AN ASSESSMENT OF THE KNOWLEDGE, ATTITUDES, PRACTICES AND BEHAVIOURS OF HEALTHCARE PRACTITIONERS TO LISTERIOSIS (CASE OF REGION C GOVERNMENT CLINICS IN ROODEPOORT, JOHANNESBURG).

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DECLARATION

I, Regina Murerwa, declare that the contents of this mini dissertation submitted for qualification of Master of Disaster Management at the University of the Free State is my own work and I have not submitted it for a qualification at another institution. I declare that I have indicated and acknowledged the sources and works of others by means of reference.

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Signature Date

DEDICATION

I would like to dedicate this research to the Almighty God. I say Ebenezer, "Thus far the LORD has helped us." I also dedicate this research to my loving husband Godwin Murerwa for his invaluable support and encouraging me to unleash my full potential. My children, Lynnet, Darryl and Ruvarashe, young as you are, I'm forever indebted for your patience and understanding when I couldn't spend enough time with you as I concentrated on my studies.

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ABSTRACT

The study was aimed at examining the knowledge, attitudes, practices and behaviours of healthcare practitioners in Region C government clinics in Roodepoort, Johannesburg, in relation to listeriosis. Listeriosis had been a rare occurrence in South Africa up to 2017. The epidemic was examined in the context of the disaster risk equation as well as the PAR model, in order to understand how it propelled into a disaster that resulted in illness and loss of lives. The practices were analysed using the progression of safety model and the disaster preparedness framework in order to understand the principles that underline efficient and effective preparedness and response mechanisms and determine the clinics' alignment with these principles. A fusion of quantitative and qualitative data collection methods was employed in the form of a semi-structured questionnaire, key informant interviews and observation methods. Probability sampling was applied in the selection of 60 respondents from Region C clinics. Although all respondents were aware of listeriosis as a result of the national publicity it had, there were knowledge gaps on the specificity of the disease that health practitioners must be intricate as experts in the medical profession. These specificities included sources of contamination or infection, mode of transmission, signs and symptoms, diagnosis, treatment and preventive mechanisms. Even trained respondents exuded knowledge gaps. The study recommends the need for further and improved training of health professionals in order to strengthen their knowledge with the disease and facilitate effective health communication, diagnosis and treatment of patients.

Collaboration with health affiliated structures at strategic and grassroots level were found to be effective in managing the outbreak. Training provided to health professionals concerning the disease was low (28.8%). Public education for patients and community took a complementary multi-media approach that included health talks, pamphlets, posters and community outreach activities. IEC resources on the disease were insufficient during the outbreak as it was depleted. Surveillance data for early warning on the listeriosis confirmed cases from the clinics and their catchment areas was not effectively used to promote vigilance on the disease because of a lack of coordination of the data between the clinics, referral hospitals and NICD. Human capacity, emergency transport and two-way radio or telephone communication were cited as impediments to effective response to emergencies. The study recommends an improvement in the preparedness and response mechanisms (practices). The findings determined that respondents' attitude towards the disease was that of concern as the majority (94.4%) expressed that vulnerable population groups to the disease needed to be given due diligence on the disease and 88.8% thought that referral of patients with listeriosis to the hospital was important and 72.7% wanted to educate patients about the disease while 27.3% were unsure.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBO	Community Based Organisation
CDC	Centers for Disease Control and Prevention
CDC NORS	Centers for Disease Control and Prevention National Outbreak Reporting System
DRR	Disaster Risk Reduction
EU	European Union
FAQ	Frequently Asked Questions
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
HRSA	Health Resources and Services Administration
IEC	Information Education and Communication
IFRC	International Federation of Red Cross and Red Crescent Societies
NELSS	National Enhanced Listeriosis Surveillance System
NGO	Non-Governmental Organisation
NNDSS	National Notifiable Disease Surveillance System
NICD	National Institute of Communicable Diseases
NHRD	National Health Research Database
PAR	Pressure And Release model
RTE	Ready to Eat Foods
SANC	South African Nursing Council
SPSS	Statistical Package for the Social Sciences
UNISDR	United Nations International Strategy for Disaster Reduction
UN	United Nations
USA	United States of America
WHO	World Health Organisation

CHAPTER 1

RESEARCH BACKGROUND, OBJECTIVES & METHODOLOGY

1.1 Background to the study

Listeriosis (also known as listeria) is a disease that is caused by ingesting food that is contaminated with the bacterium called Listeria monocytogenes, also known as "L" monocytogenes (World Health Organisation 2018). Listeria monocytogenes is a bacterium that can occupy every part of the food chain and is found in nature. This is because it can be found in water, soil, vegetables, decaying vegetation, animals, and eventually human beings, when they consume vegetables and animal products. Because of its presence in water and soil, silage and other forage such as grass and hay that are consumed by animals can get contaminated with the bacteria. On the other hand, fruits and vegetables can be contaminated from manure or soil infested with the bacteria (Tolvanen 2016:12). Similarly, animals get infected when they consume vegetation that has the bacteria. Human beings in turn, are infected when they eat fruit, vegetables, meat and meat products that are contaminated with the bacteria. Human infection with Listeria monocytogenes occurs mainly through food ingestion.

In 1977, the importance of food as a vehicle for the transmission of Listeria monocytogenes became known after 20 people in Boston in the United States of America fell ill after eating raw celery of tomatoes and lettuce (Mahendra *et al.* 2017:2). This was further validated by another outbreak in Halifax Canada linked to the ingestion of coleslaw (Hof 2003:200). Listeria monocytogenes was acknowledged as a food-borne pathogen by the World Health Organisation in 1986 (Mahendra *et al*. 2017:2).

According to a report by Kasalica *et al.* (2011: 1070), 99% of the listeriosis cases are as a result of eating food contaminated with Listeria monocytogenes and hardly any from the environment. Research has established that dosage of 100-1000 Listeria monocytogenes per gram of food (100-1000 *L. mon*. /g) is sufficient enough to cause the disease in human disease.

Although listeriosis is not a frequent occurrence, the disease is a public health concern because of the high morbidity rate (20-30%) and mortality rate it causes. Especially so amongst those with compromised immune systems in contrast to other food pathogen

diseases such as campylobacteriosis and salmonellosis (Al-Nabulsi *et al.* 2015:346). The incidence rate of listeriosis in Europe is 0.33-0.44 cases per 100 000 people. This is in contrast with 20.4 cases per 100 000 people for salmonellosis and 64.8 cases per 100 000 people for campylobacteriosis (Tolvanen 2016:12).

Given the mode of listeria contamination, everyone stands a chance of being infected with listeriosis. However, at high risk of getting listeriosis are pregnant women, new-borns, the elderly and people with chronic conditions, as their immune system is compromised (Centres for Disease Control and Prevention 2017).

Symptoms of the disease include fever, muscle aches, nausea, and diarrhoea. When the infection spreads to the nervous system, headaches, and even meningitis, stiff neck, confusion, loss of balance and convulsions may be experienced. Pregnant women may also experience mild flu-like symptoms. In pregnant women, the consequences of the disease are as severe as they can lead to miscarriage, premature delivery, and adverse infection of the new-born and even still birth (CDC 2017).

1.2 Problem statement

The disaster risk equation/formula is:

$$R = \frac{HxV}{C}$$

(Leiter 2017)

Wherein the following:

- R is Disaster-risk**,** H is Hazard, V is Vulnerability and C is Capacity

The equation is based on the premise that the risk of disaster is a product of the degree of a hazard and degree of people's vulnerability over their capacity to cope with the combination of both forces. Therefore, the risk of a disaster can be reduced when people have got the necessary capacity to cope. Such capacity includes effective warning systems, effective preparedness measures, effective preventative measures, and effective planning practices (Medecins Sans Frontieres 2013).

Similarly, the listeriosis outbreak in South Africa is a function of the hazard (the bacteria Listeria monocytogenes) and vulnerability (people at high risk of getting infected with listeriosis such as alcoholics, pregnant women, neonates, unborn babies, elderly people, people with compromised immune systems e.g. those with HV/AIDS, and people with chronic conditions such as cancer and kidney patients). The capacity to cope will include preparedness measures such as planning, vulnerability assessments, warning systems, public education and training and response mechanisms amongst others (Centre for Management of Environment & Disasters 2014).

The listeriosis outbreak became of critical health concern because according to the WHO), South Africa's epidemic is the largest ever outbreak of the bacterial disease (World Health Organisation 2018). According to a report by the National Institute of Communicable Disease of September 2017, in Gauteng alone, the incidence rate of the disease had escalated from two per million to eight per million since January 2017. At 12 cases per million, the City of Johannesburg had recorded the highest incidence rate of the disease (National Institute of Communicable Diseases 2017).

The study was stimulated by a surge in the listeriosis morbidity and mortality rates. As of June 2018, the National Institute for Communicable Diseases (NICD) reported that there were 1 049 laboratories confirmed listeriosis cases and 209 lives had been claimed by the disease. In Gauteng province alone, 386 cases were reported with 106 fatalities (National Institute of Communicable Disease, 2018:3). Such a listeriosis outbreak of this magnitude is the first of its kind in South Africa and the highest ever recorded worldwide. As such there are no documented studies in South Africa to ascertain the level of knowledge, attitudes and practices of health care practitioners in health care institutions and particularly clinics as first responders to the epidemic.

Given the background on the status of the listeriosis outbreak in South Africa, a research on the clinics' knowledge, attitudes, practices and behaviours to the outbreak will be crucial in order to reduce future morbidity and mortality rates. Moreover, clinics are the first health contact interface before cases can be escalated to hospitals. Practical and feasible solutions as a result of the research can be generated in order to prepare for and reduce the effects of the outbreak.

1.3 Research objectives

The aim of the research was:

- To assess the extent of knowledge, attitudes, practices & behaviours of healthcare practitioners in region C government clinics to listeriosis

The objectives of the research were:

- To establish the level of the healthcare practitioners' knowledge on listeriosis with regards to sources of contamination or infection, mode of transmission, signs and symptoms, diagnosis, treatment and preventive mechanisms.
- To establish the precision of healthcare practitioners' attitudes, practices and behaviours towards listeriosis
- To determine the clinics' awareness and participation in preventing transmission of listeriosis
- To come up with feasible, realistic and sustainable preparedness strategies and solutions to the listeriosis outbreak for the clinics.

1.4 Research questions

The research sought to respond to the following questions:

- What are the knowledge, practices and attitudes of the clinic staff towards the listeriosis disease?
- To what extent are the clinics well equipped to deal with the listeriosis outbreak and how effective is this?
- What strategies can be considered for adoption in order to enhance the clinics' preparedness to the listeriosis outbreak in order to reduce listeriosis vulnerability and minimise the risk of the hazard and hence reduce listeriosis morbidity and mortality rates?

1.5 Ethical considerations

1.5.1 Ethical approval from institutions.

The ethics applications and approvals progressed as follows from various institutions before data collection could commence:

- Application for ethics approval from the University of Free State: June 2018
- Application for ethics approval from the University of Witwatersrand:4 June 2018
- Ethics approval letter from the University of Witwatersrand: 22 August 2018

- Application for ethics approval to the National Health Research Database (NHRD): August 2018
- Ethics approval letter from the NHRD Johannesburg Health District Research Committee:29 November 2018
- Application to the City of Johannesburg Health Department to conduct the study in Region C clinics: 12 December 2018
- Approval letter from the City of Johannesburg Health Department to access the clinics:8 January 2019.
- Application to the City of Johannesburg Regional (Region C) Health Department to access the clinics: 14 January 2019
- Approval letter from City of Johannesburg Regional (Region C) Health Department to access the clinics: 18 January 2019.
- Ethics approval letter from the University of Free State: 22 January 2019.

1.5.2 Ethical considerations during data collection

The researcher strived to ensure that the participants were protected from any kind of psychological harm or stress that might be triggered by the nature of some questions. To mitigate this, the health staff were briefed about the nature and scope of the research so that they could be psychologically prepared to participate in the research (Leedy and Ormrod 2005:101). To this end, study information sheets adopted from the University of Witwatersrand outlining the objectives of the study, the nature of the questions in the questionnaires, the duration of completion of the questionnaires, voluntary participation in the study, confidentiality and anonymity and contact details of the researcher and supervisor for further clarity were provided to the participants.

Verbal informed consent was obtained from the participants first before they could partake in the research. The consent was basically an acknowledgement of the understanding of the contents of the study information sheet and the rights of the participants to decide to participate or not in the research (Leedy and Ormrod 2005:102).

1.6 Research methodology

1.6.1 Study areas

Roodepoort is regarded as a city in Johannesburg in the Gauteng province of South Africa. In Afrikaans, Roodepoort means red valley which is an inference to the red soil in the area The GPS Coordinates of Roodepoort are: 26.1143 S, 27.8902 E. Roodepoort has a population

density of 2021 persons/km2. The 2011 census put Roodepoort's population at 326,416 people with young people (0-14 years) constituting 21.3% of the population, the working age group (15-64 years) being 73.3% and the elderly people (65 years and above) making up 5.4% of the population (Statistics South Africa 2011).

The racial composition of Roodepoort according to the 2011 census is highlighted in table 1.1. below.

Table 1.1: Racial composition of Roodepoort population (2011 Census)

	Racial composition
Black African	51,4%
Coloured	8,2%
Indian/Asian	4,0%
White	35,4%
Other	0,9%

Source: Statistics South Africa 2011

Figure 1.1: Map of Roodepoort

Source: Map Data Afri GIS 2018

The clinics in Roodepoort classified under Region C, are nine. For the purpose of this study two clinics namely Biokinetics Centre and HIV/AIDS Information Centre were excluded as they offer biokinetics and HIV/AIDS related services only. Florida clinic, though it offers primary

health care services was also excluded from the study since it was closed pending completion of infrastructure upgrades. Therefore, the six clinics that formulated part of the research were Davidsonville, Helderkruin, Rex, Roodepoort West Princess Clinic, Weltervreden Park and Zandspruit clinics as they offer the essential elements of primary health care (Region C clinics 2018).

1.6.2 Research design

Descriptive research methodology was used for the purpose of this research. A fusion of quantitative and qualitative data collection methods that includes surveys with open and closed questions, key informant interview, observation and secondary data analysis were used. This entailed gathering mainly quantitative data that describes the knowledge, attitudes, practices and behaviours of clinic staff towards the listeriosis outbreak and then analysing and interpreting the data. In so doing, the findings of the research were used to ascertain health practitioners' precision on the disease. The rationale behind this was inductive generalisation i.e. inference of the results from the sampled population to a wider population (Leedy and Ormrod 2005:183).

1.6.3 Sample size and sampling

Data on the number of health care practitioners in each clinic was provided by the operation manager of each facility. The total number of health practitioners in the six clinics was 69. Based on the population size of 69 healthcare practitioners, the sample size of the study was calculated using an online sample size calculator that recommended a sample size of 59 for a confidence level interval of 95% and 5% margin of error (Qualtrics: 2018).

Probability sampling was used for the purpose of this study. With probability sampling, all the subjects in the study population will have an equal chance of being selected. Probability sampling has the advantage of limited bias as each sample has an equal chance of being selected (Showkat 2017). The specific probability sampling technique that was used was proportional stratified sampling. The sample size in each clinic was calculated using the same sampling fraction to ensure that this was representative of the entire population size. The sample sizes per clinic are indicated in table 1.2 below and participants were then randomly selected from each clinic (Leedy and Ormrod 2005:203).

Table 1.2: Sample size per clinic

No.	Clinic	Population size of health practitioners per clinic	Sample size per clinic	Actual number of participants to date
1	Zandspruit	21	18	18
2	Helderkruin	10	9	9
3	Princess	13	11	11
4	Weltervreden	7	6	6
5	Davidsonville	9	8	8
6	Rex Street	9	8	8
	Total	**69**	**60**	**60**

1.6.4 Data collection

Data collection and management entailed the following steps:

- **Identification of data that needed to be collected:** The data that was identified for collection included:

  - the incidents statistics of suspected listeriosis cases that had been referred for laboratory testing and those confirmed positive for the disease and those referred to hospitals.

  - information on the knowledge, practices, attitudes and behaviours of the clinic staff towards the listeriosis disease

  - listeriosis outbreak plan to deal with the disease and adherence thereof (HRSA HIV/AIDS Bureau (HAB): 2008).

- **Identification of data sources:** In view of the data that needed to be collected, the primary sources of data were identified as follows: health practitioners in the 6 clinics in Roodepoort and the Deputy Director of Public Health for the Department of Health City of Johannesburg as the key informant. Document review of the Department of Health City of Johannesburg epidemic control plan, preparedness and clinical guidelines on listeriosis diagnosis and treatment was done. The National Institute of Communicable Diseases (NICD) was also utilised as a data repository of the morbidity and mortality rates of listeriosis (Showkat 2017). The secondary sources of data used for literature review included journals, books and media articles in order to gain more insights on the research topic.

- **How the data was collected:** The data was collected using the following tools: self-administered questionnaires, key informant interviews and observation checklist. This

three-pronged approach of tools eliminated bias by way of triangulating the information (HRSA HIV/AIDS Bureau (HAB).2008). Some of the questions on the questionnaires and checklist were adopted from existing literature and this was acknowledged in the referenced.

- ✓ ***Self-administered questionnaires:*** Given the hectic schedules of clinics in providing primary health care to the public, self-administered questionnaires were provided to staff who consented to participate in the study in order not to interrupt the flow of duties at the facilities. This type of questionnaire offers advantages such as: respondents completing the tool at their own time, anonymity of respondents and hence the latter would feel not judged on the responses that they provided and there is no element of influence from the interviewer. The disadvantages with this tool are that respondents might be selective about what they want to answer and the interviewer cannot probe to get clarity on certain issues (Meadows 2003: 562). Within the questionnaire were closed and open-ended questions to solicit respondents' views and opinions on the knowledge, attitudes, practices and behaviours towards the listeriosis outbreak. Some of the responses for closed questions were weighed using the Likert Scale. Open ended questions were used to obtain clarity or seek more information on the responses provided. The closed questions have advantages such as: ease of response, comparison of responses (Meadows 2003: 565). They also provide and easy coding of responses to facilitate statistical analysis.

  The major disadvantage of closed questions is that respondents are forced to answer questions based on the options provided. To counter this, the open-ended questions were used to enable respondents to provide more information on the questions and hence ascertain the standpoint of the respondents. The disadvantages of open-ended questions is that some respondents might be reluctant to complete such questions as they can be tome consuming to complete (Meadows 2003: 565).

  Data analysis was done using Statistical Package for the Social Sciences (SPSS) and MS Excel. Qualitative data was analysed using key thematic areas.

- ✓ ***Key informant interviews***: The key informant interview was conducted with the Deputy Director of Public Health for the Department of Health City of Johannesburg. This was in the form of a face to face interview to get more in-depth

information about measures that were put by the Department of Health City of Johannesburg in supporting the clinics during the listeriosis outbreak. The main advantage of the key informant interviews was getting information from the subject experts or people who have an in-depth understanding of the issue (Better Evaluation 2014).

- ✓ ***Observation Checklist:*** This involved observing the information, education and communication resources available on the listeriosis disease, reviewing of documents and gathering statistical data on the number of clinic staff, suspected cases of listeriosis registered and those referred to hospitals or for laboratory confirmation. The advantages of using checklist was that it provided evidence to support claims made by the respondents (Showakat 204).

1.6.5 Data validation and data quality

Validity measures how well the data collection tool or the information gathered measures the aim and objectives of the research (The Association for Qualitative Research, 2018). In order to validate and establish the quality of the research instruments as well as data that would be obtained from the tools, the latter were reviewed by two health sciences research ethics committees. University of Free State and University of Witwatersrand as well as the National Health Research Database (NHRD).

1.6.6 Data analysis and reporting

Quantitative data from the questionnaires was analysed through the use of MS Excel and SPSS 16.0 i.e. Statistical Package for Social Scientists. With SPSS descriptive and inferential statistical data was generated. The results from the data analysis was summarised through charts, tables, percentages and frequencies (Mouton 2001:144). After data analysis, the information was synthesised into a report in order to present the facts gathered.

1.7 Limitations

The research topic was health related, aimed at health staff. As a result, the main limitation encountered was the long bureaucracy with the authorities in obtaining ethical clearance for field work. Approval had to be sought from the ethics committees of the University of Free State, University of Witwatersrand, NHRD, City of Johannesburg Health Department and the

Regional City of Johannesburg Health Department. This clearance process took about 8 months before final approval could be granted.

There are 7 clinics under Region C in Roodepoort. However, only 6 clinics participated in the study, as Florida Clinic was closed for infrastructure upgrades.

CHAPTER 2
LITERATURE REVIEW

2.1 Listeriosis disease

2.1.1 Sources of listeriosis infection

Listeriosis is a disease caused by ingestion of food contaminated with Listeria monocytogenes bacterium. The bacterium is found anywhere in the food chain i.e. from soil, water, vegetation, animals and ultimately to humans upon consumption of infected food and therefore is difficult to evade. The foods that have been hugely associated with this bacterium include ready to eat meat products, deli foods, soft cheese and smoked fish (World Health Organisation 2018). Mother to child transmission of the disease occurs through the following: (a) the placenta as a result of maternal circulation (CDC 2016), (b) through breathing amniotic fluid that has been infected with the bacterium (Lamont *et al*. 2011:5) and (c) during child birth as a result vaginal colonisation caused by the spread of bacteria from the lower gastro-intestinal tract to the vagina (Lamont *et al*. 2011:5).

2.1.2 Population groups that are vulnerable to listeriosis

The population groups that are at high risk of being infected with listeriosis are:

- Pregnant women (WHO 2018).
- Unborn babies (CDC 2016).
- New-born babies (CDC 2016).
- Elderly people (WHO 2018).
- People with compromised immune system (e.g. those with cancer, leukaemia, HIV/AIDS, kidney transplants, steroid therapy) (WHO 2018).
- People with chronic conditions (e.g. liver disease, kidney disease, diabetes or cancer) (CDC 2016).
- People with alcoholism (CDC 2016).

2.1.3 Signs and symptoms of listeriosis

Listeriosis presents itself in two types i.e. non-invasive and invasive. The non-invasive listeriosis is largely associated with healthy individuals and presents itself in the mild form. The

signs and symptoms of this type of listeriosis include diarrhoea, fever, headache and muscle pain (WHO 2018).

The invasive listeriosis affects disease vulnerable population groups such as pregnant women, the elderly, unborn babies, new-born babies, and people with compromised immune system (e.g. those with cancer, HIV/AIDS and organ transplants). It also affects people with alcoholism (Sloan-Gadner 2014:47). Invasive listeriosis leads to a 90% hospitalisation rate (Sloan-Gadner 2014:47). This type of listeriosis has a mortality rate of 20-30% as it is more aggressive in the signs and symptoms which include fever, muscle aches, septicaemia and meningitis (WHO 2018). According to the CDC (2016), the signs and symptoms of invasive listeriosis further depend on whether one is pregnant or not.

Pregnant women experience symptoms that mimic flu such as exhaustion, weakness and muscle pain. The consequences of listeriosis in pregnant women are dire as they can result in miscarriages, stillbirths, premature births of babies and severe infections in new-borns. In non-pregnant women, invasive listeriosis is characterised by headache, stiff neck, confusion, loss of balance or difficulties in walking, seizures, and fever and muscle pain.

2.1.4 Laboratory detection of listeriosis

According to the WHO (2018), listeriosis can be detected through the following specimens:

- Blood
- Cerebrospinal fluid
- Placenta
- Faeces of new-born babies
- Foetuses in the event of abortion

The CDC further stipulates that the diseases can also be detected or diagnosed through the amniotic fluid and other sterile body fluids (CDC 2014: 1).

2.1.5 Treatment of listeriosis

The WHO is clear that the disease can be treated with antibiotics and this is especially so for serious symptom such as meningitis. Mother to child transmission of the disease during pregnancy can be prevented by prompt uptake of antibiotics (WHO 2018).

2.1.6 Prevention of listeriosis

At household level, the basics of safeguarding oneself and others from getting infected with Listeria monocytogenes are appropriate hygiene, storage and food handling practices (Food Standards Australia New Zealand 2018). According to the WHO (2018) there are 5 basic principles to safe food that should be used in preventing food-borne diseases including listeriosis and these are:

1. **Keeping clean:** This is through the following methods that will eliminate or minimise the transfer of bacteria to food:

- Thoroughly washing hands before handling food
- Thoroughly washing hands before preparing food
- Thoroughly washing hands after using the toilet.
- Thoroughly washing and sanitising food preparation surfaces and equipment
- Safeguarding the kitchen spaces and food from insects, pests and animals (WHO 2018).
- Cleaning the refrigerator. Failure to clean the refrigerator will promote a conducive environment for the growth and multiplication of the bacteria and contamination of other foods (U.S. Food & Drug Administration 2017).

2. **Separating raw and cooked:** Raw foods such as meat, poultry, sea food and their liquids therein can harbour bacteria that can be transmitted to other foods at the time of food preparation and storage. It's necessary to circumvent contact between raw and cooked food so that there is no transfer of bacteria amongst foods. This can be done through:

- Separating different foods e.g. Separating raw meat, poultry and seafood from other foods.
- Utilising different utensils, equipment and food preparation surfaces for handling different foods e.g. using different cutting boards for different foods e.g. Meat and vegetables.
- Storing food in different containers to avoid cross contamination between raw and prepared foods (WHO 2018).

3. **Cooking food thoroughly:** The basis for high cooking temperatures and thorough heating is to destroy many microscopic organisms that may be inherent in the food. Cooking food thoroughly entails:

- Thoroughly cooking food and particularly meat, poultry, eggs and seafood.
- Ensuring that foods such as soups and stews boil to 70°C and ensuring that meat (especially pork) is cooked until it has no strains of the pink colour
- Thorough warming of cooked food before eating it (WHO 2018).

