-West University.

I will appreciate it if you will approve this research project to be executed in the food processing section of your health care institution.

_____

Ms S Klingenberg
Researcher

APPENDIX 6

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Tel (018) 082 578 8151
Fax (018) 018 298 1148
Email maffie@naschem.denel.co.za

26 March 2007

Dear Participant

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT:

STANDARDS FOR THE HAND HYGIENE OF FOOD HANDLERS

You are invited to participate in this research project. This letter is to help you to decide if you would like participate. Before you agree to take part in this study, you should fully understand what is involved. If you have any questions, do not hesitate to ask the researcher.

Participation is voluntary, you can refuse to participate or stop at any time. You as participant will be treated fairly, with respect, dignity and your welfare will be protected from discomfort and harm. A written consent form will be supplied to you to sign, accepting participation and all information and/or data will be treated anonymously. Your identity will not be revealed when the study findings is reported and published.

The research will be conducted in two stages:

1 A questionnaire – concerning your awareness, knowledge and compliance regarding your food handling practices.
2 Scientific samples of your hands – will be done by a laboratory assistant with a sterile swab in your working environment.

Participating institutions, Research committee and the Ethical committees at the North-West University, Potchefstroom and Department of Health in the North West Province have approved the research project.

The aim of the research project

- *Determine the food handler's compliance with hand hygiene during food handling.*
- *To identify the prevalence rate of Escherichia coli and Staphylococcus aureus on the hands of food handlers.*
- *Formulate standards for the hand hygiene of food handlers.*

Your participation is highly appreciated.

Regards

Ms S Klingenberg
Researcher
Contact information:
If you have any questions concerning this study, you can contact me at:
Tel: (018) 290 6292
Mobile: 082 578 8151
Fax: (018) 298 1148
maffie@naschem.denel.co.za

APPENDIX 7

INFORMED CONSENT

TITLE: STANDARDS FOR THE HAND HYGIENE OF FOOD HANDLERS

INTRODUCTION

Before you agree to take part in this research project as a food handler, you should fully understand what is involved. If you have any questions, do not hesitate to ask the researcher. You should not agree to take part unless you know what is expected of you.

WHAT IS THE PURPOSE OF THIS RESEARCH PROJECT?

1. Determine the food handler's compliance with hand hygiene during food handling.
2. To identify the prevalence rate of *Escherichia coli* and *Staphylococcus aureus* on the hands of food handlers.
3. Formulate standards for the hand hygiene of food handlers.

THE RESEARCH PROJECT CONSISTS OF TWO STAGES:

1. A questionnaire – will be completed by you the participant to evaluate your compliance regarding your food handling practices. The questionnaire is based on Department of Health's guidelines for the management and health surveillance of food handlers: Directorate: Food control: July 2000a.

2. Scientific sampling of your hands – will be done by a laboratory assistant with a sterile swab, in your working environment. The instrument will be supplied by the laboratory and the procedure of collection of the sample will be based on their protocol and precise area of the hand surface. The analyzing of the scientific skin sample will be conducted by an accredited occupational laboratory.

Hereafter, the formulation of standards for the hand hygiene of food handlers hands, will take place based on the data collected and results. All the data gathered will be kept in a safe place and will be destroyed after analysis of the data.

HAS THE RESEARCH PROJECT RECEIVED ETHICAL APPROVAL?

This research project protocol was submitted to the participating institutions, research committee and the Ethical Committees of the North-West University, Potchefstroom and the Department of Health in the North-West Province and has approved the research project.

WHAT ARE MY RIGHTS AS A PARTICIPANT IN THIS RESEARCH PROJECT?

You participation in this research project is entirely voluntary and you can refuse to participate or stop at any time.

MAY ANY OF THESE RESEARCH PROJECT PROCEDURES RESULT IN DISCOMFORT OR INCONVENIENCE?

Except for the time to participate in the research project, there is no other known discomfort or inconvenience.

WHAT ARE THE RISKS INVOLVED IN THIS TRIAL?

There are no risks involved in participation in this research project.

SOURCE OF ADDITIONAL INFORMATION

If you have any questions during this research project, please do not hesitate to approach the researcher.

Researcher: Ms S Klingenberg: (018) 290 6292
Supervisor: Prof H C Klopper: (018) 299 2395 (w)
Ms A Marx (018) 299 1689 (w)

CONFIDENTIALITY

All information obtained during this research project will be handled as confidential. Data that may be reported in scientific journals will honour this.

