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Faculty of Health Sciences

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THE DETERMINATION OF THE PREPAREDNESS OF THE CITY OF TSHWANE IN ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE

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DECLARATION

I, Itireleng Confidence Motswagae, Student Number: 11141035, declare that:

THE DETERMINATION OF THE PREPAREDNESS OF THE CITY OF TSHWANE IN ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE is my original work, and it has not been submitted before for any degree at the University of Pretoria or at any other institution. All sources that have been used or quoted have been acknowledged by means of complete references in the text and in the list of sources.

…….. ……

Signed Date

DEDICATION

I would like to dedicate this study to my beautiful children, Tirelo and Tshwanelo Motswagae, for always giving me a reason to work harder and push harder to be a better version of myself. Your love and words of encouragement keep me moving.

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ABSTRACT

Introduction: Climate poses a threat to global development, and Africa is the continent that is most vulnerable to its consequences. Although climate change is a challenge, it is not among the important problems the government has to address, but concerns about the effects of climate change may be embedded in some of the priorities of city projects and policies. The high vulnerability to climate change is based on Africa's high dependency on natural resources, poor infrastructure, poverty and weak institutional capacity to rapidly and effectively respond to the change. As it stands, South Africa is often caught unprepared with a low capacity to adapt, while weather extremes and hazards are unavoidable. The impact of the disaster depends on the preparedness measures in place.

Aims and objectives: The aim and objective of the study was to determine the preparedness of the City of Tshwane to address the health effects of climate change

Research method and design: Cross-sectional Quantitative method was used in determining the preparedness to address the health effects of climate change in the city of Tshwane. The target population for this study was 7556, while the representative sample size was 380 participants. Two-stage sampling methods were used in selecting participants for the survey. Results were presented in the form of charts, graphs and tables.

Results: The study's results indicate information regarding measures, action plans and strategies in place regarding the preparedness to address the health effects of climate change. The study's results clearly indicate that the City of Tshwane is not prepared to deal with the health effects of climate change Recommendations were made accordingly, and the limitation of the study was also revealed.

Significance of the study: The study's results offered recommendations for climate preparedness planning and provided evidence for a strategic approach to building adaptive capacity to address the health effects. In nursing practice, the findings show that climate change might be integrated into nursing education, so that knowledge and skills needed for

clinical practice in a climatic changing world can be incorporated into the curricula. In nursing research, the findings might contribute to further research on the mitigating, adaptation and resilience strategies for climatic conditions and adverse health impacts.

Key terms /concepts: climate change, determination, preparedness and health.

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CHAPTER 1

OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND

Health is primarily threatened by climate conditions brought on by weather changes (Nhamo, Mabhaudhi & Modi, 2019:1). Globally humans have experienced the symptoms of climatic changes, which have been potentially irreversible and affected many people (Hayes, Blashki, Wiseman, Burke & Reifels, 2018:6). According to (Hayes et al., 2018:4), the World Health Organization (WHO) has estimated an increase of 250,000 excess deaths per year between 2030 and 2050 due to climatic changes. Impacts included heat-related morbidity and mortality, increases in vector borne diseases such as dengue fever, malaria, respiratory illness, and morbidity and mortality due to extreme weather events. The WHO has recorded unfortunate events related to climate change, for example :(1). extremely high air temperatures that contribute to cardiovascular and respiratory disease, especially in the elderly, during the summer of 2003. A heat wave in the summer of 2003 killed about 70 000 people in Europe. (2). extreme rainfall patterns affect the supply of fresh water, resulting in compromised hygiene and increasing the risk of diarrhoeal disease, which kills over 500 000 children aged under five years every year and. (3) climate changes causing water-borne diseases and their transmission, including malaria, bilharzia and cholera (WHO, 2018).

Globally the Paris Agreement adopted in December 2015 moved the world closer to avoiding dangerous climatic changes (Höhne, Kuramochi, Warnecke, Röser, Fekete, Hagemann, et al., 2017:3). This agreement gave hope that contributing factors to dangerous climate changes, such as high temperatures, cold fronts, heavy rain and carbon dioxide, can be resolved in some cases to reduce the health effects on people (Höhne et al., 2017:3).

Climatic impact risked the benefits of sustainable development goals, with the most impact on various sectors, for example, health and economics (Long & Ziervogel, 2020:8). The vulnerability to climate change was based on Africa's high dependency on natural resources, poor infrastructure, poverty and weak institutional capacity to rapidly and effectively respond to the change (Tawane & Mugalavai, 2019:1). Sub-Saharan African countries increasingly recognised the private sector’s potential to assist the community to adapt and become

prepared to deal with climate change (Crick, Gannon, Diop, Sow, 2018:2). Limited research examined how to promote and facilitate private sector adaptation in addressing climate change in developing countries (Crick et al., 2018:2). The critical factor was how the government could provide an effective environment to facilitate these adaptations to deal with climate change (Crick et al., 2018:2).

South Africa was often caught unprepared with a low capacity to adapt, while weather extremes and hazards were inevitable (Nhamo et al., 2019:1). During winter periods, there has been an increase in frequent ear, nose and throat emergency symptoms associated with a significant increase in the rate of common occurrences of epistaxis. Climate changes causing water-borne diseases and their transmission increased the hospitalization and death associated with diarrheal diseases, especially among children under the age of five. Furthermore, there was increased access and utilisation of primary health care, coupled with a quadrupled disease burden and a deteriorating health system that offered poor quality of care in South Africa. The preparedness to manage the impact and how the disaster unfolded was essential to all countries (Nhamo et al., 2019:1). Unfortunately, despite these extreme weather changes, most people were misinformed, and with extremely low awareness levels, this was caused by the limited campaign or other problems such as poverty and political instability where the climate is less prioritised (Akrofi, Antwi & Gumbo, 2019). According to (Selormey, Dome, Osse & Logan, 2019:2) four out of 10 Africans were unfamiliar with the concept of climate change. Among these groups were rural residents, women, the poor, the less educated, and people who worked in agriculture.

In most cases, climate change negatively affected communities' health (Mogale, MolokoPhiri, Peu, Ngunyulu, Mataboge & Mulaudzi, 2016:4). As a result, there was an increased need to access emergency services (Liu, Besser, Parzefall, Riss, Mueller, 2020:1-9). According to (Ahmed, Weddih, Benhafid, Bollahi, Sidatt, Makhalla, et al.,2018:103), between 2011 and 2014, about 829 children were hospitalized because of diarrheal disease, of which 117 of those children died. Although there was a decline in the burden of diarrheal diseases due to the implementation of relevant vaccines, it still poses a significant health challenge. The occurrence of heavy tropical rainfall results in increased hospital admissions due to malaria in five hundred children yearly with high mortality and post-discharge morbidity (Holmberg, FranzénRöhl, Idro, Opoka, Bangirana, Sellgren, et al., 2017:303).

Additionally, climate change exacerbated the health threats among the vulnerable community in South Africa, such as the poor, children, women and elderly were affected the most (Shezi, Mathee, Siziba, Street, Naicker, Kunene et al., 2019:5).

South Africa has experienced its fair share of devastating climatic changes in several provinces (Wright, Chersich, Mathee, 2019:2). One example was in 2016 when the Health Department of North West reported 11 deaths of people aged 22-58, of which those died of heatstroke (Wright et al., 2019:2). During heat waves, the death toll rose among vulnerable groups such as the elderly, people with chronic diseases and infants (Wright et al., 2019:2). During these adverse occurrences, there was increased access and utilisation of primary health care, coupled with a quadruple disease burden and a deteriorating health system that offered poor quality of care in South Africa (Wright et al., 2019:2).

Climatic changes brought on a better comprehension of the full magnitude of the health effects, and the importance of preparedness will provide resourceful insight into the relevant activities that need to be prioritised (Meier, 2017:1). Furthermore, it is essential to be prepared for the uncertainty of climatic effects and climatic predictions (Wright et al., 2019:1). Santhia, Shackleton & Pereira (2018:1) indicated that municipalities were better positioned to support vulnerable groups during the adverse occurrence of climatic changes. Additionally, the municipality's preparedness for climate change provides an advantage for the country to develop flexible measures to meet future climate conditions (Meier, 2017:1). The demand for understanding the value and benefits of climate preparedness measures cannot be overemphasised (Meier, 2017:1). This study aimed to determine the preparedness of the City of Tshwane to address the health effects of climate change.

1.2 PROBLEM STATEMENT

The United Nations' Sustainable Development Goal number 13 urged countries to take urgent actions to combat climate change and its impacts (SDG13:2022). In South Africa, several adverse occurrences related to climate change affected some parts of the country. For example, in January 2012 severe flood hit Limpopo Province, with over 500 mm of rainfall recorded over a period of 24 hours. These floods caused severe damages ranging from the loss of household contents to the complete destruction of all buildings on the property (Fitchett, Hoogendoorn & Swemmer, 2016:1). Seven years later, in December 2019, there was another flood in Pretoria, which affected the Centurion area as well as the Mamelodi informal settlement, where the flood destroyed more than 700 shacks leaving people homeless. During these episodes of flood, around 1300 people were forced out of their homes (Mbatha, 2020:1).

In cities such as the City of Tshwane, the local health authorities were mandated by the country's protocols to have plans in place to address disasters and health-related

consequences associated with climate change (City of Tshwane Climate Response Strategy, 2016:3). The preparedness mandate was supported by the Sustainable Cities Project where cities' development endeavours should meet the needs of the present generation without sacrificing the needs of the future generation (Holmberg,2019:2). In order for the cities to abide by the mandates of SDG 13, they were urged to strive for the lowest pollution of land, air, and water as much as possible. Additionally, land pollution affects agricultural processes that affect food production, leading to increased cases of malnutrition and fatality. Water pollution increases diarrheal diseases such as cholera and bilharzia, subsequently resulting in the increased need to access healthcare facilities (Ndlovu, 2017:1). Of importance was the local health authorities need to have means such as the provision of clean running water, proper waste management and sanitation to mitigate the health effects of climate changes in their localities. Climate change poses a threat to global development, and Africa is the continent most vulnerable to its consequences (Tawane et al.,2019:2). Although the climate is a challenge, it was not registered among the important problems the government has to address, but concerns about the effects of climate change may be embedded in some of the priorities of city projects and policies (Selormey et al.,2019:2), In order to assess and monitor human health vulnerability to climate change, identified the Driving force-PressureStateExposure-Effect-Action (DPSEEA) framework as the most suitable framework for developing the environmental health indicators (EHIs). Nevertheless, there was a dearth of research information on the DPSEEA framework that can be utilised in addressing the health impacts driven by climate change in South Africa. Thus, this study intended to determine the preparedness to address the health effects of climate change in the city of Tshwane by adapting the DPSEEA framework.

1.3 RESEARCH QUESTION, AIM AND OBJECTIVE

1.3.1 Research question

The research question is:

Is the City of Tshwane prepared to address the health effects of climate change?

1.3.2 Aim

Therefore, the aim: of the investigator intended to determine the preparedness of the City of Tshwane to address the health effects of climate change.

1.3.3 Objectives

According to Brink, Vander Walt and Van Rensburg (2018:85), “an objective is a concrete, measurable end towards which effort or ambition is directed, and research objectives” are clear, concise, declarative statements that are written in the present tense.

The objective of the study was:

to determine the preparedness of the City of Tshwane to address the health effects of climate change

1.4 DEFINITION OF KEY TERMS

1.4.1 Determination

Determination as a noun implies “ trying hard to do something or to find out something” (Maul, Roberts, Spaight, Studer, Webb, et al.,2019:5). In this study, determination is meant to find out how prepared the City of Tshwane is to addressing the health effects of climatic changes.

1.4.2 Preparedness

Preparedness implies being ready or the readiness for something (Maul, Roberts, Spaight, Studer, Webb, et al.,2019:5). In this study, preparedness refers to the measures put in place by the City of Tshwane to address the health effects of climatic changes.

1.4.3 Climate Change

The word climate refers to the prevailing changes in weather conditions of a region as temperature, air pressure, humidity, precipitation, sunshine, cloudiness and winds through the year or averaged over a number of years (City of Tshwane Climate response strategy, 2016:3). In this study climate change referred to different weather conditions occurring in City of Tshwane region that have a negative effect on the overall health of the people of Tshwane.

1.4.4 Health

The World Health Organization (WHO) states, "Health is a state of a complete physical, mental and social wellbeing and not merely the absence of a disease”. In this study, health implied the state of well-being of the entire population that currently reside in the community in the City of Tshwane that is negatively affected by climate conditions.

1.5 SIGNIFICANCE OF THE STUDY

Study findings offered a framework for climate preparedness planning and provided evidence for a strategic approach to building adaptive capacity to address the health effects. The study revealed challenges that needed to be addressed to make efforts of addressing the health effects of climatic changes be more effective. Findings informed community engagement, outreach, education, and communication programming on addressing the health effects brought on by climatic changes.

- Nursing Practice

From the finding's climate change might be integrated into nursing education, so that knowledge and skills needed for clinical practice in a climatic changing world can be incorporated in the curricula.

- Nursing research

The findings might contribute to further research on the mitigating, adaptation and resilience strategies for climatic conditions as well as the adverse health impacts.

- Policy making

The findings of the study might assist government and policy makers to develop and adjust policies that addresses health effects brought on by climatic changes. Additionally, the findings might assist health agencies and disease expert to tackle inevitable climate related disasters to help minimize loss of life.

1.6 RESEARCH DESIGN AND METHODS

1.6.1 Study design

Research design is explained as a set of logical steps taken by the researcher to answer the research problem statement (Brink et al.,2018:96). "It forms the 'blueprint' of the study and determines the methodology used by the researcher to obtain sources of information, such as participants, elements and units of analysis, to collect and analyse the data and to interpret results" (Brink et al.,2018:96). The study followed a quantitative descriptive, cross-sectional design to determine the preparedness of addressing health effects of climate changes in the City of Tshwane. An online survey instrument using Qualtrics software was used to determine

the preparedness of the City of Tshwane to address the health effects of climate change. There were open-ended questions and specific questions about the health effects of climate change. The open-ended questions were analysed through the use of thematic coding. Thematic coding is a form of qualitative analysis that categorises text passages by a common theme (Williams, M., Moser, T,2019:7).

1.6.2 Setting

The study setting is where the study will happen, and it is the investigator's responsibility to carefully determine this location (Brink et al.,2018:149). The study took place in the City of Tshwane, which is in the central Pretoria region in Gauteng Province. The City of Tshwane makes up more than three million of the total population of Gauteng, accounting for about 24% of the province's population. Both urban and rural areas surround the city. According to the structure of the City of Tshwane municipality, there are ten service departments, but the study was only interested in 6 service departments which have a population of **7556** employees. The reason for choosing six service departments was the feasibility due to the resource availability and willingness of employees to participate in the survey. The service departments of interest were electricity, finance, water and sanitation, waste management, health and emergency department, which included (road, stormwater and housing services department).

1.6.3 Unit of analysis

The population, as referred to by (Davis & Hughes,2014: 57), is defined as a group of people from which the researcher is planning to get his or her sample of those who meet the inclusion criterion. For the purpose of the study, the population of the study were employees of the City of Tshwane in their different working departments.

1.6.4 Sampling method and sample size

- Sampling

Sampling is defined as the steps the researcher will take to select a sample from the population to gather information about the study to represent the entire population (Brink et al.,2018:132). This study selected the sample from the different City of Tshwane officials according to their different ranks or job titles. Two-stage sampling method was used for this study. The City of Tshwane is divided into ten stratums (sub-groups) which are called service departments. The first stage was to purposively select six service departments out of 10 that were used in this

study. The reason for choosing six service departments was because of the feasibility due to resource availability as well as the willingness of employees to participate in the survey. The second stage was a convenient sampling method since not all categories of staff were included; the readily available respondents willing to participate were included. Inclusion criteria

The inclusion criteria were employees working in the city of Tshwane who were ready and willing to participate in the survey.

- Sample size

The number of people participating in a given study is referred to as the sample size (Polit & Beck,2020:704). The recommendation is to use the largest sample possible because the larger the sample, the more representative it is likely to be (Polit et al.,2020: 284). This study followed Islam's (2018) paper by adopting Cochran's (1977) approach for determining the minimum sample size *n* for unknown population size and unknown degree of variability.

1.7 PARADIGM AND ASSUMPTIONS

1.7.1 Paradigm

A paradigm is a way of looking at natural phenomena that guides one's approach to enquiry (Polit et al., 2020:13). This study was guided by the positivist paradigm.

(Brink et al., 2018:25) defines positivism as a systematic way of doing research that emphasises the importance of facts that can be observed. In this study, the investigator used positivism to determine the preparedness of the city of Tshwane to address the health effects of climate change.

1.7.2 Assumptions

1.7.2.1 Ontology: Nature of reality

The positivist paradigm is based on a set of assumptions that only one reality exists and this reality can be understood, identified and measured, allowing explanations and predictions (Park, Lange & Artino,2020:2). In this study, the investigator assumed determined measures of preparedness put in place by the City of Tshwane on addressing the health effects of climate change.

1.7.2.2 Epistemology: Knowledge of reality

Positivists believe that knowledge of reality can and must be developed without being influenced by the values of the investigator and respondents. Once this knowledge has been appropriately developed, it is, therefore, the truth and accurate. For that to happen, there should be a separation between research respondents and the investigator (Park et al., 2020:2). In this research, the investigator obtained knowledge by using both open-ended questions and specific questions about the health effects of climate change to determine the preparedness of the City of Tshwane on addressing the health effects of climate change.

1.7.2.3 Methodology: How to conduct scientific research

The positivist methodology is based on engaging in research where variables can be controlled and manipulated in a particular setting (Park et al.,2020:4). This study followed a quantitative descriptive, cross-sectional design to determine the preparedness to address the health effects of climate change in the City of Tshwane.

1.8 MEASUREMENT TOOL

1.8.1 Measurement method

Measurement tools are instruments used by the investigator in gathering, manipulating and interpreting data related to the research question (Leedy & Ormrod, 2014:7). In this study, a structured questionnaire was developed through information the investigator gathered during the literature review process, and the questionnaire was based on the objectives and DPSEEA theoretical framework of the study.

The questionnaire consisted of close-ended and open-ended questions. Information gathered with the questionnaire included: Section A of the questionnaire was on the **Demographic details** of the respondents (questions 1-7). Section B: focused on measures in place to address the health effects of climate change (questions 8-15). Section C were questions related to the application of the framework (questions 27-45). Of which questions 16- 20 addressed the driving force domain, question 21-25 addressed pressure on the environment, question 26-28 addressed the state of the environment, questions 29-32 addressed exposure to humans, questions 33-38 addressed health outcomes and question 3945 addressed actions plans taken. The data collection tool is attached in **Annexure C**.

1.8.2 Reliability

Reliability is defined as “the consistency with which the instruments used to collect data measure the target attributes” (Polit et al., 2020:331). They further explain that reliability is when the instrument used to collect data gives less difference if the measurement were to be repeated. Therefore, the instrument should be accurate and consistent. To ensure reliability, the instruments used in the study were the same for all respondents of the study. According to (Bolarinwa, 2015:4), there are three dimensions of reliability, namely, stability test–retest reliability), equivalence (alternate-form reliability) and internal consistency (homogeneity). This study used internal consistency. Thus, Cronbach alpha was employed to quantify the internal consistency and reliability of the questionnaire. This Cronbach alpha reliability method is easier to use since it requires one test administration (Tavakol & Dennick, 2015:2). The internal consistency of each item (question) in the questionnaire will be determined by obtaining and comparing the alpha coefficients for each item Cronbach’s alpha reliability coefficient ranges between 0 and 1, and the closer Cronbach’s alpha coefficient is to 1.0, the greater the internal consistency of the instrument, while closer to 0 represents an instrument that is not reliable (Wong, Ong, & Kuek, 2015:4). A reliability coefficient (alpha) of 0.70 or greater is considered acceptable reliability. The rating of each item from the panel will be collected and calculated.

1.8.3 Validity

Validity of the data collection tool (questionnaire)

Validity is defined as the accuracy and truthfulness of the scientific findings of the study (Brink et al.,2018:127). Validity in this study was maintained by ensuring that the online survey questions were able to measure what was intended to measure with adaptations done on similar studies. Validity is the extent to which an instrument measures what it is intended to measure (Tavakol et al.,2015:2). There are different kinds of validity tests, namely, face validity, construct validity, content validity and criterion validity. This study used theoretical validity based on existing literature to measure the consistency of the questionnaire to be used. Face validity is a type of validity that is based on the judgement of an expert in the field being studied (Brink et al., 2018: 166). The supervisor and co-supervisor assisted in validating the questionnaire as they are experts in the study.

1.9 PILOT DATA COLLECTION

A pilot study is a small-scale trial run off an actual research study (Brink et al., 2018:216). The study was conducted on a small group of respondents from the intended population. The questionnaire was pre-tested on 38 employees (10% of the sample size), and these employees were not part of the main survey. Subsequent to the pilot study, the questionnaire was adjusted to incorporate lessons learnt during the pilot survey. The aim of the pilot study was to see if questionnaires are easily understandable and accessible on Qualtrics. Data gathered in the pilot study provided guidance for a functional study adaption through modification of the questionnaire.

1.10 DATA ANALYSIS MANAGEMENT

Data analysis was done with the assistance of the statistician. Data were entered in a computerised Microsoft excel data sheet. The coding system was developed and subsequently implemented for questions that needed post-coding (specifically for the openended questions). Chi-square test (χ^2) for the equal proportion technique was performed on the data in order to describe demographics, climate and health-related issues questions in terms of frequencies and percentages (Grove & Burns,2013:538). Descriptive statistics summarised the data in terms of simple quantitative measures such as percentages or means as well as in visual forms such as graphs, histograms and box plots (Kaliyadan & Kulkarni, 2019:10). Furthermore, the chi-square test (χ^2) for independence in a two-way contingency table was performed in order to determine if there is an association between the demographics and climate and health-related issues. The descriptive statistics in a two-way contingency table summarized relationships between variables using tools such as graphs (Kaliyadan & Kulkarni, 2019:10). Furthermore, the phi (ϕ) coefficient was used to determine the strengths of association between the two variables that were deemed to be significantly associated (Kim, 2017). The ϕ coefficient ranges between 0 and 1. A value between 0 and 0.3 is considered to be a weak association, while a value between 0.3 to 0.6 is a moderate association, and more than 0.6 is a strong association. All data were analysed using Statistical Analysis System (SAS 9.4) software.

1.11 ETHICAL CONSIDERATIONS

Ethical considerations are said to be ethical principles that guide the researcher during the research process (Brink et al., 2018: 34). These principles form moral guidelines and include

respect for persons, beneficence and justice. According to the process (Brink et al., 2018: 34), these principles are based on human rights that need to be protected in research, being the right to self-determination, privacy, anonymity, confidentially, fairness and beneficence. The researcher only conducted the study once it was approved by Ethics Committee. Informed Consent was obtained from the Gauteng Province City of Tshwane Authorities (Annexure A). The investigator administered Informed Consent to respondent prior to conducting the study refer to Annexure B.

1.11.1 Respect for human dignity

Respect for human dignity includes the right to full disclosure and to self-determination (Polit et al., 2020:154). In this study, self-determination was ensured by treating the respondents as autonomous individuals who are capable of deciding on their own if they want to participate in the study or not.