4. **Keeping food at safe temperatures:** The rationale behind ideal food storage temperatures and conditions is that the bacteria flourishes over a wide temperature range i.e. between -5 degrees Celsius and 45 degrees Celsius with 30-37 degrees Celsius being the most ideal range for the growth of the bacteria (Kasalica *et al*. 2011:1069). Keeping food at safe temperatures entails:

- Not thawing frozen food at room temperature (WHO, 2018). Defrosting food in the refrigerator or microwave is highly recommended (Food Standards Australia New Zealand 2018).
- Not storing food for a prolonged duration in the refrigerator (WHO, 2018). Refrigerated fresh-cut deli meats should be consumed within 3-5 days of being opened. On the other hand, left-over food should be covered and put in the fridge within two hours and consumed within three to four days. Refrigerated fruits and vegetables should not be kept for more than seven days (Brind'Amour, 2017).
- Serving food at the right temperature i.e. keeping cooked food piping hot (more than 60°C) prior to serving (WHO 2018).
- Refrigerating all cooked and perishable foods promptly and ideally below 5°C. In so doing, food is stored at the recommended or ideal temperature (WHO 2018).
- Not leaving cooked food at room temperature for longer than 2 hours (WHO 2018).

5. **Using safe water and raw materials:** This entails:

- Using safe water or water that has been treated to make it safe
- Thoroughly washing fruits and vegetables before eating them and particularly so if they are eaten raw
- Complying with the expiry dates of foods and therefore not eating foods past their expiry dates.
- Choosing and consuming fresh and wholesome foods
- Selecting foods processed for safety such as pasteurised milk and milk products hours (WHO 2018).
- Keeping abreast with food recalls associated with listeriosis outbreaks: This will help reduce the risk of being infected and promote better food handling, preparation and storage practices (Brind'Amour 2017).

According to the WHO (2018) people at high risk of contracting listeriosis should avoid eating the following foods:

- Unpasteurised milk and milk products
- Deli foods and ready to eat foods e.g. sausages, ham, patés, meat spreads, and cold-smoked seafood (WHO 2018).

Public education and training on foods to be avoided by pregnant women and at-risk groups is also essential. Pregnant women are at high risk of being infected with Listeria monocytogenes because of hormonal changes in their bodies that suppress their immune system. As such pregnant women should not eat the following foods:

- Ready to eat meats unless thoroughly heated before consumption (American Pregnancy Association 2018).
- Soft cheeses such as feta and brie. Pregnant women are rather advised to eat semi-hard and hard cheese such as mozzarella and cheddar cheese. Pasteurised processed cheese slices, cream cheese and cottage cheese are reportedly safe to consume (American Pregnancy Association 2018).
- Refrigerated pate or meat spreads (American Pregnancy Association 2018).
- Smoked sea food unless cooked (American Pregnancy Association 2018).

2.2 Epidemiology of listeriosis

2.2.1 Listeriosis cases in Europe

Listeriosis is under European Union surveillance because of the high morbidity, hospitalisation and mortality rates that it causes (European Centre for Disease Prevention and Control 2016:83).

According to the European Centre for Disease Prevention and Control, the number of listeriosis cases increased from 1 516 in 2011 to 2 242 in 2014 and then slightly declined to 2 206 in 2015. Across the years, the elderly people (above 64 years old) were mostly infected by the disease as between 2008 and 2015, the incidence rate in this age group increased from 56.2% in 2008 to 64.1% in 2015. Specifically, in people aged 84 years older, the incidence rate increased from 7.3% in 2008 to 12.8% in 2015 while the case fatality rate also increased from 7.5% to 19.3%. This is because of the high ageing population group in Europe (European Centre for Disease Prevention and Control 2016:83). France and Germany recorded the

highest number of listeriosis cases in 2015 with 412 and 662 cases respectively. Table 2.1 is an extract that shows the disease outbreak in countries under the European Union (EU) between 2011 and 2014.

Table 2.1: EU reported confirmed listeriosis cases: 2011 to 2015

	Number and rate per 100 000 population	
	Cases	**Rate per 100 000 population**
2011	1 516	0.36
2012	1 720	0.42
2013	1 883	0.45
2014	2 242	0.47
2015	2 206	0.46

Source: European Centre for Disease Prevention and Control 2016:82

2.2.2 Listeriosis outbreaks in Europe

Table 2.2 also summarises outbreaks of listeriosis and of Listeria gastroenteritis in Europe during1990-2002. During that period, France recorded the highest number of listeriosis outbreaks. Milk dairy products (cheese in this case) was mostly the incriminated food leading to the disease (de Valk *et al.* 2005:254).

Table 2.2: Reported outbreaks of listeriosis and of listeria gastroenteritis in Europe: 1990 to 2002

Year	Country	Observed cases	Incriminated food
1992	France	279	Pork tongue in jelly
1992	Spain	24	Unknown
1992	Norway	6	Sliced cold meat
1993	France	38	Rillettes (pork meat)
1993	Italy	18 gastroenteritis	Rice salad
1994-1995	Sweden	9	Gravid trout
1995	France	36	Cheese (raw cow's milk)
1995	Iceland	5	Unidentified
1996	Denmark	3 gastroenteritis	Unidentified
1997	France	14	Cheese (raw cow's milk)
1997	Finland	5	Cold-smoked rainbow trout
1997	Italy	1566 gastroenteritis	Corn salad

1998-1999	Finland	25	Butter
1999	English and Wales	5	Cheese /cheese salad/sandwiches
1999	France	3	Cheese (raw cow's milk)
1999-00	Finland	10	Vacuum packed fish products
2000	France	32	Pork tongue in jelly
2000	Portugal	1	Cheese
2000	Spain	15	Undetermined
2001	Belgium	1 t 2 gastroenteritis	Ice cream cake
2002	France	11	Spread raw sausage

Source: de Valk *et al.* 2005:254

2.2.3 Listeriosis cases in USA

In 2001, the USA added listeriosis to the list of nationally notifiable diseases because of the high morbidity and mortality rates it causes. The Listeria Initiative is the national surveillance system used to gather data on laboratory -confirmed cases of listeriosis in that county. The main purpose of the Listeria Initiative is to expedite the reaction time between listeriosis outbreak detection and public health intervention (CDC 2016: 1).

Table 2.3 summarises results of the Listeria Initiative for the period 2010 to 2014. Listeriosis resulted in high morbidity rates that totalled 3 101 cases with the cases on an upward trend from 87% in 2010 to 98% in 2014. The median age of invasive cases not associated with pregnancy was above 70 years. Non-pregnancy related invasive cases were at an average of 95%, hospitalisation rate was at an average of 92% and mortality rate was at an average of 20% (CDC, 2010, 2011, 2012, 2013, 2014).

An average of 12% pregnancy associated listeriosis cases was also reported. The magnitude of the impact of infection was also seen in the infant and foetal deaths recorded that were at an average of 4% and 23% respectively across the years (CDC 2010, CDC 2011, CDC 2012, CDC 2013, and CDC 2014).

Table 2.3: National listeriosis surveillance metrics by year, Listeria Initiative: 2010 to 2014

	2010	2011	2012	2013	2014
Number of state jurisdictions that reported the outbreak including the district of Columbia	**42**	**47**	**44**	**44**	**48**
Number of cases reported	577	621	582	646	675
Number of invasive cases	496 (87%)	590 (95%)	566 (97%)	633 (98%)	660 (98%)
Invasive cases not associated with pregnancy					
Number of cases	496	533 (90%)	492 (87%)	565 (89%)	564 (85%)
Median age of patients (in years)	72	71	70	72	70
Hospitalised patients	94%	94%	93%	91%	89%
Patients that died	20%	22%	16%	21%	23%
Pregnancy associated listeriosis cases					
Number of cases	72 (13%)	57 (10%)	74 (13%)	68 (11%)	96 (15%)
Live birth, infant died (for known cases)	3%	4%	4%	3%	6%
Foetal death	22%	26%	21%	21%	24%

Sources: CDC 2010, CDC 2011, CDC 2012, CDC 2013, CDC 2014

2.2.4 Listeriosis outbreaks in USA

Several listeriosis outbreaks occurred between 2010 and 2017. Most of the outbreaks were mainly attributed to milk products purchased and/ or consumed in private homes, restaurants, hospitals, grocery stores, banquet facilities, long term homes, nursing homes, assisted living facilities and farms (CDC National Outbreak Reporting System (NORS) 2018). The 5 outbreaks in 2011 resulted in the highest illnesses (168 people), highest hospitalisation (150 people) and highest deaths (35 people). Table 2.4 below is a summary of the outbreaks.

Table 2.4: Listeriosis outbreaks per year in USA

Year	Outbreaks	Illnesses	Hospitalisations	Deaths	Food vehicles
2010	5	32	29	9	Sushi, celery, pasteurised Mexican style cheese, ice cream

2011	5	168	150	35	Pasteurised ackawi cheese, pasteurised chives cheese, pasteurised Mexican style cheese, unpasteurised blue vein cheese
2012	4	36	34	5	Ricotta salata cheese
2013	10	86	77	16	cheese-le frère, Latin style soft cheese, pasteurized Mexican style cheese, frozen vegetables, hummus
2014	13	75	70	17	peaches, nectarine, mung bean sprouts, caramel apple, pasteurized Mexican style, cheese, milkshake, sprouts, raw milk, smoked fish, Mexican cheese (queso fresco and/or other)
2015	4	61	51	4	sour cream, pre-packaged lettuce, pasteurized American cheese,
2016	2	15	14	3	unpasteurized artisanal soft cheese,
2017	7	28	27	3	pasteurized cheese, unspecified queso fresco, caramel apple

Source: CDC NORS 2018

2.2.5 Listeriosis cases in Australia

Listeriosis was declared a notifiable disease in Australia in 1991.Consequently, it has a repository of documented listeriosis outbreaks through its National Enhanced Listeriosis Surveillance System (NELSS) that was established in 2010. Prior to this system, the disease was tracked through the National Notifiable Diseases Surveillance System (NNDSS) and in the OzFoodNet Outbreak Register or an outbreak case management system when it was considered an outbreak.

Table 2.5. Summarises cases of invasive listeriosis reported by NELSS between 2010 and 2013. During that period, Australia recorded 305 listeriosis cases with 85% of the cases being older than and 50 years of age and the median age was 71 years. The statistics also showed how at-risk groups such as those suffering from diabetes, heart disease, kidney and cancer are vulnerable to the disease as 81% of those infected had the afore-mentioned conditions. 94% of the infected people were admitted in hospital and 14% of the patients died. Pregnancy

related conditions accounted for 6% of the cases and of these, 5 foetal deaths and two still-births or death soon after birth were recorded (Sloan -Gadner 2014:56).

Table 2.5: Human invasive listeriosis cases by year: 2010 to 2013

Year	Number of human invasive listeriosis cases
2010	72
2011	68
2012	92
2013	73
Total	**305**

Source Sloan-Gadner 2014:56

2.2.6 Listeriosis outbreaks in Australia

The severity of listeriosis is also evidenced through the outbreaks that occurred as summarised in table 2.6 below for the period 2009 to 2013. These outbreaks were mostly as a result of consumption of cheese and RTE foods.

Table 2.6: Outbreaks of infection with Listeria monocytogenes reported by year of onset of the first case, Australia: 2009 to 2013

Year	Invasive cases	Deaths reported during the outbreak (including foetal deaths)	Foods implicated
2009	16	4	Cooked chopped chicken Chicken wraps
2010	15	6	Melons Cold meat
2012	3	1	Smoked salmon suspected
2012-2013	34	7	Cheese (brie/camembert)
2013	6	1	Profiteroles Pre-prepared frozen meals

(NSW Government 2017)

2.2.7 Listeriosis cases in Africa

The documented cases of listeriosis in Africa are few. They are shown to be from only four countries namely Algeria, Tunisia, Namibia and South Africa. Algeria reported 7 cases of the disease (Ramdani-Bouguessa and Rahal 2000: 108). During the period 2000 to 2008. Tunisia recorded 7 cases of listeriosis that included 5 new-borns and 2 infants. There was one fatality of a new-born while the rest recovered after going through antibiotic treatment (Elbeldi, A.*et al.* 2010:58). Namibia recorded its first listeriosis case in March 2018 (World Health Organisation, 2018).

2.2.8 Listeriosis cases in South Africa

Listeriosis had been a rare occurrence in South Africa up until the period January 2017 to June 2018, when 1 049 people were infected and 209 of those died (National Institute of Communicable Disease 2018:2). The National Institute for Communicable Diseases (NICD) is the surveillance system used to report on listeriosis and other communicable diseases. The cases of the disease reported historically are illustrated in table 2.7 below.

Table 2.7: Laboratory confirmed cases of listeriosis in South Africa

Period	**No. of laboratory listeriosis confirmed cases**	**No. of deaths**
August 1977- April 1978	14	6
2013	9	*Data not available*
2014	25	
2015	40	
2016	42	
January 2017- June 2018	1 049	209

Source: Manganye *et al.* 2018:55-56

2.2.9 Listeriosis outbreaks in South Africa

2.2.9.1 Listeriosis outbreak in 1977

The first documented outbreak of listeriosis in South Africa was in 1977. Between August 1977 and April 1978, 14 cases of the disease were reported in Johannesburg at Baragwanath

Hospital (McCarthy 2018). The 14 patients comprised of 5 adults and 9 infants. The 5 adults and mothers of the 9 infants resided in Johannesburg and Soweto. The 14 patients presented systematic infections caused by the bacteria Listeria monocytogenes. Systematic infection refers to infection that is spread throughout the body and hence affects the entire body. In particular, the infants presented with septicaemia and/or meningitis while all the 5 adults had meningitis. Six of the patients (2 adults and 4 infants) eventually died from the disease. Four of the patients died within 3 days of birth or admission to the hospital. The Listeria monocytogenes bacteria was isolated using blood culture and cerebrospinal fluid. Furthermore, vaginal and cervical swabs on two of the infants' mothers confirmed maternal carriage of the bacteria. Five of the infants were born with a low birth weight of less than 2.5kgs. Two of the 5 adults were found to have been more susceptible to the infection by virtue of one of them being malnourished and the other being an alcoholic. This outbreak in a way demonstrated the groups that were likely to be infected with listeriosis i.e. the infants and those with compromised immune system (Jacobs *et al.* 1978: 389-392).

2.2.9.2 Listeriosis outbreak in 2017-2018

a. Listeriosis outbreak at national level

The source of the listeriosis outbreak in South Africa in the 2017-2018 outbreak was identified as polony which is processed RTE meat that was manufactured by the Enterprise Foods industry in Polokwane city of Limpopo province. The investigation process which took about 14 months eventually led to the recall of the RTE products in March 2018 (National Institute of Communicable Disease 2018:1). Of the new laboratory confirmed cases in March 2018, 62% of the cases and/or their guardians confirmed eating polony and in many instances the Enterprise polony brand had been the most consumed one (National Institute of Communicable Disease 2018:2).

b. Listeriosis outbreak at provincial levels

Gauteng province recorded the highest number of cases of the disease (386) followed by Western Cape that had 130 cases. The breakdown of laboratory-confirmed listeriosis cases and deaths per province is summarised in table 2.8. According to the June 2018 report by the NICD, babies aged less than 28 days accounted for most of the cases at just below 450 (43%) of the 1 049 laboratory-confirmed listeriosis cases thereby signalling the severity of listeriosis on this age group and the vulnerability of pregnant women to the disease (National Institute of Communicable Disease 2018:2).

Table 2.8: Number of laboratory-confirmed listeriosis cases and deaths by province, where outcome data is available, South Africa: 01 January 2017 to 5 June 2018

Province	Outcome available (as a % of total cases in South Africa)	Number of deaths (% of those with outcome available)	Number of cases (% of total cases)
Gauteng	386 (63.2)	106 (27.5)	611 (58.2)
Western Cape	130 (98.5)	31 (23.8)	132 (12.6)
Kwa-Zulu Natal	72 (90.0)	21 (29.2)	80 (7.6)
Mpumalanga	47 (97.9)	11 (23.4)	48 (4.6)
Eastern Cape	31 (58.5)	11 (35.5)	53 (5.1)
Limpopo	50 (90.9)	11 (22.0)	55 (5.2)
Free State	30 (85.7)	8 (26.7)	35 (3.3)
North West	25 (86.2)	7 (28.0)	29 (2.8)
Northern Cape	6 (100.0)	3 (50.0)	6 (0.6)
Total	777 (74.1)	209 (26.9)	1 049

Source: National Institute of Communicable Disease 2018:3

c. Listeriosis outbreak at City of Johannesburg level

Within the City of Johannesburg were 251 laboratory confirmed cases of the disease and this was 26% of the national cases. The distribution of the cases per region is summarised in table 2.9. Region C recorded 10 cases and 1 death.

Table 2.9: Listeriosis cases and deaths per City of Johannesburg region, January 2017 to 28 March 2018

Region	Number of cases	Number of deaths
A	14	1
B	17	4
C	10	1
D	60	12
E	8	1
F	29	9
G	16	4
Unknown	97	8
Total	251	40

Source: Manganye *et al.* 2018: 56

The City of Johannesburg morbidity and mortality rates from the disease across the different age groups are summarised in the table 2.10 below. The morbidity and mortality rates were highest amongst neonates (0-28 days old) as there were 60 cases and 11 deaths. In addition, this was also found amongst the elderly (more than 61 years old) as there were 18 cases and 7 casualties.

Table 2.10: City of Johannesburg listeriosis morbidity and mortality rates

Age group	Number of laboratories confirmed listeriosis cases	Number of deaths
0-28 days	60	11
1-5 years	25	5
6-10 years	6	1
11-15 years	3	1
16-20 years	7	0
21-25 years	9	1
26-30 years	17	2
31-35 years	28	1
36-40 years	15	2
41-45 years	21	2
46-50 years	11	4
51-55 years	10	1
56-60 years	5	2
More than 65years	18	7
Unknown	16	0

Source: Manganye *et al.* 2018:55-56

2.3 Listeriosis as a disaster risk

Listeriosis as a disaster risk was firstly reviewed in the context of the disaster risk equation and then in the context of the Pressure and Release (PAR) model.

2.3.1 Listeriosis in the context of the disaster risk equation

$$R = \frac{HxV}{C}$$

(Leiter 2017)

Where R is Risk, H is Hazard, V is Vulnerability and C is Capacity

2.3.1.1 The hazard to listeriosis: Listeria monocytogenes

Listeria monocytogenes is a gram-positive rod-shaped bacterium that thrives under the following conditions/environments (Kasalica *et al.* 2011:1069).:

- with and without oxygen (Farber and Peterkin 1991:477)
- between -1.5 degrees Celsius and 45 degrees Celsius. Therefore, the bacteria can survive extreme hot and cold temperature conditions with 30-37 degrees Celsius being the most ideal range for the growth of the bacteria (Kasalica *et al.* 2011:1069).
- Water / moist conditions (U.S. Department of Health and Human Services, 2017:18).
- Neutral pH which provides ideal conditions for the proliferation of the bacteria. It can also withstand acidic and alkali conditions (Kasalica *et al*. 2011:1069).
- Excessive salty conditions (Mahendra *et al*. 2017:2).
-

Because of the diverse conditions in which Listeria monocytogenes can grow and multiply , it can survive food preservative and safety measures and hence compromise food safety and public health of people (Mahendra *et al*. 2017:2). The bacteria also display a high resistance to sanitation chemicals and measures and hence this increases the risk of food contamination during food processing. Chemicals such as iodoform peracetic and peroctanoic acid, quaternary ammonium compounds and chlorine have been proven to be effective in terminating the bacteria. Listeria monocytogenes is also resilient to UV radiation (Kasalica *et al.* 2011:1070).

2.3.1.2 Sources of Listeria monocytogenes

a. Listeria monocytogenes in water

Listeria monocytogenes infiltrates the water systems through contaminated household and industrial sewage and effluents from meat industry plants. Because of the nature of water flow in the ecosystem i.e. to underground system and to surface waters, the latter water sources also get contaminated with the bacteria. According to Tolvanen 2016:20, the bacteria is sheltered in water systems i.e. underground and surface water when the latter systems are in the confines of urban areas, crop and dairy farms and wastewaters. In food processing plants, the following promote the growth and proliferation of Listeria monocytogenes: stagnant waters,

malfunctioning drainage systems, poorly designed drainage systems that are hard to reach and clean and improperly positioned sewer lines (U.S. Department of Health and Human Services 2017:18).

Listeria monocytogenes bacteria has the distinct characteristic of surviving both extremes of temperatures i.e. hot and cold conditions. A study was conducted by Budzińska *et al.* in 2011 (2011:31) at the University of Technology and Life Sciences, Mazowiecka in Poland to determine the longevity of the bacteria in water and sewage effluents from a meat factory at 4 degrees Celsius. The study established that the survival rate was 120 days in water and 141 days in sewage. This demonstrates that the bacteria are an ever-present existence in the ecosystem and hazard to human beings and hence regular stringent monitoring of the water systems is important.

b. Listeria monocytogenes in soil

Listeria monocytogenes can be found in soil, though in small quantities. The existence of Listeria monocytogenes in soil was first proven by Welshimer and Donker-Voet in 1971. Unlike water, the survival and growth of the bacteria in soil is determined and compounded by so many components in the soil that include minerals, organic matter, plant roots, other microorganisms, viruses, and soil fauna and flora. Furthermore, the concentration of the bacteria in the soil varies with soil type and texture, the pH of the soil, water, weather and land use (Vivant *et al.* 2013:3-4). As illustrated in Figure 2.1, just like with water, soil is also a critical medium or catalyst through which plants and animals can be contaminated with the bacteria and ultimately the food products as well. Likewise, the soil gets contaminated with the bacteria through: contaminated water from the water systems, animal faeces and manure from infected animals, sewage sludge and reclaimed waste (Vivant *et.al.* 2013:1).

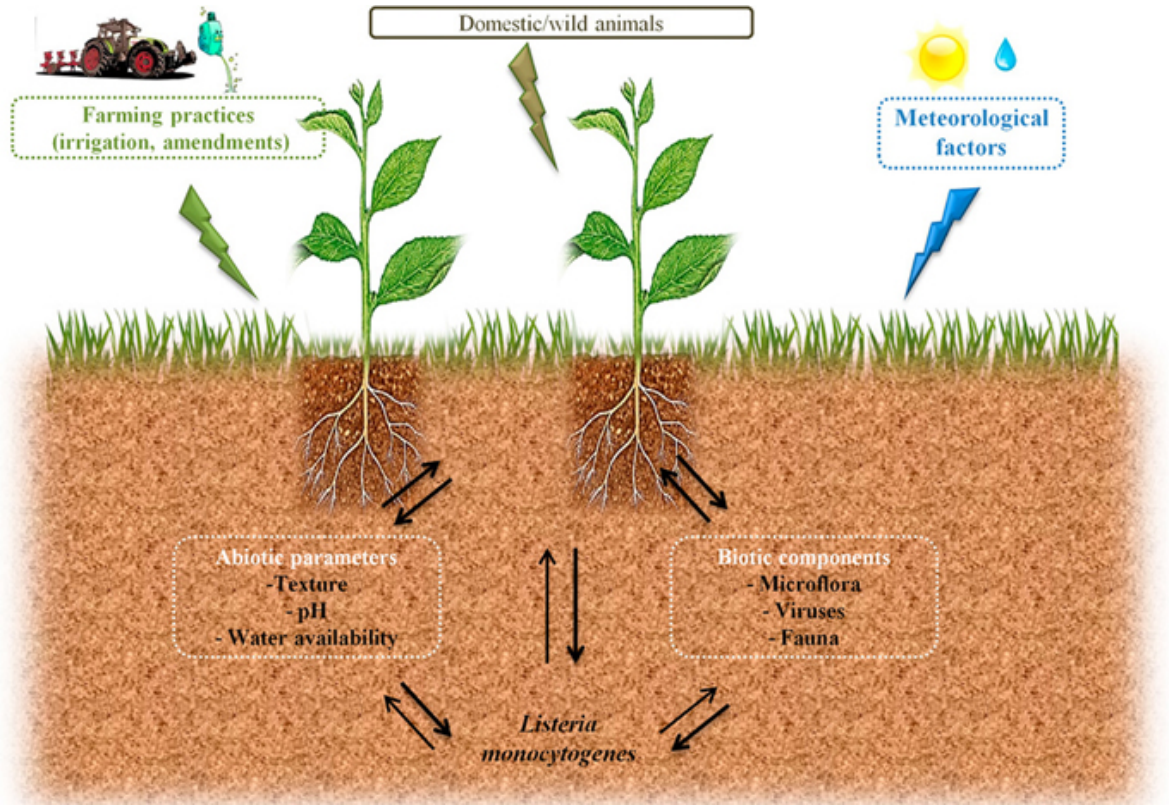


Figure 2.1: | Possible routes of transfer and circulation of L. monocytogenes in the farm environment and factors which can affect its survival in soil

Source: Vivant *et.al*. 2013:2

c. Listeria monocytogenes in milk and dairy products

Listeria monocytogenes can contaminate milk through the various stages of the food chain. Cow milk can be contaminated with the bacteria in the following ways: from the discharge that occurs after miscarriage, from diseases of the udder and from the excreta of the animals. Even healthy animals can harbour the bacterium and consequently contaminate the soil or water through excretions or even pass the bacterium through the milk (Kasalica *et al.* 2011:1071). Research has concluded that of the dairy products, soft cheeses and non-pasteurised milk are the common carriers associated with listeriosis. Many researchers in Europe have established that 2, 5-6% of raw milk samples can be contaminated with the bacteria. Based on the concentration of Listeria monocytogenes found in milk samples taken from farms and dairy plants in various countries, table 2.11 illustrates the extent to which raw milk can pose a hazard to consumers if it's not pasteurised (Kasalica *et al.* 2011:1067).