INFORMED CONSENT

I hereby confirm that I have been informed by the researcher, Ms S Klingenberg, about the nature, conduct, benefits and risks of the research project. I have also received, read and understood the invitation and information to participate in the

research project. I am aware that the results of the research project and any personal details will be anonymously processed.

I may, at any stage and without prejudice, withdraw my consent and participation in the research project. I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the research project.

Participant's name _____ (Please print)

Participant's signature_____ Date _____

I, Mrs S Klingenberg herewith confirm that the above participant has been informed fully about the nature, conduct and risks of the above research project.

Researcher's name _____ (Pease print)

Researcher's signature _____ Date_____

APPENDIX 8

QUESTIONNAIRE INFORMATION LEAFLET

I am a M.CUR. (Health science) student at the North-West University, Potchefstroom campus.

The research project is titled:
STANDARDS FOR THE HAND HYGIENE OF FOOD HANDLERS

Firstly, I would like to thank you for your willingness to participate in the research project.

You are welcome to ask questions if there is any uncertainty regarding the questions.

Your names don't appear on the questionnaire therefore your identity will be anonymous.

The most important aspect is that you must be truthful and honest in the answering of the questions, otherwise I can't assess the true state of affairs.

1. The questionnaire consists of 6 sections and 49 questions:

- **Demographic data** require your personal information.
- **Education & training,** is the training you received here as food handler in the food preparation and handling area.
- **Basic food handling hygiene practices** is how food is handled in the work areas.
- **Basic personal hygiene practices** are the personal requirements, which you as a food handler, must comply during the handling of food.
- **Department of Health** is questions based on your knowledge concerning the Department.
- **Management commitment** includes questions relating to your management and their commitment during your work day.

2. To answer the questions make a "x" in the block that you feel is the most appropriate or correct for e.g. "highest school grade completed", make a "x" in the block after the school standard you completed, "training", a "x" under yes or *no for "writing", "practical" or "none". The questions with a long line such as* "what's involved in the training", explain only in a few words what type of training you received.

Your time and participation is highly appreciated.

Regards

Sanette Klingenberg
Researcher

APPENDIX 9

FOOD HANDLERS' QUESTIONNAIRE

Demographic data

1. Employer	Hospital 1		Hospital 2		Hospital 3		Hospital 4	
2. Age	20 – 29		30 - 39		40 - 49		50 - 59	
3. Gender	M		F					
4. Highest School grade completed	None		St 5		St 6 - 8		St 8 - 10	
5. Time employed (years)	0 - 5		6 - 10		11 - 15		16 - 20	>21

Education & Training

1. *Are there training lessons given to the employees?*	Yes			No						
2. Are you shown how to do the job?	Yes			No						
3. Are you shown regularly?	Yes			No						
	Written				Practical				None	
4. *What's involved in these training lessons?*	Yes		No		Yes		No			
5. How are your knowledge tested?	Yes		No		Yes		No			
6. What's involved in the retraining?	Yes		No		Yes		No			

Basic food handling hygiene practices

1. Do you handle raw and cooked food together? — Yes ____ No ____

	After each task	1 - 2 /day	3 - 4 /day	>5 /day	Never
2. How many times a day is the work surfaces and equipment cleaned?					
3. How many times are clean utensils used when food is handled?					
4. How many times is clean water used to clean equipment?					

	Cover		Cover & left		Cover & fridge		None
5. In what way are food protected against dust, insects, etc?	Yes		Yes		Yes		

6. What is done with the *spoiled and waste food*? _____

7. What is jour responsibility regarding hygiene during food handling? _____

8. What does food contamination mean? _____

	Withdrawn from work	Covered with plaster & work	Other work
9. When you have an open sore, what happens?			