Should respondents take part in the study, they have the full right to withdraw their participation at any point without any penalties. Coercion of respondents was not done. This was ensured by not offering any rewards or penalties to respondents who chose to be part of the study or chose not to be part of the study.

1.11.2 Confidentiality and Anonymity

Anonymity in the study was ensured by allowing data collection to remain anonymous and not to be linked to the respondents (Polit et al., 2020:162). In this study, data collected from the respondents was only available to the investigator and codes were used to capture data instead of the respondent's name.

1.11.3 Justice

Refers to the participant's right to fair selection and treatment (Brink et al., 2018:36). In the study, all respondents from the six service departments who were readily available were given an equal chance of being selected, and all respondents were treated fairly. Should they decide not to participate, they were not discriminated against.

1.11.4 Beneficence and non-maleficence

It is the investigator's duty to ensure that the research does not impose harm and maximizes the benefits (Polit et al., 2020:162). In this study, no risk or harm was posed to the respondents as they were only required to fill in an online survey. Respondents participate voluntarily and can withdraw from the study at any time without any penalties.

1.12 THEORETICAL FRAMEWORK

A theoretical framework is defined as a network or interlinked system or relationship of assumptions, expectations and beliefs (Tamene, 2016:2). A framework is an essential and central element of the research design that guides both the investigator and reader about what is going on, what has been done and how it has been done (Tamene, 2016:2). The framework was developed by the world health organisation (WHO, 1996b, 1997a,b, 1999a). In this study, the investigator used the DPSEEA framework to determine the preparedness of the city of Tshwane to address the health effects of climate change. The reason for using this framework was because it incorporated the domain factors relating to climate change indicators and was able to address the research question.

Indicators are the driving force which leads to pressures in the environment in the form of production, consumption and waste release. This contributes to changes in the state of the environment, for example, increased temperature and increased rainfall patterns. Increased temperature causes increased heat waves and droughts. We experience weather extremes such as floods, storms, and rising sea levels with increased rainfall patterns. Therefore, exposure occurs when humans come in contact with hazards leading to a negative effect on human health and well-being. These negative effects include injuries and heat-related diseases such as heat exhaustion, heat strokes, respiratory diseases and cardiovascular diseases. Among others, it assists and supports decision-making on ways to reduce the burden of the disease brought on by climate change (Füssel, 2015:3). Additionally, the framework chosen was helpful in developing a set of environmental health indicators in the proposal for monitoring health impacts of climate changes (Füssel, 2015:3). The following components of the framework was used to structure the questionnaire, in addition to the literature review that will also be sought.

The DPSEEA framework was an acronym for the following components.

D Driving force (anthropogenic): These are developmental forces such as population growth, agriculture as well as land usage that may have a negative impact on the health status. These are looking into the pollutants resulting from human activity. The investigator expounds on this component further in the questionnaire to try to find the relation. E.g., Do you think the population is responsible for climate change? (Annexure C-Questions 16 to 20).

P Pressure (on the environment): This component identifies the environmental pressures, such as food production patterns, consumption patterns as well as behavioural patterns, leading to greenhouse effects as well as the creation of aerosol. (Questions 21-25 sought the pressure on the environment).

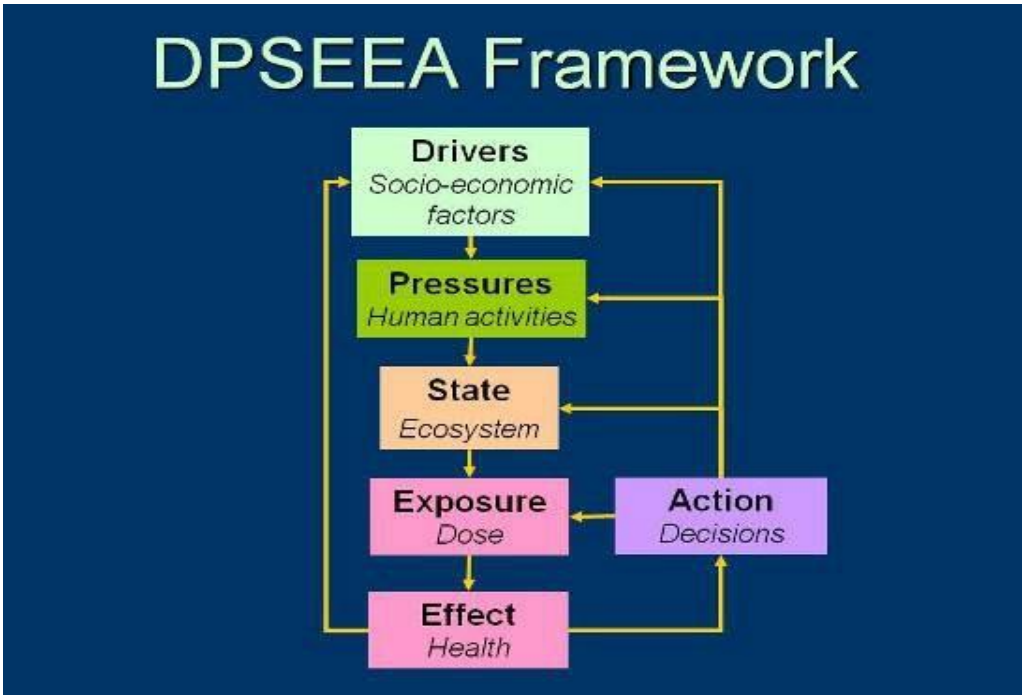
S State (of the environment): This component refers to natural hazards, availability of resources and level of land pollution that may result in long-term climate changes. The following section of the questionnaire identified this component (Questions 26-28). There are adequate waste and sanitation management services within the communities. Any natural hazards, such as flooding, have been experienced within the city of Tshwane.

E1 Exposure (of humans; i.e., the interaction between the environment and humans): Physical exposure and pathogen intakes such as heatwaves, flooding, drought and air pollution. This component took into consideration any health-related data that was gathered on the exposure of humans. Questions 29-32 addressed this.

E2 Effect (in humans): Health outcomes such as well-being, morbidity and mortality, the following section on the questionnaire identified this component (Questions 33 to 38). This also assessed the readiness of the services to address the health impacts and to see if any data had been collected on the statistics related to climate change and the morbidity and mortality rates.

An Action: An action plan for each component. The following section of the questionnaire identified this component (Questions 39-45). This was to determine measures put in place to address the driving forces, pressures and states on the environment, exposure and effects on humans. The framework was used to formulate a questionnaire to determine the preparedness of the city of Tshwane to address the health effects of climate change and to achieve the study objectives, which determined the measure put in place by the city of Tshwane.

Figure 1.1: DPSEEA Framework



1.13 ORGANISATION OF THESIS

The table below indicates an overview of the organization of the thesis

Table 1.1: Organisation of thesis

CHAPTER	HEADING	BRIEF SUMMARY OF CHAPTER
Chapter 1	Overview of the study	This chapter includes the introduction, statement of the problem, research question, aims and objectives of the study, definition of key concepts, settings of the study, philosophical assumptions, delineation of the study, significant contribution and theoretical framework.
Chapter 2	Review of related literature and studies	This chapter includes some related literature and studies of both international, national and local studies done about the preparedness to address the health effects of climate change.
Chapter 3	Research Methodology	This chapter presents the research methodologies used in the study. This includes the research design, population and unit analysis, recruitment process, sample method and sample size.
Chapter 4	Presentation of the results	This chapter presents the collection and organization of data. This includes data collection tools, validation of data collection tools, data collection procedures as well as the pilot study.
Chapter 5	Discussion of the results	This chapter indicates the way in which data will be analysed, how the reliability of the questionnaire will be tested as well the quality control of the research outcomes
Chapter 6	Conclusion and recommendations based on results	This chapter offers the summary of findings, conclusion and recommendation in accordance with the results

1.14 SUMMARY OF CHAPTER

This chapter has introduced the study and provided information on the orientation and the theoretical framework of the study. The chapter further presented the problem statement, research question, aims and objectives of the study, definition of key concepts, settings of the study, philosophical assumptions, delineation of the study and significant contribution of the study. A summary of the research methodology applied in the study was also presented. The next chapter presents a literature review and related studies done on addressing the health effects of climate change.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter explored the study overview on various aspects, such as the introduction and background to the research topic, the problem statement, the definition of key terms, the theoretical framework, the research methods, and the study design.

This chapter includes some related literature and studies of both international, national and local studies done about the preparedness to address the health effects of climate change.

2.2 AIMS OF THE LITERATURE REVIEW

The investigator conducted this literature review in order to explore available knowledge on the preparedness of different cities to address the health effects of climate change.

2.3 LITERATURE REVIEW PROCESS

Brink et al., (2018:57) define literature review as finding, reading, understanding and forming conclusions about published research and theory as well as presenting it in an organised manner. Polit and Beck (2017:257) refer to a literature review as a critical summary of existing knowledge on the topic of interest in order for the research problem to be placed in context. The review of the existing scholarship or available body of knowledge that helps the investigator to see how other scholars have investigated the research problem that they are interested in is described as a literature review by De Vos, Strydom, Fouche and Deport (2018: 297).

Creswell (2014:57) states that a literature review helps to determine whether the topic is worth studying and provides insight into which the investigator can limit the scope to a needed area of inquiry. Gray, Grove and Sutherland (2018:120) state that the purpose of conducting a literature review is to discover recent, relevant information about a particular phenomenon.

The literature sources reviewed will identify the gap between what has been written about the topic and what has not been written, as well as possible flaws in the Literature (Maree 2018:26). To identify the research problem and refine the research question by placing the study in the context of the general body of knowledge, which minimises possibilities of unintentional duplication and increases the probability that the study makes a valuable contribution (Brink et al., 2018:58).

The review was rigorously conducted to; determine what is already known about the proposed research topic or question, appraise the quality of the research evidence and synthesize the research evidence from studies of the highest quality. Furthermore, through the review, the investigator identified the research gaps and priorities for generating new evidence to fill these gaps, avoid unnecessary duplication of research, and shape future research projects and plans (Polit et al., 2017:170). Therefore, the literature review gives an idea of established knowledge about similar studies, as well as what is unknown about the research problem (Brink et al., 2015:54).

The investigator followed the principles of a systematic review approach, and this was shown through a literature review. For the robustness of the reviews, systematic reviews collect and critically analyse multiple research studies or papers from a quantitative study through logical processes. The review provided an exhaustive summary of the available literature that is relevant to the study research question with the assimilation of statistical quantitative deductions (Polit et al., 2017:647).

2.3.1 Identification and formulation of a review question

The review question for this literature review became: How are the different cities prepared to address the health effects of climate change?

2.3.2 Generation of a search strategy

Several libraries and databases were utilised to obtain information about the preparedness of the City of Tshwane to address the health effects of climate change. The search terms used for literature were constructed within the scope of the study that is related to the health effects of climate change and carried out electronically using databases. The key terms used for scientific and scholarly information were: health and climate, climate changes and health, effects of climate changes, addressing the health effects of climate changes, climate changes in different cities, climate changes in South Africa, and extreme weather events.

2.3.3 Execution of the search and selection of the relevant studies

The search for the scientific evidence and reference lists of the articles was carried out electronically by using the Scopus database, ScienceDirect, Google scholar, the City of Tshwane database, the City of Johannesburg metropolitan database and the University of Pretoria library resources, which includes articles and review. The sources provide a comprehensive data output from different professions, such as nursing, nursing education, engineering, and social science, among others. The literature search was conducted aiming to extract the available knowledge on addressing the health effects of climate change. The search for literature remained merely within the scope of this study, and the databases provided the most relevant information as well as suggestions. The required information for the study was obtained through abstracts, reports, analysis, results of the reports, discussions, and recommendations from different works of literature and studies assisted in not missing out on any vital and important information.

2.3.4 Inclusion criteria

In this literature review, the following inclusion and exclusion criteria were used:

Articles on climate and health

Articles about the health effects of climate changes

Articles related to addressing the health effects of climate changes

Articles about how different cities address the health effects of climate changes

Articles published in English

Articles published from 2013 to 2020

2.3.5 Exclusion criteria

Articles not related to climate and health

Articles not about the health effects of climate changes

Articles not related to addressing the health effects of climate changes

Articles not about how different cities address the health effects of climate changes

Articles not published in English

Articles not published between 2013 to 2020

2.3.6 Extracting data

To discuss the health effects of climate change, more than thirty (30) articles, five (5) published theses, four (4) unpublished theses and three mixed-method studies were reviewed globally and locally. Fifty (50) titles were identified, from which twenty (20) abstracts were examined as they met the inclusion criteria. The twenty (20) abstracts were further examined to verify if they address the research question: How are the different cities prepared to address the health effects of climate change? This question guided the literature search strategy adopted in this study.

2.4 DISCUSSION OF FINDINGS FROM THE LITERATURE REVIEW

2.4.1 Climate changes from a global perspective

Climate change is a global public health emergency with implications of disrupted access to care and emergency services (Theron, Bill, Hynes, Stassen & Rublee, 2022:3). The African continent is particularly vulnerable to climate-related extreme weather events due to an already overburdened health system, lack of early warning signs, poverty, inadequate infrastructure, and variable adaptive capacity (Tawane et al., 2019:2). Emergency care services are not only utilized during these events but are also threatened by these hazards. Considering that the effects of climate change are expected to increase in intensity and prevalence, it is increasingly important for emergency care to prepare for the health effects of changes in the climate (Theron et al., 2022:3).

Climate change has an impact on all living things on earth, including people's health and wellbeing, energy, water resources, food, natural and forest ecosystem, sea level and air quality(Alwreikat & Lalanan, 2022:4). Climate change is inevitable and is already evident in many parts of the world (Alwreikat & Lalanan, 2022:4). Climate change is among the most challenging and critical issues in our society. This phenomenon concerns all countries all over the world(Alwreikat et al., 2022:4).

Climate change is caused by several processes that release a large volume of heat-trapping gases into the atmosphere. These trapped gasses cause the atmosphere to warm faster than naturally, resulting in devastating health effects (Theron et al., 2022:3). Extreme weather events include droughts, floods, wildfires, cyclones and heat waves (Theron et al., 2022:3).

These extreme weather conditions contribute to life-threatening health conditions such as traumatic injuries, heat-related illnesses, asthma diseases, cardiovascular disease, psychological disorders and an increase in vector-borne diseases such as malaria (Theron et al., 2022:3). Unfortunately, over time extreme weather conditions are expected to increase in both intensity and frequency.

2.4.2 Climate changes according to a national perspective

Given South Africa increased burden of disease, climate change is a health issue which necessitates urgent health sector response**.** The growing impact of climate change has major challenges for South Africans, especially for the vulnerable groups in the country (Chersich, Wright, Venter, Rees, Scorgie & Erasmus., 2018:2). Frequent environmental changes are creating effects on multiple domains, from different weather changes to food scarcity and an increased burden of diseases (Chersich et al., 2018:2). In South Africa, the country's response to climate change is negatively affected by policy uncertainty and corruption, especially in the energy and transport sector, and health unprepared for the effects of climatic changes (Chersich et al., 2018:2).

2.4.3 Climate changes from a local perspective

It is challenging to produce reliable information about the future health risks of extreme weather events , especially at a local scale. Most projects do not include local estimates of future risks and costs and make allowance for the potential implementation of adaptation(Curtis, Fair, Wistow, Val & Oven., 2015:3). There is little evidence available on the future impacts of the healthcare system. Furthermore, there is a dearth of research as well a gap regarding climate change health preparedness literature (Theron et al., 2022:3).

2.4.4 Types of climate changes affecting the health system

The growing impacts of climate change have significant implications for the health system, with South Africa's health system experiencing a quadrupled burden of disease. The below extreme weather conditions affect the health system and social care systems the most.

2.4.4.1 Impact of Heat waves

Heat waves are extreme high air temperatures that contribute to certain diseases, such as cardiovascular and respiratory disease, especially in the elderly (World Health

Organisation., 2018). Heatwaves cause problems with the functionality of hospitals, such as medical equipment and storage of medicines, by means of acquiring additional cool rooms to store and preserve medication. Heatwaves affect thermal comfort for patients that are hospitalised. Staff members of the hospitals also experience some sort of discomfort. Hospital admissions due to respiratory diseases increase ambulance call-out rates (Curtis et al., 2015:2).

2.4.4.2 Impacts of cold waves

Cold waves are extremely low temperatures. Due to cold waves, ambulance response times have become longer, and patients find it difficult to access health care facilities. Impacts on health service due to frequent consultation and treatment of respiratory infections. Emergency treatment for injuries resulting from falls in ice and snow, especially the vulnerable group such the elderly people(Curtis et al., 2015:2).

2.4.4.3 Impacts of flood

Flood events are caused by extremely heavy rainfall events and patterns. These flood events can interrupt health service delivery and accessibility for local populations. They also have a significant impact on public health and on the population to sustain its livelihood (Wright, Kapwata, du Preez, Wernecke, Garland, Nkosi, Landman, Dyson & Norval., 2021:4).

Extreme rainfall patterns affect the supply of fresh water, resulting in compromised hygiene and increasing the risk of diarrhoeal disease, which kills over 500 000 children aged under five years every year (WHO., 2018). The prevalence of vector-borne diseases, such as malaria, bilharzia, and cholera, also increased during extreme rainfall events, resulting in an increase in hospital admissions (Hayes et al., 2018:4). Essential infrastructure on which health services depend may also be damaged.

2.4.4.4 Impacts of droughts

While heavy rainfall and flooding are projected to increase in certain areas of South Africa, dry conditions in areas such as the western interior and the northern parts of the west coast can lead to drought with negative impacts on food security and nutrition (Wright et al., 2021:4). The health impacts of droughts include malnutrition due to reduced food production and increased risk of diarrheal disease due to lack of water to ensure proper hygiene (Hayes et al., 2018:4). Following an extended drought event between 2015 and 2016 in KwaZulu-Natal, the prevalence of stunting among children under five years of age rose because of increased food insecurity. Furthermore, the severe water restrictions imposed in Cape Town due to a severe drought between 2016 and 2018 led to economic losses in the agricultural sector and increased unemployment (United Nations University, 2018:6). After the droughts period, there was a surge in mosquito numbers, leading to malaria outbreaks when the first rains fell because of increased breeding sites and the absence of predators and competitors caused by the drought (Wright et al., 2021;2).

2.4.5 Climate changes and proposed solutions

The investigator exposed multiple challenges with a proposed solution on how Africa can mitigate the health effects of climate change (Theron et al., 2022:3). The table below 2.1 is a summary of the findings and proposed solution in the study done by Theron et al., 2022:4.

Table 2.1: Climatic challenges and proposed solution

Identified vulnerabilities'	Proposed solutions
• Increased mortality rate, severe injuries and increased hospitalization during floods	• Implementations of early warning systems, timely evacuation and effective medical attention
• Local burden of communicable and noncommunicable diseases	• Implementation of national hazards emergency preparedness plan
• Poor drainage system, hygiene and sanitation in communities	• Mobilisation of community members to assist in cleaning the community itself

• Poor building conditions and design • Clay ground gets muddy and makes patient transportation with wheelchairs a great challenge	• Building new areas, walls and improved storm draining systems to reduce flooding inside healthcare facilities
• Lack of ventilation and increased hospital discomfort during admission periods	• Improve ventilation of the building during extreme heat • Real-time temperature monitoring inside health facilities is of great importance

2.4.6 Health and other sectors roles

The health sector has a vital role to play in mitigating the impacts of climate change. The proposed National Health Insurance will give equal access to care and treatment for all South Africans, with particular emphasis on disease prevention and health promotion, with emphasis on protecting communities against the health risks of climatic change (Chersich et al., 2018:3). Furthermore, the health sector maintains information data systems and databases needed to track climate-sensitive diseases such as malaria, which is a notifiable disease in South Africa (Chersich et al., 2018:3). In addition, the response of an already burdened health system remains unclear. The World Health Organization promotes the 'Health in All Policies' approach, which integrates health into environmental and disaster risk management policies, with major efforts to prevent the adverse effects of climate change on human health by adding health promotions and awareness campaign strategies(WHO, 2014).

A critical role of the health sector is recording data required for the analyses of the impacts of climate change on disease prevalence. The healthcare system in South Africa faces challenges such as a lack of capacity and financial support, and, despite attempts to improve the quality of care, it is not optimal (Maphumulo & Bhengu, 2019:1). Health data are often lacking from primary healthcare facilities, and where they do exist, they may not be in the appropriate temporal or spatial scale for application in climate analyses (The Africa Report, 2020:7). Data are typically paper-based, thus prone to error and loss, and require entry into electronic systems, which is labour-intensive and time-consuming. Biometric data collection would be an improvement benefitting climate change and health research.

2.4.6.1 Preparedness, disaster risk management and public awareness

Societal resilience to climatic change is critical, and the early detection of disease trends due to alterations in climate is vital to facilitate effective interventions. The National Climate Change Response Plan describes potential health challenges, including vector- and waterborne diseases, heat stress and diseases related to air pollution exposure (Wright et al., 2021:3). It calls for increased data collection and research on links between climate and health and tracking of climate-related diseases as part of a national Monitoring and Evaluation System (Department of Environmental Affairs and Tourism, 2004:8). Policies such as the Disaster Management Amendment Act No.16 of 2015 now explicitly call for climate change inclusion in disaster risk assessments (Department of Environmental Affairs, 2018:8). This is applicable across all spheres of government and includes the development of early warning mechanisms.

2.4.6.2 South African Commitments to international and national commitments policies to address climate change and human health risks

The table below indicates the commitment of all stakeholders to mitigating climate change's health effects.

Table 2.2: Commitments, actions, and activities

Commitments, actions, activities	Description
The Constitution of the Republic of South Africa (No 108 of 1996) Section 24 (1996)	Everyone has the right to have an environment that is not harmful to their health or well-being for both present and future generations.
Drought Management Plan (2005)	Focuses on institutional arrangements, integrated institutional capacity, disaster
	Risk assessment and reduction planning, and response and recovery from drought.

Libreville Declaration on Health and Environment (2008)	The African Libreville Declaration on Health and Environment also supports actions from the Paris Agreement around adaptation, particularly for maternal and child health.
National Climate Change Response Policy White Paper (2011)	A comprehensive framework to address climate change adaptation, mitigation, and resilience development. A response strategy is laid out, and actions are prioritized. For example, integrated planning across sectors is a necessity.
Intended Nationally Determined Contribution (2015) (https://unfccc.int/)	Commits to addressing climate change based on science and equity. The need for financial and capacity support is emphasized to implement the proposed interventions, such as early warning system preparation
Paris Agreement (2016)	South Africa is a party to the Paris Agreement within the United National Framework Convention on Climate Change that deals with greenhouse gas emissions mitigation, adaptation, and finance
The National Development Plan 2030 (2017)	South Africa's overarching guide mentions the need to address the disproportionate impacts of climate change on the poor, especially women and children
The Climate Change Bill (2018)	Calls for action to build an effective climate change response and to ensure the long-term, just transition to a climate resilient and lower carbon economy and society within the context of sustainable development.

2.4.7 Education, training and capacity building

South Africa is committed to including education on climate change and to training in educational policy. Appropriate content and materials for disparate audiences and settings are required. While the National Curriculum and Assessment Policy includes an explanation of what climate change means, little is discussed regarding precautions individuals can take to

protect their health (Department of Environmental Affairs, 2017:8). Training for teachers, health professionals and environmental health practitioners at tertiary institutions about climate change and health should be included.