Table 2.11: Presence of Listeria monocytogenes in raw milk

Country	Sampling location	Presence of L. monocytogenes %

Estonia	Collection tank of the farm and dairy plant	37
Scotland	Collection tank of the farm	15,6
Uganda	Collection tank of the dairy plant	13
The Netherlands	Raw milk	4,38
Sweden	Silo tank of the dairy plant	19,6
	Collection tank of the farm	1
USA	Raw milk	4
Iran	Raw milk in dairy plant	1,7-3,3
Turkey	Raw milk	1,17

Source: Kasalica *et al.* 2011: 1073

Post -pasteurization of milk and dairy products production is a hazard analysis and critical control point that calls for robust and efficient sanitation practices since this is the common stage at which contamination occurs. This is because the bacterium can form fibrils which can adhere to solid surfaces thereby creating a biofilm that is resistant to degradation and therefore will continue to multiply thereby re-contaminating the food products. The development of the biofilm is prompted and perpetuated by the habitation of other bacteria on the surfaces (King *et al.* 2014:9).

The dairy products include cheese, ice-cream, yoghurt and butter. The low temperatures and even freezing temperatures that milk and dairy products are subjected to, the nutritional composition of the products as well as their inherent moisture content provides ideal conditions for the bacteria to breed and flourish. The rate of growth and development of the bacteria in the milk and dairy products also depends on the type of the product, its chemical composition and the processing and storage conditions (Kasalica *et al*. 2011: 1067).

According to Kasalica *et al*. (2011: 1073), cheese processed from unpasteurised milk, is likely to be more lacerated with the bacteria compared to cheese produced from pasteurised milk. In addition, soft cheese, by virtue of having a higher moisture content and low pH, promote the growth and multiplication of the bacteria compared to the semi-hard and hard cheese (Kasalica *et al.* 2011: 1074).

A number of factors increase the likelihood of the presence of Listeria monocytogenes in cheese and these include insufficient pasteurisation, post pasteurisation contamination, low storage temperatures, poor sanitation procedures. Intrinsically, the growth and multiplication of the bacteria in the cheese is influenced by the composition, pH, moisture content, salt

content, and storage conditions of the cheese (Kasalica *et al*. 2011: 1073). Two outbreaks in Finland in 1998 and 1999 proved that Listeria monocytogenes can be found in butter as well (Kasalica *et al*. 2011:1068). Table 2.12 is a summary of listeriosis caused by consumption of milk and dairy products

Table 2.12: Listeriosis in humans caused by consumption of milk and dairy products

Country	Period	Food Source	Total infected	Died
USA, California	June-August 1985	Soft cheese	142	48
Switzerland	1983-1987	Soft cheese	122	34
USA	2000-2001	Mexican type of soft cheese	12	5
Switzerland	2005	Soft cheese	10	3
USA	1994	Past Chocolate milk	45	0
France	1995	Fresh cheese	17	4
Finland	1998-1999	Butter	25	6
USA	2000-2001	Mexican type of soft cheese	12	5

Source: Kasalica *et al.* 2011:1068-1071

d. Listeria monocytogenes in fruits and vegetables

Listeria monocytogenes finds its way to fruits and vegetables through water and soil contaminated with the bacteria. In a cyclic fashion, the bacteria makes its presence again in the ecosystem when human beings and animals consume the fruits and vegetables and excrete into the environment or water systems. Figure 2.2 demonstrates the cycle through which the transmission process unfolds. In essence the first port of contamination is straight from the environment and the bacteria becomes inherent in the plants (Zhu *et al.* 2017:3). Root vegetables mainly get contaminated with the bacteria as a result of prolonged interaction with the soil. Vegetables also get contaminated at the pre-harvest stage as a result of application of manure from infected animals, presence of wild animals on the farms, watering the vegetables with contaminated water as well as soil cultivation (Tolvanen, 2016:21).

Contamination also occurs at the post-harvest phase as a consequence of human handling and utilisation of equipment already contaminated with the bacteria. Sterilisation of the fruits and vegetables is done through the use of UV radiation and antimicrobial agents but in some instances complete eradication of the bacteria is compounded by the resistance nature of the bacteria to different conditions (Zhu *et al.* 2017:4-5).

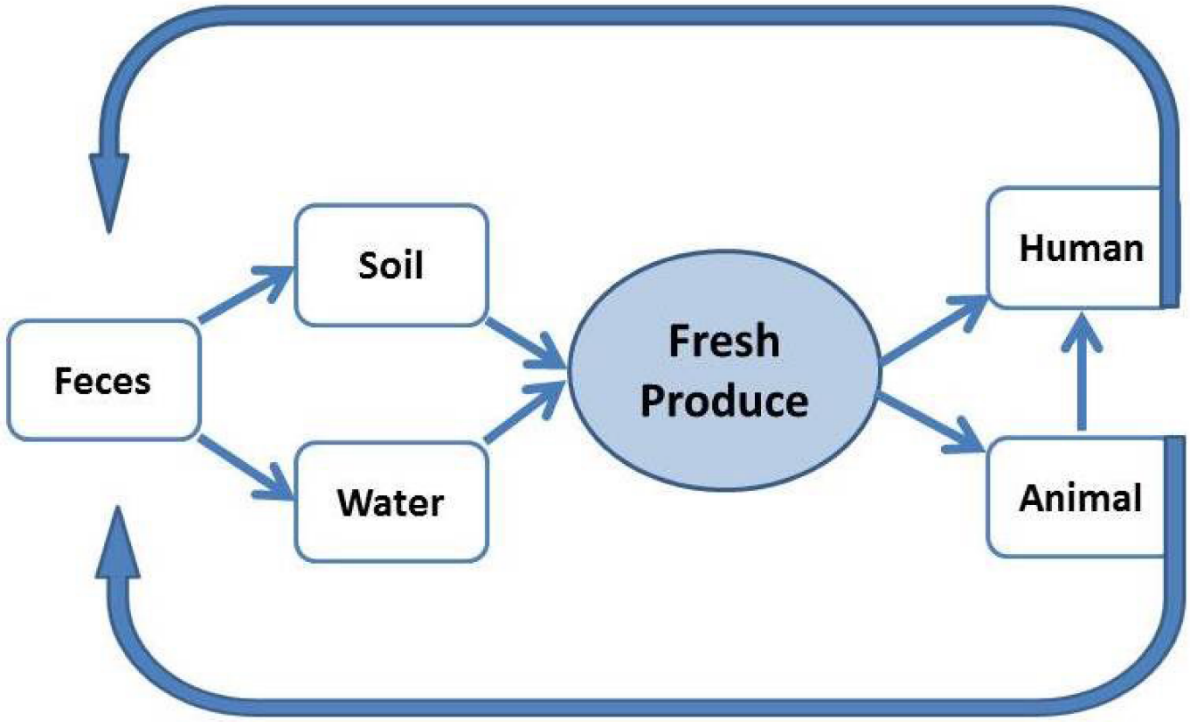


Figure 2.2. Potential pathways of L. monocytogenes transmission to humans via fresh produce.

Source: Zhu *et al.* 2017:3

Table 2.13 provides examples of the extent to which Listeria monocytogenes was present in sampled fruits and vegetables thereby also illustrating the potential dangers to humans if consumed.

Table 2.13: Selected studies that reported the prevalence of L. monocytogenes in fresh produce

Produce	**Country**	**Prévalence**
		Number of total analysed samples (number and percent of positive sample for L. monocytogenes)
Vegetables	China	140 (8, 5.7%)
Parsley	Poland	30 (3, 10.0%)
	Malaysia	16 (4, 25.0%)
	Brazil	22 (1, 4.5%)
Collard greens	Brazil	30 (1, 3.3%)
	Brazil	24 (1, 4.2%)
Lettuce	Brazil	152 (3, 2.0%)

Cabbage	Malaysia	32 (7, 21.9%)
	Brazil	11 (2, 18.2%)
Spinach	Brazil	11 (1, 9.1%)
Carrot	Malaysia	33 (8, 24.2%)
Tomato	Malaysia	32 (7, 21.9%)
Cucumber	Malaysia Greece	32 (7, 21.9%)
Sprouts	Korean	112 (1, 0.9%)

Source: Zhu *et al.* 2017:5

Table 2.14 provides examples of listeriosis outbreaks caused by consumption of fruits and vegetables (Zhu *et al.* 2017:3).

Table 2.14.: Listeriosis outbreaks associated with fresh produce

Outbreak Location	Year	Cases	Deaths	Food vehicle
Boston, USA	1979	20	3 (15%)	Raw vegetables
NOVA Scotia, Canada	1981	41	17 (41%)	Vegetable mix for coleslaw
Moncaliera and Gavieno, Italy	1997	2930	0 (0%)	Corn
Texas, USA	2010	10	5 (50%)	Chopped celery
Colorado, USA	2011	147	33 (22%)	Whole cantaloupes
Colrado, USA	2011	99	15 (15%)	Lettuce
Illinois and Michigan, USA	2014	5	2 (40%)	Mung bean sprouts
California, USA	2014	32	1 (33%)	Caramel apples
Ohio, USA	2016	19	1 (5%)	Packaged salads

Source: Zhu *et al.* 2017:3

e. Listeria monocytogenes in meat and RTE foods

Comparatively speaking, ruminants are more likely to harbour the bacteria Listeria monocytogenes than other farm animals. The majority of listeriosis cases reported in ruminants are as a result of consumption of inappropriately fermented and poor-quality silage. However even good quality silage can also be a haven of the bacteria. There is also a correlation between the pH of silage and the bacteria's presence in raw milk (Tolvanen, 2016:21).

RTE foods become contaminated with the bacteria during processing as a result of factors such as poor sanitary state of the processing plant as well as the ability of the bacteria to form bio-films on the processing equipment that can result in recontamination of the RTE foods

(Ricci *et al.*2017: 4). Furthermore, these RTE foods carry a high risk of the bacteria if there is protracted storage at temperatures ideal for the growth and proliferation of the bacteria (Sloan-Gadner 2014:47).

According to Ricci *et al* 2017:4, between 2008 and 2015, fishery products accounted for the highest (3-10%) annual non-compliance of Listeria monocytogenes at food processing sites in the European Union and RTE foods of meat origin tailed at 1-7%.

f. Listeria monocytogenes on food production equipment

Food production facility areas are also vehicles for the transmission of the food-borne pathogen as there is cross-contamination or recontamination between the food and food processing equipment (Kornacki n.d.: 2).

Research has established that RTE foods largely get contaminated from the processing environment rather than directly from the raw materials. The RTE foods mostly get contaminated during post-process handling procedures such as slicing and packaging. Listeria monocytogenes also has the ability to proliferate for years on food plant equipment such as conveyors, packaging machines and slicing machines that are usually hard to clean and this therefore leads to post-processing contamination of processed foods (Tolvanen, 2016:25).

Listeria monocytogenes also has the aptitude to strongly attach to surfaces such as stainless steel, plastic and rubber and form biofilms. The adhesive and biofilm formation traits of the bacteria enables it to have stress tenacity and allows its survival thereby contributing to the persistence of the bacteria in food processing plants (Tolvanen 2016:22).

The cross-contamination or recontamination of food may be as a result of unsanitary operating and maintenance/repair practices, and unsanitary equipment/facility design. At times despite the intensive sanitation and hygiene measures in place, the bacteria can still grow and multiply because of its competitive advantage of being able to withstand pH, temperature, salt conditions and sanitation and hygiene measures. Some parts of the food processing plants, be it equipment, walls or floors, may be difficult to access for cleaning purposes and as such can be a breeding ground for the growth and multiplication of the bacteria. Especially if it is where food particles accumulate and there are also moist conditions (Kornacki n.d.:2).

In summary, according to the South African National Institute of Communicable Diseases, based on global listeriosis outbreaks , the following foods present listeriosis risk: eggs, fruits, root vegetables, ready to eat salads, sandwich spreads/dips, mayonnaise, processed meat (biltong/sausages), meat spreads (pate, paste, brawn), chicken/poultry, hard cheese and yoghurt. The higher risk foods include: unpasteurised milk, cured or smoked sea food, cold meat (ham and polony), raw vegetables, soft cheeses (cream cheese) and cream/ ice cream (Jackson 2017).

2.3.1.3 Vulnerability to listeriosis

The different population groups that are vulnerable to listeriosis are discussed below.

a. Elderly people

According to Schewon (2015:68), the elderly people that are 65 years old and above are four times more likely to contract listeriosis than other age groups. The reason behind this is that as one grows older the immune system becomes feeble, there is a reduction in the acid levels in the stomach and more health issues surface thereby compounding one to take medication. All these factors weaken the immune system thereby increasing the elderly people's vulnerability to infection (Brind'Amour 2017).

b. People with chronic conditions and HIV/AIDS

HIV/AIDS and other chronic conditions such as cancer, diabetes, kidney and liver diseases among others compromises the immune system thereby increasing one's vulnerability to infection. Because of such conditions, these people have to take drugs such as steroids, chemotherapy, TNF-antagonists and other medications that can also compromise the body's defence mechanism against infections (Brind'Amour 2017).

In cancer patients, the combination of a cancer condition and high dosages of chemotherapy weakens one's immune system and as such makes them even more vulnerable to listeriosis (Brind'Amour, 2017). The disease is quite serious in patients with the cancer types of chronic lymphocytic leukaemia or acute lymphoblastic leukaemia (Ramsakal *et.al*. 2004).

c. Alcoholics

People with alcoholism are more prone to severe bouts of infections as chronic alcohol intake weakens the immune system. This condition heightens alcoholics' predisposition to listeriosis (Szabo 1999:832).

d. Pregnant women

Pregnant women are at high risk of contracting listeriosis as they are twenty times more likely to get the disease than other population groups (Mateus *et al.* 2013:2-3). Infection mostly occurs during the third trimester of pregnancy as at this stage because of hormonal changes the immune system will be supressed and at its weakest (Lamont *et al.* 2011:4). The consequences of the disease in this population group are dire and they include miscarriages, premature deliveries, stillbirths and maternal and neonatal sepsis (Mateus *et al.* 2013: 3). A case in point of the degree of vulnerability of pregnant women to listeriosis infection was in 1985 when 65.5% of the 142 cases of people infected with the disease were pregnant women. The source of the outbreak was traced to Mexican cheese produced from unpasteurised milk (Lamont *et al.* 2011:4).

However, listeriosis in pregnant women might be difficult to detect for the following reasons: (1) the diagnostic methods are difficult to apply, (2) the women might not display any signs and symptoms of the disease and if there is any it can be non-specific medical ones such as flu, headaches, vomiting, etc. that might not be conclusive of the disease and (3) the disease might be misconstrued for other conditions associated with the placenta (Mateus *et al.*2013: 3).

e. Unborn babies and neonates (new-borns)

L. monocytogenes can infect the fetus in the mother's womb: (1) by infiltrating the placenta through the maternal circulation and (2) through the unborn baby breathing in infected amniotic fluid (Lamont *et al*. 2011:5). The neonate can also be infected after colonisation from maternal gastro-intestinal or vaginal carriage (Bamford *et al.* 2017:9).

2.3.1.4 Capacity to respond to listeriosis

The capacities of people, communities or country to respond to a potential disaster such as listeriosis depends on their level of preparedness. The disaster preparedness framework in table 2.17 is an essential tool that outlines actions or strategies that can be taken to prepare for, respond to and minimise the impact of disasters (International Federation of Red Cross and Red Crescent Societies 2000:6).

2.3.1.5 Disaster preparedness framework

Table 2.15: Disaster Preparedness Framework

Disaster Preparedness Framework: Components of Preparedness		
Vulnerability Assessment	**Planning**	**Institutional Framework**
Information System	**Resource Base**	**Warning Systems**
Response Mechanisms	**Public Education and Training**	**Rehearsals**

Source: Centre for Management of Environment & Disasters 2014

1) Vulnerability assessment

The development and implementation of disaster preparedness strategies should be informed by a comprehensive appraisal, ranking and prioritisation of the hazards and risks that people are predisposed to and their resilience to those hazards. The vulnerability assessment should: profile the nature, rate of recurrence and likely impact of a hazard to the community; pin-point the areas and communities that are prone to and susceptible to those hazards; identify the population groups that are most likely to be affected by the hazard and assess the aptitude of the community to deal with the impact of the hazards (IFRC 2000:10).In the context of listeriosis, vulnerability assessments will include gathering and analysing data on: listeriosis incidence rates , profiling the hazard (Listeria monocytogenes bacteria) in terms of e.g. potential sources of infection and how its transmitted, the population groups that are vulnerable to listeriosis and how the disease affects them as well as the geographical distribution of the disease.

2) Planning

Preparedness planning facilitates seamless execution of response activities in the event of a disaster. Even before a disaster strikes, having a plan at hand ensures that there are fundamentals in place such as: medicines, proper communication channels and trained staff to deal with emergencies and educate the public about imminent disasters. Proper planning enhances the swiftness and effectiveness of the response to a disaster and minimises loss of lives. The planning entails establishing organisational resources, establishing the functions of human resources personnel, coming up with policies and procedures and developing preparedness activities geared towards efficient and effective disaster preparation and emergency response (IFRC 2000:11). A comprehensive preliminary plan in anticipation of a

disaster must encompass training of response personnel, and public education on disaster response strategies (IFRC 2000:13).In the context of listeriosis, this entails having a preparedness and response plan that articulates: the roles and responsibilities of different stakeholders before and during a disaster, a plan for capacity building of those stakeholders to efficiently and effectively be prepared and respond to the disaster, the public education strategies to raise awareness about the disease to the public, standard operation procedures e.g. for taking food or clinical specimens for laboratory testing and the communication protocols to follow for official communication of information.

3) Institutional framework

In order to maximise on available resources, organisations should be well-coordinated in terms of identifying who should champion executing certain tasks or providecertain resources based on their capacities in the event of a disaster. It is advisable for this level of coordination to start in the preparedness planning phase so that there are no setbacks when an actual disaster strikes. This is essential as it will minimise duplication of efforts as well as under-servicing or over-servicing people at the expense of others. The communities affected should also partake in this. (IFRC 2000:12). In the context of listeriosis, this entails the Department of Health coordinating with health affiliated civic organisations, institutions, corporates and food industries to pool resources together including human resources and also to delineate roles and responsibilities before, during and after a disaster.

4) Information system

Effective disaster preparedness and response is a function of timely collection, analysis and acting on data presented before, during and after a disaster strikes. Prior to the disaster, there should be a repository of data that explains the nature or characteristics of the hazard, how it can be detected and the early warning information to be cognisant of if it were to strike. During the disaster, data on the needs of the affected people should be promptly gathered in order to inform and respond to their immediate survival necessities. After the disaster, recovery from the disaster should be well-documented. Therefore, it's imperative that there be a data management system in place that guides or informs what type of information should be collected, how it should be collected, who should collect it, when should it be collected, who will analyse it and how it will be incorporated into fast decision-making processes (IFRC 2000:12-13).In the context of listeriosis, this entails having a wealth of information about the sources of Listeria monocytogenes, transmission routes, how it is diagnosed, detected and treated pre-disaster. During the disaster, data on the needs of the health institutions to effectively respond to the disaster is gathered. Examples are: human resources, essential medicines, clinical specimens' apparatus and emergency transport.

5) Resource base

Finance is a key resource that is mandatory in order to fund the other resources that are required such as medication, transport, human resources, and communication systems. As such there should be plans, memorandums of understanding and strategies for mobilising and obtaining emergency funds to deal with disasters. Therefore, there should also be policies and procedures to guide the acquisition and disbursement of funds as well as activating appeals for request for money (IFRC 2000:14).

6) Warning systems

People's ability to be well-prepared for disasters can be enhanced if they receive information pertaining to a disaster. Thus, early warning systems (Christian *et al.* 2017). Therefore, early warning systems serve to detect, forecast and provide alerts of imminent hazards. Early warning systems should convey factual information regarding the actual and possible risks associated with the hazard as well as preventive and protective measures that people can adopt to alleviate the impact of the hazard. Information from early warning systems should expedite decision making and response mechanisms. Early warning information can be obtained from a diverse of sources such as the government, health institutions in the case of disease outbreaks and even from newspapers, television, radio and internet (IFRC 2000:13-14).

7) Response mechanisms

The effectiveness of response to disasters can be enhanced if the preparedness plan incorporates the following strategies: recruitment and appointment of well-trained assessment teams, assessment protocols and data priorities for an emergency response, mechanisms to set up critical amenities such as mobile hospitals and logistics for obtaining medical supplies (IFRC 2000:10-11).

8) Public education and training

Public education and training are indispensable tools of empowering people with knowledge (IFRC, 2000:14). Public education and training are also essential in avoiding or minimising morbidity and mortality rates. The public should be sensitised with information pertaining to sources of listeriosis, high risk foods, vulnerable population groups, preventative mechanisms and the signs and symptoms of the disease. Public education and training of disasters should be everyone's responsibility including schools, community-based organisations, churches, non-governmental organisations, clinics, hospitals and media fraternities (U.S. National Committee for the Decade for Natural Disaster Reduction**,** 1991:19). Other forms of raising

awareness to the pubic regarding listeriosis includes pamphlets, brochures, posters, games, training videos and public service announcements or campaigns (U.S. National Committee for the Decade for Natural Disaster Reduction 1991:17).

In addition, health practitioners also need to know how to diagnose and treat the disease. The training part on listeriosis can take the form of in-service training, conferences, and workshops and can be part of the syllabus in schools and tertiary institutions. (U.S. National Committee for the Decade for Natural Disaster Reduction 1991:17).

9) Rehearsals

The robustness of a preparedness plan can be tested through rehearsing its components so that areas of improvement can be identified and rectified. Rehearsals are effective when they are conducted systematically and cut across all stakeholders involved in disaster response. Rehearsals can mirror aspects such as, stakeholder coordination meetings, logistics operations etc. (IFRC 2000:15).

2.3.1.6 Disaster Risk

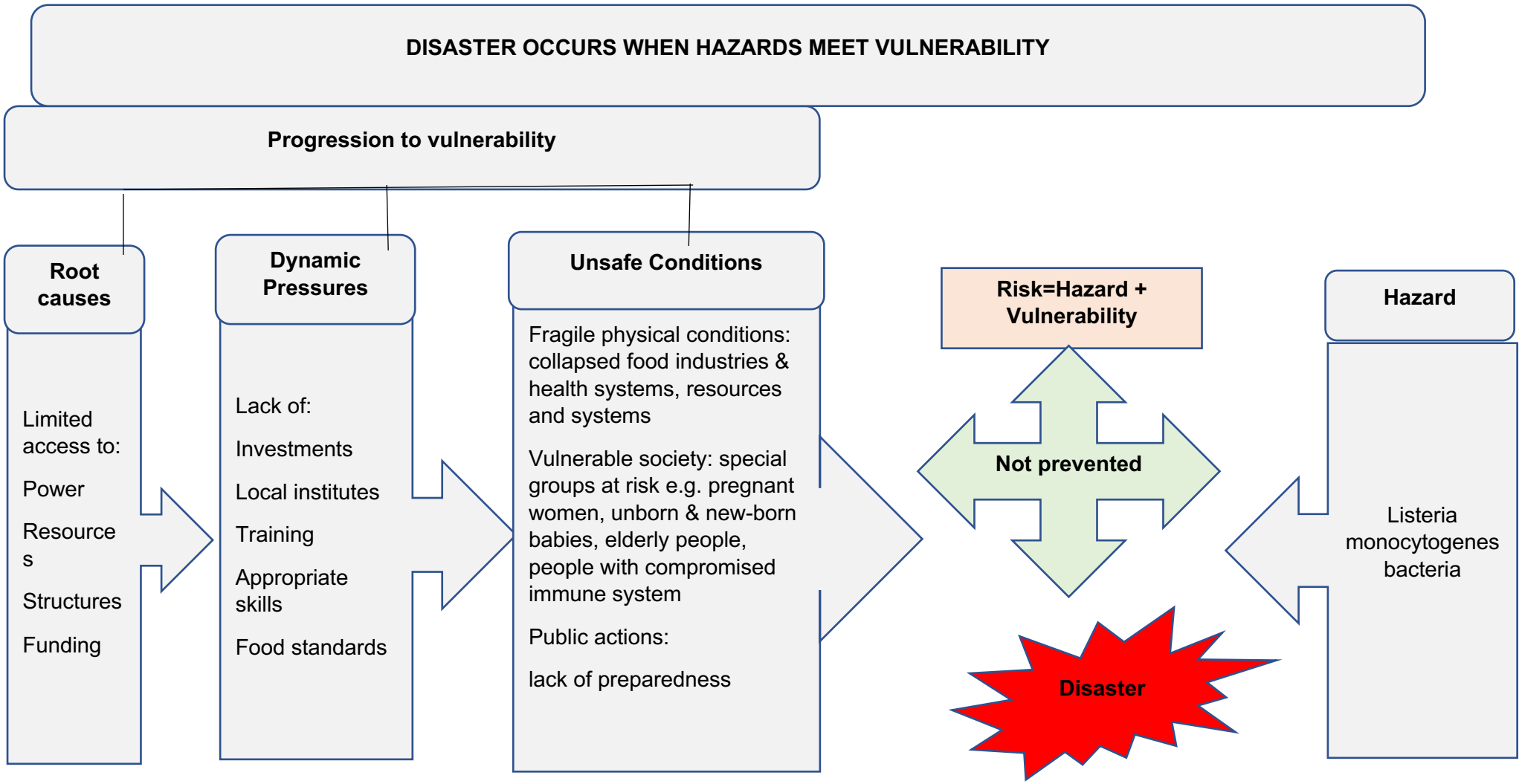
As a result of the symbiotic relationship between the hazard (Listeria monocytogenes) and the vulnerability of people (mostly based on their physiological conditions) and capacity to cope or respond to the hazard (for instance public education and training, early warning systems, resource base, response mechanisms, etc.), a disaster risk can occur. Such disaster risk is characterised by illnesses and loss of lives as highlighted under the epidemiology of listeriosis. The disease also has a negative impact on the economy. For instance, every year, food borne diseases of roughly 5.4 million cases with listeriosis included costs Australia AUD $1.2 billion. Between 2005 and 2014, Listeria monocytogenes accounted for 45% of food recalls in Australia as food got contaminated by this bacterium and especially so ready to eat meat products thereby entailing revenue loss in the food industry (Jennison *et al.* 2017:2).