10. Is it necessary to scrub your hands and nails between food handlings?	Yes		No	
11. Why? _____				
12. Do you undergo medical examinations?	Yes		No	
13. Did they take swabs from your hands?	Yes		No	
14. Did you receive any feedback?	Yes		No	

Basic personal hygiene practices

1. Do you always wear overalls during work?	Yes		No	
2. Are you allowed to wear jewellery on your fingers?	Yes		No	
3. Do you receive clean hair coverings, overalls and gloves every day before you start work (PPE)?	Yes		No	
4. Do you wear clean hair coverings, overalls and gloves every day?	Yes		No	
5. Are there facilities to shower?	Yes		No	
6. Are you using it every day?	Yes		No	

7. Why? _____

8. Is there soap available to wash your hands during the day?	Yes		No	
9. Are there clean towels available every day?	Yes		No	

10. How do you dry your hands after washing it?	Towel	Paper towel	Air blower	None

11. Are you allowed to work with an open sore/cut on your hands?	Yes		No	

What is the reason why you're not allowed to blow your nose or sneeze at your workplace? _____

Department of Health

1. Do you know who the Department of Health is?	Yes		No	
2. Has one of Depart. of Health's inspector's been here?	Yes		No	

3. What did he/she do? _____

Management's involvement

1. Is the supervisor doing hygiene inspections daily?	Yes		No	
2. Is there a person to do hygiene inspections in the work area/s?	Yes		No	

3. How are hygiene standards maintained? _____

4. Are you encouraged to report hygiene problems to the supervisor?	Yes		No	
5. If hygiene problems are reported, are discussions held to address it?	Yes		No	
6. Are problems corrected after reporting/s?	Yes		No	
7. Is it compulsory to report when you are sick, for e.g. with diarrhoea or flu?	Yes		No	

8. Why? _____

Questions base on:

SOUTH AFRICA. Department of Health Directorate: Food Control. 2000a. Guidelines for the Management and Health Surveillance of Food handlers. Pretoria: Government press. 12 p.

CERTIFICATE OF ACCREDITATION

This is to certify that:

LANCET LABORATORIES
MICROBIOLOGY LABORATORY

Testing Laboratory No. M0026

Is a South African National Accreditation System Accredited Laboratory
for four years commencing **August 2005** provided that
all SANAS conditions and requirements are complied with.

This certificate is valid for:

MICROBIOLOGY TESTING

as per scope on accompanying schedule

THE LABORATORY COMPLIES WITH ISO/IEC 17025
INTERPRETED FOR MEDICAL LABORATORIES

While this certificate remains valid,
the Accredited Laboratory named above
is authorised to issue SANAS certificates.

Executive Director

"Recognised as the official national accreditation body by the Department of Trade and Industry of the Republic of South Africa"

This certificate is only valid when accompanied by its schedule of accreditation.

S A N A S

ACCREDITED LABORATORY

SCHEDULE OF ACCREDITATION

Testing Laboratory Number: M0025

Permanent Address of Laboratory:	Signatories:	
Lancet Laboratories Head Office Microbiology Cnr Stanley & Menton Roads Richmond Johannesburg 2092	Hanlie Kuun Dr. H.T. Booker	: Contact Person : Signatories as authorised by the Head of Laboratory
Postal Address P. O. Box 8475 Johannesburg 2000		
Tel : (011) 358 0705/6/7 Fax : (011) 358 0711	Issue No Date of Issue Expiry date	: 5 : October 2005 : August 2009

Materials/Products Tested	Types of Tests/Properties Measured, Range of Measurement	Standard Specifications, Equipment/ Techniques Used
BACTERIOLOGY		
	Microscopic examination of Clinical Specimens for: Bacteria Eosinophils Cells Cryptosporidia Parasites Male Fertility	Gram Stain Hansel Stain Cell Count (Wet Prep) Auromine 'O Stain Concentration (Wet Prep) Post Vasectomy
	Bacterial Culture of Clinical Specimens	Appropriate Media Bactec 9240
	Identification of Bacteria Isolated	Biochemical Tests Commercial Kits Agglutination Vitek 2

Original date of accreditation: November 2001

Executive Director

S A N A S

ACCREDITED
LABORATORY

Laboratory No: M0025
Date of issue: October 2005
Expiry date: August 2009

Materials/Products Tested	Types of Tests/Properties Measured, Range of Measurement	Standard Specifications, Equipment/ Techniques Used
BACTERIOLOGY (CONTINUED	Detection of Viruses: Adenovirus Rotavirus	Commercial Kits
	Sensitivity Testing of Bacteria: Kirby Bauer Vitek 2 Etest MIC	
	Detection of Occult Blood	Commercial Kits
	Urine chemistry analysis (instrumentation)	Clinitek 500 Urine Analyser
	Automated Blood Cultures	Bactec 9240

Original date of accreditation: November 2001 Page 2 of 2

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Executive Director