2.5 SUMMARY OF CHAPTER

This chapter presented some related literature and studies of both international, national and local studies done about the preparedness to address the health effects of climate change. The chapter further explored different weather extreme that affects the health system negatively. In addition, the chapter outlines the possible solutions to curbing the detrimental effects of changes in the climate and the commitment made by different stakeholders.

The next chapter will present the research methodologies used in the study. This includes the research design, population and unit analysis, recruitment process, sample method and sample size.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Chapter 2 discussed scientific evidence on international, national and local studies conducted about the preparedness to address climate change's health effects. This chapter presents the research methodology that was used in the study. This includes aspects on research design, research population and unit analysis, recruitment process, sample method and sample size and data collection

3.2 AIM AND OBJECTIVE OF THE STUDY

The study aims to determine the preparedness of the city of Tshwane to address the health effects of climate change.

3.3 RESEARCH APPROACH

According to (Salvador, 2016:78), research methodology is one major component of research, a way in which the research will take place. The study used a quantitative research approach to determine the preparedness of the City of Tshwane to address the health effects of climate change. Quantitative research deals with the process of data collection, analysing the data using statistical procedures, interpreting, and writing the result of a study (Creswell, 2014:19). Quantitative research investigates a phenomenon that lends itself to make a specification of measurement and quantification and involves a rigorous and controlled design (Polit et al., 2017:741). A quantitative study was chosen in this study for determining the preparedness of the City of Tshwane to address the health effects of climate change. The reason for choosing quantitative research was because a large amount of data was being collected from different departments of the City of Tshwane.

3.4 RESEARCH DESIGN

Research design is explained as a set of logical steps taken by the investigator to answer the research problem statement (Brink et al., 2018:81). “It forms the ‘blueprint’ of the study and

determines the methodology used by the investigator to obtain sources of information, such as respondents, elements and units of analysis, to collect and analyse the data and to interpret results" (Brink et al., 2018:81). This study followed a descriptive, cross-sectional design to determine the preparedness of the City of Tshwane on addressing health effects of climate change.

3.4.1 Descriptive design

The descriptive designs are intended to "identify and justify the current problems and practice in order to make judgements or to determine what others in a similar situation are doing" (Grove, Burns & Gray, 2013:215). These designs are said to be based on information gathered from a representative sample of the population. In this study, a descriptive survey was conducted to gather information on how the City of Tshwane is prepared to address the health effects of climate change. "The emphasis in the collection of data in descriptive studies is on structured observation, questionnaires and interviews or survey studies" (Brink et al., 2018: 97). An online survey instrument method was adapted from similar studies using Qualtrics Software, together with a structured questionnaire. Therefore, the study described how the City of Tshwane was prepared to address the health effects of climate change. Visual presentations using graphs, tables, and charts made the results easier to understand.

3.4.2 Cross-sectional

A cross-sectional study is defined as a type of research that is nonconcurrent in nature and done at a specific point in time. Information from respondents is collected at the same time and limited to a given time period (Brink et al., 2018: 97). This meant that many study respondents could be answering the same survey questions from different locations at different times.

3.5 POPULATION / UNIT OF ANALYSIS

In the quantitative research approach, the population is referred to as the unit of analysis, and it) is defined as a group of people from which the researcher is planning to get his or her sample. These are the people who meet the inclusion criteria. For the purpose of the study, the population of the study was the employees of the City of Tshwane in their different working departments. The service departments of interest were electricity, finance, water and sanitation, waste management, health and emergency department, which included (road,

storm water and housing services department). Only those employees who were on hand were to be recruited to partake in the study.

3.6 INCLUSION CRITERIA

Employees of the City of Tshwane working in the following service departments of interest, electricity, finance, water and sanitation, waste management, health and emergency department, which included (road, storm water and housing services department). The investigator considered employees readily available and willing to partake in the study.

3.7 EXCLUSION CRITERIA

City of Tshwane employees working in other departments besides the following service were excluded. Service department of interest was electricity, finance, water and sanitation, waste management, health and emergency department, which included (road, storm water and housing services department.

3.8 SAMPLING METHOD AND SAMPLE SIZE

3.8.1 Sampling

Sampling is defined as the steps the investigator will take to select a sample from the population to gather information about the study to represent the entire population (Brink et al., 2018): 128). This study selected the sample from the different City of Tshwane officials according to their different ranks or job titles. A convenient sampling method was used because not all categories of staff were included; the readily available respondents willing to participate were included. Convenience sampling (also known as Haphazard Sampling or Accidental Sampling) is a non-probability in which the investigator selects respondents that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate (Etikan, Musa & Alkassim, 2016:4).

The City of Tshwane is divided into ten stratums (sub-groups) which are called service departments. Six service departments out of 10 that was used in this study. The service departments of interest were electricity, finance, water and sanitation, waste management, health and emergency department, which included (road, storm water and housing services department).

The online survey was sent to the Head of the Department, who then published the email. The consent form is part of the survey. Those who were willing to participate had to click on the continue button and move to the stage, which was the survey.

3.8.2 Sample size

The number of people participating in a given study is referred to as the sample size (Polit et al., 2017:714). The recommendation is to use the largest sample possible because the lager the sample, the more representative it is likely to be (Polit et al.,2017: 284). Cochran's (1997) formula was used to determine the minimum sample size, where *n is* for unknown population size and unknown degree of variability. At a 5% level of precision, where the confidence level is 95% with a corresponding standard normal deviation of 1.96, the sample size was given by:

$$nn = \frac{pp(1 - pp)zz_{\alpha\alpha}^{2}}{ee2\ 2}$$

$$nn = \frac{ppppzz^{2}}{ee_{2}}$$

The respondents were from different service departments, as mentioned above, offered by the City of Tshwane. Furthermore, the sample size proportional to each stratum (service points) was determined by using stratified proportional sampling. Stratified proportional random sampling breaks subgroups into stratums. Dividing out the population by strata helps a researcher easily choose the appropriate number of individuals from each stratum based on the proportions of the population. The Barreiro & Albandoz (2014:8) study was adopted in order to determine the sample size of each stratum (service points) and is given by the following formula:

$$nn_{ii} = nn.\ \frac{NN_{ii}}{NN}$$

Were, n_i = sample size for each stratum n = required sample size

N_i = population size for each stratum

N= size of the population

The six service departments used in this study had a total population of 7556 employees (N) with subpopulation (N_i) of 1788, 2435, 1765, 682, 505, 381 for electricity, finance, water and sanitation, waste management, health and emergency department, respectively. The proportional sample size within each stratum (service point) used in this study is illustrated in Table 3.1 below.

Table 3.1: Summary of the sample stratum

Departments (City of Tshwane with N=7556)

n =	**384**	**Electricity**	**Finance**	**Water and sanitation**	**Waste management**	**Health**	**Other**	**Total**
N_i		1788	2435	1765	682	505	381	7556
Actual n_i proportional to sample size		91	124	90	34	26	19	384

3.9 RECRUITMENT PROCESS OF POTENTIAL RESPONDENTS

After permission to conduct the study was granted by the University of Pretoria research ethics committee, the investigator had to obtain permission from the chief executive manager of the City of Tshwane to conduct the study. The investigator followed the following process to request permission to conduct the study. 1. The investigator secured an appointment with the chief executive manager of the municipality for research briefing meeting. During the meeting, the investigator presented the study's aims and objectives. The proposal was submitted with the permission letter from the ethics committee to the chief executive manager for further reference and understanding. 2. The chief executive manager advised the investigator to write an inclusive email to the six service departments to invite the employees to partake in the study. In line with the POPIA Act, the Manager was the one to publish the email to all the listserv in different service departments across the City of Tshwane. Not only email but other

different forms of communication platforms were used to notify the employees about the study. The investigator went to different City of Tshwane service departments to further explain the importance of the study and how it is beneficial for our environment and encourage those that have not participated in the study to kindly do so.

3.10 PILOT STUDY

A pilot study is a small-scale trial run from an actual research study (Brink et al., 2018:161). The pilot study was conducted on a small group of respondents from the intended population. The questionnaire was pre-tested on 38 employees (10% of the sample size), and these employees were not part of the main survey. After the pilot study, the questionnaire was adjusted to incorporate lessons learnt during the pilot survey. The questionnaire had 47 questions of which two of the questions were duplicated. Adjustments were made, and two duplicated questions were removed, leaving 45questions on the questionnaire. The aim of the pilot study was to see if questionnaires were easily understandable and accessible on Qualtrics. Data gathered in the pilot study provided guidance for a functional study adaption through modification of the questionnaire. The process was conducted as would the main study in terms of recruitment, inclusion criteria, exclusion criteria, and ethical application. The data collected during the pilot study were analysed. The findings were examined for the feasibility of the instrument for the full research study. The findings indicated that the study is feasible; the instrument is appropriate and easy to understand. The result of the pilot study was not included in the main research study.

3.11 DATA COLLECTION AND PROCEDURE

Data collection is the gathering of information to address the research problem (Polit et al.,2017:725). According to Brink et al. (2018:134), the intent of data collection is to provide an audit trail of the study by including a clear and specific explanation of how data were collected. It also involves where the results come from and the reason for the method selected.

As indicated above, this study was an online survey using Qualtrics software after permission was obtained from the Ethics Committee of the Faculty of Health Sciences, University of Pretoria and the City of Tshwane. An online survey instrument method was adapted from similar studies using Qualtrics Software.

Qualtrics is a web-based survey tool that can create surveys and analyse responses. The investigator, a registered university student, has free access to the software. The survey took

about 25-30 minutes to complete. The survey format allowed the respondents to save their responses and resume them at a later stage if needed.

Three reminder messages were sent via email at points 10 days, three weeks, and four weeks following the reintroduction with notification of the survey closing date. At the first round of the distribution of the survey link, only four participants responded on day 10. Three weeks later, there were 20 participants.

Second round, the investigator secured an appointment with the municipal manager to discuss feedback on participation, remind them about the aims and objectives of the study, and request further assistance from the manager to encourage the participation of employees in the study.

Four weeks after the meeting with the municipal manager, an additional twenty respondents were on the survey. Every time the investigator had to send a reminder email and the survey link to the respondents of the City of Tshwane. This was to encourage the employees to partake in the study. By the end of the second round, only 44 employees participated in the online survey.

In the third round, the investigator secured another meeting to physically visit the following service departments in the City of Tshwane: electricity, finance, water and sanitation, waste management, and health and emergency department to hand out questionnaires and consent.

The investigator visited the service point for three succession days, two weeks apart, to encourage participation in the study. On the first day of arrival at the City of Tshwane department, the investigator re-introduced herself to the municipal manager and explained and reminded her of the reason for the visit.

The manager called a brief meeting with one person from each working department to introduce the investigator and make them aware of her presence and reasons for being there. The investigator was given space in the boardroom for employees interested in the study to sign hard copy of the consent form and fill out the questionnaire. Some employees requested the hard copy of consent form and questionnaire to fill in their offices for convenience.

This process was followed for all departments of interest during the six days visit of the investigator. The results of the six days visit resulted in sixty employees responding to the survey of the study by filling the hard copy consent form and questionnaire . Forty-four employees participated in the online survey. The survey closing time was extended to encourage as much participation as possible. Data collection was both physical and online. The total number of those who participated in the study from the physical data collection and online data collection was counted to hundred and four (N104).

Table 3.2: Data collected summary

Summary of data collected from different service departments

	Number of employees	Number of employees proportional to the sample size	Completed questionnaires
Electricity department	1788	91	24
Finance department	2435	124	12
Water and sanitation	1765	90	12
Waste management	682	34	19
Health	505	26	15
Emergency services	381	19	22
Total	7556	384	104

Table 3.2 above displays a summary of the data analysis of the study. At the time of the study, City of Tshwane had a total number of 7556 employees. The study comprises six service departments of interest, namely: electricity department which had 1788 employees and 91 employees proportional to the sample size, however only 24 employees responded to the study. Finance department had 2435 employees and 124 employees proportional to the sample size, although only 112 employees responded to the study. Water and sanitation

department had 1765 employees and 90 employees proportional to the sample size but only 12 employees responded to the study. Waste management department had 682 employees and 34 employees proportional to the sample size, yet 19 employees responded to the study. Health department had 505 employees and 20 employees proportional to the sample size but only 15 employees responded to the study. Emergency department had 381 employees and 19 employees proportional to the sample size however only 22 employees responded to the study. The total number of employees proportional to the sample size required for the study was 384. Nevertheless only 104 responded to the study from different service departments. All respondents were employees of the City of Tshwane local municipality.

3.12 MEASUREMENT TOOLS AND PROCEDURE

Measurement tools are instruments used by investigator in gathering, manipulating and interpreting data related to the research question (Leedy et al., 2014:7). In this study, a structured questionnaire was developed through information the investigator gathered during the literature review process, and the questionnaire was based on the objectives and DPSEEA theoretical framework of the study.

The questionnaire consisted of close-ended and open-ended questions. Information gathered with the questionnaire included:

Section A of the questionnaire was **Demographic details** of the respondents (questions 13). These were checkboxes for the respondents to tick the relevant box.

Section B: Gathered information on measures in place to address the health effects of climate change (questions 4-12). These were also checkboxes for the respondents to tick the relevant box.

Section C: Gathered information were questions related to the application of the framework (questions 13-45). Questions 16-20 addressed the driving force domain, question 21-25 addressed pressure on the environment, question 26-28 addressed the state of the environment, question 29-32 addressed exposure to humans, question 33-38 addressed health outcomes and question 39-47 addressed action plans taken. These were both checkboxes and text responses. The data collection tool is attached as **Annexure C**.

3.13 DATA ANALYSIS

Data analysis was done with the assistance of the statistician. Data were entered in a computerised Microsoft excel data sheet.

3.13.1 Preparation for analysis of numerical data

Completed forms about survey from the respondents were collected as hard copies. The investigator collected the hard copies of both the consent forms and questionaire during the six days visits to different service departemants of City of Tshwane. However the data obtained through online surveys was downloaded from the qualitrics website and both were captured on Excel sheet by the investigator for the process of data analysis. Data was checked and cleaned for errors. Thereafter data was sent to the statistician for analysis.

3.13.2 Coding process

The coding system was developed and subsequently implemented for questions that needed post-coding (specifically for the open-ended questions). “Coding is the process of analysing text data by taking them apart to see what they yield before putting the data back together in a meaningful way” (Cresswell., 2015:156).

It is a short description of words and phrases that give meaning to data related to the investigators analytical interest (Lester, Cho & Lochmiller., 2020:100). There are three phases of coding used during data analysis. In the first phase, the investigator generally assigns codes to the entire data set by identifying important statement, experiences and reflections (Lester et al., 2020:100).

This phase of coding is known as open coding, and it aims to express data and phenomena in the form of concepts (Williams & Moser., 2019:48). The second phase of coding frequently returns the investigator to passages of data in order to formulate additional codes. The aim of the second codes is to connect statements, experiences and reflections of the research respondents to the study analysis of interest (Lester et al., 2020:100).

This phase is known as axial coding, where collected data is refined and aligned by identifying relationships between open codes to develop core codes (Williams et al., 2019:50). The final coding phase known as the selective coding allows the investigator to integrate organized data into categories, themes and graphs (Williams et al., 2019:50). The themes that emerged from the data analysis are discussed in chapter 4, under question 42,43 and 44.

3.13.3 Statistical Tests and representation used

All data were analysed using Statistical Analysis System (SAS 9.4) software. Chi-square test (χ^2) for the equal proportion technique was performed on the data in order to describe demographics, climate and health-related issues questions in terms of frequencies and percentages (Grove et al., 2013:538). Descriptive statistics summarised the data in terms of simple quantitative measures such as percentages or means as well as in the visual form such as graphs, histograms and box plots (Kaliyadan & Kulkarni, 2019:10). Furthermore, the chisquare test (χ^2) for independence in a two-way contingency table was performed in order to determine if there was an association between the demographics and climate and healthrelated issues. The descriptive statistics in a two-way contingency table summarized relationships between variables using tools such as graphs (Kaliyadan et al.,2019:10). Furthermore, the phi (ϕ) coefficient was used to determine the strengths of association between the two variables that were deemed to be significantly associated (Kim, 2017:14). The ϕ coefficient ranges between 0 and 1. A value between 0 and 0.3 is considered to be a weak association, while a value between 0.3 to 0.6 is moderate, and more than 0.6 is a strong association. Chapter 4 will discuss Data Analysis in detail.

3.14 RIGOURS/QUALITY CONTROL

Rigours is defined as the principle of the true value of the research outcomes (Brink et al., 2018: 82). According to (Grove et al., 2017:36), rigours refer to "striving of excellence in research" that requires discipline, adherence to detail and meticulous accuracy. In order to achieve accurate results for the study, the data set and the instruments were validated and reliable. There are different kinds of validity tests namely face validity, construct validity, content validity and criterion validity. Face validity is a type of validity that is based on the judgement of expert in the field being studies (Brink et al., 2018: 166).

The statistician was part of the developing stage of the questionnaire (data collection tool), whereby face validity was applied in order to evaluate and ensure that the data collection tool included all the items that were essential as well as eliminate undesirable items to a particular construct domain (Taherdoost, 2016:28). The supervisor and co-supervisor assisted in validating the questionnaire as they are experts of the study.

The process of face validity included intensive literature reviews in order to extract related items to be used in developing the questionnaire. The items in the developed questionnaire were evaluated by the supervisory team. Insignificant items such as the age and gender of

participants were eliminated as it has no relevancy to the study. Only significant items were included in the data collection tool. Subsequent to data analysis, Cronbach alpha was used to measure the consistency across parts of the data collection tool.

3.14.1 Validity of the data collection tool

Validity is defined as the accuracy and truthfulness of the scientific findings of the study (Brink et al., 2018: 151). Validity in this study was maintained by ensuring that the online survey questions were able to measure what was intended to measure with adaptations done on similar studies. Validity is the extent to which an instrument measures what it is intended to measure (Tavakol et al., 2015:8). There are different kinds of validity tests, namely content validity, face validity, construct validity, and criterion validity.

Content validity is an assessment of how well an instrument represents all components of variables to be measured (Brink et al., 2018:151). Additionally, content validity is a type of validity used when formulating questionnaires, interview schedules and interview guides. For content validity, the investigator developed the tool based on existing literature. Through the literature, the investigator was able to measure the consistency of the questionnaire used. By definition, face validity is a type of validity that is based on the expert's judgement in the field being studied (Brink et al., 2018: 153). In order to ensure this criterion, the investigator consulted the supervisory team to validate the questionnaire, as they are experts in the study. Construct validity is a type of validity that measure the relationship between instruments and theories (Brink et al., 2018:154). Criterion validity is a type of approach to establish a relationship between scores on instruments and other external criteria (Brink et al., 2018:152)

The investigator subsequently conducted a pilot study on the tool through an online survey. Various statistical tests, such as the Chi-square test (χ^2) technique in SAS program, were used to analyse and summarise data. Moreover, frequencies and percentages, as well as determining the association between variables using a two-way contingency table. Furthermore, the phi (ϕ) coefficient was used in determining the strengths of significant association between variables

3.14.2 Testing reliability of the questionnaire

Reliability is defined as “the consistency with which the instruments used to collect data measure the target attributes” (Polit et al., 2017:331). Furthermore, the reliability of an instrument is explained in terms of the ability of the instrument to collect data with the same results or less difference if the measurement is repeated. For the instrument to be reliable, it

should be accurate and consistent. In this study, reliability was ensured by using the same instrument for all the respondents.

According to (Bolarinwa, 2015:34), there are three dimensions of reliability, namely, stability test–retest reliability), equivalence (alternate-form reliability) and internal consistency (homogeneity). This study used internal consistency. Thus, Cronbach alpha was employed to quantify the internal consistency and reliability of the questionnaire.

This Cronbach alpha reliability method was easier to use since it requires one test administration (Tavakol et al.,2015:2). The internal consistency of each item (question) in the questionnaire was determined by obtaining and comparing the alpha coefficients for each item (Wong et al., 2015:2). Cronbach's alpha reliability coefficient ranges between 0 and 1, and the closer Cronbach's alpha coefficient is to 1.0, the greater the internal consistency of the instrument, while closer to 0 represents an instrument that is not reliable (Wong et al., 2015:2).

A reliability coefficient (alpha) of 0.70 or greater is considered acceptable reliability. The rating of each item from the panel was collected and calculated. According to (George & Mallery, 2016:1), the rules of thumb for Cronbach alpha are given as follows:

Table 3.3: Comparison procedures content reliability

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Conditions that could affect Cronbach values are:

i. Numbers of items; the scale of <10 variables could cause Cronbach alpha to be low

ii. Distribution of score; normality increases Cronbach alpha value, while skewed data reduces it

iii. Timing; Cronbach alpha does not indicate the stability or consistency of the test over time

iv. The wording of the items; the negative-worded questionnaire should be reversed before scoring

Items with 0, 1 and negative scores: Ensure that items/statements that have 0 s, 1 s and negatives are eliminated.

3.15 SUMMARY OF CHAPTER

The chapter described in detail the research methodology used in data collection and outlined how the research questions were answered. A discussion was carried out on the research method, design, data collection, procedure and how the study was conducted. Chapter four discussed the data analysis and the results of the study accordingly.

CHAPTER 4

PRESENTATION OF RESULTS

4.1 INTRODUCTION

The previous chapter discussed the research design method and how the data was collected. This chapter presents the handling of the data, its processing and the results obtained. The findings were subsequently used to answer the research questions. Conclusions were derived based on statistical inferences and recommendations given.

4.2 DESCRIPTIVE STATISTICS

4.2.1 Brief description of data collection

The data were collected through an online survey and survey structured questionnaire (hard printed copies), as discussed in chapter three (3). A total of 104 responses were received from both the online and paper-based survey questionnaires. Of these, 44 were online responses, and 60 were hard copies. A descriptive statistical analysis using frequencies and percentages was performed, followed by a Chi-Squared test. Some of the respondents did not answer all of the questionnaires. Meanwhile, the percentages were presented based on the total number of participants responding to each individual variable.

4.2.2 The Research Instrument

A structured questionnaire and online survey were both used in this study, and it involved three sections as follows.

- **Section A: Demographic data**

Section A of the questionnaire consists of three (3) questions that provide important information on the respondents' demographic data.

The respondents were to choose only one option of the statement in the appropriate column of their choice.

- **Section B: Measures in place to address the health effects of climate changes**

The second section consists of the mixed-response method with fourteen (14) questions. The respondents were expected to choose one or multiple options for a statement by marking it in the appropriate column. The section has a Likert scale and open-ended questions for the respondents to specify and explain further. All the responses to the questionnaire were analysed descriptively.

- **Section C were questions related to the application of the framework**

The third section also consists of mixed responses with twenty-eight (28) questions. Questions 13-20 addressed the driving force domain, questions 21-25 addressed pressure on the environment, questions 26-28 addressed the state of the environment, questions 29-32 addressed exposure to humans, and questions 33-38 addressed health outcomes and health outcomes and questions 39-45 addressed actions plans taken.

4.2.3 Validity and reliability of the instrument

The internal consistency of the questionnaire in this study was determined using the Cronbach alpha test. All items of the questionnaire in this study had a coefficient of greater than 0.6, while the overall coefficient of Cronbach's alpha was 0.7, as discussed in chapter three (3).