2.3.2 Disaster Theory: Pressure And Release (PAR) model in the context of listeriosis

The Pressure and Release (PAR) model is an ideal model that clearly depicts that disaster is a consequence of a link between vulnerability factors and hazards. Listeriosis can be regarded as a natural disaster that caused a menace in South Africa.

The PAR model views or conceptualises vulnerability as a progression that starts as a chain reaction from root causes that then translate to dynamic pressures and ultimately unsafe conditions.

Figure 2.3: PAR model in the context of listeriosis



1. Root causes

According to the PAR model, root causes are those deeply entrenched and often "remote" influences that start the chain of vulnerability. They are remote in the sense that: (1) they could be a product of historical events, (2) they may emanate from global centres of economic or political power and (3) although intangible, they could be founded on ideologies that relate to culture, beliefs and social relations. The root causes of vulnerability are mainly economic, political and demographic developments or processes and are shaped by the structures, systems and ideologies thereof. These root causes influence the allocation and apportionment of resources amongst people (Wisner *et al.* 2003:52).

2. Dynamic pressures

In the build-up of the progression of vulnerability, dynamic pressures are those activities and processes that act as catalysts in time and space to transform the impact of root causes into unsafe conditions in relation to the different hazards imminent to the people. In other words, dynamic pressures are the immediate indicators of underlying political, economic and social patterns. As indicated in figure 2.3, the dynamic pressures include lack of investment, local institutes, training and appropriate skills. (Wisner *et al*. 2003:54).

3. Unsafe conditions

Unsafe conditions are the explicit ways in which people's vulnerability is displayed temporally and spatially concurrently with a hazard. Unsafe conditions can include dilapidated infrastructure and resources & systems, lack of preparedness, endemic diseases and vulnerable groups at risk in the society (Wisner *et al*. 2003:55).

In the case of risk of development or occurrence of listeriosis according to the PAR model, the progression of vulnerability coupled with the hazard of the bacteria Listeria monocytogenes makes people at risk or susceptible to contracting listeriosis and therefore a "disaster risk" is created (Tsasis and Nirupama 2008:7).

2.3.2 Disaster Risk Reduction: Progression of safety in the context of listeriosis

Conversely, the Disaster Risk Reduction (DRR) provides pointers through which unsafe conditions from root causes, dynamic pressures and other underlying unsafe conditions are changed into safe conditions before they escalate into disasters. Figure 2.4 below illustrates the Progression of safety in the context of listeriosis (Wisner et al. 2012:55).

The Progression of safety in the context of listeriosis

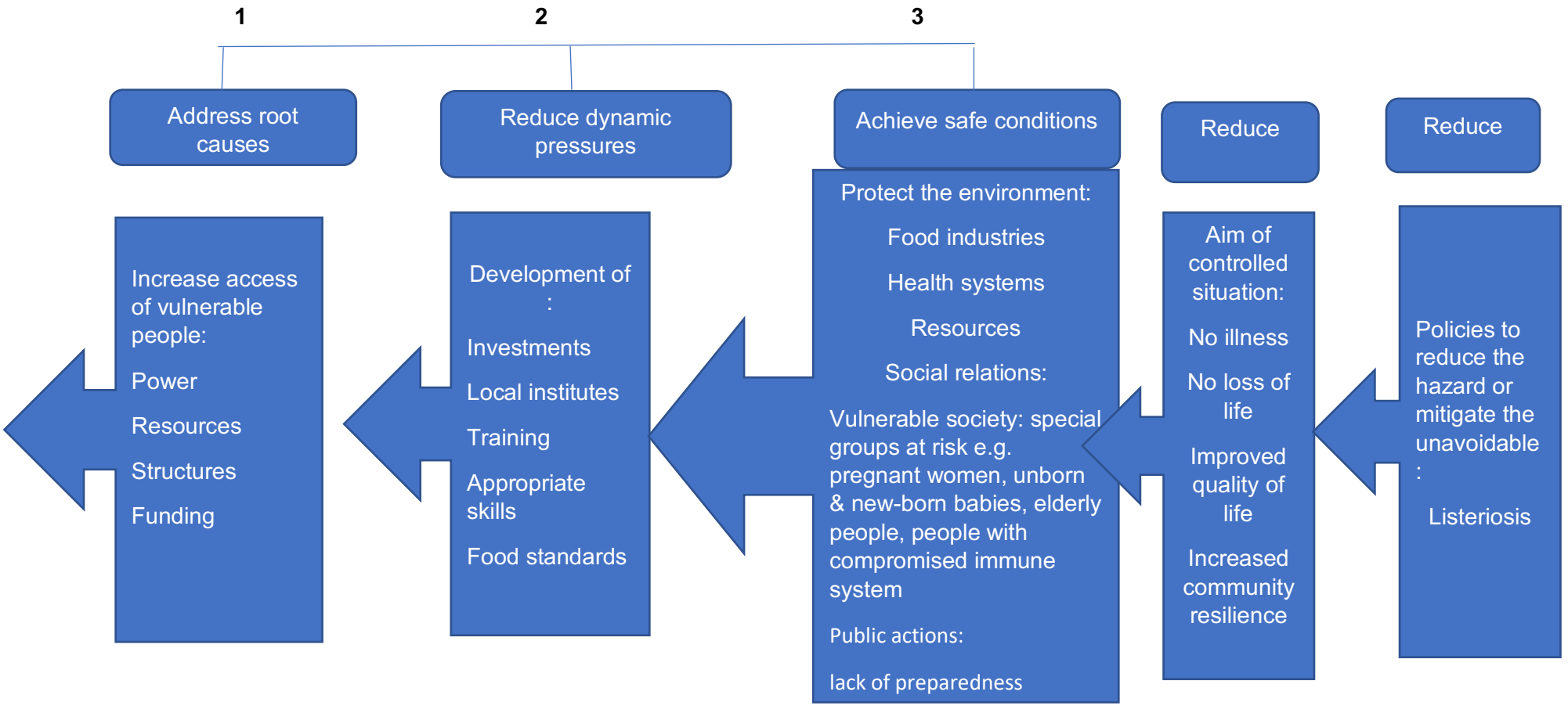


Figure 2.4: Progression of safety in the context of listeriosis, adopted from Wisner et al. 2012:55

Source: Wisner et al. 2012:55

2.4 Previous studies on health care practitioners' knowledge, attitudes, practices & behaviours towards listeriosis

2.4.1 Knowledge of listeriosis

2.4.1.1 General awareness of listeriosis

Though listeriosis is rare, it's imperative to establish health professionals' acquaintance with it as when it strikes it has tremendous devastating consequences of ill-health and death like what happened in South Africa during the 2017/2018 outbreak. Therefore, practitioners should be armed with the right knowledge and skills base to be prepared for it. There are no prior studies that have been done in Africa including South Africa to ascertain health professional's awareness of listeriosis. Some studies have only focused on food safety knowledge without zooming into listeriosis. However, studies that have been done in other countries on heath professionals' awareness of the disease have established awareness gaps in terms knowledge of the existence of the disease and/or the bacterium Listeria monocytogenes that causes the disease.

For instance, a study in the USA by Buffer *et al.* (2012:1312), of registered nurses and registered dieticians, in a journal titled "health professionals' knowledge and understanding about *Listeria monocytogenes* indicates a need for improved professional training", indicated that there was lack of knowledge/ awareness about bacteria that causes the disease (Listeria monocytogenes). This was because less than 10% of the registered dieticians and less than 5% of the registered nurses had heard a lot about the bacteria while about 35% and about 10% of the registered dieticians and registered nurses respectively had heard quite a bit about the bacteria (Buffer *et al*. 2012:1313). Self-rated understanding of the bacteria was also low as about 8% of the registered dieticians and about 2% of the registered nurses rated their understanding about the bacteria between very high and high while about 55% and about 18% of the registered dieticians and registered nurses respectively rated their understanding as moderate (Buffer *et al.* 2012:1313). The study also further established that only 3% and 10.5% of the registered nurses and registered dieticians respectively had received training about Listeria monocytogenes. This partly explains low self-reported awareness and understanding of the bacteria. Furthermore 28% and 84.6% of the registered nurses and registered dieticians respectively had received training in food safety (Buffer *et al.* 2012:1312).

Another study by Kirkham and Berkowitz (2010:161) in British Columbia in Canada on the knowledge, counselling practices and learning needs of health practitioners regarding risk factors for listeriosis in pregnancy established that there are knowledge variations about the disease amongst different streams of health professionals depending on the level of interaction with at risk population groups. The study proved that the majority (86%) of the midwives likely knew about listeriosis than physicians. Prenatal care practitioners (92%) were more likely aware of the disease than 73.5% who did not render that care (Kirkham and Berkowitz 2010:161). The study further established that content knowledge of the disease was the same amongst prenatal care practitioners only and amongst prenatal and intrapartum care practitioners only.

Medeiros and Buffer (2012:694) conducted a study on the current food safety knowledge of registered dieticians whom they divided into 2 categories i.e. Those who taught patients about food safety and those who did not and also intended not to teach patients about food safety. 58.9% of the registered dieticians who taught patients about food safety had heard quite a bit to a lot about listeriosis compared to 49.7% who did not teach patients about food safety (Medeiros and Buffer 2012:692). Self-reported understanding of the bacterium was higher amongst registered dieticians who taught patients about food safety as 22.6% of them rated their understanding high to very high compared to 8.1% of the registered dieticians who did not teach patients about food safety (Medeiros and Buffer 2012:693).

2.4.1.2 Knowledge of food sources associated with listeriosis

There are no studies that have been conducted in South Africa to establish health professionals' knowledge of foods that are at high risk of harbouring the bacteria that causes listeriosis. Nevertheless, prior studies in other countries have indicated knowledge deficiency of food sources of the disease amongst health professionals thereby risking impartation of insufficient knowledge of at high risk foods to the public. The gap that is there in South Africa is that nothing is known about the level of health professionals' familiarity with high risk listeriosis foods and hence the need for the study in the country.

The extent of knowledge gaps amongst registered dieticians and registered nurses with regards to food sources highly affiliated with the bacterium Listeria monocytogenes was established by the food safety recommendations that both groups provided to vulnerable population groups to listeriosis in a USA study by Buffer *et al*. (2012:1315). The results established that only 50% of the registered nurses provided food safety recommendations regarding the consumption of deli meats and hot dogs to pregnant women, 36% provided such

advice to elderly people and 24.6% provided such advice to immunocompromised people. 48.9% of the registered nurses provided food safety recommendations regarding the consumption of certain dairy products to pregnant women, 40.5% provided such advice to elderly people and 32.4% provided such advice to immunocompromised people. On the other hand, 71.6% of the registered dieticians provided food safety recommendations regarding the consumption of deli meats and hot dogs to pregnant women, 33.1% provided such advice to elderly people and 48.8% provided such advice to immunocompromised people. 66.7% of the registered dieticians provided food safety recommendations regarding the consumption of certain dairy products to pregnant women, 60.1% provided such advice to elderly people and 54.2% provided such advice to immunocompromised people. These findings further demonstrate knowledge gaps amongst registered nurses and dieticians about population groups that are vulnerable to listeriosis (Buffer *et al*.2012:1315).

An Australian study by Arrish *et al.* (2016:12) in a journal titled "Australian midwives and provision of nutrition education during pregnancy: a cross sectional survey of nutrition knowledge, attitudes and confidence", established that 77.8% of the health professionals were aware of all the food sources presented to them that were highly associated with listeriosis during pregnancy. These were soft cheeses, prepared salads and cold meats. Soft cheeses were popularly identified by 98.8% of the respondents, pre-pared salads by 88.8% and cold meats by 83.6% (Arrish *et al*, 2016:28).

A New Zealand study by Elias and Green (2007:293) established that both midwives trained and untrained in nutrition education had good knowledge of ready-made salads from deli and soft cheese such as brie, blue and ricotta as listeriosis risk foods. For example, soft cheese as a high risk listeriosis food was identified by 88% and 92% of the midwives who had received nutrition education and those who had not received nutrition education respectively. Ready-made salads from deli as a high risk listeriosis food was identified by 96% and 97% of the midwives who had received nutrition education and those who had not received nutrition education respectively. However cooked mussels were the least known as a high listeriosis risk food as it was only identified by 50% and 47% of the midwives who had received nutrition education and those who had not received nutrition education respectively.

2.4.1.3 Knowledge of how listeriosis can be prevented

No prior studies have been done in South Africa to ascertain the level of knowledge of listeriosis prevention strategies amongst health practitioners. Studies done in other countries have established knowledge gaps in this regard.

The degree of knowledge gaps amongst registered dieticians and registered nurses with regards to listeriosis preventative mechanisms was established by the prevention recommendations that both groups provided to vulnerable population groups to listeriosis in a USA study by Buffer *et al*. (2012:1315). The results established that only 8.9% of the registered nurses provided recommendations regarding cleaning the refrigerator to pregnant women, 28.8% provided such advice to elderly people and 21.7% provided such advice to immunocompromised people. 31.8% of the registered nurses provided recommendations regarding cold food storage, time, temperature and location to pregnant women, 33.3% provided such advice to elderly people and 25.2% provided such advice to immunocompromised people. On the other hand, 14.9% of the registered dieticians provided recommendations regarding cleaning the refrigerator to pregnant women, 25.2% provided such advice to elderly people and 27.1% provided such advice to immunocompromised people. 30.4% of the registered dieticians provided recommendations regarding cold food storage, time, temperature and location to pregnant women, 58.4% provided such advice to elderly people and 60.4% provided such advice to immunocompromised people.

Wohlgenant *et al.* (2012:754) in USA conducted a focus group study on the role of healthcare providers and caregivers in educating older adults about foodborne illness prevention. The healthcare providers or caregivers included physicians, physician assistant, registered nurses, nurse practitioners, home healthcare providers and relative caregivers. The qualitative study established that the majority of the participants were unaware of the guidelines of how listeriosis could be prevented. Such advice included that elderly people should consume reheated deli meats and avert soft cheese and deli salads (Wohlgenant *et al.* 2012:758).

2.4.1.4 Knowledge of vulnerable population groups at risk of listeriosis

There have been no studies that have been conducted in South Africa to ascertain health professionals' knowledge of the population groups that are vulnerable to listeriosis in order to be more vigilant of the signs and symptoms of the disease in these population groups and reduce morbidity and mortality rates. The few studies on health professionals' knowledge of the population groups at risk of listeriosis established some unawareness on the extent of vulnerability of pregnant women to the disease.

For instance, a Canadian study by Kirkham and Berkowitz (2010:161) established that only 18% of the health professionals were able to identify that pregnant women were at greater risk of listeriosis than other population groups.

The USA study by Buffer *et al*. (2012:1313), established that registered dieticians identified at risk population groups to listeriosis (pregnant women, foetuses, neonates, children, elderly people and organ transplant patients) better than registered nurses. However, in as much as this was the case, the extent of knowledge gaps amongst registered nurses and registered dieticians was established when they were asked if they had provided any food safety consumption and food handling recommendations to pregnant women, the elderly and immunocompromised people. As highlighted in earlier sections, there were variations in the advice given amongst the population groups thereby entailing that at-risk population groups were not accurately identified by both groups (Buffer *et al*. 2012:1315).

A Canadian study by Cook*,* Graves and Kirkham (2018) established that only 35.7% of the health care practitioners were cognizant that listeriosis was more prevalent in pregnant women.

2.4.1.5 Knowledge of the signs and symptoms of listeriosis

There is no literature on South Africa's healthcare practitioners' acquaintance with the signs and symptoms of listeriosis for proper diagnosis of the disease. However, a study by Bondarianzadeh*,* Yeatman and Condon Paoloni (2011:223) established that the information that the midwives provided to the pregnant women during consultations was in many instances void of the risk that listeriosis could pose to them and their unborn babies. About 30% of the midwives deliberately omitted sharing the listeria risk with the women in order not to distraught them. The study was silent on whether the midwives could identify the signs and symptoms of the disease with precision.

2.4.1.6 Knowledge of the laboratory detection methods and treatment of listeriosis

There have been no studies that have been conducted in South Africa nor elsewhere to ascertain health professionals' knowledge with the laboratory detection methods and treatment of listeriosis.

2.4.2 Attitudes, practices and behaviours towards listeriosis

There have not been any prior studies in South Africa that detail the information dissemination strategies used by practitioners as well as their effectiveness to relay listeriosis information be it counselling, health talks, use of posters, brochures, videos, etc.

The few studies done in other countries have pointed to some deficiencies amongst health professionals with regards to counselling practices, adequacy of information that they provide to the public, their confidence levels, and a low number of health professionals who actually relay listeriosis information to the public.

2.4.2.1 Attitude towards listeriosis

A New Zealand study by Elias and Green (2007:293) ascertained midwives' confidence in providing nutrition information on listeriosis and it established that 43.2% were very confident,13.8% were moderately confident and 1.4% were not confident.

According to a study by Mulliner *et al.* (1995:38), in a journal titled A study exploring midwives' education in, knowledge of and attitudes to nutrition in pregnancy, 48% of the respondents expressed lack of self confidence in discussing food scares pertaining to Listeria monocytogenes and bovine spongiform encephalopathy.

2.4.2.2 Practices & behaviour towards listeriosis

A USA study by Wong *et al.* (2004: S214) in a journal titled Physicians as Food-Safety Educators: A Practices and Perceptions Survey established that only 28% of the physicians rendered food safety information pertaining to listeriosis.

Ross *et al.* (2009:1190) established that only 59.8% of the respondents provided counselling to patients on how to prevent Listeria monocytogenes infection and the rationale thereof.

From the study by (Kirkham and Berkowitz 2010:163), counselling practices were low amongst practitioners as only 33% provided advice on risk factors for listeriosis to pregnant women. Comparatively, midwives provided more counselling to pregnant women about the foods such as soft cheese, unpasteurised milk, deli meat, hot dogs, refrigerated smoked sea food and unwashed fruits and vegetables that put them at risk of listeriosis. Lack of knowledge on the food sources of listeria (64% response) by practitioners as well as the fact that the disease is rare and therefore not of interest or importance to pregnant women (34% responses) were cited as the main reasons for not counselling pregnant women. Other reasons included lack of time to provide the advice, forgetfulness and that some practitioners did not provide prenatal care. Kirkham and Berkowitz established that the low counselling levels were synonymous

with other studies in which pregnant women had indicated that they had seldomly been provided with listeriosis advice by their health practitioners.

An exploratory study of videotaped consultations by Pereboom *et al.* (2014:34) to ascertain what information Dutch midwives gave clients about toxoplasmosis, listeriosis and cytomegalovirus prevention established an inadequacy in the information that they provided to pregnant women on prevention of infectious diseases. The midwives did not provide comprehensive information as recommended by the national brochure and the study concluded that the midwives may have banked on the women to read the information on their own.

A qualitative study of the Australian midwives' approaches to Listeria education as a food-related risk during pregnancy by Bondarianzadeh *et al*. (2011:226) established that the midwives' approach to listeria education was a result of their communication style and the weight of importance they placed on listeriosis. The study by Bondarianzadeh *et al*. (2011:226) established that comparatively, the midwives primarily focused on conveying information on high risk listeria food groups than offering the pregnant women with a broad range of other foods that were associated with listeriosis. The information provided by the midwives during their engagement with pregnant women also centred mainly on the potential food sources of listeriosis and not so much on other preventative strategies like food hygiene and food handling practices as such practices were perceived to be common sense (Bondarianzadeh *et al*. 2011:223).

Preconceived notions based on the pregnant women's appearance, educational levels and the fact that the women had alternative sources of information played an influential role on the extent of food handling practices information that could be conveyed to the pregnant women (Bondarianzadeh *et al*. 2011: 226). Other reasons cited for the non-provision of food hygiene and handling practices advice to the pregnant women included: perception by 70% of the midwives that it was the women's obligation to personally solicit such information from a plethora of sources and ignorance by 50% of the midwives who after the discussion indicated that they would give it a thought (Bondarianzadeh *et al*. 2011:224). Generally, midwives avoided information overload on the pregnant women and hence stuck to highlighting high risk listeria foods with the hope that for further information, the women could refer to other data sources (Bondarianzadeh *et al*. 2011:224).

CHAPTER 3
DATA PRESENTATION & ANALYSIS

3.1 Demographics

3.1.1 Age and gender of respondents

A total of 60 respondents participated in the study. Demographics data on the gender, age, highest level of qualification, current occupation and years of working experience in the current occupation was gathered. At 88.3%, females were the majority of the respondents while males constituted 11.7%. The age distribution of the respondents is illustrated in figure 3.1 wherein the bulk of the respondents at 40% were in the 41-50-year age category. In the 31-40-year age group were 25% of the respondents. The 51-60-year age group made up 15% of the respondents. 13% of the respondents were in the 21-30-year age group and another 7% was 61 years older and above.

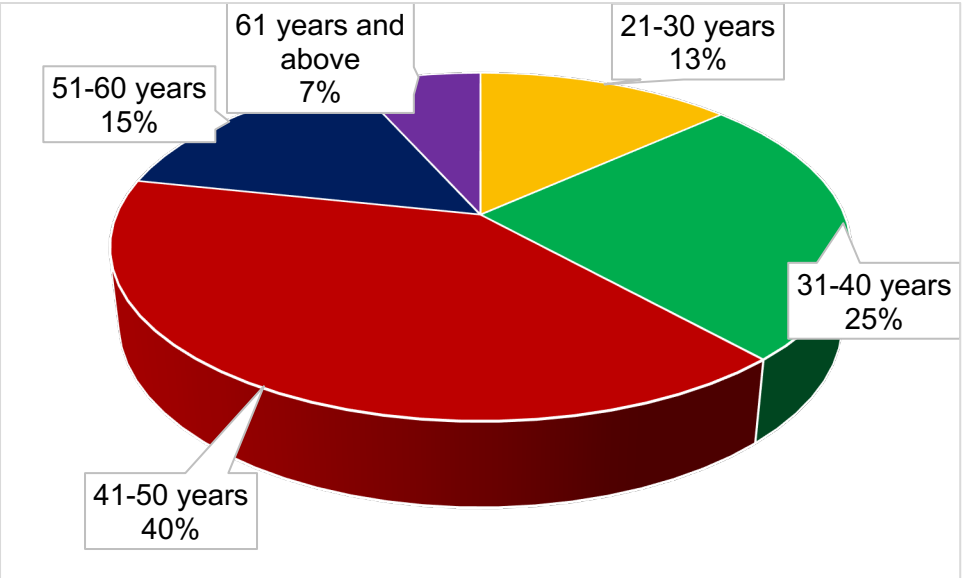


Figure 3.1: Age distribution of the respondents

3.1.2 Occupation

The South African Nursing Council (SANC) defines the roles and responsibilities of enrolled nurses as including: provision of nursing care to address the health requirements of patients, provision of a tailor-made nursing care plan that also encompasses checking of vital signs and how patients respond to medication and treatment, health promotion and disease prevention

and supporting with diagnostic and therapeutic procedures under the supervision of registered medical personnel (South African Nursing Council 1991).

Registered nurses usually possess a diploma or a degree in nursing as minimum qualifications and are a notch above enrolled nurses in terms of qualifications and skills that they can execute. According to the SANC, the functions of registered or professional nurses are inclusive of the following: detection of health problems in patients and providing referral for further assessments or treatment if need be, providing treatment to patients, monitoring of vital signs in patients as well as how the patients respond to medication and other diseases, health promotion including nutrition and prevention of diseases, maintenance of appropriate body fluid, electrolyte and acid balance in patients, aiding with diagnostic, operative and therapeutic procedures for patients and coordinating the patients' health care plan provided by different medical personnel (South African Nursing Council 1991).

The National Health Promotion Policy and Strategy articulates the scope of practice of health promoters at district and sub-district level as inclusive of the following: providing health promotion services in health institutions , being part of the epidemic preparedness response team, steering community-based health promotion programmes, implementing health campaigns and be in the fore front of advocacy of health in communities, provision of health-related information, education and communication material, establishing multi-sectoral forums in the communities to address health issues, assisting field workers with health promotion interventions and capacity building of staff on health related matters (The National Health Promotion Policy and Strategy 2015-2019:25).

The majority of the respondents in the study were professional nurses (63.3%) followed by enrolled nurses at 25%. Health promoters and operational/facility managers stood at 6.7% and 5% respectively. The study established that female professional and enrolled nurses (80%) comprised a large proportion of the nurses while 8.4% were males as illustrated in figure 3.2 below. This is synonymous with national statistics that also indicate that the nursing labour force is dominated by females. According to a study by Mahlathi and Jabulani 2017:18, 90.4% of the registered and enrolled nurses were females while 9.6% were males.

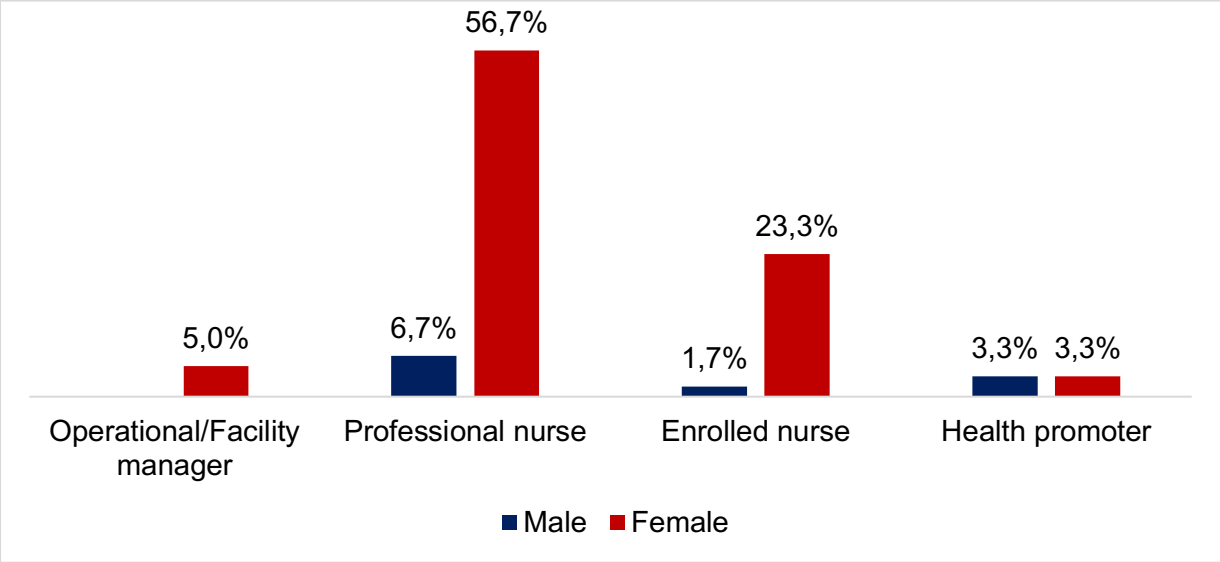


Figure 3.2: Gender breakdown of respondents by occupation

3.1.3 Qualifications

Overall, 13.4% of the respondents had a degree as the highest level of qualification, 63.4% had a diploma, 20% had a certificate and 3.4% had secondary school education as the highest level of qualifications. Specifically, amongst the respondents, the highest levels of qualification by occupation at the clinic were as follows as illustrated in figure 3.3 below: 5% of the operational managers had a degree, 6.7% and 56.7% of the professional nurses had degrees and diplomas respectively, 5% of the enrolled nurses had a diploma while 18.3% had a certificate, and 1.7% had secondary school education. 1.7% of the health promoters had a degree while another 1.7% had a diploma, another 1.7% had a certificate and another 1.7% had secondary school education.

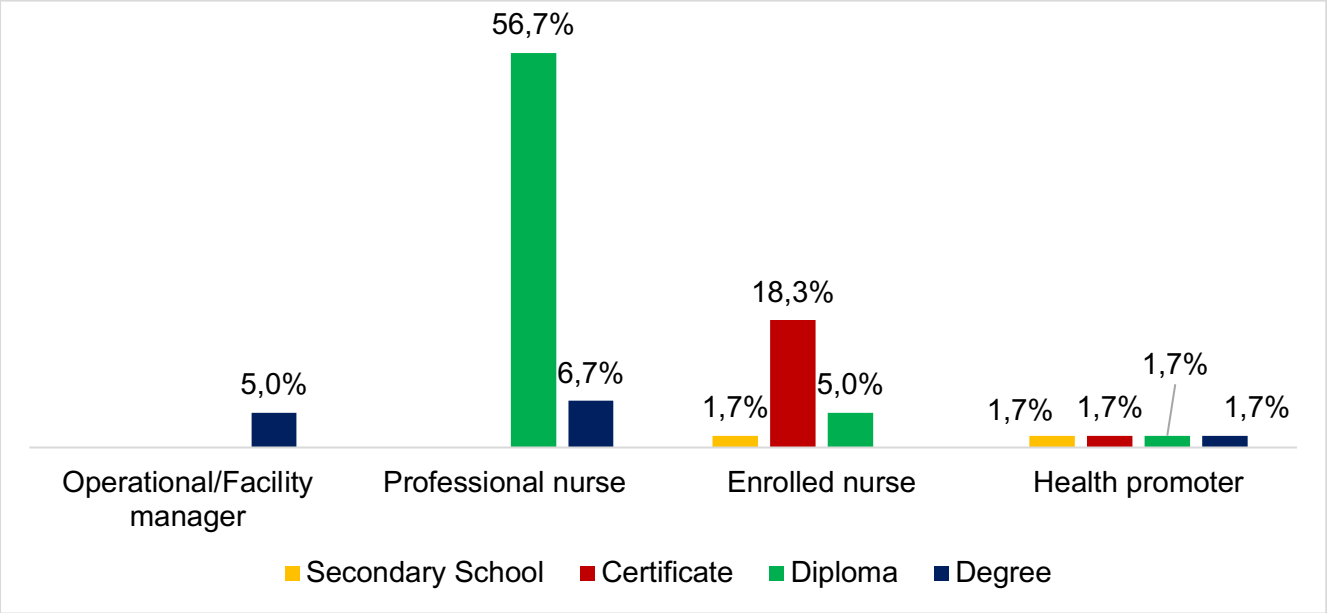


Figure 3.3: Highest level of qualifications by occupation of the respondents

3.1.4 Years in current occupation

As demonstrated in figure 3.4 below, the majority (32%) of the respondents had spent 0-5 years in their current occupation. 30% of the respondents had 6-10 years' practice in their occupation, 15% had 11-15 years' experience and 12% had spent 16-20 years in their occupation. Only 8% had spent more than 25 years in their current occupation and 3% had spent 21-25 years in their practice.

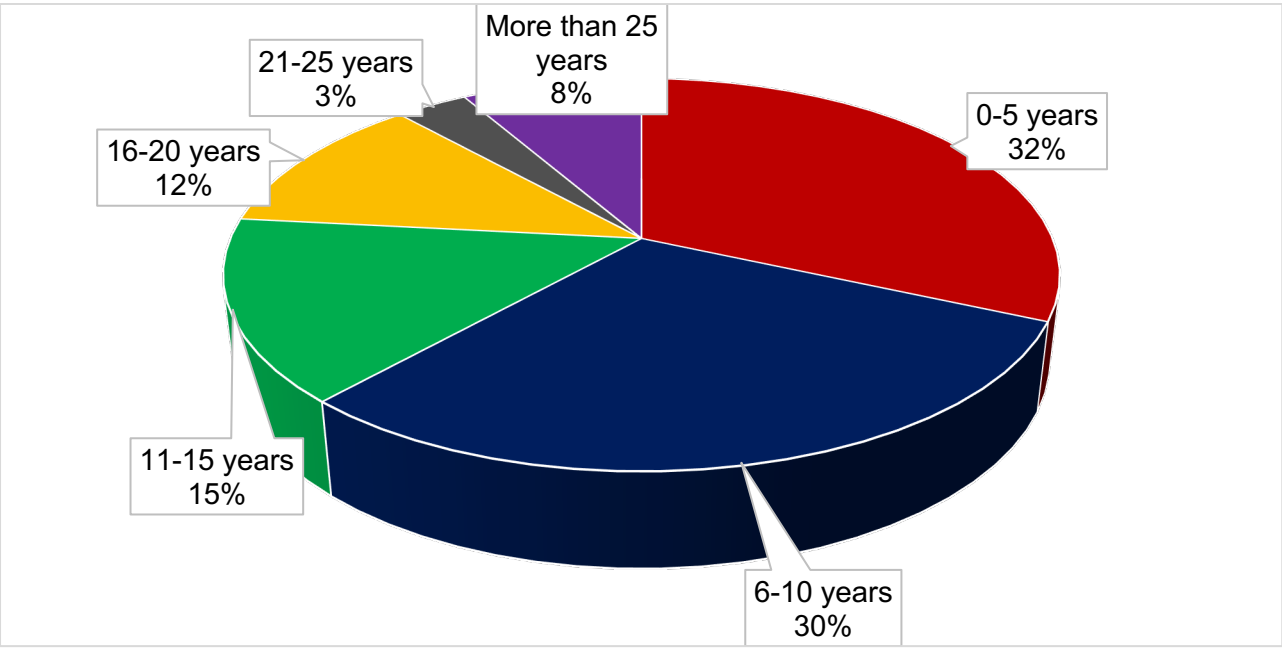


Figure 3.4: Years spent by respondents in their current occupation

3.2 Knowledge of listeriosis

Knowledge questions in this context were essential because the public mostly relies on healthcare practitioners for health-related information and medical assistance. But for people to get accurate information and quality health care, it also means that health professionals must have a good repository of medical knowledge.

3.2.1 Listeriosis awareness

Respondents were asked if they were aware of a disease called listeriosis and 100% of them answered that they were cognisant of it. As a follow up, respondents were then requested to indicate their sources of information about the disease and this also entailed multiple selection of responses. Media-television, radio, social media applications emerged as the most popular source of information on the disease as indicated by 80% of the respondents in figure 3.5 followed by pamphlets, posters, newsletters and journals as highlighted by 56.7% of the respondents. Only 5% of the respondents indicated that they learnt about the disease through formal education while 20% stated that they got to know about listeriosis because of on the job experience.18.3% and 15% got to know about the disease through workshops and training respectively. Figure 3.5 below summarises the sources of information about the disease.

Only 28.8% of the respondents stated that clinic or the City of Johannesburg Department of Health had provided them with training on the disease in the last 6 to 12 months. The City of Johannesburg regarded the workshops/ trainings as coined in the researcher's questionnaire as briefings. Therefore, for the sake of reporting, the City of Johannesburg term of briefing will be utilised.

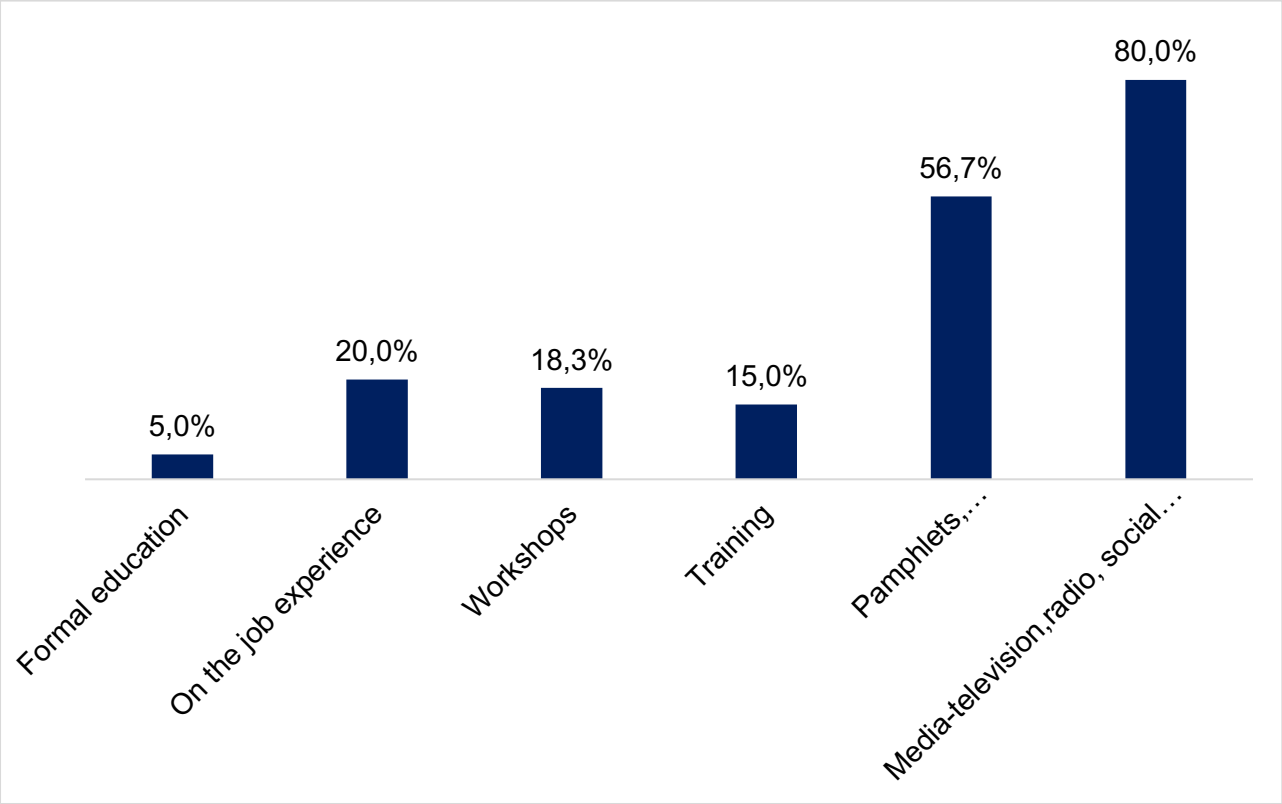


Figure 3.5: Sources of information for the listeriosis disease

3.2.2 Knowledge of listeriosis sources of infection/transmission

Meat emerged as the most known source of listeriosis infection as 85% of the respondents identified with it as illustrated in figure 3.6 below. Processed foods, ready to eat meats, unpasteurised milk and soft cheese and vegetables were singly pin pointed by 84.7%, 83.3%, 78.3% and 60% of the respondents as sources of listeria infection respectively.40.4% of the respondents singled out smoked fish products as a source of infection. Another 38.6% knew that the source of listeriosis infection could be soil. 26.3% of the respondents knew that water could be a source of listeriosis disease.

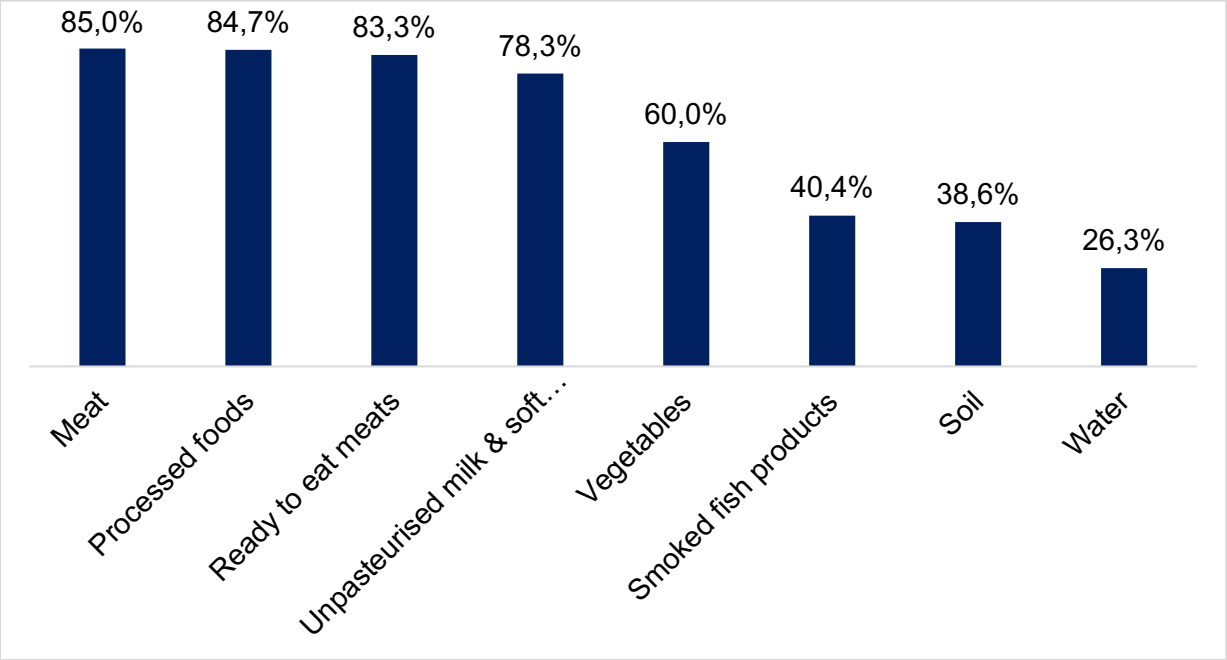


Figure 3.6: Knowledge of listeriosis sources of infection/transmission

3.2.3 Knowledge of listeriosis sources of infection / transmission amongst those trained

The knowledge levels on the sources of listeriosis was assessed for the respondents that had received training on the disease. Respondents gave multiple responses for the sources of infection. The results established that even though the respondents were trained and some of them went as far as getting more insights about the disease from pamphlets and the media, there were still some knowledge gaps on identifying all food sources of listeriosis. The majority of the respondents (88.2%) identified meat, processed foods and unpasteurised milk and soft cheese as sources of infection while ready to eat meats and vegetables were identified by 82.4% and 70.6% of the respondents respectively. Soil, water and smoked fish products were identified by 41.2%, 29.4% and 29.4% of the respondents respectively. The results are summarised in figure 3.7 below.

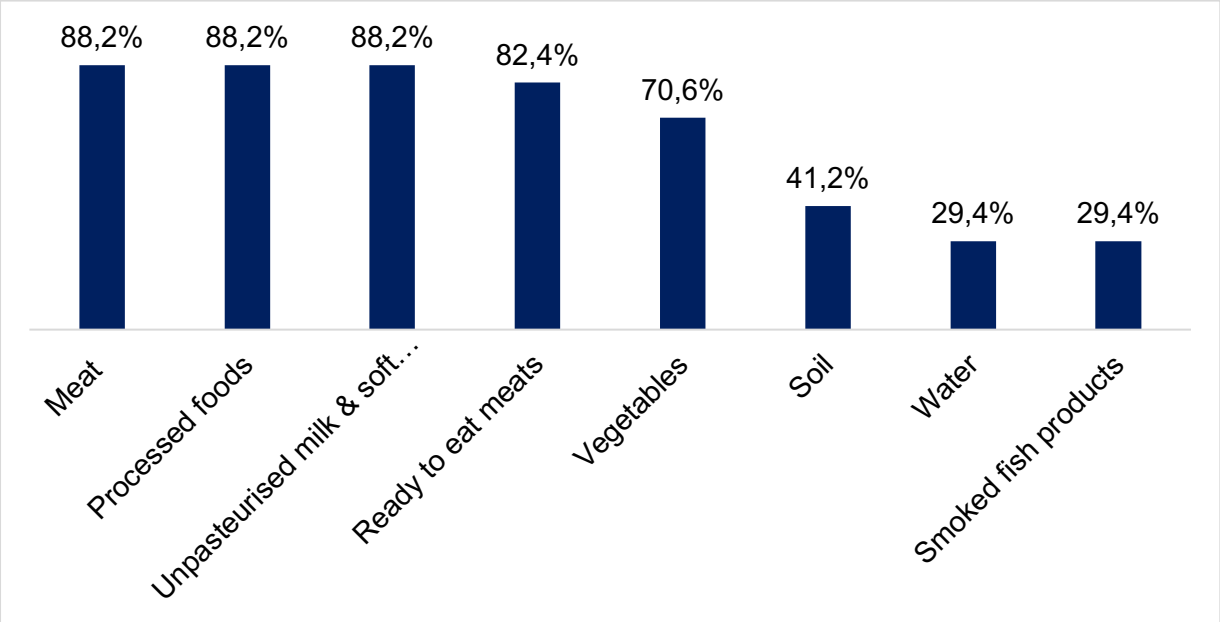


Figure 3.7: Knowledge of listeriosis sources of infection/transmission amongst those trained

3.2.4 Knowledge of how one can be infected with listeriosis

94.7% of the respondents were able to accurately identify that one could get listeriosis through ingestion of food contaminated with the bacteria as illustrated in table 3.1. 59.3% of the respondents were also able to correctly identify that the disease could be transmitted from a pregnant mother to her unborn child. Only a mere 31% knew that the disease could be passed to babies during birth.6.8% and 5.4% of the respondents incorrectly stated that one could get the disease through coughing/sneezing and shaking hands with each other respectively.100% of the respondents correctly dismissed as false that the disease could be passed through sexual intercourse.

Table 3.1: Knowledge of how one can be infected with listeriosis

Accurately identified the modes of listeriosis infection		**Inaccurately identified the modes of listeriosis infection**	
Ingestion of food contaminated with the bacteria	94,7%	Coughing/sneezing	6,8%
From a pregnant mother to her unborn child	59,3%	Shaking hands	5,4%
During birth	31,0%		

3.2.5 Knowledge of how listeriosis can be transmitted amongst those trained

The knowledge levels on listeriosis transmission amongst those trained was assessed and multiple responses were allowed. All respondents were aware that the disease could be transmitted through ingestion of food contaminated food products. However, despite the training, the respondents' precision on listeriosis transmission from a pregnant mother to her unborn child and during birth was low as 47.1% and 25% respectively knew that these were alternative modes of transmission. All respondents correctly identified that the disease could not be transmitted through sexual intercourse. Even though respondents in this case were trained, 5.9% and 6.3% of the respondents attributed listeriosis transmission to coughing/sneezing and shaking hands with each other respectively. The results are summarised in table 3.2 below.

Table 3.2: Knowledge of how listeriosis can be transmitted amongst those trained

Accurately identified the modes of listeriosis infection		**Inaccurately identified the modes of listeriosis infection**	
Ingestion of food contaminated with the bacteria	100,0%	Coughing/sneezing	5,9%
From a pregnant mother to her unborn child	47,1%	Shaking hands	6,3%
During birth	25,0%		

3.2.6 Knowledge of the signs and symptoms of listeriosis

The majority of the respondents were aware of the following signs and symptoms associated with listeriosis as illustrated in figure 3.8 below: fever (identified by 98.3% of the respondents), nausea (identified by 94.8% of the respondents), vomiting (identified by 94.8% of the respondents) and diarrhoea (identified by 93.3% of the respondents). 80% of the respondents managed to identify headache as another sign and symptom of listeriosis. Muscle aches as another symptom of listeriosis was identified by 77.6% of the respondents. The other signs and symptoms were not so popular with the respondents and these included: stiff neck (only identified by 54.4% of the respondents), loss of balance (only identified by 52.6% of the respondents), confusion (only identified by 52.5% of the respondents) and seizures (only identified by 45.6% of the respondents).

The clinics had the responsibility of line-listing any suspected cases of listeriosis through diagnosing them and referring them to hospitals for further assessment and treatment as well as following up on the cases to establish if the cases were positive for listeriosis. At clinic level, the facilities were provided with guidelines on clinical diagnosis and treatment to refer to.

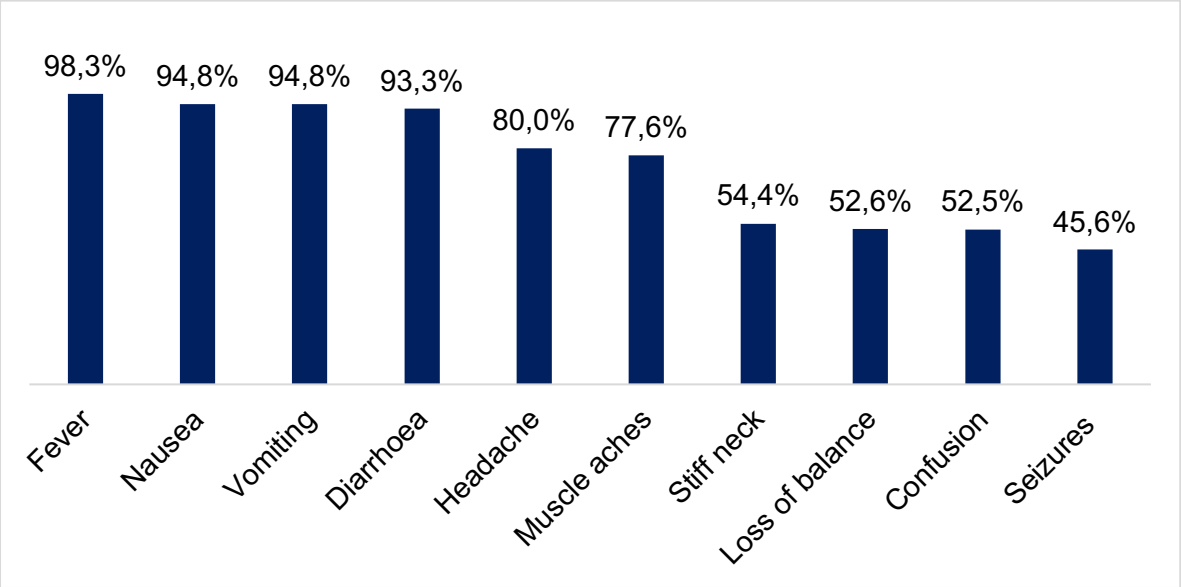


Figure 3.8: Knowledge of the signs and symptoms of listeriosis

3.2.7 Knowledge of the signs and symptoms of listeriosis amongst those trained

The knowledge levels on signs and symptoms of listeriosis amongst those trained was assessed and multiple responses were allowed. All respondents identified the common signs and symptoms of food-borne diseases such as fever, nausea and vomiting. Diarrhoea was identified by 94.1% of the respondents. Precision levels for the other signs and symptoms was low as summarised in figure 3.9 below.