4.3 SECTION A: DEMOGRAPHIC DATA

QUESTION 1: HIGHEST EDUCATION LEVEL

Question one addresses the highest education qualification of the respondents (Table 4.1).

Table 4.1 shows the highest education level of respondents and frequencies as represented in the sample.

Table 4.1: Education level of respondents

Highest education level	Frequency (Percent)	Probability

No schooling	1 (0.96)	
Primary education	4 (3.85)	<.0001H
Secondary education	5 (4.81)	
Tertiary	94 (90.38)	

Table 4.1 above shows the highest education level of the respondents.

In this current study, it is evident that most respondents had tertiary education 90.38% (n=94), followed by secondary education 4.81%(n=5), primary education 3.85% (n=4) and no schooling 0.96% (n=94). The probability value is <.0001, which is significant for the study. Based on the result, the highest number of employees have acquired a higher level of education qualification.

QUESTION 2: EMPLOYMENT LEVEL

This question addresses the employment level of the respondents. This indicated the percentage of employment status.

Table 4.2: Employment level of participant

Employment level	Frequency (Percent)	Probability
Full-time	89 (85.58)	
Part-time	15 (14.42)	<.0001

Table 4.2 above suggest that most respondents in the City of Tshwane are full-time employees of the city. With 85.58% (n=89) and part-time at 14.42% (n=15).

QUESTION 3: YEARS OF SERVICE IN THE CITY OF TSHWANE

This question addresses the number of years the City of Tshwane has employed the participants.

Figure 4.1: Years of service in the City of Tshwane

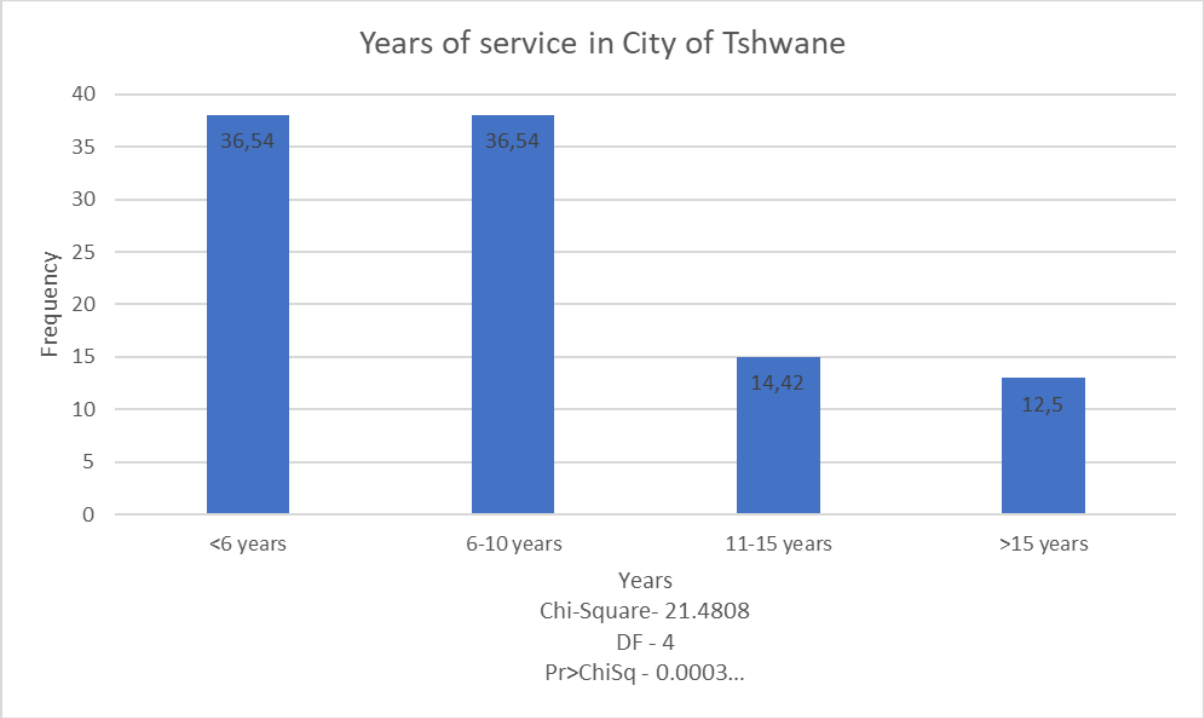


Figure 4.1 indicates that 36.54% of respondents have been employed by the City of Tshwane for about less than six years, with the same number employed for about 6-10 years, followed by 11-15 years at 14.42%, and more than 15 years at 12.5%.

SECTION B: MEASURES IN PLACE TO ADDRESS THE HEALTH EFFECTS OF CLIMATE CHANGES

QUESTION 4: WHICH SERVICE POINT ARE YOU WORKING FOR?

The question aimed to obtain information with regard to the service point the respondents are working for and their involvement in the City of Tshwane.

Figure 4.2: Employment service point of the respondents

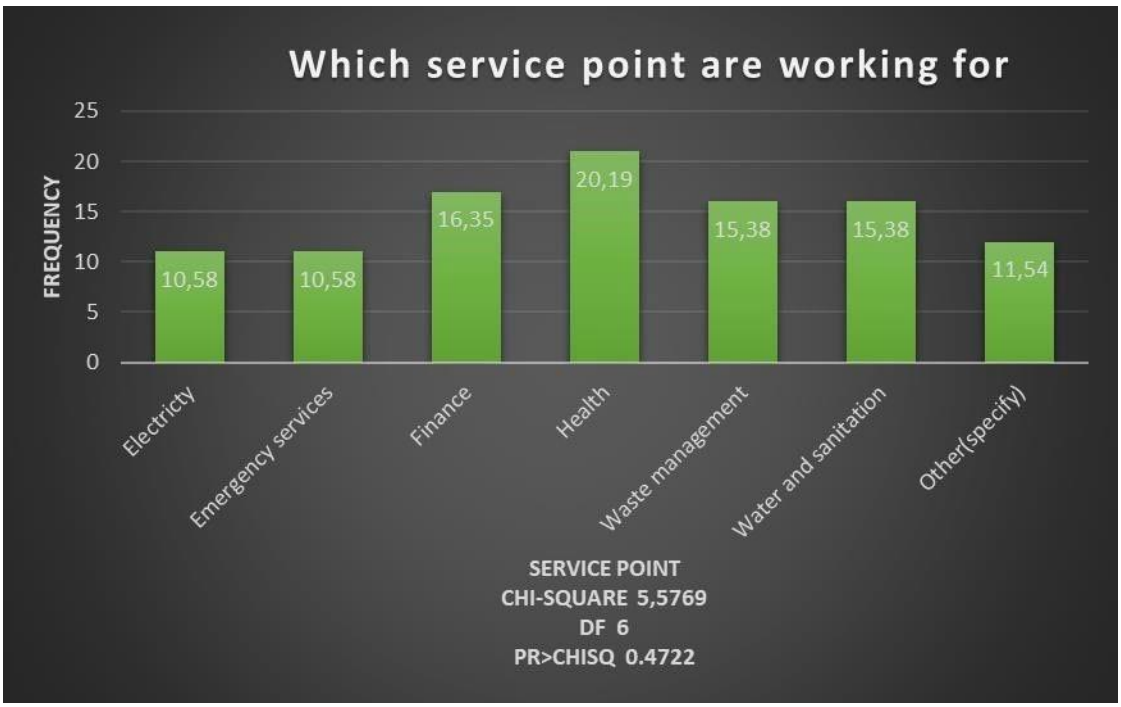


Figure 4.2 shows the different service departments the respondents are working for. This ranges from electricity, emergency service point, finance, health, waste management, water and sanitation and other service points in the City of Tshwane.

From this graph, 10,58% of the respondent work in the electricity department. Another 10.58% of respondent work in emergency service department. 16.35% are working in the finance department. Most respondents were from the health department, with 20.19%. 15,38% of respondent work in waste management department. 15.38% are working in water and sanitation department. 11.54% work in other department.

The results suggest that only 20.19% of respondents work for the health sector, which is a low percentage, considering that health is one of the most important services in mitigating climate change's health effects.

QUESTION 5: WHICH AREA DO YOU COVER FOR THE DELIVERY OF SERVICES?

The respondents were asked to indicate which area they cover for service delivery.

Figure 4.3: Areas covered for delivery of services

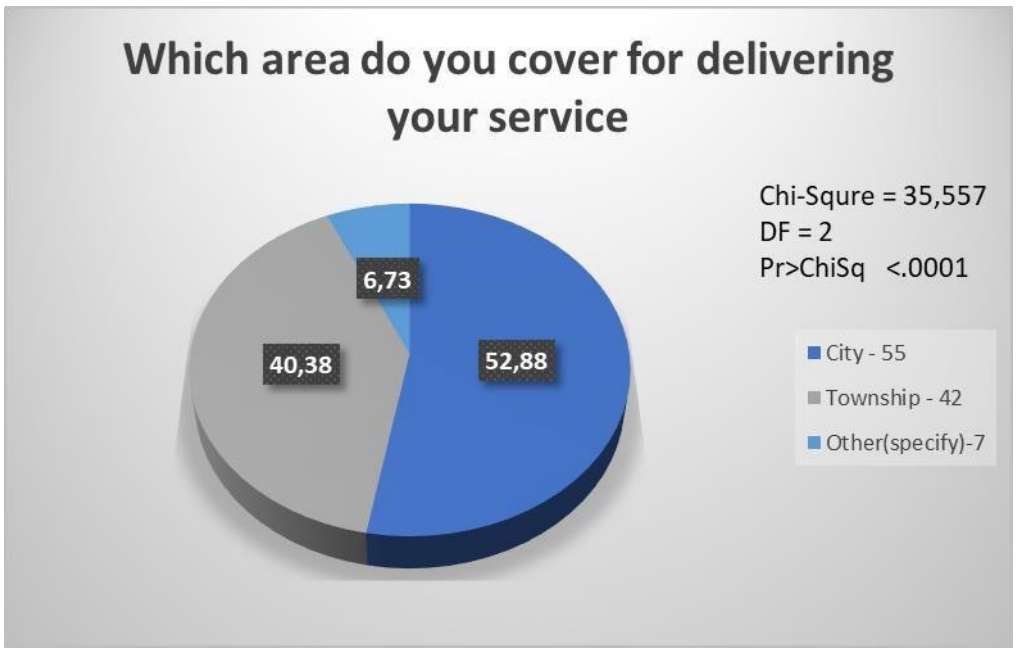


Figure 4.3 indicates that most respondents cover the city as the biggest area they deliver services to, followed by the township and other areas, such as rural areas. 52.88% of delivery of services done by the City of Tshwane is in the city, with 40.38% at townships and 6.73% in other areas such as rural areas.

QUESTION 6: HAS THE NUMBER OF INFORMAL SETTLEMENTS INCREASED IN THE PAST YEAR?

The question is intended to understand whether there has been an increase in the number of informal settlements in the past year.

Table 4.3: Number of informal settlements

Has the number of informal settlements increased in the past years	Frequency (Percent)	Probability
Yes	12 (11.54)	<.0001
No	92 (88.46)	

Table 4.3 above, contrary to expectation, this research did not find a significant increase in the number of informal settlements in the past year. As evidenced by the result, 88.46% of the respondent of the City of Tshwane responded that the number of informal settlements has not increased in the past year. With 11.54% responding, there has been a significant increase in the number of informal settlements.

QUESTION 7: ARE THE HOUSES BUILT NEXT TO THE FOLLOWING LANDSCAPE?

The question intends to know whether there are houses being built in the following areas.

Forest, landfill, mountain, river, veld, shopping centre.

Figure 4.4: Houses build next to the following land-scapes

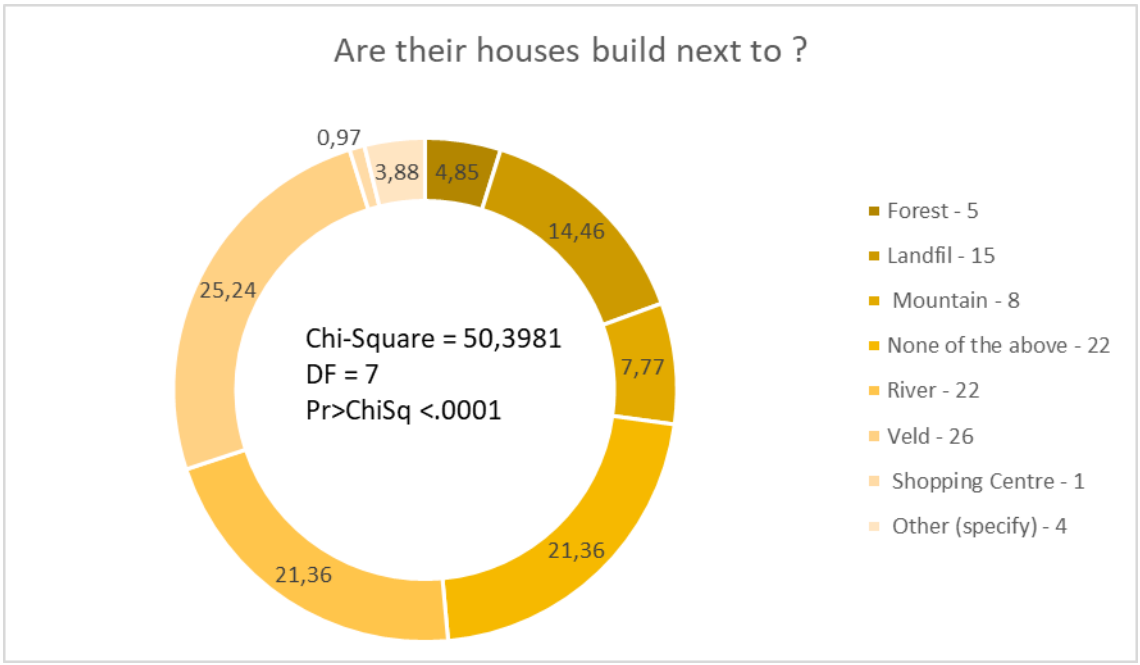


Figure 4.4 shows that 25.24% responded that most houses are built next to the veld, with 21.36% built in the river, 14.46% building next to landfills, 7.77% built next to mountains, 4.58% built next to the forest and 0.97% next to shopping centres. However, another 21.36% responded that no houses are built on the above, with another 3.88% responding on other areas, such as rural areas.

QUESTION 8: DOES THE AREA HAVE ELECTRICITY?

The question aimed to obtain information regarding whether the area has electricity.

Table 4.4: Does the area have electricity?

Does the area have electricity	Frequency (Percent)	Probability

Yes	52 (50.00)	1.0000
No	52 (50.00)	

Table 4.4 above shows that half of the City of Tshwane respondents responded that half of the area has electricity, and the other half responded that the area has no electricity.

The City of Tshwane data base profile of 2018 indicates that 92% of the area has electricity. Where 65% is prepaid, and 27% is conventional prepaid meters. Meanwhile, only 8% use other sources and not paying for electricity (City of Tshwane community survey., 2016:26)

QUESTION 8.1: IF NO, WHAT IS THEIR SOURCE OF LIGHTING?

The question aimed to understand if there is no source of electricity, then what are the residents of the city using as a source of lighting

Figure 4.5: Source of lighting

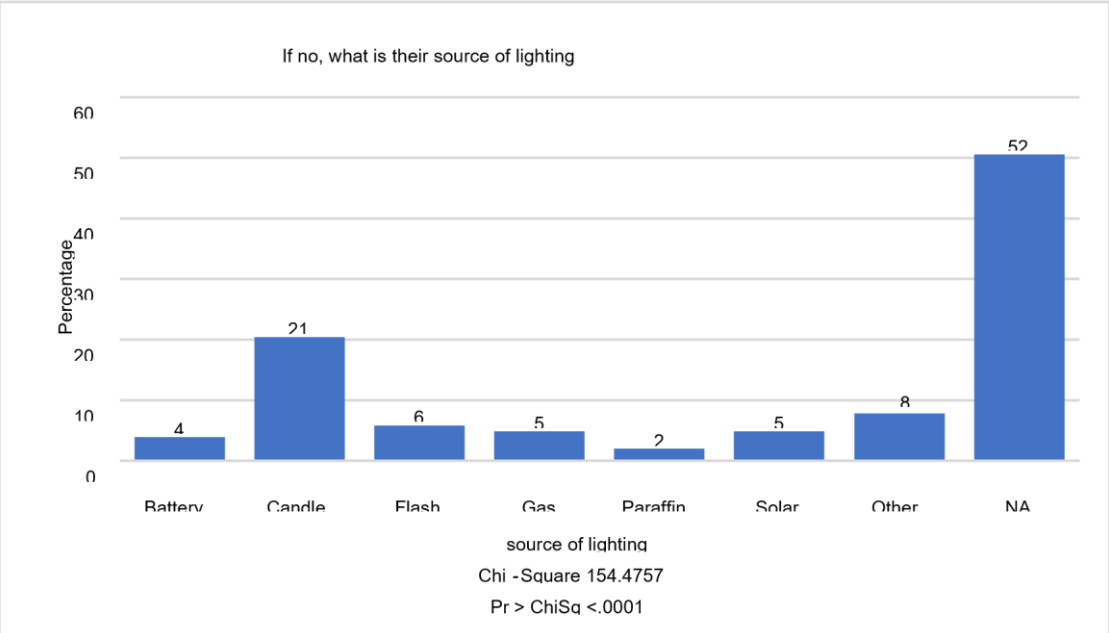


Figure 4.5 shows that the majority of the respondents believe that most areas use electricity. This is seen by 52% of respondents, who responded to others. Those who believe the areas have no electricity indicate that their source of lighting is using candles21%, followed by others without specifying. With 6% believing they use flash. Solar and gas at both 5%, and other using

batteries. The last 2% believe they use paraffin. 50% of the respondents responded that there is no electricity in the area.

The results indicated above may not reflect the information in the City of Tshwane database, as it indicates that only 8% of the area does not use and pay for electricity. They use other means as their source of lighting, such as the ones outlined on the figure 4.5 (City of Tshwane community survey., 2016:26).

QUESTION 8.2: IF NO, WHAT ARE THEY USING FOR COOKING AND HEATING FOOD?

Figure 4.6: Method used for cooking and heating food

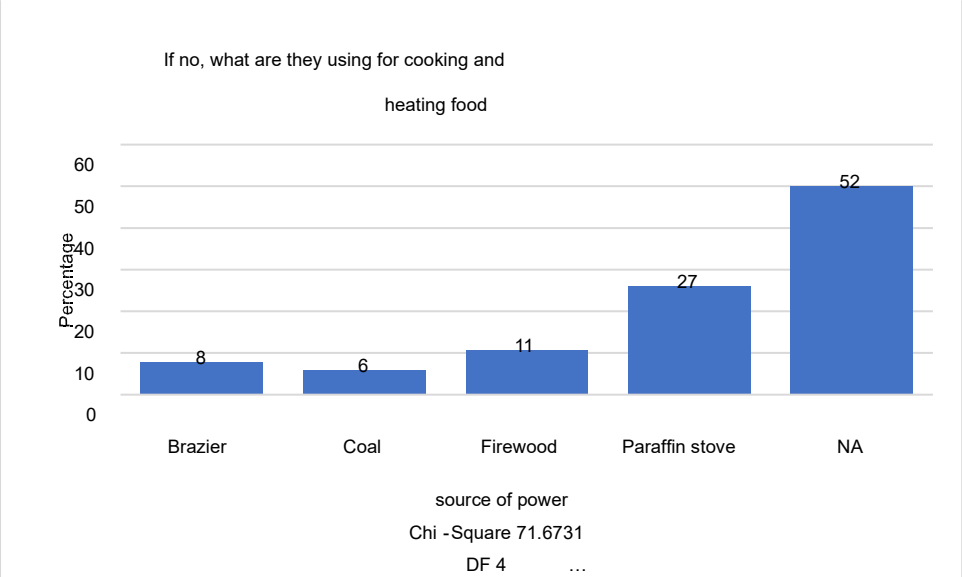


Figure 4.6 indicates that 52% of respondents indicate that they use electricity. While 27% use a paraffin stove for cooking. 11% use firewood. 8% use brazier, and 6% use coal.

The results indicated above may not reflect the information in the City of Tshwane database, as it indicates that only 8% of the area does not use and pay for electricity. They use other means to cook and heat food, as indicated in figure 4.6 (City of Tshwane community survey., 2016:38).

QUESTION 9: DOES THE AREA HAVE A WORKING WATER SYSTEM?

The question aimed to obtain information on whether the area has a working water system

Table 4.5: Working water system

	Frequency (Percent)	Probability
Yes	73 (70.19)	<.0001
No	31 (29.81)	

Table 4.5 shows that 70.19% responded that the area has a working water system, while the other 29.81% responded otherwise.

QUESTION 9.1: WHAT TYPE OF WORKING WATER SYSTEM DOES THE AREA USE?

The question aimed at understanding the type of water system the area uses.

Figure 4.7: Types of working water system

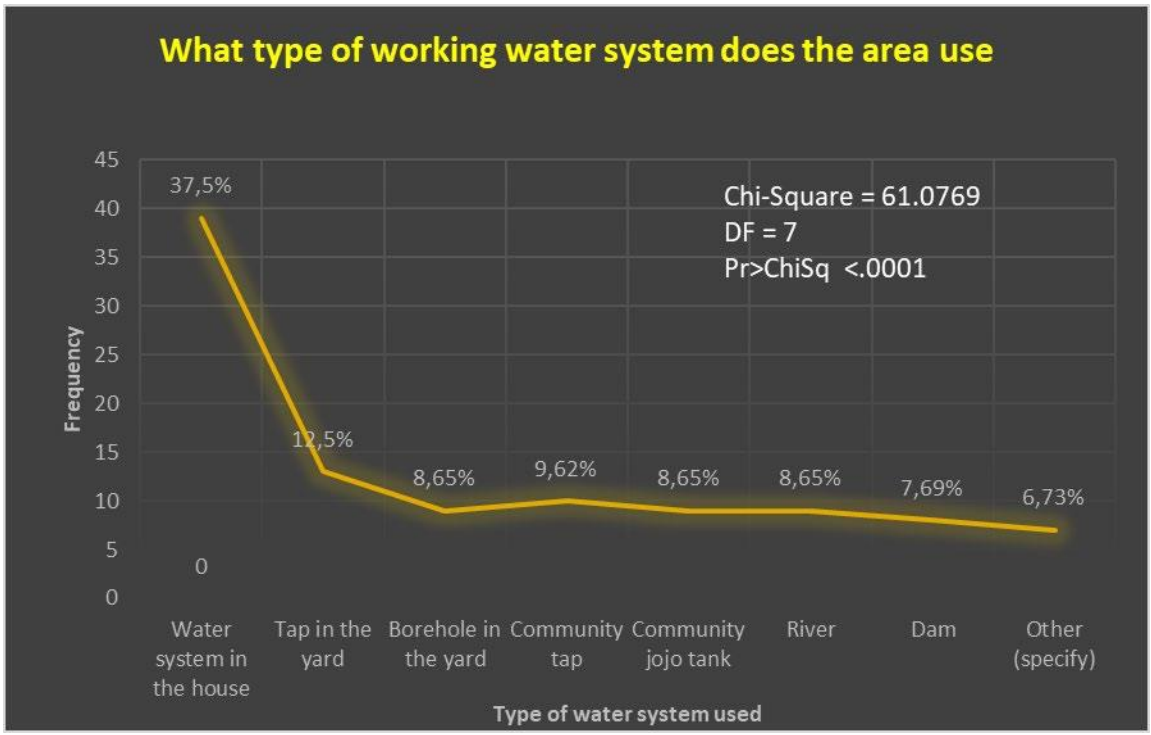


Figure 4.7 shows that 37.5% responded that they use water systems in their houses, and 12.5% responded that they have taps in the yards.9.62% responded that they use community taps. 8.65% responded that they have boreholes in the yard, others use community JoJo tanks, and another 8.65% get their source of water from the river. 7.69% get their source of water

from nearby dams. The last 6.73% responded that they get water from other sources not mentioned above, harvesting rainfall water through gutters and downpipes.

QUESTION 10: DOES THE AREA HAVE A PROPER SANITATION SYSTEM?

The question aimed to understand if the area has a proper sanitation system **Table 4.6: Sanitation system**

Does the area have a proper sanitation system	Frequency (Percent)	Probability
Yes	58 (55.77)	0.2393
No	46 (44.23)	

Table 4.6 indicates that 55.77% responded that the area has a proper sanitation system, while the other 44.23% responded otherwise.

QUESTION 10.1: WHAT SANITATION SYSTEM DO THEY USE IN THE COMMUNITY?

This question is intended to understand the type of water system in the community.

Figure 4.8: Types of sanitation systems used in the community

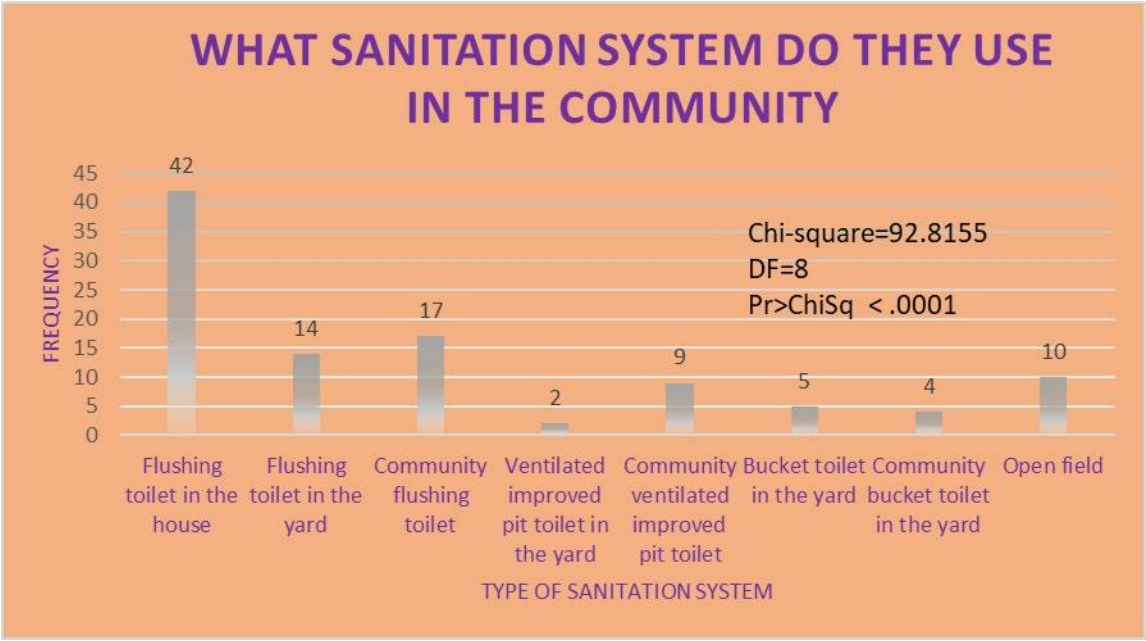


Figure 4.8 shows that 42% of the community has flushing toilets in the house, while 14% indicates that they have flushing toilets in the yard. 17% of the community uses community flushing toilets. 2% indicated they use ventilated improved pit toilets in their yards. 9% used community-improved ventilated pit toilets. 5% uses bucket toilet in the yard. 4% uses community bucket toilet in the yard. The last 10% use the open field as their sources of sanitation system.

QUESTION 11: DOES THE AREA HAVE A PROPER WASTE MANAGEMENT SYSTEM?

The question intends to know if the area has a proper waste management system.

Table 4.7: Waste management system

Does the area have a proper waste management system	Frequency (Percent)	Probability
Yes	59 (56.73)	0.1698
No	45 (43.27)	

Table 4.7 shows that 56.73% of the community has proper waste management, while the other 43.27% does not have a proper waste management system.

QUESTION 11.1: WHICH WASTE MANAGEMENT SYSTEM DO THEY HAVE IN THE COMMUNITY?

The question tends to understand which waste management system is in use.

Figure 4.9: Types of waste management systems

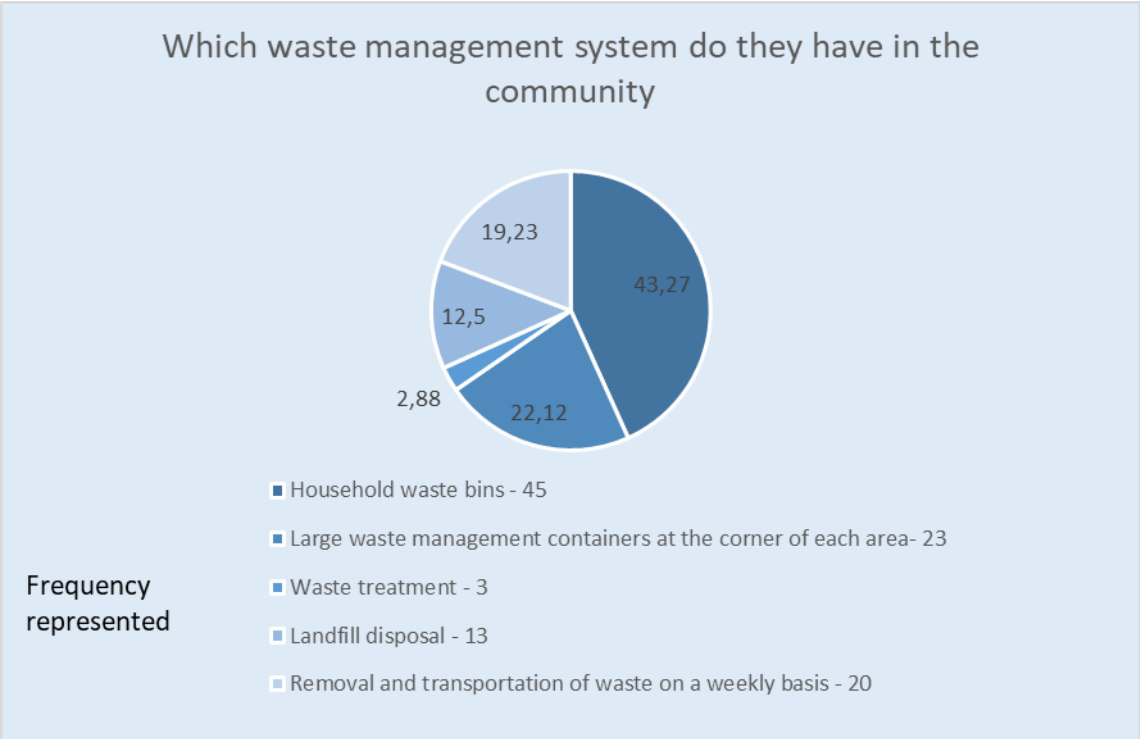


Figure 4.9 indicates that 43.27% of the community uses household bins, 22.12% uses larges waste management containers at the corner of each area, and 19.23% uses removal and transportation of waste on a weekly basis. 12.5% uses landfill as their waste management system. Furthermore, 2.88% use waste treatment as their source of disposal. 83% of waste is removed weekly by the City of Tshwane waste removal services (City of Tshwane community survey., 2016:38).

QUESTION 12: DOES THE AREA HAVE ACCESS TO ESSENTIAL PRIMARY HEALTHCARE?

The question aimed at gaining knowledge on whether the area has access to essential primary health services.

Table 4.8: Access to essential primary health care

Does the area have access to essential primary health care?	Frequency (Percent)	Probability
Yes	82 (78.85)	<.0001
No	22 (21.15)	

Table 4.8 below indicates that 78.85% of the community in the area has access to essential primary health care, while the other 21.15% responded otherwise.

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QUESTION 12.1: WHAT ESSENTIAL PRIMARY HEALTHCARE DO THEY HAVE IN THE COMMUNITY?

The question aimed to understand the type of essential primary health care they have and the distance to it.

Figure 4.10: Distances of access to essential primary healthcare

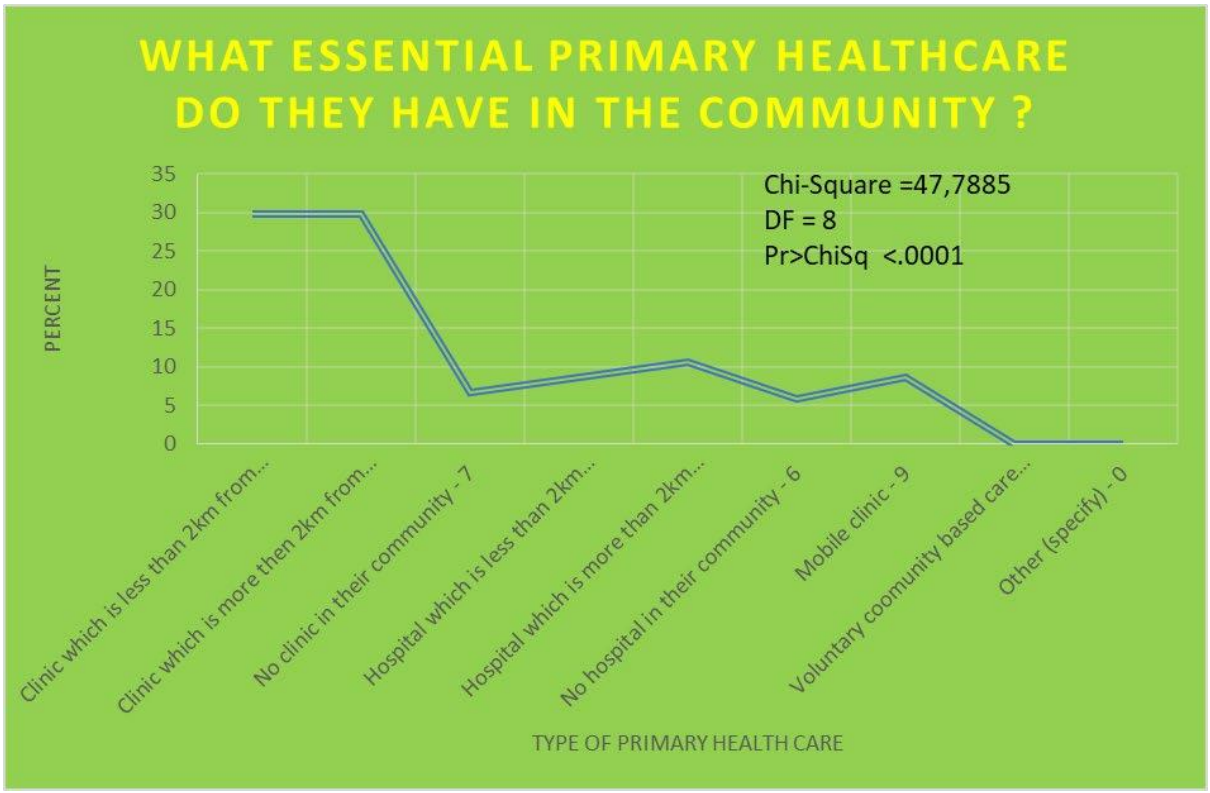


Figure 4.10 indicates that 29.81% respond that there is a clinic less than 2km away from the community, while another 29.81 respond that the clinic is more than 2km away. 5.77% indicated that there is no hospital around the area.

While 8.65% respond that there is a hospital less than 2km away. 10.58% indicates that the hospital is more than 2km away. Another 8.65% use mobile clinics. 6.73% indicates there is no clinic around the area.

SECTION C: Questions underpinned by the DPSEEA FRAMEWORK on the determination of the preparedness of the City of Tshwane for the health effects of climate change.

QUESTION 13: WHAT DOES CLIMATE CHANGE MEAN TO YOU?

This question was asked to obtain information on what climate change meant.

Figure 4.11: Meaning of climate change

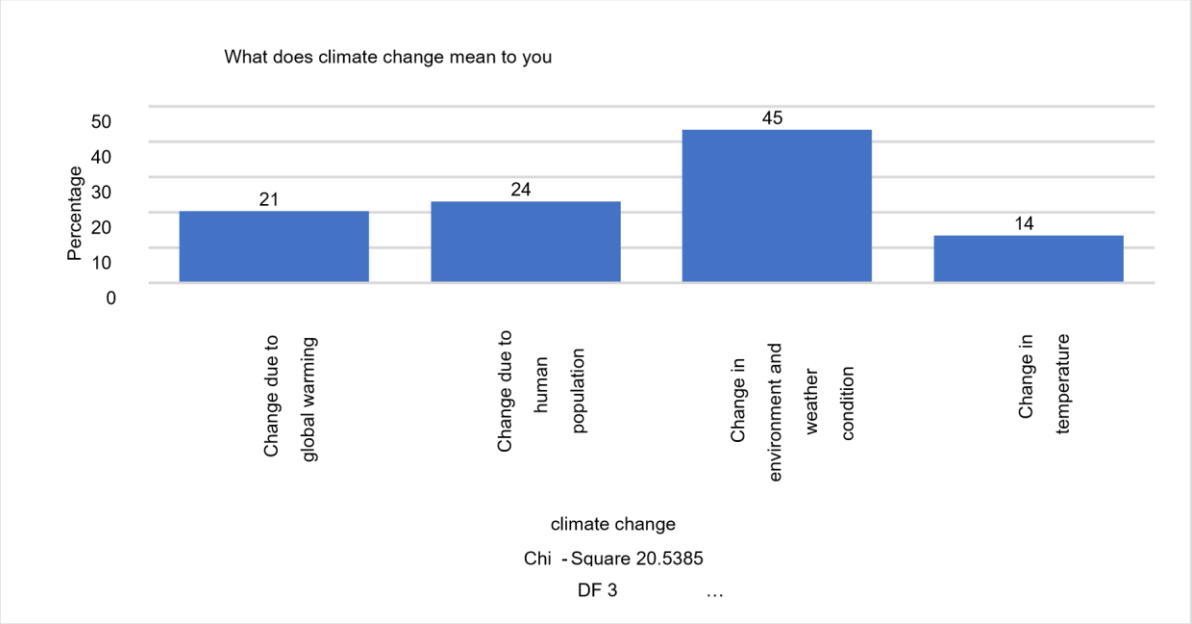


Figure 4.11 shows that the majority of respondents, 45% believe climate change means environmental weather conditions. Another 24% of respondents believed that climate change refers to changes brought about by the human population. 21% of respondents believe that climate change is due to global warming. The last 14% believe that climate change is due to temperature changes.

. **QUESTION 14: DO YOU THINK THE POPULATION GROWTH IS RESPONSIBLE FOR CLIMATE CHANGE?**

This question is aimed at understanding whether population growth is responsible for climate changes.

Table 4.11 below indicates that 74.04% of the respondent agree that population growth is responsible for climate change, while 25.96% disagree.

Table 4.9: Population growth is responsible for climate change

Do you think population growth is responsible for climate change	Frequency (Percent)	Probability

Yes **No**	77 (74.04) **27 (25.96)**	**<.0001**

QUESTION 15: Do you think the larger the population size, the more environmental change occurs?

The question aimed to determine whether the lager population makes environmental changes.

Table 4.10: Population size in response to environmental changes

Do you think the larger the population size, the more environmental changes occur	**Frequency (Percent)**	**Probability**
Yes **No**	97 (93.27) **7 (6.73)**	**<.0001**

Table 4.9 indicates that 93.27% of respondent agree that a larger population makes environmental changes occur, while 6.73% disagree.

QUESTION 16: Do you think land use through destroying forests and building informal settlements negatively affects climate change?

The question intended to understand if destroying forests and building informal settlements have a negative effect on climate changes

Table 4.11: Land use through destroying forests and buildings

Do you think land use through destroying forests and building informal settlements negatively affects climate change?	Frequency (Percent)	Probability
Yes	84 (80.77)	<.0001
No	20 (19.23)	

Table 4.11 shows that 80.77% agreed that destroying forests and building informal settlements have a negative effect on climate change. 19.23% of respondents disagree.

QUESTION 17: Do you think land use through building industrial sites has a negative effect on climate change?

The goal of this question was to understand if land use through building industrial sites has negative effects on climate change.

Table 4.12: Land use through building industrial sites

Do you think land use through building industrial sites has a negative effect on climate change?	Frequency (Percent)	Probability
Yes	92 (88.46)	<.0001
No	12 (11.54)	

Table 4.10 shows that respondents responded that 88.46% agree that land use through building industrial sites has a negative effect on climate change. 11.54% of respondents disagree that land use through industrial site building does not negatively affect climate change. The probability statistic for this was <.0001.

QUESTION 18: Do you think building houses next to waste landfills have a negative effect on climate change and human health?

The goal of this question was to understand whether building houses next to waste landfills have a negative effect on climate change and human health.

Table 4.13: Building houses next to waste landfills

Do you think building houses next to waste landfills have a negative effect on climate change and human health	Frequency (Percent)	Probability
Yes	92 (88.46)	<.0001
No	12 (11.54)	

Table 4.13 shows that 88.46% of respondents agree that building houses next to waste landfills negatively affects climate change and human health. The other 11.54% of respondents did not agree with that question.

QUESTION 19: Do you think building houses next to rivers has a negative effect on climate change and human health?

The question intended to know whether building houses next to rivers has a negative effect on climate change and human health

Table 4.14: Building houses next to rivers

Do you think building houses next to rivers has a negative effect on climate change and human health	Frequency (Percent)	Probability
Yes	76 (73.08)	<.0001
No	13 (14.42)	
Maybe	15 (12.5)	

Table 4.14 below indicates that 73.08% of respondents believe that building houses next to rivers negatively affects climate and human health. 14.42% disagree, and 12.5% are unsure whether that's true or not.

QUESTION 20: Do you think the use of fossil fuels, such as oils, coals, etc., has a negative effect on climate change and human health?

This question is intended to understand how the use of fuels affects the environment Table 4.15: Use of fossil fuels

Does the use of fossil fuels such as oils and coal have a negative effect on climate change and human health	Frequency (Percent)	Probability
Yes	81(77.88)	<.0001
No	23 (22.12)	

Table 4.15 indicate that 77.88% of respondents agree that the use of fossil fuel such as oils and coal have a negative effect on climate change and human health. The 22.12% disagree

that the use of fossil fuels such as oil and coal has no effect on climate change and human health.

QUESTION 21: Do you think the use of electricity instead of fossil fuels has a positive effect on climate change and human health?

The question intended to know the effects of electricity in comparison to fossil fuel

Table 4.16: The use of electricity

Does the use of electricity instead of fossil fuels have a positive effect on climate change and human health	Frequency (Percent)	Probability
Yes	82 (78.85)	<.0001
No	22 (21.15)	

Figure 4.16 shows 78.85% of respondents agree that the use of electricity has positive effects on climate change and human health. The 21.15% of respondents disagree that using electricity has no effects on climate change and human health compared to using fossil fuel.

QUESTION 22: Do you think providing communities with proper water and sanitation systems is important for climate change and human health?

The question intended to know whether providing proper water and sanitation is important for climate change and human health.

Table 4.17: Providing water and sanitation

Do you think providing communities with proper water and sanitation systems is important for climate change and human health	Frequency (Percent)	Probability

Yes	94 (90.38)	
No	10 (9.62)	1.0000

Table 4.17 indicates that 90.38% of respondents agree that providing communities with proper water and sanitation system has an important factor in climate change and human health. 9.62% of respondents disagree with that factor.

QUESTION 23: Do you think dumping waste at any place (e.g., river, any side, etc.) has a negative effect on climate change and human health?

This question is intended to know how dumping waste at any place affects climate.

Table 4.18: Dumping of waste

Do you think dumping waste at any point has negative effects on climate change and human health	Frequency (Percent)	Probability
Yes	103 (97.12)	1.0000
No	3 (2.88)	

Table 4.18 shows that the majority of responded believe that dumping waste at any place has a negative effect on climate change and human health. This accounts for 97.12% of the respondents. A small percentage has a different view. This is only 2.88% of respondents in the City of Tshwane.

QUESTION 24: Do you think that using common transport is important for climate change?

This question is intended to find out whether the use of common transport is important to changes in the climate.

Table 4.19: The use of common transport

Provision of common transport	Frequency (Percent)	Probability
Yes	88 (84.62)	<.0001
No	16(15.38)	

Table 4.19 indicates that the majority of respondents agree that using common transport is important for climate change. The other 15.38% disagree that using common transport is not important for climate change.

QUESTION 25: Do you think that provision of proper primary health care systems is important to climate change?

This question intends to discover if a primary health care system is important for climate changes

Table 4.20: Provision of primary health care

Provision of common transport	Frequency (Percent)	Probability
Yes	94 (90.38)	<.0001
No	10(9.62)	

Table 4.19 shows that 90.38% believe that the provision of a proper primary health care system is important for climate change. The other 9.62% believe otherwise.

QUESTION 26: Do you think the City of Tshwane provides proper primary healthcare systems for urban, rural and township communities?

This question intends to understand whether the City of Tshwane provides proper primary health care.

Table 4.21: Does the city provide primary health care services?

Do you think the City of Tshwane provides proper primary healthcare systems for urban, rural and township communities	Frequency (Percent)	Probability
Yes	82 (78.85)	<.0001
No	22 (21.15)	

This table indicates the city of Tshwane employees agree that the city provides a primary healthcare system. This amount to 78.85% of respondents. The other 21.15% disagree.

QUESTION 27: Do you think the City of Tshwane provides proper water and sanitation system for urban, rural and township communities

This question is intended to determine whether the city of Tshwane provide proper waste and sanitation system for urban, rural and township communities.

Table 4.22: Provision of water and sanitation

Do you think the City of Tshwane provides proper water and sanitation systems for urban, rural and township communities	Frequency (Percent)	Probability
Yes	86 (82.69)	<.0001
No	18 (17.31)	

Table 4.22 indicates that 82.69% of respondents agree that the city provides proper water and sanitation system for urban, rural and township communities. The other 17.31% disagree.

The figures in table 4.21 below were supported by the City of Tshwane database profile of 2018, indicating that the city provides households with water access levels. Presenting that 67% of households have water pipes inside their houses, 22% with water pipes inside their yards, 32% have communal water pipes and 6,7% with no formal water pipes (City of Tshwane community survey., 2016). Furthermore, 79% of the community has flushing toilets in their houses, where 2.2% uses improved ventilated pit toilets in the yard, 13% uses community ventilated improved pit toilet, 0.1% use bucket system and 4.3% with no toilets (City of Tshwane community survey., 2016).

QUESTION 28: Do you think the City of Tshwane provides electricity for urban, rural and township communities?

This question intends to understand whether electricity is being provided to communities.