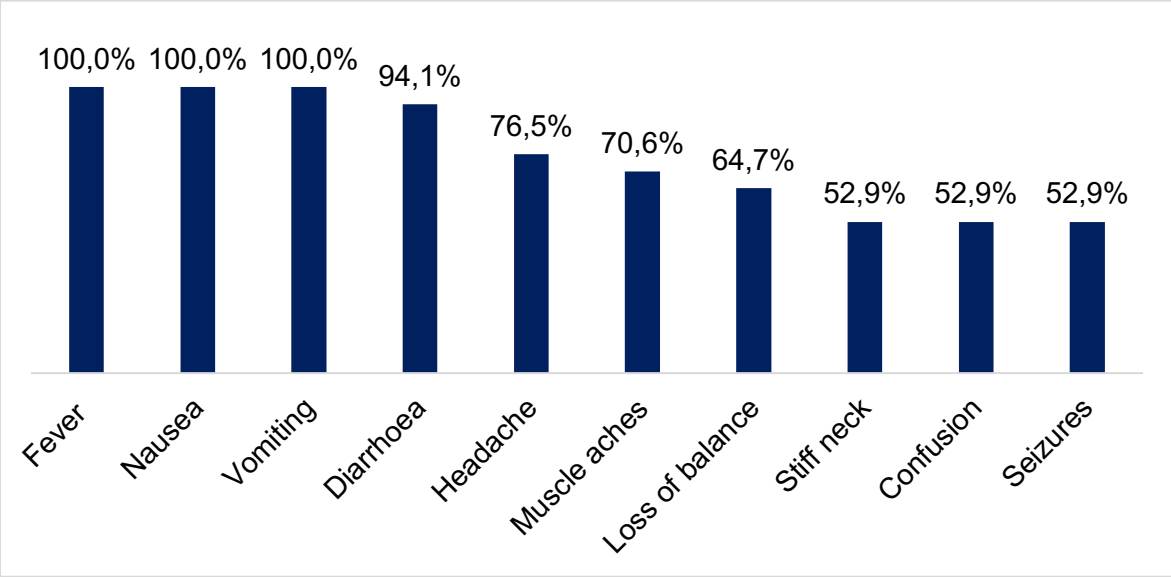


Figure 3.9: Knowledge of the signs and symptoms of listeriosis amongst those trained

3.2.8 Knowledge of how listeriosis can be prevented

From a list provided, respondents were asked to identify how listeriosis could be prevented. Table 3.3 below is a summary that displays the percentages of respondents who correctly identified the different prevention methods. The majority of the respondents correctly identified the following methods of preventing listeriosis: thoroughly cooking raw foods from animal sources, such as beef, pork or poultry (identified by 95% of the respondents), washing and decontamination of kitchen surfaces and utensils regularly, particularly after preparing raw meat, poultry and eggs, including industrial kitchens (identified by 94.9% of the respondents), washing raw vegetables and fruits thoroughly before eating, (identified by 91.5% of the respondents), washing your hands before preparing food, before eating and after going to the toilet (identified by 88.1% of the respondents), keeping abreast with food recalls associated with listeriosis outbreaks (identified by 87.7% of the respondents), adhering to the expiry date of the food products (identified by 86.4% of the respondents), storing food at the recommended temperature (identified by 83.1% of the respondents), consuming refrigerated fresh-cut deli meats within a few days (identified by 78.9% of the respondents), serving food at the right temperature (identified by 78% of the respondents), separating different foods in order to avoid cross contamination (identified by 72.4% of the respondents), cleaning the refrigerator (identified by 69.5% of the respondents) , using only pasteurized dairy products (identified by 69.4% of the respondents), using different cutting boards for vegetables and meat (identified by 67.8% of the respondents), avoiding keeping refrigerated fruits and vegetables for more than seven days(identified by 64.4% of the respondents).

The other prevention methods that were not so popular with the respondents included: having fridge temperatures below 4 degrees Celsius (only identified by 49.1% of the respondents), defrosting ready to eat frozen food in the refrigerator or microwave (only identified by 47.4% of the respondents) and having freezer temperatures below minus 18 degrees Celsius (only identified by 37.7% of the respondents).

Table 3.3: Knowledge of listeriosis prevention methods

Knowledge of listeriosis prevention methods	%
Thoroughly cooking raw foods from animal sources, such as beef, pork or poultry	95,0%
Washing and decontamination of kitchen surfaces and utensils regularly, particularly after preparing raw meat, poultry and eggs, including industrial kitchens	94,9%
Washing raw vegetables and fruits thoroughly before eating	91,5%
Washing your hands before preparing food, before eating and after going to the toilet	88,1%
Keeping abreast with food recalls associated with listeriosis outbreaks	87,7%
Adhering to the expiry date of the food products	86,4%
Storing food at the recommended temperature	83,1%
Consuming refrigerated fresh-cut deli meats within a few days	78,9%
Serving food at the right temperature	78,0%
Separating different foods: In order to avoid cross contamination	72,4%
Cleaning the refrigerator	69,5%
Using only pasteurized dairy products	69,4%
Using different cutting boards for vegetables and meat	67,8%
Avoiding keeping refrigerated fruits and vegetables for more than seven days	64,4%
Having fridge temperatures below 4 degrees Celsius	49,1%
Defrosting ready to eat frozen food in the refrigerator or microwave	47,4%
Having freezer temperatures below minus 18 degrees Celsius	37,7%

3.2.9 Knowledge of listeriosis prevention methods amongst those trained

The knowledge levels on prevention of listeriosis amongst those trained was assessed and multiple responses were allowed. Knowledge on listeriosis prevention methods was spot on

as identified by 100% of the respondents are summarised in table 3.4 below for: thoroughly cooking raw foods from animal sources and washing and decontamination of kitchen surfaces and utensils regularly, particularly after preparing raw meat, poultry and eggs, including industrial kitchens such as beef, pork or poultry relatively good and the results. The least common prevention methods from the responses included: using different cutting boards for vegetables and meat (58.8%), defrosting ready to eat frozen food in the refrigerator or microwave (53.3%), cleaning the refrigerator (52.9%), having fridge temperatures below 4 degrees Celsius (46.7%) and having freezer temperatures below minus 18 degrees Celsius (33.3%).

Table 3.4: Knowledge of listeriosis prevention methods amongst those trained

Knowledge of listeriosis prevention methods	%
Thoroughly cooking raw foods from animal sources, such as beef, pork or poultry	100,0 %
Washing and decontamination of kitchen surfaces and utensils regularly, particularly after preparing raw meat, poultry and eggs, including industrial kitchens	100,0 %
Washing raw vegetables and fruits thoroughly before eating	94,1%
Washing your hands before preparing food, before eating and after going to the toilet	94,1%
Keeping abreast with food recalls associated with listeriosis outbreaks	94,1%
Consuming refrigerated fresh-cut deli meats within a few days	88,2%
Adhering to the expiry date of the food products	82,4%
Storing food at the recommended temperature	82,4%
Separating different foods: In order to avoid cross contamination	82,4%
Using only pasteurized dairy products	82,4%
Serving food at the right temperature	75,0%
Avoiding keeping refrigerated fruits and vegetables for more than seven days	64,7%
Using different cutting boards for vegetables and meat	58,8%
Defrosting ready to eat frozen food in the refrigerator or microwave	53,3%
Cleaning the refrigerator	52,9%
Having fridge temperatures below 4 degrees Celsius	46,7%
Having freezer temperatures below minus 18 degrees Celsius	33,3%

3.2.10 Knowledge of the population groups vulnerable to listeriosis

Respondents were asked to identify the population groups that were most vulnerable to listeriosis. As illustrated in figure 3.10 below, the majority of the respondents (94.9%) correctly identified pregnant women to be vulnerable to listeriosis, followed by people with compromised immune system (e.g. those with cancer, HIV/AIDS) as identified by 93.2% of the respondents and elderly people as identified by 91.5% of the respondents. People with chronic conditions (e.g. liver disease, kidney disease, diabetes or cancer), unborn babies and new-born babies were accurately identified by 89.8%, 77.6% and 70.7% of the respondents respectively as other groups at vulnerable to listeriosis. Only 48.3% of the respondents knew that people with alcoholism were also vulnerable to listeriosis.

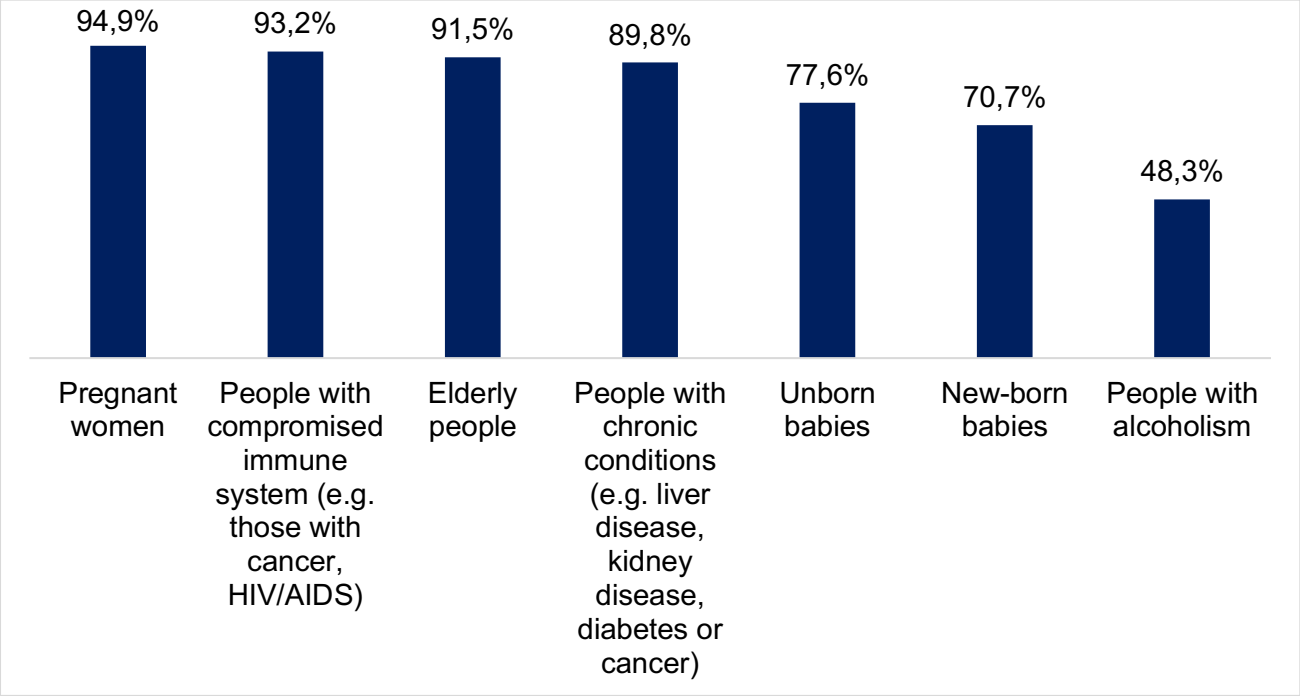


Figure 3.10: Knowledge of the population groups vulnerable to listeriosis

3.2.11 Knowledge of the population groups vulnerable to listeriosis amongst those trained

The knowledge levels on the population groups most vulnerable to listeriosis amongst those trained was assessed and multiple responses were allowed. All the respondents accurately identified pregnant women, the elderly and people with compromised immune system e.g. Those with cancer and HIV/AIDS as being at high risk of the disease as illustrated in figure 3.11 below. Knowledge of people with chronic conditions (e.g. liver disease, kidney disease,

diabetes or cancer), new-born babies and unborn babies as being at high risk of the disease was demonstrated by 88.2%, 87.5% and 75% of the respondents respectively. People with alcoholism as another vulnerable population group to listeriosis was less common as only 43.8% identified them as a high-risk group.

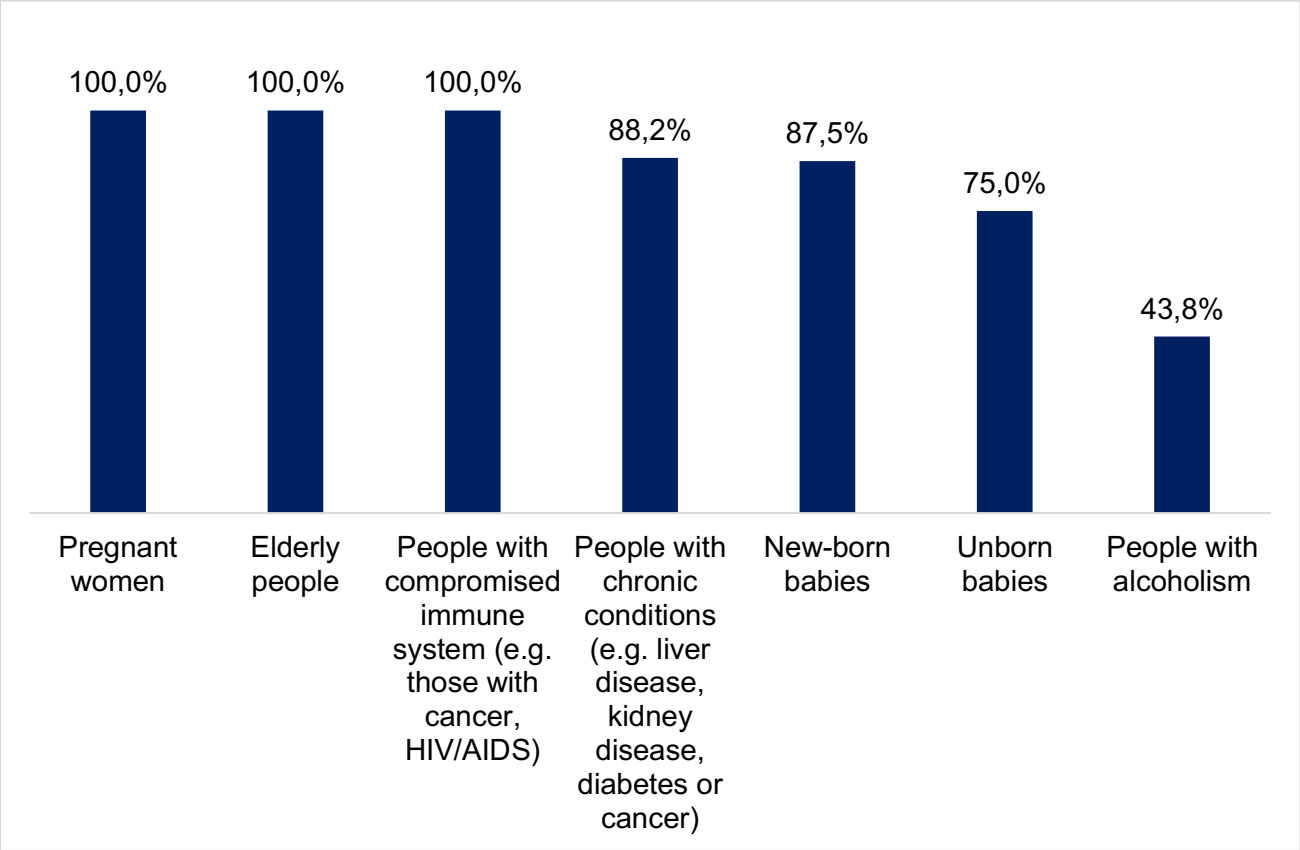


Figure 3.11: Knowledge of the population groups most vulnerable to listeriosis amongst those trained

3.2.12 Knowledge of foods that most vulnerable population groups to listeriosis should avoid eating

Respondents were asked to identify the foods that people most vulnerable to getting listeriosis should avoid eating. Foods from delicatessen counters (e.g. prepared salads, cold meats) that have not been heated/reheated adequately emerged as the most popular food by 93.2% of the respondents that people at high risk of getting listeriosis should avoid eating followed by raw or unpasteurized milk, or dairy products that contain unpasteurized milk as indicated by 89.8% of the respondents.63.6% of the respondents identified refrigerated pâtés and 59.6% of the respondents identified soft cheeses (e.g. feta, goat, Brie) as other foods that should be avoided by high risk listeria population groups. The results are tabulated in table 3.5 below.

Table 3.5: Knowledge of the food that most vulnerable population groups to listeriosis should avoid eating

Food that most vulnerable population groups to listeriosis should avoid eating	%
Foods from delicatessen counters (e.g. prepared salads, cold meats) that have not been heated/reheated adequately	93.2%
Raw or unpasteurized milk, or dairy products that contain unpasteurized milk	89.8%
Refrigerated pâtés	63.6%
Soft cheeses (e.g. feta, goat, Brie)	59.6%

3.2.13 Knowledge of the food that most vulnerable population groups to listeriosis should avoid eating amongst those trained

The majority of the health practitioners who were trained (94.1%) identified foods from delicatessen counters as to be avoided. 88.2% identified raw or unpasteurized milk, or dairy products that contain unpasteurized milk and 62.5% identified soft cheeses (e.g. feta, goat, Brie) as other foods that had to be avoided by at risk population groups to listeriosis. Refrigerated pâtés were the least known as only 53.3% of the respondents identified it as one of the foods to be avoided. The results are summarised in table 3.6 below.

Table 3.6: Knowledge of the food that most vulnerable population groups to listeriosis should avoid eating amongst those trained

Food that most vulnerable population groups to listeriosis should avoid eating	%
Foods from delicatessen counters (e.g. prepared salads, cold meats) that have not been heated/reheated adequately	94.1%
Raw or unpasteurized milk, or dairy products that contain unpasteurized milk	88.2%
Soft cheeses (e.g. feta, goat, Brie)	62.5%
Refrigerated pâtés	53.3%

3.2.14 Knowledge of how listeriosis can be laboratory detected using clinical specimens

Respondents were requested to indicate all the responses that they had knowledge of, when assessing how listeriosis could be laboratory detected. 93.2% of the respondents' pin-pointed blood as a clinical specimen. Amniotic fluid had 61.8% responses and the placenta had 60.7% responses. Cerebrospinal fluid (CSF) as a clinical specimen was identified by 57.1% of the respondents. Only 47.1 % also knew that listeriosis could be detected through other sterile body fluids. The response rates are demonstrated in figure 3.12 below.

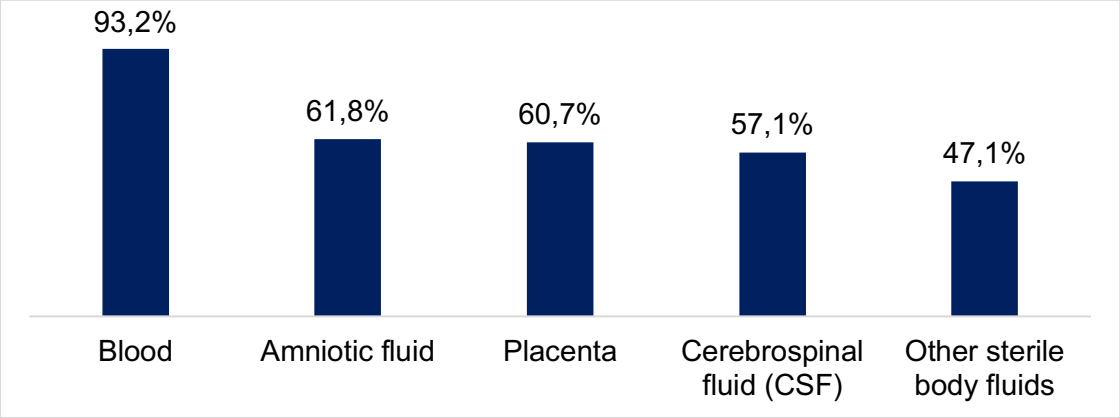


Figure 3.12: Knowledge of how listeriosis can be laboratory detected

3.2.15 Knowledge of how listeriosis can be laboratory detected using clinical specimens amongst those trained

As illustrated in figure 3.13 below, all the respondents knew that listeriosis could be laboratory detected through blood samples. The other respondents were not familiar with other diagnostic such as amniotic fluid, placenta and cerebrospinal fluid that were identified by 62.5%, 62.5% and 60% of the respondents respectively. 33.3% of the respondents managed to identify the use of other sterile body fluids for detecting the disease.

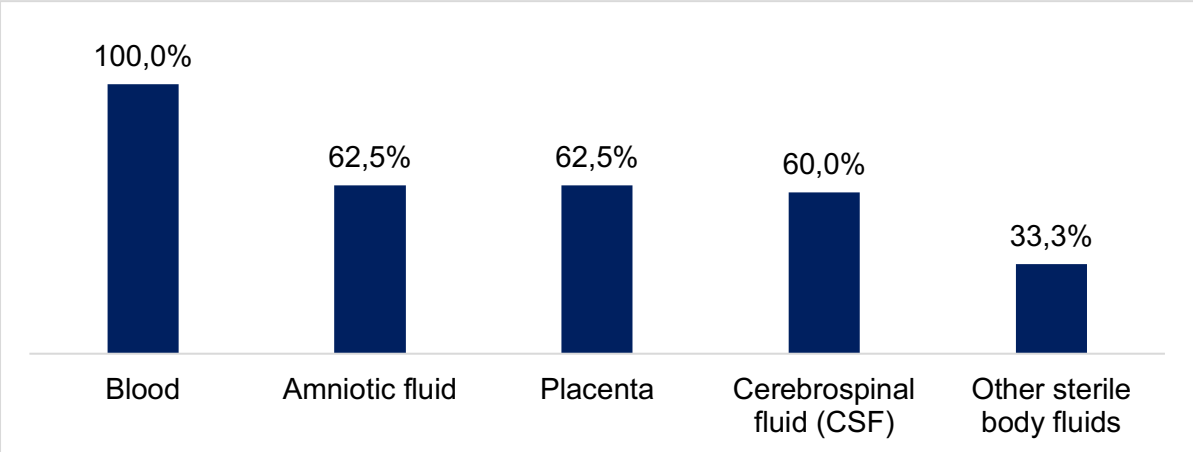


Figure 3.13: Knowledge of how listeriosis can be laboratory detected using clinical specimens

3.2.16 Knowledge of how listeriosis can be treated

84.9% of the respondents were aware that listeriosis could be treated with antibiotics. 88.2% of the health practitioners trained were knowledgeable that listeriosis could be treated with antibiotics.

3.3 Practices

3.3.1 Preparedness and response plan for listeriosis

In light of the listeriosis outbreak, the City of Johannesburg Health Department developed a preparedness and response plan for listeriosis in 2017 (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017: 1-9). The preparedness stage aimed to capacitate the outbreak response teams on how to proficiently respond to the outbreak and this encompassed trainings(briefings) of health practitioners and other stakeholders such as Non-Governmental Organisations (NGOs), Community-Based Organisations (CBOs), faith healers and traditional healers, health talks to patients who visited the clinics, provision of guidelines and standard operating procedures to clinics, community sensitisation through health talks and IEC materials, acting on information from formal and informal sources about any suspected cases of the disease as well as maintaining constant communication with the NICD and Gauteng Department of Health who were responsible for testing clinical specimens. The preparedness plan also aimed to ensure that the required resources for response activities were available (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017:1).

3.3.2 Information system

According to data provided by the Region C Roodepoort clinics, there were no listeriosis cases that were recorded/ registered in their clinics during the outbreak. However, according to Manganye et al. 2018: 56 in the Southern African Journal of Public Health - Listeriosis in the City of Johannesburg, South Africa, Region C clinics recorded 10 cases and 1 death of listeriosis.

3.3.3 Public education and training

3.3.3.1 Training of stakeholders

As part of preparedness at strategic level, the City of Johannesburg Health Department devised a public education and training action plan that was jointly steered by environmental health practitioners, surveillance officers, outbreak response teams, health promoters and epidemic preparedness operations managers (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017: 1-9). The first tier of the public education and training took a multi-stakeholder approach to briefing on listeriosis. The anticipated outcomes included having vigilant and knowledgeable stakeholders, enhanced management of suspected cases of listeriosis and timely referral of suspected cases (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017: 1-9).The stakeholders briefed included department of health employees such as nurses and health promoters at the departmental' s regional, district, sub-district and clinic levels including Region C clinics, doctors in government and private practice, hospitals, field workers that are paid a stipend by the City of Johannesburg Health Department, NGOs, CBOs, faith healers, traditional healers and field workers.

The briefing focused on the Listeria monocytogenes bacteria, sources of the disease, how the disease is transmitted, signs and symptoms of the diseases, the most vulnerable populations to the disease, how the disease can be diagnosed, prevented and treated. The briefing was complemented with provision of listeriosis IEC documents that included Frequently Asked Questions (FAQ) document, presentations and guidelines (City of Johannesburg Health Department, Action Plan on Listeriosis Outbreak in the City of Johannesburg, n.d.1). The FAQ document sought to clarify questions around what exactly is the disease listeriosis, the epidemiology of the disease in the country, people most likely to be infected with listeriosis, how one can become infected with listeriosis, the signs and symptoms of listeriosis, detection of the disease using clinical specimens, treatment of the disease, how the disease can be averted and it also provided contact details in case one wanted more information about the disease (National Institute for Communicable Diseases Outbreak Response Unit Division of Public Health Surveillance and Response Listeriosis Frequently Asked Questions 2016: 1-2).

Consequent to that, the response mechanism to the outbreak was for the briefed personnel to provide in-service briefing to clinic staff and staff at various NGOs and CBOs in order to improve on the coverage of raising awareness of staff about the disease. Follow up presentations were made at the clinics by the stakeholders who had been briefed in the first sessions in order to reinforce the messaging. The clinics were also provided with pamphlets, posters and clinical guidelines on listeriosis diagnosis and treatment.

The findings established that only 28.8% of the practitioners in the clinics were trained. The training was rated as excellent by19% of the respondents, good by 75% and fair by 6%. The reasons for the ratings of excellent and good included: the opportune time at which the training had been provided, the content of the training i.e. clarity on the causes, mode of infection, signs and symptoms as well as management of the disease. One of the comments for the fair rating was that some of the questions were not clearly explained.