Table 4.23: Provision of electricity

Do you think the City of Tshwane provides electricity for urban, rural and township communities?	Frequency (Percent)	Probability
Yes	75(76.53)	<.0001
No	23 (23.47)	

Table 4.23 shows the City of Tshwane provides electricity for urban, rural and township communities. This is provided by 76.53% of the City of Tshwane employees who are the respondents. However, 23.47% of respondents disagree that the City of Tshwane does not provide electricity to communities.

QUESTION 29: Do you think the City of Tshwane provides a proper waste management system for urban, rural and township communities?

This question aims to determine whether the City of Tshwane provide proper waste management

Table 4.24: Provision of waste management

Do you think the City of Tshwane provides a waste management system for urban, rural and township communities?	Frequency (Percent)	Probability
Yes	82(78.85)	<.0001
No	22 (21.15)	

Table 4.24 indicates that the majority of the respondents, 78.85%, agree that the City of Tshwane provides a proper waste management system for urban, rural and township communities. The minority of respondents, 21.15%, disagree that the City of Tshwane provides proper waste management. 83% of waste is removed weekly by the City of Tshwane waste removal services (City of Tshwane community survey., 2016).

QUESTION 30: Do you think the City of Tshwane is ready to deal with health issues related to climate?

The aim of this question was to determine whether the city is ready to deal with the health issues of climate change.

Table 4.25: Is Tshwane ready to deal with health issues?

Do you think the City of Tshwane is ready to deal with health issues related to climate	Frequency (Percent)	Probability
Yes	53 (50.96)	<.0001
No	51(49.04)	

Table 4.25 indicates that 50.96% of respondents agree that the City is ready to deal with health issues related to climate change. At the same time, 49.04% disagree with that question.

QUESTION 31: Are there any measures put in place by the City of Tshwane to address the health impacts of climate change?

The question intends to determine whether there are measures in place to address the health effects of climate change.

Table 4.26: Measures in place to address the health effects

Are there measures in place to address the health impacts	Frequency (Percent)	Probability
Yes	68 (65.38)	<.0001
No	36 (34.64)	

Table 4.26 shows that the majority of respondents, 65.38% agree that the city has put measures in place to address the health effects of climate change. The rest of the respondents, 34.64%, disagree.

QUESTION 32: Does the City of Tshwane have enough fire engines to deal with veld fire emergencies?

The question intends to determine whether the city has enough fire engines.

Table 4.27: Fire engines

Does the City of Tshwane have enough fire engines to deal with veld fire emergencies	Frequency (Percent)	Probability
Yes	44 (42.31)	0.1167
No	60 (57.69)	

Table 4.27 shows that the majority of respondents, 57.69% disagree that the city does not have enough fire engines to deal with fire emergencies. The rest of the respondents, 42.31%, agree that the city has enough fire engines. The City of Tshwane has 21 fire stations, with four important emergency services, being national emergency, police, fire and ambulance services (City of Tshwane community survey., 2016:28).

The department has about 84 fire-fighting vehicle resources, 42 fire engines, five truck/ladder companies,11 water tanker trucks and 26 bush/grass fire units. These resources are adequate to deal with fire emergencies in the seven subdistricts of the City of Tshwane.

QUESTION 33: Does the City of Tshwane have enough ambulances to deal with emergencies?

This question aimed to understand if the city has enough ambulances to deal with emergencies.

Table 4.28: Ambulances to deal with emergencies

Does the City of Tshwane have enough ambulances to deal with emergencies?	Frequency (Percent)	Probability
Yes	44 (42.31)	0.1167
No	60 (57.69)	

Table 4.28 shows that the majority of respondents, 57.69% disagree that the city does not have enough ambulances to deal with emergencies. The rest of the respondents, 42.31%, agree that the city has enough ambulances.

QUESTION 34: Does the City of Tshwane have free basic emergency health care training given to urban, township and rural communities?

The question sought to find out whether Tshwane has free basic emergency health care training.

Table 4.29: Basic emergency healthcare training

Does the city have free emergency health care training?	Frequency (Percent)	Probability
Yes	47 (45.19)	0.3268
No	57 (54.81)	

Table 4.29 indicates that the majority of the respondents, 54.81% disagree that the city has free basic emergency health care training given to urban, township and rural communities. 45.19% of respondents agree that the city has free basic emergency health training given.

QUESTION 35: Does the City of Tshwane have free basic fire management training given to urban, township and rural communities in cases of fire outbreaks?

The question sought to find out whether Tshwane has free basic fire management training.

Table 4.30: Basic fire management training

Does the city have free basic fire management training?	Frequency (Percent)	Probability
Yes	36 (34.64)	0.0017
No	68 (65.38)	

Table 4.30 indicates that the majority of the respondents, 65.38% disagree that the City of Tshwane has free basic fire management training given to urban, township and rural communities in case of fire outbreaks. 34.64% agree that the City of Tshwane has free basic fire management.

QUESTION 36: Do you think that the current approach to climate change preparedness approach by COT is sufficient?

The question was asked to gain insight from the respondents based on whether the preparedness approach by the City of Tshwane is sufficient

Table 4.31: Current approach to climate changes

Do you th approach to climate approach is	Frequency (Percent)	Probability
Yes	43 (41.35)	0.3268
No	61 (58.65)	

Table 4.31 shows that most respondents, 58.65%, disagree that the current approach to climate change preparedness is sufficient. 41.35% of respondents agree that the current approaches are sufficient.

QUESTION 37: What are climate preparedness strategies in place expected to achieve?

The aim of this question was to understand what the preparedness strategies in place are expected to achieve.

Figure 4.12: Preparedness strategies expected to achieve

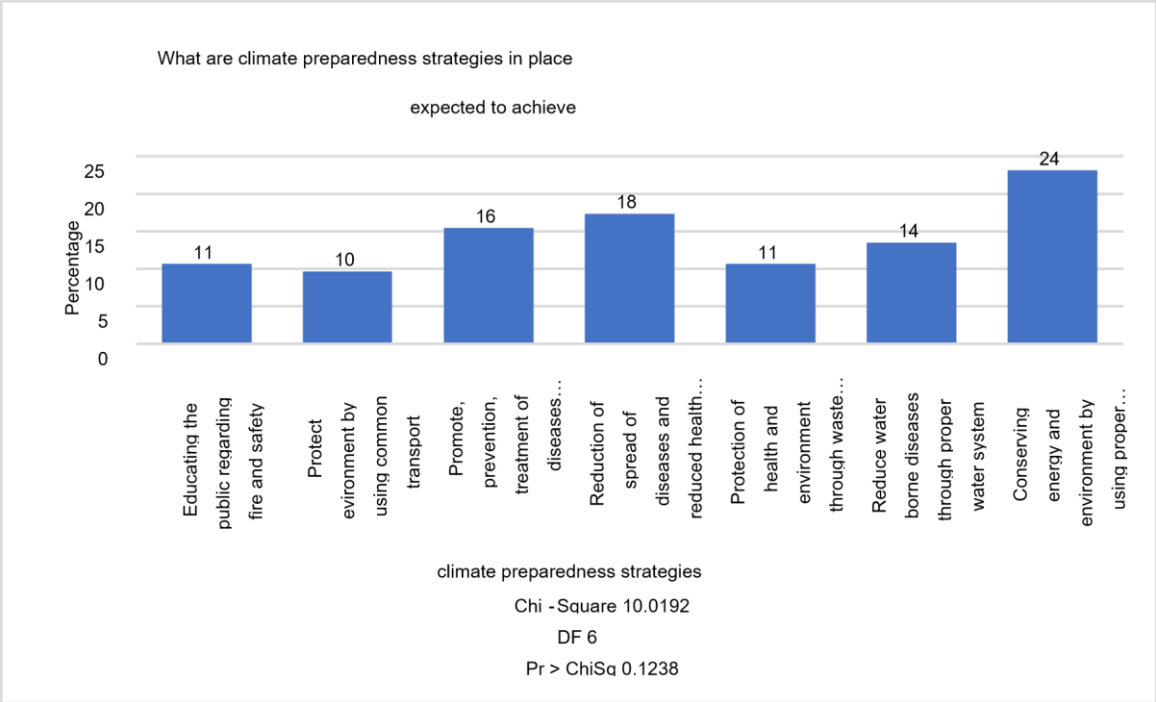


Figure 4.12 indicate the majority of the respondents, 24%, believe that the strategies are aimed at conserving energy and the environment by using proper lighting and heating system.

Followed by 18% of respondents believe that climate preparedness strategies in place are to reduce the spread of disease and reduce health system costs. Followed by 16% believing that the strategies are meant to promote, prevent and treat diseases through the primary health care system. 14% of respondents shows that the strategies are meant to reduce water borne diseases through the proper water system. 11% believe in educating the public regarding fire and safety. Another 11% believe the strategies are meant to protect health and the environment through waste management. The last 10% of respondents believe the strategies in place are meant to protect the environment through using common transport.

QUESTION 38: Do you undergo refresher disaster management training that prepares you should a need arise?

The question was asked to obtain information on whether the employees of the City of Tshwane undergo refresher disaster management training.

Table 4.32: Refresher disaster management training

Do you undergomanagement disaster training	Frequency (Percent)	Probability
Yes	44 (42.31)	<.0001
No	60 (57.69)	

Table 4.32 indicates that 57.69% of respondents disagree that they go for refresher disaster management training. 42.31% of respondents agreed that they go for refresher disaster management training.

QUESTION 39: If yes, when was your last training?

This question aimed to understand how often the respondents go for training. **Figure**

4.13: Last training of refresher management

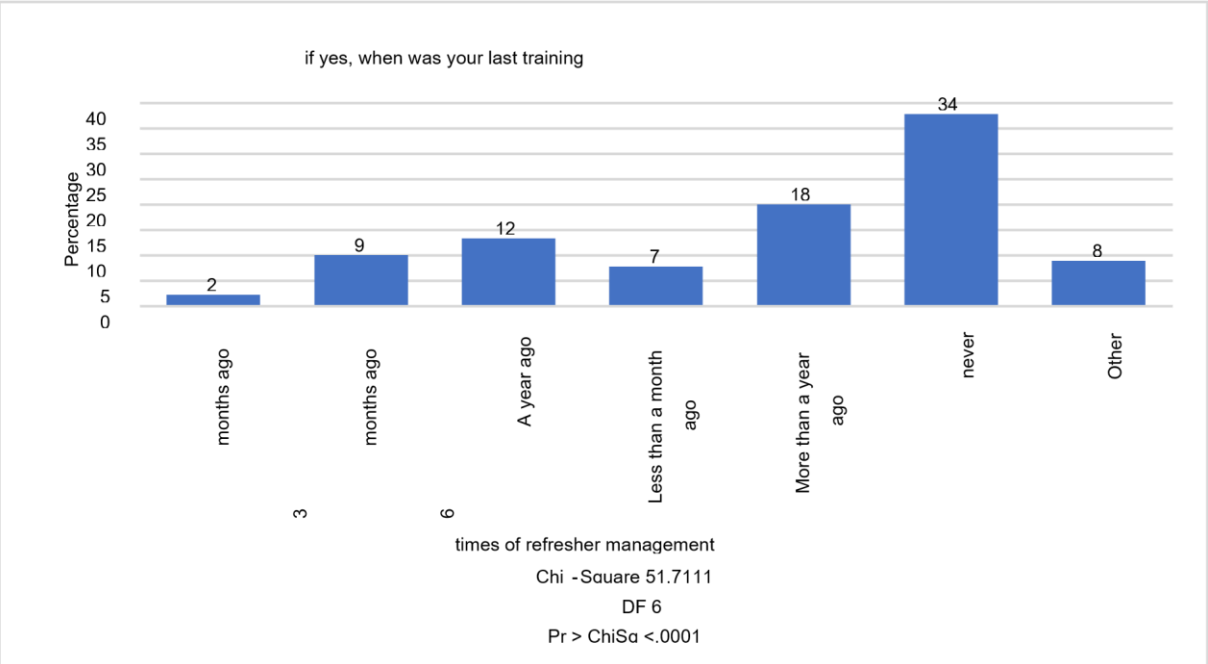
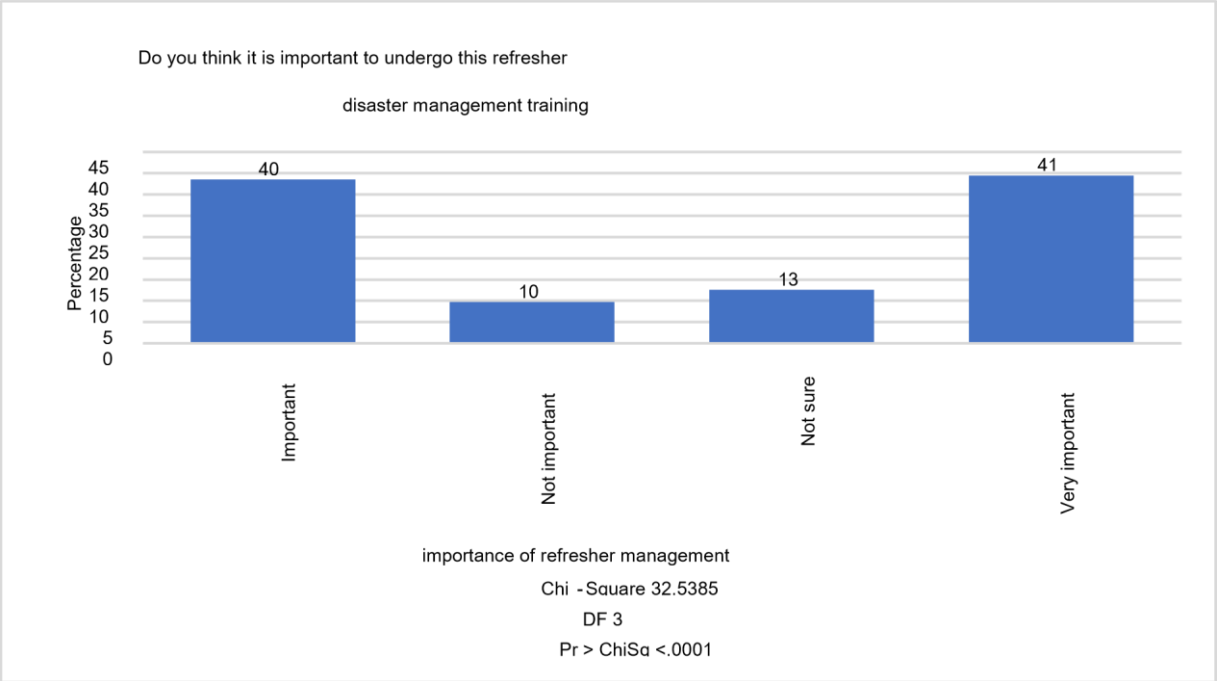


Figure 4.13 shows most respondents, 34%, have never gone for refresher training, followed by 18% went more than a year ago. 12% of respondents went a year ago, 9% six months ago, 8% not really specifying, 7% less than a year ago and 2% three months ago.

QUESTION 40: Do you think its important to undergo refresher disaster management training?

The primary goal of this question was to understand how important refresher training is.

Figure 4.14: Is undergoing training important?



This figure indicates that the majority of respondents, 41%, believe it is very important to undergo refresher training, followed by 40% saying its important, with 13% not sure and 10% saying going for refresher courses is not important.

QUESTION 41: Awareness campaigns are conducted through which channel?

This question is intended to understand through which communication channels awareness campaigns are done on climate change and the health effects thereof.

Figure 4.15: Awareness campaign

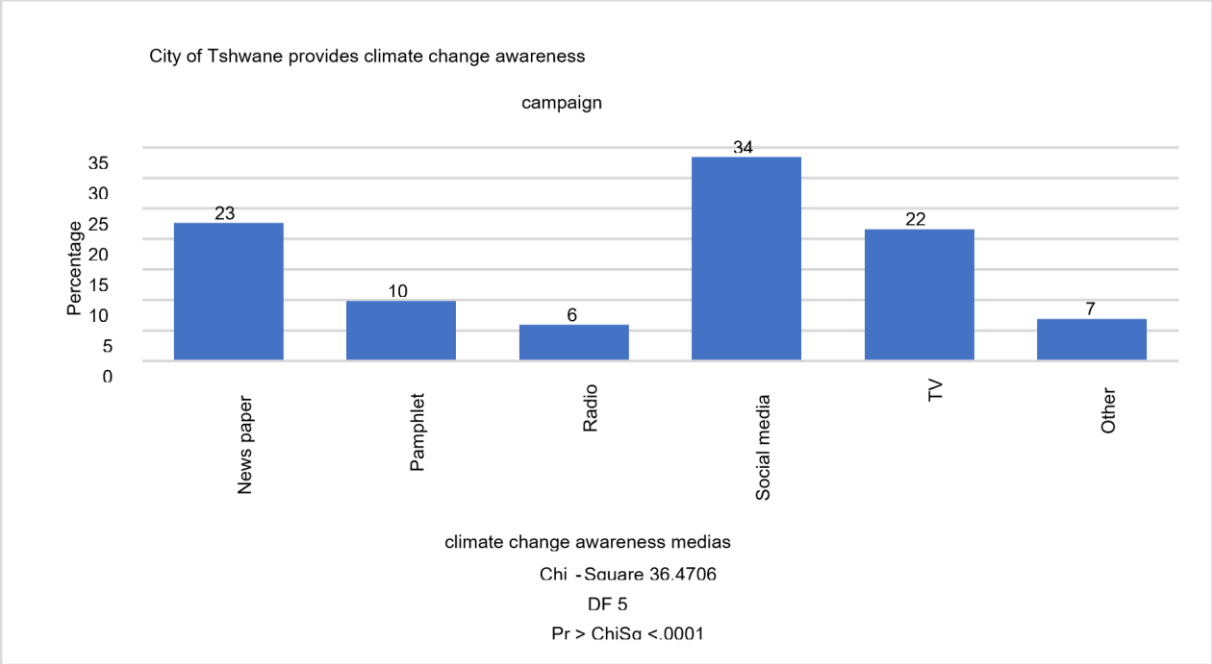


Figure 4.15 shows that most awareness campaigns, 34%, are done through social media, followed by 23% in newspapers, 22% on TV stations, 10% on pamphlets, 6% on radio and 7% on other channels not mentioned above.

QUESTION 42: What are some of the environmental factors affecting health and climate change?

This question is aimed at comprehending the different environmental factors affecting health and climate change.

Figure 4.16: Environmental factors affecting climate changes

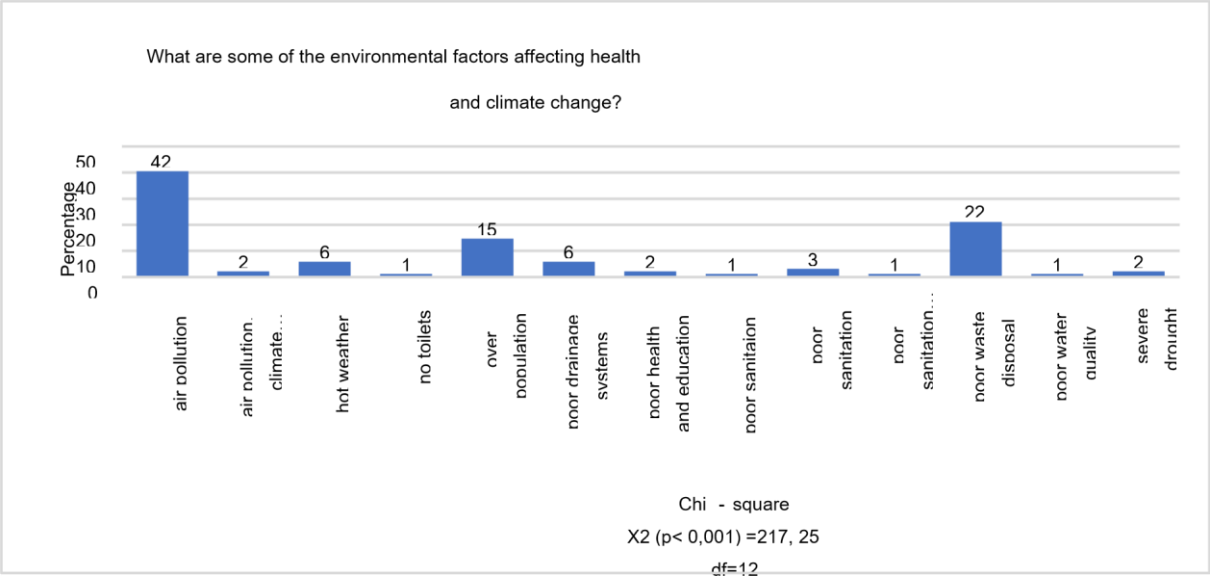


Figure 4.16 outlines that the majority of respondents, 42%, believe that air pollution is the biggest factor, followed by poor waste disposal at 22%, and 15% outlining overpopulation. 6% thought the biggest factor was hot water, poor drainage system, and 4% poor sanitation. 2% thought air pollution, climate change, poor health and education and severe drought was the biggest problem. Lastly, 1% believe that not having toilets, poor sanitation disposal and poor water quality were the biggest problems.

Table4.33 Theme that emerged from question42, figure4.16.

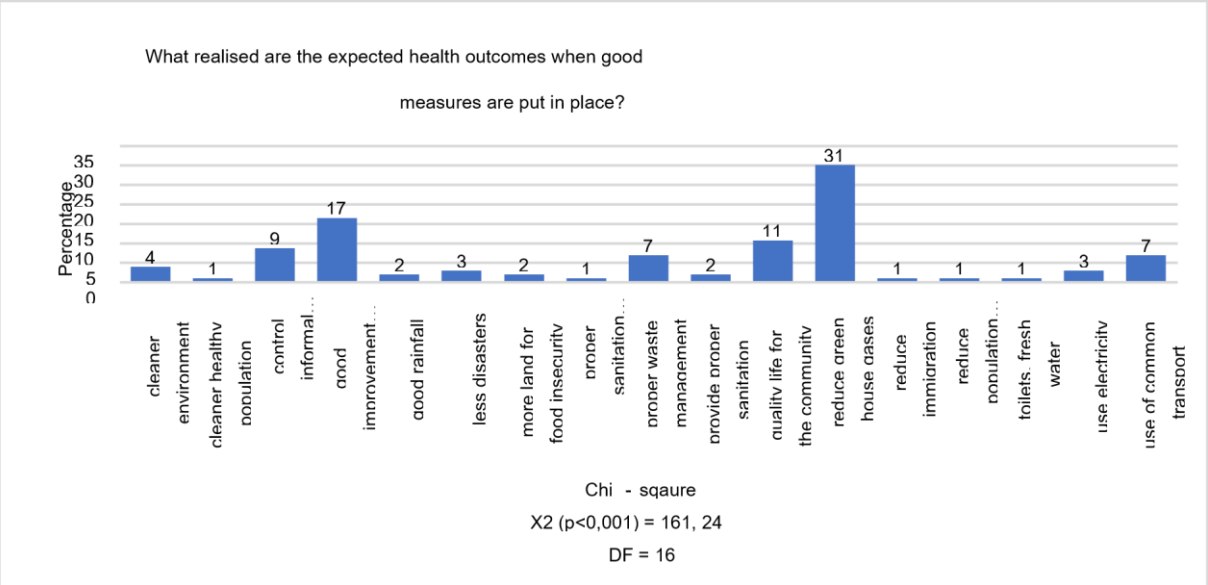
Themes	Frequency	percentage
Pollution	48.07	85
Poor sanitation	33.6	35
Total	81.6	85

According to the results in table 4.33, 85% of responded infers that pollution is an environmental factor that affects climate change, and 35% poor sanitation

QUESTION 43: What are some of the expected health outcomes when good measures are put in place?

The main point of this question is to know what will happen to health outcomes when good measures for climate change are put in place.

Figure 4.17: Expected health outcomes



The results, as seen in figure 4.17, suggest that 31% of respondents felt there would be a reduction of greenhouse gas effects, and 17% believed there would be a good environmental improvement. 11% indicate there will be quality of life for the community, 9% mentioned control of the informal settlement, 4% a cleaner environment, and 3% believe fewer disasters and the use of electricity will be achieved. 2% suggest there will be good rainfall, providing proper sanitation and more land for food insecurity. The remaining 1% felt a cleaner healthy population, proper sanitation and waste disposal, reduction of migration, reduction of population growth, toilets, and freshwater are good expected outcomes when good measures are put in place.

Table4.34 Themes that emerged from question43, figure 17.

Themes	Frequency	Percentage
Reduce population	12.6	13
Improve sanitation	9.71	10
Reduce pollution	33.9	35

Total	56.2	58

It is apparent from table4.34, that, when good measure are put in place, the following health outcomes are expected. 35.% respondent said there will be reduction of pollution, 10% said they will be improved sanitation and 13% said there will be reduced population.

QUESTION 44: What can the City of Tshwane improve in order to be prepared for the health effects of climate change?

This question is intended to point out what the city can improve in order to be prepared for the effects of climate change.

Figure 4.18: Improvement measures

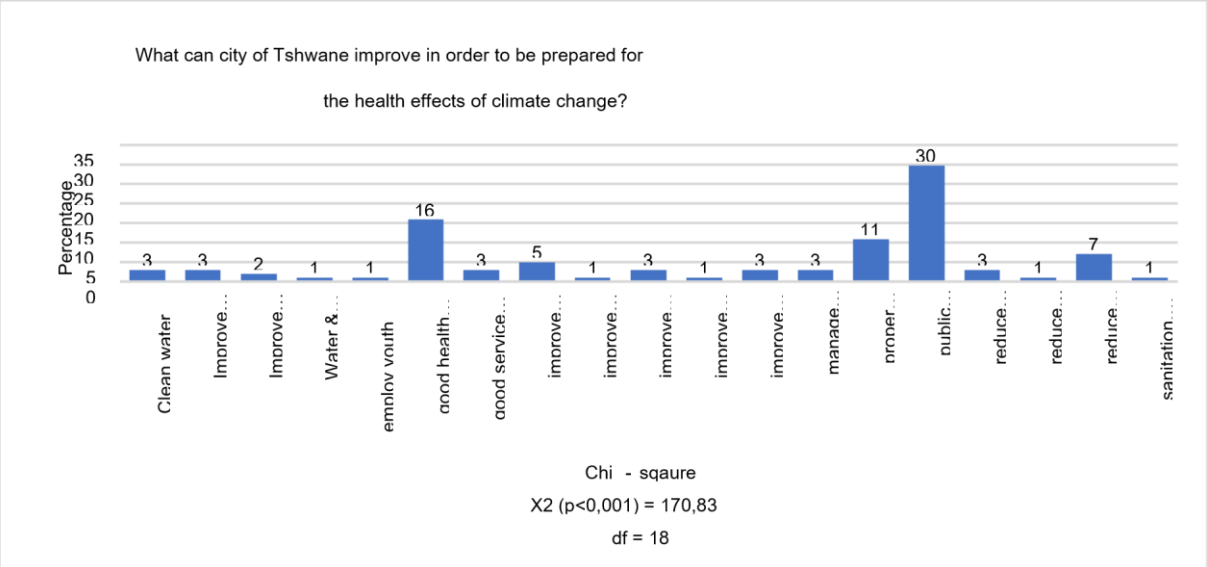


Figure 4.18 explains that 30% of respondents felt that public awareness is a major area in need of improvement, while 16% believe that good health for the community is another area of improvement. 11% point out proper housing, and 7% believe there should be a reduction in vehicles. 5% say that to improve sanitation. 3% cleaner water, improved sanitation, good service delivery, improved sanitation and waste disposal, managed population increase and reduced informal settlement. 2% improve sanitation. And the rest of the 1% indicates water and sanitation, employing youth, improving gaseous exchange, and reducing population growth.

Table4.35 Themes that emerged from question 44, figure 4.18.

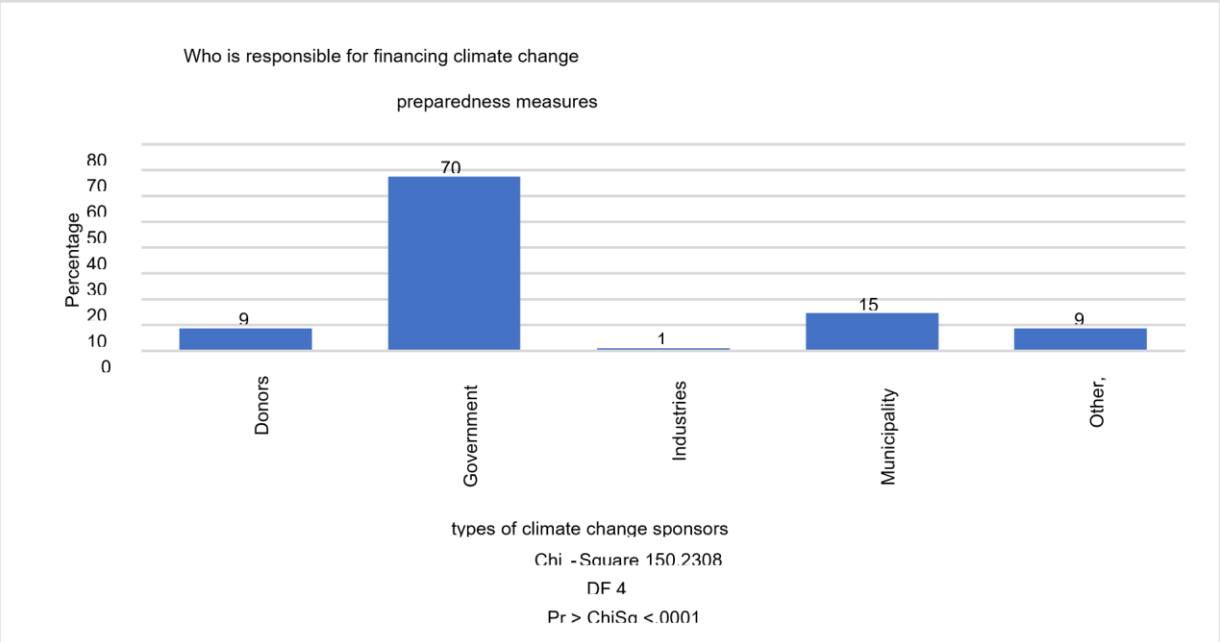
Themes	Frequency	Percentages
Improve sanitation	16.2	17
Reduce informal settlement	19.7	20
Improve service delivery	18.8	19
Total	54.71	56

The results in the above table4.35, suggest that the following measures should be improved in order to prepare for health effects of climate change. 17% of respondents indicated improve sanitation, 20% reduce informal settlement, and 19% improve service delivery

QUESTION 45: Who is responsible for financing climate change preparedness measures?

This question was asked to understand who is responsible for financing climate preparedness strategies

Figure 4.19: Financing climate changes



This bar graph indicates that 70% of respondents believe the government is responsible for the financial implications of climate change preparedness awareness, followed by 15%

indicating that it is a municipal responsibility, and 9% believing it should be donor funded. Another 9% believe other funders should be responsible. Finally, 1% believe the awareness campaign should be funded through industrial avenues.

4.4 SUMMARY OF CHAPTER

In this chapter, the data analysis and results were discussed. Section A of the questionnaire consisted of the demographic data of the participants, section B and section C, which was based on the theoretical framework. This discussion was done through the use of tables and charts, with their percentages of frequencies. The next chapter will discuss the results of this chapter in more depth.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 INTRODUCTION

The results of the analysed data from the questionnaire used were presented in chapter four (4). This chapter presents the discussions of the results in more detail as supported by the literature.

5.2 DISCUSSION OF FINDINGS

The discussions will be presented chronologically according to the results and the structured questionnaire. The discussion will be guided by the aim and objectives of the research.

The research results from data analysis and interpretation reflected were divided into the following section.

- Section A: Demographic data
- Section B: Measures in place to address the health effects of climate changes
  • Section C: Questions underpinned by the DPSEEA FRAMEWORK on the determination of the preparedness of the City of Tshwane for the health effects of climate change

5.2.1 Demographic data

The demographic data of the respondents discussed in this section are the highest level of education, employment level and years of service

Based on the result presented, the highest number of employees have acquired a higher level of education (90.38%). The respondents acquired tertiary qualifications in health sciences, electricians, financial administrators, emergency care and others. Providing availability of enough skilled and motivated employees to deliver effective and efficient services to the community in accordance with their needs (Wang, Jin, Wang, Zhao, Sang and Yaun, 2020:1). Educated employees help the city to advance and grow by coming up with the innovative idea,

on how to mitigate the health effects of climate. They also assist the city in growth opportunities to succeed in today's global economy and advance the country to a better tomorrow.

Furthermore, there is the best use of talent, societal and self-fulfilment (Bosu & Dawson-Amooh, 2022:1)

85.58% of the city's employees are full-time workers with a permanent contract, and the majority are employed for more than six years (63.46%) (the City of Tshwane Socio-Economic Profile, 2016:26). Additionally, a positive organizational climate leads to higher levels of organizational commitment, with employees staying in the company for longer service, delivering different services to the community such as primary health care, water and sanitation, electricity and more (Berberoglu, 2018:1).

5.2.2 Measures in place to address the health effects of climate changes

The respondents' data discussed in this section is based on measures in place to address the health effects of climate change.

Questions 6-7 address the issues of informal settlement.

As evidenced by the result, 88.46% of the respondents of the City of Tshwane responded that the number of informal settlements has not increased in the past year. With City of Tshwane profile database (2018:30) indicating that 75% of household dwellings are formal dwelling units. A formal dwelling unit is defined as a structure built according to approved plans. This category includes a house on a separate stand, flat or apartment, townhouses, rooms in the backyard, rooms, and flatlets with or without running water or flushing toilets within a dwelling.

Multiple studies have argued that there is an increase in the number of informal settlements every year. Further research indicates that as the number of informal settlements is rapidly growing, the government is finding it very difficult to provide adequate infrastructure and sustainable infrastructure (Netshieneulu., 2019:1). A major challenge for climate change adaptations is based on how to build resilience for the billion urban dwellers who are living in an informal settlement. These informal settlements are concentrated in urban centres in low- and middle-income nations (Satterhwalte, Archer, Colenbrander, Dodman, Hardoy and Patel., 2018:5).

Many informal settlements are built on land sites with a risk of flooding and land sliding, and these lands are usually chosen by a residence with the mindset of being less likely to be

evicted from the chosen site, the land being unattractive to developers (Satterhwalte et al., 2018:5). The issue is that most informal settlements are concentrated on a high level of risk from infectious diseases, accidental fires, natural hazards and pollution. With these conditions of life in the informal settlement, there is an increased risk of most climate change impacts such as high temperatures, heatwaves and floods (Satterhwalte et al., 2018:6). Upgrading informal settlements are becoming a common practice in many nations, usually driven by local government in response to democratic pressure, some projects driven by community organization and supported by local government (Satterhwalte et al., 2018:6). These upgrades are meant to ensure formal good quality buildings on safer sites with quality infrastructure and services to reduce health risk associations and improve services which include pipe water, sewers, storm drains, electricity, health care and emergency services (Satterhwalte et al., 2018:6).

In the absence of more effective policies, most of the world's growth in urban population will be accommodated in informal settlements. Looking at the projected rates and regions of urban population growth by 2050, there is an urgent need to build resilience to climate change in these settlements. There is also an urgent need to expand the supply and reduce the cost of "formal" (i.e., legal) housing that provides low-income groups with safer and more accessible alternatives to informal settlements (Satterhwalte, Archer, Colenbrander, Dodman, Hardoy, Mittlin and Patel, 2020:143). Rapid and unplanned urbanization, in combination with the impacts of climate change, increases the vulnerability of the urban poor to natural hazards. The rapid growth of cities places much greater pressure on the state and civil society organizations to provide adequate and affordable shelter and services for the urban poor (Williams, Costa, Sutherland, Celliers and Scheffran, 2019:158).

Various research has shown that most governments do not collect data on informal settlements or their inhabitants (Satterhwalte et al., 2020:143). The residents of informal settlements are a population often neglected by research, resulting in very limited availability of information regarding its increase (Borg, Andersen, Karekezi, Yonga, Furu, Kallestrup, Krae. 2021:2). Censuses should be able to provide detailed data on informal settlements to improve preparation measures to reduce and upgrade informal settlement (Satterhwalte et al., 2020:143).

Questions 8-8.2 are about information regarding electricity.

More than half of the City of Tshwane respondents responded that half of the area has electricity, and the other half responded that the area has no electricity. The City of Tshwane

database profile of 2018 indicates that 92% of the area has electricity. Where 65% is prepaid, and 27% is conventional prepaid meters. Meanwhile, only 8% use other sources and not paying for electricity (City of Tshwane community survey., 2016:30).

Electrification is widely considered an attractive solution for reducing oil dependency and environmental impact (Zang and Fujimori, 2019:1). Electricity offers an alternative to conventional fossil-fuel technologies, and switching to electricity has been proposed as a significant way to reduce direct CO2 emissions and ease the imbalance between the supply and demand (Zang et al., 2019:1)Great transformation of the global energy system is required for climate change mitigation. However, energy demand patterns and supply systems are subject to climate change impacts. These impacts should help the decarbonisation pathway in its effort to mitigate and adapt to climate change impacts effectively (Cronin, Anandarajah and Dessens, 2018:79). Research on climate change impacts on renewable energy is becoming increasingly relevant due to the vulnerability of the sector and to the continual development of methodologies and availability of data to mitigate climate change impacts. Public and private decision-making needs specific research to identify gaps that still exist in certain geographical regions and technologies (Salaun and Cerda., 2019:1). Renewables will play a major role in low carbon future in order to meet the climate goal, as the physical impact of climate change is amongst the challenges that renewables energy will have to face with implications of reliability and performance of the energy system (Salaun et al., 2019:1).

In the United Nations' sustainable development goals, goal 7 indicates affordable and clean energy is about ensuring access to clean and affordable energy, which is a vital component of agriculture, business, communications, education, healthcare and transportation. It further outlines that lack of access to clean energy hinders economic and human development. The United Nations further indicates that the latest data suggest that as the world continues to strive to advance towards sustainable energy targets, the current pace of progress is insufficient to achieve goal 7 by 2030. According to this report by the United Nations, with this pace the world is moving at, only 92% of the world population will have access to cleaner renewable energy by 2030, leaving 670 million of the population unserved.

Questions 9-12 involve a data discussion related to water, sanitation, waste management and access to the primary health care department.

The majority of respondents indicated that the area has working water, sanitation and waste management systems in place, as well as access to primary health care.

This is supported by the City of Tshwane data base profile of 2018, which showed that 67% of households have water pipes inside their houses, and 22% have water pipes inside their yards. 32% had communal water pipes, and 6.7% had no formal water pipes. 79% of the community has flushing toilets in their houses, 2.2% use improved ventilated pit toilets in the yard, 13% use community ventilated improved pit toilets, 0.1% use a bucket system, and 4.3% have no toilets. Furthermore, 83% of waste is removed weekly by the City of Tshwane waste removal services (City of Tshwane community survey, 2016:28).

Access to safe water, sanitation and hygiene is the most basic human need for health and well-being. According to the united nation sustainable goals, billions of people are going to lack access to water, sanitation and waste management services by 2030 unless the progression increases four-fold. The shortage of these services is based on the rapid growth of population, urbanization and increased water needs for agriculture, industry and energy sector. Additionally, many countries are facing degraded water-related ecosystems and water scarcity caused by climate change. To mitigate these challenges, the United Nations urges countries to increase their current rates of progression by four folds, indicating that achieving these targets would save about 829,000 annually from the death of diseases related to unsafe water, inadequate sanitation and poor waste management practices.

The City of Tshwane has 5 district hospitals, eight community health clinics, six mobile clinics, six satellite clinics and 47 clinics, of which 22 are managed and owned by the City of Tshwane (City of Tshwane Community Survey, 2016:28). Charles-Akalonu, Umo, and Amadi (2021:1) indicate that most clinics are situated within 2kms, of their respective wards and serving communities. This implies that access to health care is not an issue for most community members. Mathebula, 2021:20, indicates that upgrading the informal settlement project has improved multiple services with access to those services such as water, sanitation waste and primary health care. The provision of quality infrastructure and services also improves the construction of reliable, safe water piped to homes, the good provision within the household for sanitation, paved roads and paths, storm and surface drains and connection to electricity grids of which most informal settlements residents lack (Satterhwalte et al., 2018:6).

Although access to health care is not an issue for the majority of community members of the City of Tshwane, United Nations argues that the Covid-19 pandemic coursed a severe disruption in essential health services, triggering the increase of anxiety and depression in the community, lowering the global life expectancy, and interrupting the progression towards ending HIV, tuberculosis and malaria. The united nation further indicates a dropped coverage on immunization, resulting in increased death from TB and malaria.

5.2.3 Measures underpinned by the DPSEEA FRAMEWORK on the determination of the preparedness of the City of Tshwane for the health effects of climate change

The information gathered from the respondent outlined the following discussion.

Questions 13-15 report information aimed at understanding the meaning of climate changes, population growth and environmental factors.

The majority of respondents, 45%, believe that climate change means environmental weather conditions. Followed by 24% of the respondent who believes that climate change refers to changes brought on by the human population. 21% of respondents believe that climate change is due to global warming. The last 14% believe that climate change is due to temperature changes.

Climate change is the manifestation of heat waves, floods, wildfires, and droughts due to atmospheric pressure and greenhouse emissions (Boyd, Chaffin, Dorkenoo, Jackson, Harrington, Guetta, Nordionder, De Rosa, Raju, Scown, Soo and Staurt-Smith., 2021:1). Climate change is also human-induced associated with developmental failures and lack of sufficient mitigation and adaptation (Boyd et al., 2021:1). United nation defines climate changes as the global temperature rise of 1.1 degrees above the pre-industrial level glaciers melting and sea level rising.

The effect of population growth courses, land degradation, deforestation, habitat destruction and loss of bio-diversity (Kaytesa & Ayechew., 2021:1). The results of deforestation lead to the wood being used to make a fire in most areas of the city where there are informal settlement and no access to electricity. This results in increased air pollution, which negatively impacts the environment due to carbon dioxide in the atmosphere (Ahmed & Magidie., 2020:177). With increased population growth and land usage, future climate variability is predicted to have profound impacts. Some of these impacts are on global food security. Future population growth yield crop production leading to severe food insecurity, with land used for building. Food insecurity results in undernourishment, placing a burden on a weak healthcare system (Molotoks, Smith, Dawson, 2021:1)

The impacts of climate change also include flooding and drought, displacing millions of people, sinking them into poverty and hunger, and denying them access to services such as health and education. Further increasing the devastating effects of Covid-19, which left millions of people without employment. United nation indicates that climate impacts course expansion in

inequalities and decreases economic growth. According to the United Nations, 700 million people are at risk of displacement by drought alone by 2030. Saving lives and livelihoods depend on urgent steps to be taken to mitigate the impacts of climate change.

Questions 16-21 & 42 point out data related to land usage and its effect on climate change and human health.

Survival of all species depends on nature. Nature is a provider of oxygen, regulates our weather patterns, pollinates our crops and produces food (Sustainable development gaol report, 2022:6). Unfortunately, 75% of the earth's surface is affected by human activity, squeezing wildlife and nature into a tight corner of the planet. Human activity and climate changes causing deforestation and desertification have negative impacts on human lives. The importance of forests is to sustain life on earth and play a major role in the fight against climate change. The attributes of deforestation are associated with the development of many informal settlements situated in different locations in the City of Tshwane - in low, medium, and high population density areas (Ahmed & Magidi, 2022:177). There are also well-managed and maintained open areas such as nature reserves and a stadium. When urban areas develop, some open areas are left undeveloped, thereby leading to inhabit open veld (Ahmed et al., 2022:177). These areas have high natural tree species, which have suffered from massive deforestation for firewood. Some of the natural areas still maintain thick bushes, but they are closer to informal settlements, where the source of energy is firewood (Ahmed et al., 2022:177).

Some urban renewal projects on shopping malls and mining that have been established in the city have brought about an increase in air pollution, which negatively impacts the environment (Ahmed et al., 2020:177). The results also reveal that any house built close to dumping sites is in a hazardous environment. Dumping mixed materials of waste in streams and river banks. There is a probability of human exposure to this hazardous material through water, air and soil via oral and dermal to local and downstream communities (Dladla, Machete, Shale, 2020:1). A study confirms the negative effects of building next to rivers as being flooding. Flooding has catastrophic effects, not only on infrastructure but on human life as a whole. With building houses next to rivers, the impact of flooding also leads to loss of life due to drowning, especially with the re-occurrences of heavy rains in some parts of the city (Fujita & Shaw., 2018:62). The United Nations urges nations that invest in land restoration is crucial for improving human lives, reducing vulnerability and the risk of a sinking economy.

Questions 22-29 & 32-33 focus on information about the provision of services in the city of Tshwane

When communities are provided with proper water and sanitation, it reduces the health effects brought on by using contaminated water with hazardous materials. Thus, intern reducing the incidence of oral faecal and contaminated water diseases such as cholera, diarrhoea, dysentery, hepatitis A and typhoid (Caminade, Mclntyre, Jones, 2019:158).

The aim of providing primary health care to the community is to promote a population of healthy individuals. A healthy population creates a healthy environment. Planting vegetable gardens, flowers and trees, do not only assist in restoring the balance of oxygen and carbon dioxide in the atmosphere but also leads to disease-free, fit and healthy lifestyles of walking and jogging (Baldochi & Penuelas, 2018:1). Using common transport and ride-sharing, reduce carbon dioxide emission, as most people will be in a similar car than individual transport. The effect of common transportation on climate change reduces carbon dioxide gases from transport to air which is harmful to the atmosphere (Wang et al., 2020:1).

Questions 30-31, 36-37 & 43-44 describe measures in place to address the health effects of climate change by the City of Tshwane

The City of Tshwane has an evidence base action plan which is consistent with the Paris Agreement. This action plan builds on the climate response strategy of 2017. This action plans outlines the prevention of global warming exceeding 1.5 degrees Celsius above pre-industrial levels by translating the aspirations of the Paris Agreement into city-level action (Tshwane Climate Action Plan, 2015:36).

Enhance and protect the City's natural ability to buffer climate change impacts, develop an integrated approach to water management in the City, building climate-resilient communities, promote mixed-use densification and transit-oriented development, promote cleaner mobility Intervention, retrofit existing buildings and build green buildings, promote energy efficiency, promote cleaner and renewable energy, divert waste from landfills and find innovative uses for waste Intervention and pursue sustainability support mechanisms.