50% of the respondents that were trained expressed that they needed more training so that they can be capacitated more on the following:

- About the bacteria
- How to treat imminent symptoms
- What exactly to educate the community about the outbreak
- In the event of another outbreak, what can be done more to prevent it and cure patients
- Identifying other symptoms of the disease for better diagnosis, treatment and immediate management at the clinics
- The role of health inspectors in the outbreak

3.3.3.2 Public education of the clinic patients & the community

Public education of the clinic patients & the community entailed various awareness dissemination methods explained below.

a. Health talks/ awareness sessions

Respondents were asked if the clinic held awareness sessions / health talks on the listeriosis disease with the patients/ people who visited the clinic during the listeria outbreak in 2017 and 2018. 74.5% of the respondents answered yes and 25.5% said no. Of those who answered yes, 60% cited that the frequency of the health talks was daily, 37.5% stated that it was at least once a week and 2.5% stated that it was every month. Respondents were then requested

to highlight other methods which the clinic used to relay listeriosis information to patients and people who visited the clinic and the results are summarised in figure 3.14 below.

b. Pamphlets

88.2% of the respondents indicated pamphlets as one of the methods that was used at clinic level. A review of the pamphlets developed by the City of Johannesburg Health Department established that they came in different languages such as English, Afrikaans, IsiXhosa and IsiZulu in order to cater for the different language preferences of patients and people who visited the clinic. The pamphlets explained the disease by articulating the sources of the bacteria i.e. Listeria monocytogenes, the routes of infection, foods that are most commonly associated with the bacteria and the precautionary methods that one should take when consuming them as well as food hygiene practices, the time lapse between infection and the commencement of symptoms, the population groups most vulnerable to the disease, the signs and symptoms of the disease and how it can be diagnosed and treated (City of Johannesburg Health Department Know more about Listeriosis, n.d.).

c. Posters

49% of the respondents also indicated that posters were another method used while 12% said one on one sessions with patients were conducted. A review of the WHO poster that was provided to the clinics by the City of Johannesburg Health Department established that it conveyed messages on food hygiene handling and storage practices and the rationale behind doing so. For instance, it relayed messages on basic hygiene practices before handling food, e.g. washing of hands and cleaning food preparation surfaces and utensils in order to eliminate or minimise the conveyance of bacteria to food.

It highlighted the need to separate raw foods from other foods as well as the utilisation of different utensils and equipment when handling raw foods and storage of food in containers in order to circumvent contact between raw and cooked food. Raw foods such as meat, poultry, sea food and their liquids therein can harbour bacteria that can be transmitted to other foods at the time of food preparation and storage. Cooking of food thoroughly and mostly meat, poultry, eggs and sea food by ensuring that its cooked at high temperatures of as high as 70 degrees Celsius and ensuring that meat its cooked until it had no strains of pink colour especially pork is essential. Any food that needs to be warmed should be heated thoroughly. The basis for high cooking temperatures and thorough heating is to destroy many microscopic organisms that may be inherent in the food.

The posters also advised people on ideal food storage temperatures and environments. For example, it cautioned people not to leave cooked food at room temperature for longer than 2 hours, advised that cooked and perishable foods be stored in the refrigerator at a recommended temperature of minus 5 degrees Celsius, advised that food should be thoroughly heated (beyond 60 degrees Celsius at most) before it can be consumed, avoid keeping food for a prolonged duration in the refrigerator and avoid defrosting frozen food at room temperature (WHO, n.d.).The rationale behind ideal food storage temperatures and conditions was that the bacteria flourishes over a wide temperature range i.e. between -5 degrees Celsius and 45 degrees Celsius with 30-37 degrees Celsius being the most ideal range for the growth of the bacteria (Kasalica *et al.* 2011:1069). The importance of washing fresh produce before eating it, consuming pasteurised milk and complying with expiry dates of food products was highlighted (WHO, n.d.).

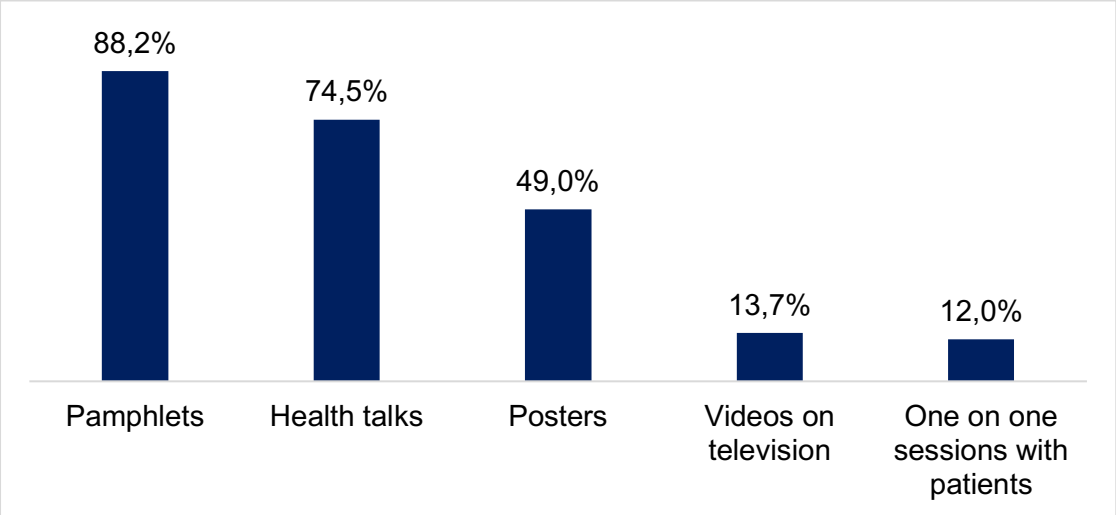


Figure 3.14: Methods used to disseminate information about listeriosis to patients & people who visited the clinics

On being asked if the clinic did a gthorough job in informing people and patients who came to the clinic, concerning the listeriosis disease, 85.5% of the respondents agreed.

d. Community outreach

84.9% of the respondents indicated that there was community outreach regarding listeriosis. On being asked the different approaches that were utilised to reach out to the community, the majority of the respondents (84.8%) cited the use of community workers/ field workers .67.4% of the responses were for pamphlets. Posters, community radio stations, community meetings, community newspapers and videos on television were mentioned by 45.7%, 21.7%, 15.2%, 15.2 and 11.1% of the respondents respectively as illustrated in figure 3.15 below.

Health promoters in conjunction with community health workers/fieldworkers and ward-based outreach teams were integral in stirring or initiating social mobilisation in the community by raising awareness and sensitising the communities about the disease. The information disseminated included how listeriosis could be prevented or avoided and the foods that most vulnerable people to listeriosis should avoid eating (City of Johannesburg, Health Department, Action Plan on Listeriosis Outbreak in the City of Johannesburg, n.d.1). This was done through campaign trails that targeted formal and informal settlements, taxi ranks, bus stations and formal and informal food vendors in order to sensitise and raise awareness to the community about the disease. The modus operandi involved individual and groups awareness, door to door visits as well as distribution of pamphlets and posters. The awareness campaigns were effective to the extent that the community reported on cases such as children at pre-schools displaying likely signs of the disease and these leads were promptly followed through by environmental health technicians who took samples of the food that had been consumed (City of Johannesburg, Health Department, Action Plan on Listeriosis Outbreak in the City of Johannesburg, n.d.1).

Because the source of the outbreak was not yet established, the environmental health practitioners went as far as reaching out to the farmers and their workers in order to reduce the likelihood of contamination of raw food in the farms (City of Johannesburg, Health Department, Action Plan on Listeriosis Outbreak in the City of Johannesburg, n.d.2).

Health promoters have regular planned scheduled visits in the schools according to the health calendar. When the listeriosis outbreak occurred, health promoters also targeted schools as part of raising awareness.

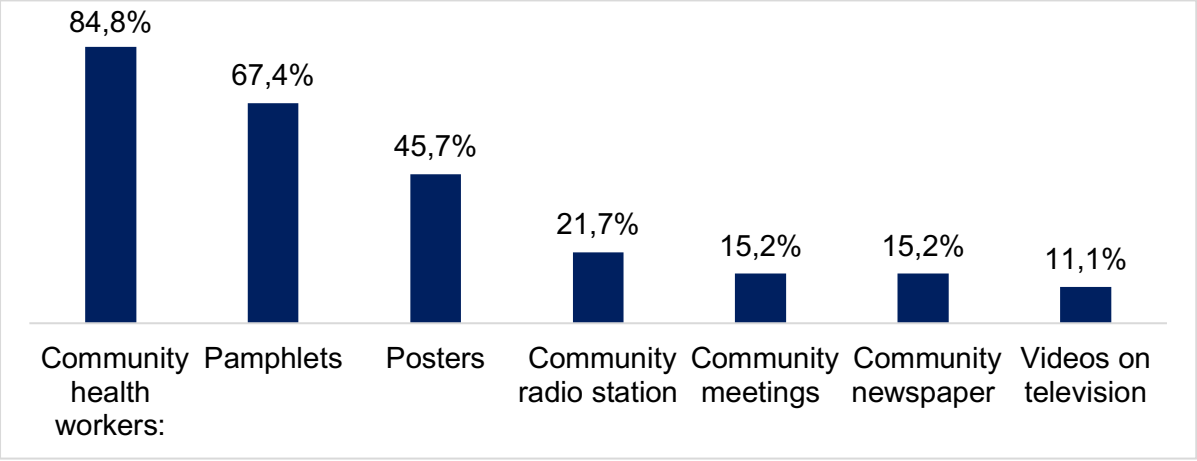


Figure 3.15: Methods used to disseminate information about listeriosis to the community

Respondents were asked if the clinic had a committee in place to deal with the management of disease outbreaks and only 16.4% of the respondents confirmed this. The roles and responsibilities of the committee were articulated as raising disease awareness and to liaise with clinics, communities and schools and creches.

3.3.4 Response mechanisms

The response phase of the plan was divided into three sections. The first part was alert management were the City of Johannesburg Health Department followed through on formal and informal alerts and conducted field investigation to investigate suspected cases of the disease provided the alerts met certain norms. These norms included the credibility of the source of information, the population groups affected and their geographical area, their food consumption history as well as the morbidity and mortality rates as informed by epidemiological and surveillance data, the accessibility of the health institutions to the affected people as well as the capacity of the health facilities to respond to the cases and the media interest in covering the outbreak in the area in order to manage accurate reporting (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017:4-5).

The second stage was field management and was led by the environmental health practitioners who worked in close collaboration with the outbreak response team, clinic staff and community leaders. This process involved collection of food samples eaten by suspected listeriosis cases for laboratory testing and profiling of the cases by completing the case investigation form. The case investigation form captured the following information: the demographics of the patient, type of dwelling, water source, sanitation source, whether there is a refrigerator at the patient's dwellings, dietary history of food consumed including the names of restaurants, take-aways , vendors and shops from which the food was purchased from, the types of any high risk foods that were consumed before the patient got sick, the clinical signs and symptoms exhibited by the patient, any risk factors that the patient might have that makes him/ her vulnerable to the disease e.g. Alcoholism, chronic liver disease, chronic renal disease, pregnancy, malignancy, metabolic diseases such as diabetes, advanced age, pregnancy, immunosuppression treatment e.g. Steroids and chemotherapy, HIV status and prematurity i.e. age at birth (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017:5-7).

Suspected cases of listeriosis were then referred to the hospital for further assessments that included laboratory testing and treatment and were to be further followed upon to determine the outcome. Education on the disease was continuous and health practitioners were encouraged to be on alert for more cases (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017:6).

The third stage was field response and this entailed pooling resources including human resources together in order to execute the relevant public health response with the objective of firstly avoiding further infections and secondly providing the appropriate treatment regime to listeria positive cases. The activities involved at this stage included:

- Following up and referring cases with signs and symptoms that matched those of listeriosis to hospitals
- Re-diagnosis and re-assessment for alternative diseases for patients with laboratory clinical specimens that tested negative for listeriosis. If need be, listeriosis negative cases could be discharged from the hospital in line with the discharge protocol and long-term follow up plan.
- Providing listeriosis patients with the best medical care and psychological and psychosocial support.
- Training of other health care facilities inside and outside of the catchment area of the outbreak on using surveillance data for detection of listeriosis cases and its clinical management i.e. diagnosis and treatment.
- Intensifying listeriosis awareness through mass media communication with the aim of restoring confidence and informing communities on how the outbreak had been handled and what the community could do to avoid contracting the disease and encouraging the use of health facilities if there are any suspected cases of the disease (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017: 7-10).

The preparedness and response plan for listeriosis was to be monitored in terms of tracking whether activities stipulated in the plan were being implemented and if there were any challenges being encountered along the way. The plan was to be evaluated in terms of how the outbreak response team met the objectives, for example, whether people's exposure to the hazard was reduced and whether the best care / treatment was provided to the patients who had listeriosis (City of Johannesburg Outbreak Preparedness and Response Plan for Listeriosis 2017:10).

3.3.4.1 Health inspections

Environmental health technicians were the key people in carrying out health inspections in the interest of public health safety against the disease. Health inspections entailed the environmental health technicians conducting food safety investigations at food outlets and retails that were within 5km radius of suspected cases of listeriosis infection. The investigations involved taking food specimens for testing at the laboratory. Any outlet with specimens that tested positive for the listeriosis monocytogenes bacteria was temporarily closed pending further investigations. The environmental health technicians followed formal and informal leads.

3.3.4.2 Listeriosis management plan/guideline

As illustrated in figure 3.16 below, 44.2% of the respondents had knowledge of the existence of a plan or guideline on how to deal with the listeriosis disease. 55.8% of the respondents had no knowledge of the guideline and this could be attributed to the fact that the clinics never encountered any listeriosis cases and probably if any cases had been encountered it would have prompted alertness on its existence. However, 69.2% of the respondents that were trained/briefed on the disease were aware of a plan or guideline on how to deal with listeriosis while 30.8% were not aware of it.

This plan or guideline was on the clinical recommendations and diagnosis of the disease. It covered the following elements: microbiology of the bacteria and where its commonly found, signs and symptoms, diagnosis and treatment and also provided reference of a case investigation form that had to be completed in the event of any suspected cases of the disease.33.3% of the respondents stated that the plan had been followed to a great extent while 66.7% cited that the plan had somewhat been followed.

Figure 3.16: Knowledge of a plan or guidelines on how to deal with the listeriosis disease

3.3.5 Resource base

The findings determined that there were different perceptions as to the adequacy of resources available in the clinics. 43.7% of the respondents acknowledged that there were inadequate human resources in the clinics. Another 43.8% stated that emergency transport was not reliably available when needed. 40.5% disagreed that there was a reliable means of communication (two-way radio or telephone). The results are summarised in table 3.7 below.

Table 3.7: Perceptions on the availability of resources

	Strongly Agree	Agree	Strongly disagree	Disagree
The clinic has adequate human resources to deal with cases of listeriosis	16.4%	40%	25.5%	18.2%
Emergency transport is available reliably when needed	10.4%	45.8%	27.1%	16.7%
There is a reliable means of communication (two-way radio or telephone).	12.8%	46.8%	27.7%	12.8%

3.3.6 Institutional framework

The management and control of the outbreak was done in line with the National Department of Health Communicable Disease guidelines and Surveillance Policy (Johannesburg Health Services Listeria Cases Report City of Johannesburg 2017: 6). 84.8% of the respondents confirmed that field workers were also used to reach out to the wider community with regards to the listeriosis disease. Partnerships with other stakeholders in managing the disease were confirmed by 44% for with health orientated community and civic organisations in the catchment area and 69.2% for other departments like Environmental health, Education and other sections within health like Health Promotion. However, at clinic level, only 30% of the respondents agreed that clinics received a supportive monitoring visit at least once a month to support personnel, monitor the quality of service and identify needs and priorities with regards to the listeriosis disease. The results are summarised in table 3.8 below.

Table 3.8: Perceptions on collaboration with other stakeholders

	Strongly Agree	Agree	Strongly disagree	Disagree
The clinic collaborates with health orientated community and civic organisations in the catchment area in order to manage the listeriosis disease	8%	36%	34%	22%
The clinic collaborates with other departments like Environmental health, Education and other sections within health like Health Promotion	17.3%	51.9%	17.3%	13.4%
The clinic receives a supportive monitoring visit at least once a month to support personnel, monitor the quality of service and identify needs and priorities with regards to the listeriosis disease	10%	20%	34%	36%

3.4 Attitudes and behaviours

All the respondents acknowledged that they were concerned about listeriosis. On being asked how they felt about educating patients who came to the clinics about the disease, 72.7% of the respondents stated that they were partial to clinic visits and 27.3% stated that they were unsure. The 31.6% who were unsure could be an indication that they were not really confident to do so. The results are summarised in figure 3.17 below.

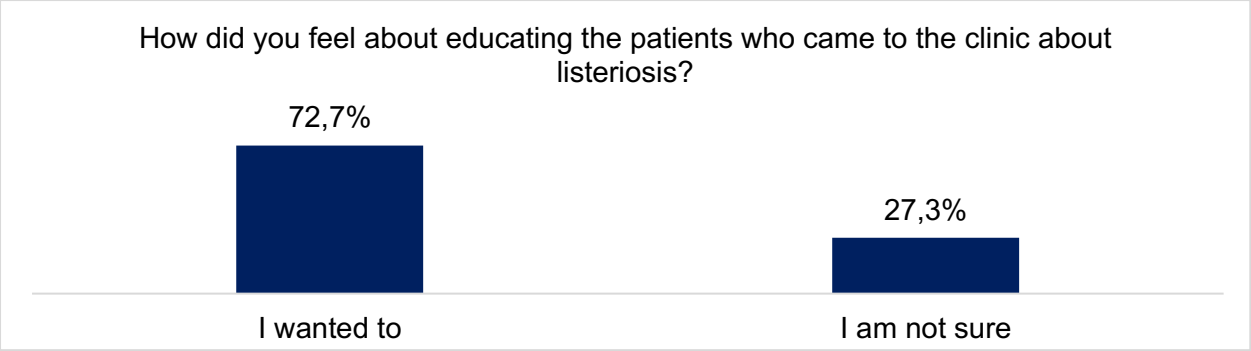


Figure 3.17: Respondents attitude towards educating who came to the clinic about listeriosis

On being asked if pregnant women, infants, the elderly, people with chronic diseases and HIV/AIDS should be given due consideration when it comes to listeriosis, 88.8% of the respondents strongly agreed and agreed to this while 11.1% strongly disagreed and disagreed

to this. The results are illustrated in figure 3.18 below. These results to some extent illustrate the recognition by the 88.8% that these population groups are at higher risk to the disease.

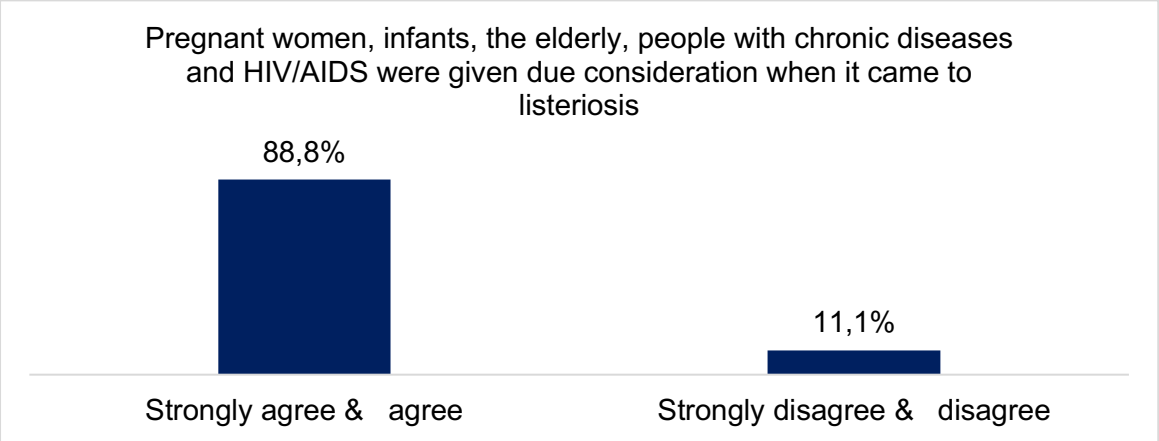


Figure 3.18: Respondents attitude towards if pregnant women, infants, the elderly, people with chronic diseases and HIV/AIDS should be given due consideration when it comes to listeriosis

On being asked if referral to a hospital was important when a patient was suspected of having listeriosis, 94.4% of the respondents strongly agreed while 5.6% strongly disagreed. The results are illustrated in figure 3.19 below. These results to some extent illustrate the recognition by the 94.4% that the disease could be a fatal one and hence the referral for specialised care.

Figure 3.19: Respondents attitude towards if referral to a hospital was important when a patient was suspected of having listeriosis

CHAPTER 4
CONCLUSION AND RECOMMENDATIONS

The loss of life and illnesses caused by the listeriosis outbreak during the period of 2017 to 2018 prompted the researcher to examine the health professionals' acquaintance with the disease and their readiness to deal with it. Previous studies concerning health professionals' knowledge and practices on listeriosis have been mainly concducted in Europe, USA, Canada and Australia and this study was the first one for South Africa. The study aimed to assess the extent of knowledge, attitudes, practices & behaviours of healthcare practitioners in region C government clinics to listeriosis. The study acknowledged the importance of knowledge as a powerful tool for health professionals in order to render health support by minimising the public's exposure and vulnerability to the disease and in so doing build their resilience. Disaster preparedness and response mechanisms were also recognised as essential strategies that can foster effective institutional practices in response to future outbreaks. Extensive literature review was conducted to understand what constitutes listeriosis as a disaster by looking at different models such as the PAR model and the disaster risk equation. The disaster preparedness framework and the progression of safety models were used to understand the capacities that had to be in place to manage the disease. The research was conducted in 6 clinics using quantitative and qualitative data collection methods. The conclusion of the study based on the findings is explained in this section.

4.1 Knowledge of listeriosis

The study revealed that the ost popular sources of information for health professionals concerning listeriosis were media-television, radio, social media applications as indicated by 80% of the responses. While social media is a platform, abundant with health information that is easily accessible, the major downfall of it is the credibility of information on those sites. According to Ventola: 2014, one of the disadvantages is that *"the medical information may be unreferenced, incomplete or informal and thus there is lack of quality and reliability"* as anyone can post or upload content on these platforms. Therefore, it is disturbing to note that most of the health care practitioners obtained information from this and there were a few responses for formal education (5%), workshops (18.3%) and trainings (15%).

The study established that respondents, including those who received training in terms of listeriosis, had knowledge gaps on the disease as explained in the sections below. Studies such as by Simou (2015):41) at a national level in Greece have pointed to the fact that most

people regard the health information that they obtain from health practitioners as truthful, reliable and credible as highlighted by 95.6% of the respondents in the study. Another Australian study by Bondarianzadeh (2007): 470 established that when it came to listeriosis advice, pregnant women trusted medical doctors and midwives as providers of credible advice than other sources. It is against this backdrop that it is critical for health professionals to be armoured with the correct information as patients are highly reliant and dependable on them to relay the correct information on sources of listeriosis.

The study determined that healthcare practitioners had incomplete knowledge of the comprehensive sources of listeriosis infection thereby entailing information gaps on the sources. These findings are synonymous with previous studies that have been done before, for example by Arrish et al. (2016:12) in Australia who ascertained that only 77.8% of the health professionals were cognisant of the food sources highly associated with listeriosis during pregnancy. Despite the public announcement of the source of listeriosis outbreak in March 2018 as polony which is a ready to eat food, only 83.3% of the respondents identified the latter as a source of infection.

Although the majority of the respondents (94.7%) identified that listeriosis could be transmitted through consumption of food contaminated with the bacteria that causes the disease, there was incomplete knowledge on the other modes of transmission of the disease. Consequently, health practitioners risked ill-advising people and especially pregnant women on how babies could be infected with listeriosis thereby compromising the preventative measures that pregnant women could have taken against the disease. The ripple effect of this would be increased listeriosis morbidity and mortality rates amongst neonates as babies

The study ascertained that health professionals mostly knew the signs and symptoms such as such as diarrhoea, nausea and vomiting that were characteristic of food-borne diseases. However, there was incomplete knowledge of the other signs and symptoms that were also distinctive of listeriosis such as headache, muscle aches, stiff neck, and loss of balance, confusion and seizures. The knock-on effect of this would be improper preliminary diagnosis of the treatment to facilitate further treatment or referral.

The study established that respondents were mostly knowledgeable on the use of blood specimens as a listeriosis clinical detection method as established amongst 93.2% of the respondents. The study concluded that there were information gaps amongst respondents on other detection methods.

The study determined that only 84.9% of the respondents knew that the disease could be treated with antibiotics. The lack of awareness of antibiotics as a treatment remedy by 15.1% could have dire consequences as those infected could fail to be provided with the correct treatment regimen due to lack of knowledge by the health professionals.

In order to deter Listeria monocytogenes bacteria (*the hazard)* from culminating into a disaster (listeriosis disease), proactive strategies need to be undertaken. This includes adoption of food preparation, storage and hygiene practices in order to minimise and/or prevent the spread and multiplication of the bacteria that consequently results in the disease when one consumes such contaminated food (WHO 2018). Similar to prior studies like by Buffer et al. (2012:1315), health professionals exhibited gaps on listeriosis prevention strategies.

The study established that there was lack of knowledge regarding vulnerable population groups to listeriosis. The most unknown were unborn babies, new-born babies and people with alcoholism. This unfamiliarity has the causal consequence of missing out on these high-risk population groups for thorough screening & diagnosis of them for any possibility of listeriosis to minimise the progression of the disease as well as fatality cases. Even prior studies by Kirkham and Berkowitz (2010:161) in Canada have pointed that health professionals have incomplete knowledge on listeriosis population groups as in this instance only 18% knew that pregnant women were at higher risk of the disease than other population groups.

4.2 Practices

The City of Johannesburg Health Department instituted a preparedness and response plan. The plan comprehensively articulated the basic pre-requisites that had to be in place such as training of personnel and their functions, communication protocols, guidelines on listeriosis management, IEC materials and public education strategies. The extent of execution of the plan is explained in further sections below.

4.2.1 Information System & Warning System

From a disaster preparedness perspective, the finding on the disjuncture of listeriosis cases between the clinics and Manganye et al. In Region C points to deficiencies in the information systems as there was lack of coordination in terms of relaying feedback and follow ups for confirmed listeriosis cases from the clinics/ their catchment areas amongst the institutions concerned (referral hospitals, NICD and the clinics). This in turn resulted in lack of early

warning systems to the clinics because even though the disease outbreak was reported on the national radar, the lack of communication of this surveillance data to some extent could have compromised the clinics ability to be well- prepared for the disease (Christian et al. 2017). The surveillance information could have been crucial in increasing vigilance in terms of enhanced screening of patients for possibility of the disease and enhancing public education on the disease (IFRC 2000:13-14).

4.2.2 Public education and training

The findings determined that in a bid to enforce community level preparedness to listeriosis awareness, the training targeted community structures such as NGOs, CBOs, faith healers and traditional healers as ambassadors of sensitisation about the disease. Because patients could seek medical assistance anywhere, the training also targeted doctors in government and private practice and hospitals.

The training coverage of health professionals as the first responders to the outbreak was low as merely 28.8% of the respondents were trained. This finding also shows that there was limited in-service training i.e. training of trainers in order to reach a great number of practitioners. This also illustrates gaps in the level of disaster preparedness to the outbreak from a planning and public education and training framework. For instance, as part of preparedness planning there should have been concerted efforts to ensure that the majority of healthcare practitioners were trained as they were the response personnel to the outbreak (IFRC 2000:13). The findings also determined that there were knowledge gaps amongst the trainees.

The findings determined that patient awareness of the disease who took a multi-faceted approach of methods that complemented each other. At clinic level, health talks were one of the most plausible methods of reaching a wider group of people in clinics given the busy settings of those institutions. The posters and pamphlets had the advantage of wider coverage to patients and the community at large and the pamphlets also mostly came in different languages. Observation in all the six clinics established that there was an abundance of posters and pamphlets around HIV/AIDS, tuberculosis and vaccinations amongst others. On the contrary there was no single IEC material regarding listeriosis and discussions with the clinic staff and the key informant established that the resources had run out during the height of the listeriosis outbreak as the clinic sought to inform both patients and the community at large regarding the disease.

The fact that 84.9% of the respondents were aware of community outreach on the disease is an indication and affirmation of the existence and extent of public education and training at a wider community level. However, the 15.1% who were not aware of it could be an indication of the lack of coordination and effective communication on bringing staff on board on community outreach activities.

As part of public education and training and response mechanism, the City of Johannesburg Department of Health embarked on an extensive community outreach drive to raise awareness on the disease beyond the confines of the clinic. The outreach was led by the health promoters in collaboration with fieldworkers and ward-based outreach teams. The effectiveness of the outreach was also seen in community participation in reporting any suspected listeriosis cases so that they could be further investigated by environmental health practitioners. Even though other multi-media platforms cited by respondents, e.g. community radio stations, community newspapers, etc might seem nominal it's also validation that those communication channels were used even though the majority of the respondents (84.8%) were mostly aware of community/fieldworkers as an indispensable tool in raising awareness in the communities. Pamphlets as mentioned by 67.4% of the respondents reached the wider community with information.

4.2.3 Response Mechanisms

A listeriosis management plan/guideline can be regarded as one of the strategies that can be used to improve the effectiveness to the listeriosis outbreak (IFRC 2000:10). The plan was an essential document to guide health professionals with proper preliminary diagnosis of the disease pending referral to hospitals for further assessment and laboratory confirmation (Bamford et al. 2017:3-4). However not all healthcare practitioners at clinic level were trained/briefed on listeriosis and not all practitioners were familiar with the plan or guideline on how to deal with the disease. As the "first responders" to primary health care it's critical that health professionals be equipped with the knowledge and skills on how to deal with the disease also given its rarity so that they do not misdiagnose patients or fail to offer the necessary education pertaining to the disease.

4.2.4 Resource base

Disaster preparedness entails that there be a good resource base in preparation for a disaster before, during and after it strikes (Centre for Management of Environment & Disasters 2014). According to Kent 1994: 293 resources are necessary for catapulting preparedness and hence it's imperative that there be in place at the time of need. The findings established that the

different resources such as human resources, emergency transport and two-way radio or telephone communication are not available at the desired levels to ensure optimum response to emergencies. These findings could entail clinics operating under highly pressurised environments and not being able to respond and support emergency cases timeously. Not only should the requisite human resources be available, but it should also be well-skilled & trained. In this instance, there was a deficit of trained health practitioners armed with the right knowledge and skills base around the disease. The findings also established that even the trained practitioners still exhibited knowledge gaps.

4.2.5 Institutional Framework

According to IFRC 2000:11, coordination of plans and activities with stakeholders with a niche in the disaster at hand is crucial for a successful disaster response as it maximise delivery of services and avoid replication of activities. The findings established that the clinics made use of existing structures such as health promoters and field workers in community outreach and this has the advantage of ensuring the robustness and sustainability of future outbreaks and solidifies their impetus and group camaraderie (Kent 1994:296). Inter-departmental collaboration within the City Health Department with departments such as environmental health and health promotion was good. The environmental health division offered expertise such as health inspections and food sampling for laboratory testing of the bacteria. The health promotion section offered the prowess of public education and training through community mobilisation, sensitisation and awareness on the disease. NGOs and CBOs were also roped in to conduct community outreach on the disease but their level of involvement according to the clinics was a bit limited or less intense.

4.3 Attitudes and behaviours

Generally, the study established that respondents had a positive attitude towards the management of listeriosis. Approximately three-quarters of the respondents were confident about teaching patients about listeriosis while a quarter of them were unsure. The fact that 94.4% of the respondents agreed that referral to a hospital was important when a patient was suspected of having listeriosis is an indication of an understanding that the disease could culminate into a hazard if not well managed. The fact that 88.8% of the respondents agreed that pregnant women, infants, the elderly, people with chronic diseases and HIV/AIDS should be given due consideration when it comes to listeriosis is a recognition that these are vulnerable population groups and respondents are more likely to give them priority in screening them for the disease and providing the right nutrition advice.

4.4 Recommendations

One of the objectives of the study was to come up with feasible, realistic and sustainable preparedness strategies and solutions to the listeriosis outbreak for the clinics. In view of the findings, the recommendations are as follows:

4.4.1 Training of health practitioners

Since listeriosis is rare disease, it in a way kind of caught South Africa off-guard including health practitioners. Therefore, it is recommended that though rare, it be included in the nursing' training curriculum so that health professionals can be better prepared to deal with future encounters of the disease.

An investment needs to be made concerning the improvement of the training coverage of health practitioners when considering the disease. The training of trainers needs to be promoted so that there is knowledge transfer to a wider group of practitioners. This training of trainers can be in the form of structured peer training at clinic level without necessarily taking most of the practitioners from the facility.

Refresher training also needs to be provided and improved in order to close the information gaps on the disease. The intensity of the training needs to be improved to make it more robust.

Emphasis should also be placed in acquainting the health practitioners with the listeriosis management plan/guideline and there can be actually simulation exercises/ rehearsals in this regard in order to gauge the level of the practitioners' capability in using it. This will improve the clinical diagnosis and management of listeriosis in order to reduce morbidity and mortality rates that can emanate from misdiagnosis.

4.4.2 Coordination mechanisms

Information coordination between the clinics, referral hospitals and the NICD needs to be improved so that the clinics can effectively make use of surveillance data in order to increase vigilance to the disease.

4.4.3 Resources

Funding needs to be injected into listeriosis IEC materials such as posters, pamphlets/brochures and display boards so that they are made available and visible in the

clinics and be visible in the clinics. These resources can have the value addition of being used as reference materials by health practitioners. They can also act as a stimulus in enhancing an increased awareness and bringing about more detailed knowledge around the disease. This is more so because the disease is of rare occurrence but with a high case fatality rate and as such constant reminders of the disease should always be there so that health professionals and the community are not caught unaware with a lack of knowledge on it.

At the City of Johannesburg Health Departmental level, there is need to make concerted efforts to ensure that the clinics have adequate resources such as human resources, emergency transport in order to expedite responses to emergency cases.

The City of Johannesburg Health Department also recommended increased human resources capacity of environmental health practitioners. This comes against the backdrop that the turnaround of results from samples sent to the NICD by environmental health practitioners was long as the latter did not have sufficient capacity to deal with the large volumes of samples that it was receiving. Environmental health practitioners were over-worked and could not manage to cope with the amount of work. It was a time-consuming process to to access to all regions with regards to taking specimens from food outlets as they were the only experts who were trained to do so. This raised the risk that in the event that the outlets had listeria positive food, people would still continue buying from them because of lack of knowledge.

Conclusion

The study established that there are knowledge gaps concerning the disease amongst health practitioners which need to be addressed in order for the clinics to be prepared for future outbreaks. Even though the City of Johannesburg Health Department provided training/briefings on listeriosis, not everyone was trained/briefed and those that were trained still require refresher training as they still exhibited knowledge gaps. The study also established that community awareness of the disease was strong and that health inspections of food and retail outlets was done effectively. The study also established that the City of Johannesburg Health Department had a well written preparedness and response plan. However, operationalisation needs to be improved at grassroots level i.e. training of health staff in the clinics.

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APPENDIX 1: KEY CONCEPTS & DEFINITIONS

Disaster is defined as “a serious disruption of the functioning of a community or society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope with using its own resources” (UNISDR 2017).

Hazard is defined as “a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation” (UNISDR 2017).

Vulnerability is defined as “the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazard.” (UNISDR 2017).

Capacity is defined as “the combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. Annotation: Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.” (UNISDR 2017).

Coping capacity is defined as “the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks.” (UNISDR 2017).

Disaster-risk is defined as "the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, and capacity" (UNISDR 2017).

Disaster preparedness is defined as "the knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters" (UNISDR 2017).

Disaster preparedness plan "establishes arrangements in advance to enable timely, effective and appropriate responses to specific potential hazardous events or emerging disaster situations that might threaten society or the environment" (UNISDR 2017).

Ready to eat (RTE) foods: herein refers to "categories typically associated with human listeriosis, i.e. 'meat and meat products,' 'fish and fish products,' and 'milk and milk products' and, food of plant-derived origin." (Ricci et al.2017: 4).

APPENDIX 2: QUESTIONNAIRES

NB: Some of the questions were adopted from existing literature from: (1) American Pregnancy Association 2018 (2) Brind'Amour, n.d (3) CDC, (4) Clark 2007. (5) Department of Health 2000: 1-120 (6) Food Standards Australia New Zealand 2018 and (7) Kasalica et al. 2011:1069 and (8) WHO.

HEALTH STAFF QUESTIONNAIRE

Good day, my name is Regina Murerwa and I am studying for a Master's Degree in Disaster Management at the University of the Free State. I am carrying out a research on the knowledge, attitudes, practices and behaviours of healthcare practitioners to listeriosis in region C government clinics in Roodepoort. The aim of the study is to come up with feasible, realistic and sustainable preparedness strategies and solutions for clinics in case of future listeriosis outbreak.

Participation is voluntary, that refusal to participate will involve no penalty. You may discontinue participation at any time without penalty. There is no requirement to provide a reason for withdrawing and any data collected on you will in default be destroyed, unless you specifically consent to its retention.

Confidentiality: Personal information will be treated in the strictest confidence and will only be available to the Principal Investigator (Regina Murerwa) and my Supervisor (Dr Jonathan Lukusa Tshimwanga), in the case wherein the Principal Investigator is a postgraduate student. The only exceptions - and all of them are rare - would normally be:

1. personal information may be disclosed if required by law
2. the Human Research Ethics Committees of the University may exceptionally require personal data to respond to a formal complaint, or for a compliance audit
3. the South African Health Products Regulatory Authority (SAHPRA), which is the successor body to the South African Medicines Control Council (SAMCC), might conceivably require access to personal data, if conducting an investigation into a drug trial

If results are published, this may, exceptionally, lead to cohort, or more rarely, individual identification. All data collected in the course of the study will be securely retained for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Anonymity will be guaranteed as you will not write your name on the questionnaire**.**

If you agree to participate in this study, please kindly complete this questionnaire as honestly as possible.

Name of clinic: _____

Date: _____

SECTION 1: DEMOGRAPHICS

Please tick the appropriate response

1. What is your gender?	1. Male 2. Female
2. What is your age group?	1. 18-20 years 2. 21-30 years 3. 31-40 years 4. 41-50 years 5. 51-60 years 6. 60 years and above
3. What is your highest level of education?	1. No schooling 2. Primary School 3. Secondary School 4. Certificate 5. Diploma 6. Degree

	7. Masters 8. Doctorate
4. What is your current occupation at this clinic?	1. Operational/Facility Manager 2. Doctor 3. Professional nurse 4. Enrolled nurse 5. Lay Counsellor 6. Pharmacy Assistant 7. Other (specify)_____
5. For how many years have you been in your current occupation?	1. 0-5 years 2. 6-10 years 3. 11-15 years 4. 16-20 years 5. 21-25 years 6. More than 25 years

SECTION 2: KNOWLEDGE OF LISTERIOSIS

6. Are you aware of the disease called listeriosis?
   1. Yes 2. No

If the answer is yes, proceed to question 7

7. How did you learn about the disease? Please tick the appropriate responses

1.Formal education while still studying	
2.On the job experience	
3.Workshops	
4.Trainings	
5.Pamphlets/ Posters/ Newsletters/Journals	
6.Media (television, radio, social media applications)	
7.Other (please specify) _____	

8. Has the clinic or department of health provided you with training on the disease in the last 6 to 12 months?
   1. Yes 2. No
9. If the answer is yes, proceed to question 10, 11, 12 and 13.
10. How would you rate the relevance of the training?
    1. Excellent 2. Somewhat 3. Poor
11. Please provide a reason for your rating

_____

_____

_____

12. Do you feel you need more training on the listerioisis disease?
    1. Yes 2. No

13. If your answer is no, please provide reasons and state the areas that you need further training on

_____

_____

_____

Which of the following statements are true or false?

		True/ False
14.Listeria can be found in	1.Vegetables	
	2.Meat	
	3.Processed foods	
	4.Ready to eat meats	
	5.Unpasteurised milk and soft cheese	
	6.Smoked fish products	
	7.Soil	
	8.Water	
15.Listeriosis can be transmitted through	1.Sexual intercourse	
	2.Coughing/sneezing	
	3.From a pregnant mother to her unborn child	
	4.During birth	
	5.Ingestion of contaminated food products	
	6.Shaking hands with each other	
16.The symptoms of listeriosis include:	1.Diarrhoea	
	2.Fever	
	3.Nausea	
	4.Vomiting	
	5.Muscle aches	
	6.Headache	
	7.Stiff neck	
	8.Confusion	
	9.Loss of balance	
	10.Seizures	
17.Listeriosis	1.Using only pasteurized dairy products	
	2.Thoroughly cooking raw foods from animal sources, such as beef, pork or poultry	

can be prevented by:	3.Serving food at the right temperature	
	4.Defrosting ready to eat frozen food in the refrigerator or microwave	
	5.Avoiding keeping refrigerated fruits and vegetables for more than seven days	
	6.Storing food at the recommended temperature	
	7.Adhering to the expiry date of the food products	
	8.Consuming freshly cooked and prepared food	
	9.Using different cutting boards for vegetables and meat	
	10.Cleaning the refrigerator	
	11.Separating different foods: In order to avoid cross contamination	
	12.Keeping abreast with food recalls associated with listeriosis outbreaks	
	13.Consuming refrigerated fresh-cut deli meats within a few days	
	14.Washing your hands before preparing food, before eating and after going to the toilet	
	15.Washing and decontamination of kitchen surfaces and utensils regularly, particularly after preparing raw meat, poultry and eggs, including industrial kitchens	
	16.Washing raw vegetables and fruits thoroughly before eating	
	17.Having fridge temperatures below 4 degrees Celsius	
	18.Having freezer temperatures below minus 18 degrees Celsius	
18.The people at high risk of getting listeriosis include:	1.Pregnant women	
	2.Unborn babies	
	3.New-born babies	
	4.Elderly people	
	5.People with compromised immune system (e.g. those with cancer, HIV/AIDS)	
	6.People with chronic conditions (e.g. liver disease, kidney disease, diabetes, cancer or alcoholism)	
	7.People with alcoholism	

19.The people at high risk of getting listeriosis should avoid eating:	1.Raw or unpasteurized milk, or dairy products that contain unpasteurized milk	
	2.Soft cheeses (e.g. feta, goat, Brie)	
	3.Foods from delicatessen counters (e.g. prepared salads, cold meats) that have not been heated/reheated adequately	
	4.Refrigerated pâtés	
20.Listerioisis can be detected through the following clinical specimens	1.Blood	
	2.Cerebrospinal fluid (CSF)	
	3.Amniotic fluid	
	4.Placenta	
	5.Other sterile body fluids	
21.Listerioisis can be treated with:	Antibiotics	

SECTION 3: COMMUNICATION

22. Does the clinic hold awareness sessions / health talks on the listeriosis disease with the patients/ people who visit the clinic?

    1. Yes 2. No

If your answer is yes, proceed to question 23

23. How often does the clinic hold awareness sessions / health talk to communicate the listeriosis disease to the patients/ people who visit the clinic? Please tick the appropriate response.

Daily	
At least once a week	
Every month	
Every 3 months	
Never	

24. Are there other ways that the clinic communicates the listeriosis disease with the people / patients who visit the clinic?

    1. Yes 2. No

If your answer is yes, proceed to question25

25. How else is information on the listeriosis disease communicated with the people / patients who visit the clinic? Please tick the appropriate response.

Posters	
Pamphlets	
One on one sessions with patients	
Videos on television	

26. Is the information presented in the local language?

    1. Yes 2. No

27. Does the clinic reach out to the wider community with regards to the listeriosis disease?

1. Yes 2. No

If your answer is yes, proceed to question 28 and 29.

28. How does the clinic reach out to the wider community with regards to the listeriosis disease?

Community health workers	
Community meetings	
Posters	
Pamphlets	
Community radio station	
Community newspaper	
Videos on television	

29. What information is relayed to the people and patients? Please tick the appropriate response.

Potential food sources that contain the bacteria that cause listeriosis	
Signs and symptoms of listeriosis	
How listeriosis can be prevented	
How listeriosis can be treated	
Population groups that are at high risk of getting listeriosis	

SECTION 4: PRACTICES

30. Does the clinic have a committee in place to deal with the management of disease outbreaks?

    1. Yes 2. No

If the answer is yes, proceed to question 31

32. What are the roles and responsibilities of that committee?

_____

_____

_____

_____

33. Does the clinic have a plan or guidelines on how to deal with the listeriosis disease?

    1. Yes 2. No

34. In your opinion, to what extent is the plan or guidelines followed?

1. To a great extent 2. Somewhat 3. To a small extent 4. Not at all

35. Please provide reason for your response

_____

_____

_____

_____

Give a rating for the following statements:

In the event that patients with listeriosis come to the clinic:	Strongly Agree	Agree	Disagree	Strongly Disagree
36.The clinic has adequate human resources to deal with cases of listeriosis				
37. There is standard treatment guidelines and the essential drug list (EDL) manual.				
38.Staff are able to follow the listeriosis disease management protocols and standard treatment guidelines when a patient presents symptoms of listeriosis				
39.The clinic takes clinical specimens for laboratory tests from patients suspected of having listeriosis				

40.There is sufficient medical equipment and containers to take clinical specimens from the patients for laboratory testing				
41.The laboratory results are received from the lab within the specified turnaround times				
42.There are sufficient medicines and supplies as per the essential drug list for Primary Health Care, with a mechanism in place for stock control and ordering of stock				
43.Emergency transport is available reliably when needed				
44. There is a reliable means of communication (two-way radio or telephone).				
45.There will be good coordination between the clinic and the referral hospital				
46. Suspected cases are reported immediately by phone or other communication method.				
47.A clear system for referrals and feedback on referrals is in place and will be adhered to				

48.Please provide any comments on the above statements

_____

_____

_____

_____

Please rate the following statements

	Strongly Agree	Agree	Disagree	Strongly disagree
49.All staff are trained in the management of listeriosis disease and have continuing education every 6 months or when there are reports of increased cases of listeriosis in other towns or provinces				

50.The clinic is doing a good job in informing people and patients who come to the clinic about the listeriosis disease				
51.The clinic has organised and/or conducted outreach services for the community on the listeriosis diseases				
52.There is a functioning community health committee in the clinic catchment area.				
53.The clinic has sensitised, and receives support from, the community health committee with regards to the listeriosis disease				
54.The clinic has trained community health care promoters to educate the community about the listeriosis disease				
55.The clinic plans and implements a district focused and community-based activities, where health workers are familiar with their catchment area population profile, health problems and needs and use data collected at clinic level for this purpose.				
56.The clinic collaborate with health orientated community and civic organisations in the catchment area in order to manage the listeriosis disease				
57.The clinic collaborates with other departments like Environmental health, Education and other sections within health like Health Promotion				
58.The clinic receives a supportive monitoring visit at least once a month to support personnel, monitor the quality of service and identify needs and priorities with regards to the listeriosis disease				
59.Monthly data on the listeriosis disease are checked, graphed, displayed and discussed with staff and the health committee.				

60.Please provide any comments on the above statements

_____

_____

SECTION 5: ATTITUDES

	I want to	I do not want to	I am not sure
61.How do you feel about educating the patients who come to the clinic about listeriosis?			
62.How do you feel about treating people with listeriosis?			
63.How do you feel about taking clinical specimens for laboratory tests from patients suspected of having listeriosis?			

	Strongly Agree	Agree	Disagree	Strongly disagree
64.I'm concerned about the listeriosis disease				
65.Pregnant women, infants, the elderly, people with chronic diseases and HIV/AIDS should be given due consideration when it comes to listeriosis				
66.Referral to a hospital is important when a patient is suspected of having listeriosis				

OBSERVATION CHECKLIST

Name of clinic: _____

Date: _____

Data collected by: _____

Good day, my name is Regina Murerwa and I am studying for a Masters Degree in Disaster Management at the University of the Free State. I am carrying out a research on the knowledge, attitudes, practices and behaviours of healthcare practitioners to listeriosis in region C government clinics in Roodepoort. The aim of the study is to come up with feasible, realistic and sustainable preparedness strategies and solutions for clinics in case of future listeriosis outbreak.

I'm requesting for permission to collect through observation that is pertinent to the research. This includes data on staff personnel, statistics on listeriosis cases that the clinic had, information, education and communication material and on any guidelines/ plans in place to manage listeriosis.

Participation is voluntary, that refusal to participate will involve no penalty. You may discontinue participation at any time without penalty. There is no requirement to provide a reason for withdrawing and any data collected on you will in default be destroyed, unless you specifically consent to its retention.

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If results are published, this may, exceptionally, lead to cohort, or more rarely, individual identification. All data collected in the course of the study will be securely retained for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Anonymity will be guaranteed as you will not write your name on the questionnaire**.**

If you agree to participate in this study, I would like to proceed by asking you a few questions.

SECTION A: HUMAN RESOURCES PERSONNEL

Source of information: _____

Personnel	**Numbers**
Operational/ Facility Manager	
Doctors	
Professional nurses	
Enrolled nurses	
Lay counsellors	

Pharmacy assistants	
Administration clerk/ Receptionist	
Cleaners	
Groundsman	
Other (specify)	

SECTION B: LISTERIOSIS CASES

Source of information: _____

No. of registered cases of suspected listeriosis	**No. of cases of suspected listeriosis referred to hospital**	**No. of cases of suspected listeriosis that had clinical specimens taken for laboratory confirmation**

SECTION C: INFORMATION EDUCATION & COMMUNICATION RESOURCES ON THE LISTERIOSIS DISEASE

Posters	**Yes/ No**	**Comments**
Pamphlets/ Brochures		
Posters		
Videos on television		
Other (specify)_____		

SECTION D: LISTERIOSIS DISEASE MANAGEMENT PLAN/ GUIDELINE

No.		**Yes/No**	**Comments**
1	Does the plan provide information on the reference prints and education material to use?		
2	Does the plan provide information on the patient education information that should be provided?		
3	Does the plan provide information on the equipment that the hospital should have/		

4	Does the plan provide information on the medical supplies that the hospital should have?		
5	Does the plan provide information the competence that health staff should have in order to manage the disease?		
6	Does the plan provide clear referral procedures?		
7	Does the plan provide information on how patient records should be kept?		
8	Does the plan provide information on which partners /organisations to collaborate with in managing the disease?		

KEY INFORMANT INTERVIEW

Good day, my name is Regina Murerwa and I am studying for a Masters Degree in Disaster Management at the University of the Free State. I am carrying out a research on the knowledge, attitudes, practices and behaviours of healthcare practitioners to listeriosis in region C government clinics in Roodepoort. The aim of the study is to come up with feasible, realistic and sustainable preparedness strategies and solutions for clinics in case of future listeriosis outbreak.

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If results are published, this may, exceptionally, lead to cohort, or more rarely, individual identification. All data collected in the course of the study will be securely retained for two (2) years, if a scientific publication arises from the study and six (6) years, if there is no publication. Thereafter it will be destroyed accordingly.

Anonymity will be guaranteed as you will not write your name on the questionnaire**.**

If you agree to participate in this study, I would like to proceed by asking you a few questions.

1. How has the listeriosis outbreak affected people?

2. What measures have been put in place by your organisation in managing the listeriosis outbreak?

3. Which civic organisations has your organisation partnered with and what is their contribution in managing the listeriosis outbreak?

4. What role can the community play in preventing and reducing the morbidity and mortality rates of the disease?

5. What can be done differently in future in order to improve the country's preparedness to similar outbreaks?