Tshwane reconfirms its commitment to playing its part in addressing global climate change by ensuring that Tshwane becomes a net-zero carbon and climate-resilient city by 2050. As a rapidly growing capital city and a regional knowledge hub, the city has the opportunity to pursue an ambitious, evidence-based sustainable growth strategy to combat climate change and shape a safer, cleaner, healthier, more prosperous and more equitable future for all

residents. The City of Tshwane also has the chance to serve as a climate action trailblazer, inspiring other cities in South Africa and beyond (Tshwane Climate Action Plan, 2015:36).

The climate action plan builds on the City's Climate Response Strategy of 2017, a solid evidence base consisting of a Greenhouse Gas Emissions Inventory (GHGEI) and a Climate Risk and Vulnerability Assessment, best-practice research and extensive stakeholder engagement (Tshwane climate action plan). The goals of the climate preparedness strategy are to protect vulnerable communities, infrastructure and other assets from the impacts of climatic change. It is important to build the resilience of people and communities to ensure that they can withstand climate impacts through education and information sharing (Tshwane Climate Action Plan, 2015:38).

When good measures are put in place, the direct, indirect and social dynamic effects of climate changes on health and well-being producing the following health impacts such as cardiovascular diseases, respiratory infectious diseases, undernutrition, mental health illnesses, allergies and poisoning are prevented (Tshwane Climate Action Plan, 2015).

The development of a net-zero carbon-resilient infrastructure can contribute to the overall resilience of Tshwane and enhance the city's risk profile. Furthermore, it promotes healthier people by promoting good air quality practices (Tshwane climate action plan, 2015:38). The United Nations argues that for the nation to be ready for mitigation of climate change effects, they should achieve to limit global warming to 1.5° Celsius above pre-industrial levels, as set out in the Paris Agreement and global greenhouse gas emissions will need to peak before 2025. Then they must decline by 43 per cent by 2030 and to net zero by 2050. According to recent data indicated by the United Nations, current national commitments are not sufficient to meet the 1.5°C target.

Questions 34-35 & 38-41 demonstrate information regarding training and campaign development offered by the City of Tshwane

Providing quality education for all is fundamental to creating a peaceful and prosperous world. Education gives people the knowledge and skills they need to stay healthy, get jobs and foster tolerance (Sustainable Development Goal Report, 2022:17).

The City of Tshwane has an integrated development division. This division is responsible for education, training and liaison. The purpose of this department is to give basic firefighting and medical training courses not only to staff but also to the community (City of Tshwane Environmental Education and Awareness Strategy, 2015:23). Tshwane training policy outlines

that there are workshops for junior management functional level or certain job categories according to departmental need. The aims of this training are to monitor staff composition and identify promotional opportunities and individual development (City of Tshwane Environmental Education and Awareness Strategy, 2015:23). The refresher courses are important to promote vertical and horizontal development in the areas of responsibility. It also ensures a consistent team of highly qualified and motivated candidates for all key positions and responsibilities. Also assist employees in developing careers (City of Tshwane Environmental Education and Awareness Strategy, 2015:23).

Health promotion and training programmes are the main mechanisms for equipping the community with knowledge and information. Environmental health programs also interact formally and informally with the public on a wide range of health education and training initiatives. This initiative emphasises the promotion of a healthy lifestyle, personal hygiene, safe and healthy environment (City of Tshwane Environmental Education and Awareness Strategy, 2015:23). Climate change poses a challenge to countries across the world, with news media being an important source of information on the issue. News media attention varies across countries and is often associated with political, scientific, and partly societal focusing events. Based on automated content analysis, news media do not only cover ecological changes or climate science but also focus predominantly on the societal dimension of climate change. They emphasize how humans are aware of, affected by, battle, or cause climate change (Hase, Mahl, Schafer, Keller, 2018:1).

Question 45 suggests who is responsible for the financial support of the City of Tshwane

The data gathered indicates that 70% of respondents believe the government is responsible for the financial implications of climate change preparedness awareness, followed by 15% indicating that it is a municipal responsibility, followed by 9% believing it is donor-funded, and another 9% believing its other funders. And finally, 1% believe the awareness campaign is funded by industrial avenues. Tshwane receives operational grants and operational subsidies from the national government. Six billion are shared and distributed amongst different divisions of the municipality, such as health, public transport, municipal human settlement, research and technology, and others (City of Tshwane Socio-Economic Profile, 2016:26).

5.3 SUMMARY OF CHAPTER

This chapter discussed the results of chapter 4 in more detail. The next chapter will present an overview and summary of the discussion in chapter 5, recommendation, contribution to the body of knowledge and final conclusion of the study.

CHAPTER 6

SUMMARY, RECOMMENDATIONS, LIMITATIONS OF THE STUDY AND FINAL CONCLUSIONS

6.1 INTRODUCTION

The previous chapter presented a discussion of results based on chapter four, data analysis. This chapter presents an overview of research findings and conclusions based on the result of this study on the preparedness to address the health effects of climate change. Recommendations will be explained below for further action, and limitations of the study accordingly.

6.2 RESEARCH QUESTION, AIM AND OBJECTIVE

The research question is:

- Is the City of Tshwane prepared to address the health effects of climate change?

Therefore, the aim: of the researcher intended to determine the preparedness of the City of Tshwane to address the health effects of climate change.

6.3 OBJECTIVES

According to (Brink et al.,2018:85), “an objective is a concrete, measurable end towards which effort or ambition is directed and research objectives” are clear, concise, declarative statements that are written in the present tense.

The objective of the study was:

- to determine the preparedness of the City of Tshwane to address the health effects of climate change.

6.4 OVERVIEW OF RESEARCH RESULTS

The research results from data analysis and interpretation reflected were divided into the following sections:

- Section A: Demographic data

The results of the demographic data indicated that most respondents had a tertiary qualification, with full time employment contract and 11-15years of service in the City of Tshwane.

- Section B: Measures in place to address the health effects of climate changes

High number of respondents were working from waste management department, with 52,8% of services delivered in the city, and 92% of respondents believing there is no significant increase in the number of informal settlements, although 25% of houses are build next to the veld. The results further indicates that, the City of Tshwane strive to effective and adequately provide services such, electricity, waste management, sanitation, transportation, housing and health to mitigate the health effects of climate changes.

- Section C: Questions underpinned by the DPSEEA FRAMEWORK on the determination of the preparedness of the City of Tshwane for the health effects of climate change.

The results indicate that population growth is responsible for climate changes, leading to environmental changes. These environmental changes progress to destroying of forest, to build industrial sites. With population growth there is increased formation of informal settlement, poor sanitation and waste management. Education, training and public awareness is vital to implementation of strategies to reduce the negative effects of climate changes.

6.5 RECOMMENDATION

In this study, the recommendations provide some clarity and direction for the necessary action to be taken that will assist in mitigating the health effects of climate change.

6.5.1 Recommendation for Health

- Recycle medical waste made of recyclable material made of plastic and copper to reduce the burden on waste management.

- Implementation of climate education on medical staff and awareness among patients and visitors.

  Improve and implement climate-friendly health facilities through the creation of smoke zones and separation of recyclable waste.

6.5.2 Recommendations for future research

- It is important to conduct a similar study or studies in mitigation of climate changes within Gauteng and South Africa at large. This will provide more data that will enable comparison, which will indicate similarities and uniqueness (if any) between provinces and provide a national outlook.
- More research study is required in nursing education related to innovative ways to implement the strategies related to the mitigation of climate effects.
- Nurse educators play a huge role in students learning about climate change. It is important to carry out similar studies using a qualitative approach to how best implementations can be carried out
- An experimental study needs to be carried out to measure the effects of climate change mitigation strategies.
- More research is required in the use and creation of renewable energy as opposed to burning fossil fuels for the creation of electricity.

6.5.3 Recommendation for the City of Tshwane

Below are recommendations based on the findings of Chapter 4.

- The commitment outlined in the Paris agreement, Tshwane climate action plan and Tshwane climate response strategy must be implemented by 2050, irrespective of political interferences and changes.
- Uplift the poor and vulnerable by managing resources for the benefit of present and future generations.
- Enhance public awareness and understanding of climate change. Promote sustainable development and its interconnected economic, social and ecological pillars

6.5.4 Recommendations for nursing education

- Based on the results, climate change might be integrated into nursing education, so that knowledge and skills needed for clinical practice in a climatic-changing world can be incorporated into the curricula.

Educators are required to adapt numerous teaching methods and approaches to meet the nursing students' needs and requirements to actively participate in mitigation strategies and climate change education.

6.5.5 Recommendation for policymakers

- Policies and laws should be formulated and adjusted to hold those responsible for environmental degradation, resisting and delaying the implementation of climate strategies and action plans to account.
- Policies should be implemented to monitor the targets set out for sustainable development goals 3- provision of good health and wellbeing, goal 6- provision of clean water and sanitation, goal 7- affordable and clean energy, and most importantly, goal 13- climate action, which affects the above-mentioned goals.

6.6 CONTRIBUTION TO THE BODY OF KNOWLEDGE

The aim of the researcher was to determine the preparedness of the city of Tshwane to address the health effects of climate change. The results of the study significantly contribute towards the body of knowledge in the City of Tshwane, the nursing education field and policy formation within South Africa and globally.

The literature review in chapter two (2) was supported by the findings in (chapter 4) of this study that there is a need for the acceleration of the preparedness of the City of Tshwane to address the health effects of climate change and implementation of measures and strategies in place irrespective of any pollical changes and interferences.

The results provide an encouraging background and deep insight into measures in place city of Tshwane to address the health effects of climate change, which can be carried out in other municipalities and South Africa as a whole.

6.7 LIMITATIONS

The data collection process came with some unforeseen challenges, even though the investigator tried to collect data as best possible within the extended period to present the most effective results considering the present coronavirus pandemic.

The study was a success in the end, and the following limitations were identified in this study.

The study was conducted within the selected city of Tshwane departments but more than one department participated in the study . However, the results of this study cannot be generalised.

- The accessibility of the respondents was strictly limited due to the emergence of the coronavirus pandemic, which contributed to an unfavourable situation of movement restrictions. As a result, the online survey did not obtain a good number of participants.
- Even though the City of Tshwane was willing and extremely helpful in reaching out to the potential participant after multiple communication and request (104) were ultimately the number of participants who participated in the study.
- The literature on preparedness for the health effects of climate change is relatively limited. However, to mitigate these limitations, the researcher had to align the result of the study with relevant literature and recommendations.

6.8 FINAL CONCLUSIONS

The study aimed to determine the preparedness of the city of Tshwane to address the health effects of climate change.

The research study was guided by the aim of the study, research questions and research objective. The study also revealed valuable information regarding measures, action plans and strategies in place regarding the preparedness to address the health effects of climate change. Recommendations were made accordingly, and the limitation of the study was also revealed. The results of the study clearly indicate that the City of Tshwane is not prepared to deal with the health effects of climate change, as evidenced by an increased number of informal settlement that contributes adversely to littering, poor waste management, sanitation and deforestation. Clocking of the drainage system leads to flooding, which results in multiple health problems and disease causation such as diarrhoea, bilharzia and cholera, among others. Multiple pulmonary diseases such as asthma, chronic obstructive pulmonary diseases and heart disease are exacerbated as a result of deforestation.

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ANNEXURE A

DECLARATION OF ORIGINALITY: UNIVERSITY OF PRETORIA

Itireleng Confidence Motswagae

Annexures

ANNEXURE A: DECLARATION OF ORIGINALITY: UNIVERSITY OF PRETORIA

Full names of student: Itireleng Motswagae

Student number: u11141035

Topic of work: THE DETERMINATION OF THE PREPAREDNESS OF THE CITY OF TSHWANE IN ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE.

Declaration:

1. I understand what plagiarism is and am aware of the University's policy in this regard.

2. I declare that this proposal is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.

3. I have not used work previously produced by another student or any other person to hand in as my own.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

I.C MOTSWAGAE

SIGNATURE **DATE**

ANNEXURE B

INFORMATION LEAFLET AND CONSENT FORM

ANNEXURE B: INFORMATION LEAFLET AND CONSENT FORM

ICD 1A

PARTICIPANT'S INFORMATION & INFORMED CONSENT DOCUMENT

STUDY TITLE: THE DETERMINATION OF THE PREPAREDNESS OF THE CITY OF TSHWANE IN ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE

.

Principal Investigators: Itireleng Motswagae

Student Number**:**11141035

Institution: University of Pretoria

DAYTIME AND AFTER-HOURS TELEPHONE NUMBER(S):

Daytime number: 0716828322

Afterhours number: 0716828322

Email address: itirelengmotswagae@gmail.com

Dear Prospective Participant

1. Introduction

You are invited to volunteer for a research study. I am a student in the Master's degree of Nursing in the Department of Health Care Sciences at the University of Pretoria. This information in this document is to help you to decide if you would like to participate. Before you agree to take part in this study you should fully understand what is involved. If you have any questions, which are not fully explained in this document, do not hesitate to ask the researcher. You should not agree to take part unless you are completely happy about all the procedures involved.

2. Purpose of the study

The aim of this study is to determine the preparedness of City of Tshwane in addressing the health effects of climate changes. By doing so we wish to learn more about health effects of climate change and how prepared City of Tshwane is, in addressing this health effects.

Annexures

3. Explanation of procedure's followed

This study involves answering some questions regarding health effects of climatic changes and the preparedness of City of Tshwane in addressing these effects. Your email address will also be requested, so you can answer the online survey on your own time within the period of 6weeks. The survey should take about 25-30minutes to complete, the format will allow you the participant to be able to save your responses and resume to it at later stage if need be. Three reminder messages will be sent via email at points 10 days, three weeks, and 4 weeks following the reintroduction with notification of the survey closing date. The survey should close six weeks after opening.

4. Risk and Discomfort involved

There are no medical risks and discomfort associated with the study, as the study will take place online.

There will be telecommunication as well email communication. No invasive procedures.

5. Benefits of the study

Although you may not benefit directly. Study findings offer a framework for climate preparedness planning and provide evidence for a strategic approach to building adaptive capacity to address the health effects. The study will reveal challenges that may need to be addressed to make efforts more effective. Findings will inform community engagement, outreach, education, and communication programming on addressing the health effects brought on by climatic changes. The study finding will also assist policy makers, to include climate change preparedness in their mandates.

You will not be paid to take part in the study. There are no costs involved for you to be part of the study.

Your participation in this study is entirely voluntary and you can refuse to participate or stop at any time without stating any reason.

This Protocol was submitted to the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, telephone numbers 012 356 3084 / 012 356 3085 and written approval has been granted by that committee.

Confidentiality

Annexures

All information obtained during the course of this study will be regarded as confidential. Each participant that is taking part will be provided with an alphanumeric coded number e.g. A001.

This will ensure confidentiality of information so collected. Only the researcher will be able to identify you as participant.

Results will be published or presented in such a fashion that participants remain unidentifiable.

I confirm that the person requesting my consent to take part in this study has told me about the nature and process, any risks or discomforts, and the benefits of the study.

- I have also received, read and understood the above written information about the study.
- I have had adequate time to ask questions and I have no objections to participate in this study.
- I am aware that the information obtained in the study, including personal details, will be anonymously processed and presented in the reporting of results.
- I understand that I will not be penalized in any way should I wish to discontinue with the study
- I am participating willingly.
- I have received a signed copy of this informed consent agreement.

_____ _____

Participant's name (Please print) Date

_____ _____

Participant's signature Date

_____ _____

Researcher's name (Please print) Date

_____ _____

Researcher's signature (Please print) Date

Itireleng Confidence Motswagae

ANNEXURE C

DATA COLLECTION INSTRUMENT

Itireleng Confidence Motswagae

Annexures

ANNEXURE C: DATA COLLECTION INSTRUMENT

QUESTIONNAIRE FOR ONLINE SURVEY

Title of the study: THE DETERMINATION OF THE PREPAREDNESS OF THE CITY OF TSHWANE IN ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE

Instructions: Please complete all the sections by either ticking or filling the relevant block

SECTION A

DEMOGRAPHIC INFORMATION

Please take note the age and gender of participants is removed, as it has no relevancy to study

1. Highest education level	
No schooling Primary education Secondary education Tertiary education	
Other, specify:	

2. Employment level

Full-time Part-time	

Annexures

3. Years of service in COT municipality	
< 6 years 6-10 years 11-15 years >15years	

SECTION B

4. Which service point are you working for	
Electricity	
Finance	
Water and sanitation	
Waste management	
Health	
Emergency services	
Other, specify:	

5. Which areas do you cover for delivering your service	
City	
Township	
Other, specify: (e.g. Informal settlements)	

Annexures

6. Has the number of informal settlements increased in the past years

Yes No	

7. Are their houses build next to:

River	
Veld	
Mountain	
Landfill	
Forest	
None of the above	
Other, specify: (e.g. Informal settlements)	

8. Does the area have electricity

Yes	
No	

8.1. If no, what is their source of lighting

Candle	

Annexures

Paraffin light (lanterns)	
Solar panel	
Battery light	
Flash light (torch)	
Generator	
Gas light	
Other, specify:	

8.2. If no, what are they using for cooking and heating food

Brazier	
Paraffin stove	
Solar panel	
Coal	
Firewood	
Generator	
Other, specify:	

9. Does the area have working water system

Yes No	

Annexures

9.1. What type of working water system does your area use	
Water system in the house	
Tap in the yard	
Borehole in the yard	
Community tap	
Community jojo tanks	
River	
Dam	
Other, specify:	

10. Does the area have proper sanitation system	
Yes No	

10.1. What sanitation system do they use in the community

Flushing toilet in the house	
Flushing toilet in the yard Community Flushing toilet ventilated improved pit toilet in the yard Community ventilated improved pit toilet	
Bucket toilets in the yard	
Community bucket toilets in the yard	

Annexures

Open field (e.g. fields, bushes, next to river, etc.)
Other, specify:

11. Does the area have proper waste management system
Yes No

11.1. Which waste management system do they have in the community
Household waste bins
Large waste management containers at the corners of each area
Removal and transportation of waste on a weekly basis
Waste treatment
Landfill disposal

Annexures

Other, specify:

12. Does the area have access to essential primary healthcare
Yes No

12.1. What essential primary healthcare do they have the community	
Clinic which is less the 2 km from their community	
Clinic which is more than 2 km from their community	
No clinic in their community	
Hospital which is less than 2 km from their community	
Hospital which is more than 2 km from their community No hospital in their community	
Mobile clinic	
Voluntary community-based care service	
Other, specify:	

SECTION C: Questions underpinned by the DPSEEA FRAMEWORK on determination of the preparedness of City of Tshwane for the health effects of climate change

13. What does climate change mean to you	
Change in temperature	
Change in environment and weather conditions	
Climate change due to human population	
Climate change due to global warming	

Other, specify:

14. Do you think population growth is responsible for climate change?	Yes
	No

15. Do you think the larger the population size the more environmental change occurs?	Yes
	No

16. Do you think land use through destroying forests and building informal settlements have a negative effect on the climate change?	Yes
	No

17. Do you think land use through building industrial sites have a negative effect on the climate change?	Yes
	No

18. Do you think building houses next to waste landfills have a negative effect on the climate change and human health?	Yes
	No

19. Do you think building houses next to rivers have a negative effect on the climate change and human health?	Yes
	No

20. Do you think the use of fossil fuels such as oils, coals, etc. have a negative effect on climate change and human health	Yes

	No

21. Do you think use of electricity instead of fossil fuels have a positive effect on climate change and human health?	Yes
	No

22. Do you think providing communities with proper water and sanitation systems is important for climate change and human health?	Yes
	No

23. Do you think dumping waste at any place (e.g. river, any side, etc.) have a negative effect on climate change and human health?	Yes
	No
24. Do you think that using common transport important for climate change?	Yes
	No

25. Is provision of proper primary health care systems important for climate changes?	Yes
	No

26. Do you think City of Tshwane provides proper primary healthcare systems for urban, rural and township communities?	Yes
	No

27. Do you think City of Tshwane provides proper water and sanitation system for urban, rural and township communities?	Yes
	No

28. Do you think City of Tshwane provides electricity for urban, rural and township communities?	Yes
	No

29. Do you think City of Tshwane provides proper waste management system for urban, rural and township communities?	Yes
	No

30. Do you think City of Tshwane is ready to deal with health issues related to climate?	
	Yes
	No

31. Are there any measures put in place by City of Tshwane to address the health impacts of climate changes?	
	Yes
	No

32. Does City of Tshwane have enough fire engines to deal with veld fire emergencies?	
Yes No	

33. Does City of Tshwane have enough ambulances to deal emergencies?	
Yes	
No	

34. Does City of Tshwane have free basic emergency health care training given to urban, township and rural community?	
Yes No	

35. Does City of Tshwane have free basic fire management training given to urban, township and rural community in cases of fire outbreaks?	
Yes No	

36.Do you think that the current approach to climate change preparedness approach by COT is sufficient?	
Yes	
No	

37 What are climate preparedness strategies in place expected to achieve?	
Conserving energy and environment by using proper lighting and heating systems	

Annexures

What are climate preparedness strategies in place expected to achieve?	
Conserving energy and environment by using proper lighting and heating systems	
Reduction of spread of diseases and reduced health system costs through improved sanitation	
Protection of health and environment through waste management	
Reduce water borne diseases through proper water system	
Protect environment (air pollution) through using common transport	
Promote, prevention, treatment of diseases through primary healthcare system	
Educating the public regarding fire and safety	
Other, specify:	

38. Do you undergo refresher disaster management training that prepares you should a need arise?	
Yes No	

39. If yes, when was your last training?	
Less than a month ago	

3 months ago	
6 months ago	
A year ago	
More than a year ago	

Other, specify:

40. Do you think it is important to undergo this refresher disaster management training	
Very important	
Important	
Not sure	
Not important	
Not very important	
Other, specify:	

41. Awareness campaigns are conducted through which channel?	
Pamphlet	
Radio	
TV	
News paper	
Social media	

Annexures

Other, specify:

42. What are some of the environmental factors affecting health and climate change?

43. What are some of the expected health outcomes when good measures are put in place?

44. What can city of Tshwane improve in order to be prepared for the health effects of climate change?

45. Who is responsible for financing climate change preparedness measures?	
Government	
Donors	
Industries	
Municipality	
Private industry	
Other, specify:	

Annexures

Thank you for taking the time to complete this questionnaire.

ANNEXURE D

APPROVAL LETTER RESEARCH AND POSTGRADUATE COMMITTEE

ANNEXURE D: APPROVAL LETTER RESEARCH AND POSTGRADUATE COMMITTEE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

School of Health Care Sciences

Room 3-75. HW Snyman North

University of Pretoria,

Private Bag X323

ARCADIA

0007

Tel: 012 356-3233

Joyce.mothabeng@up.ac.za

19 April 2021

Faculty Ethics Committee

Faculty of Health Sciences

University of Pretoria

To whom it may concern,

Evaluation of a protocol for the following student:

Student Motswagae I - Department of Nursing Science (MNur); student number: 11141035

Title: The determination of preparedness of the City of Tshwane in addressing the health effects of climate change

Annexures

This letter serves to confirm that the above mentioned protocol was discussed by the Postgraduate Committee of the School of Health Care Sciences during the On- line meeting of 17 February 2021.The proposal was accepted with minor changes, and the corrections were effected. It is hereby referred to your committee for ethical clearance.

Sincerely yours,

Professor DJ Mothabeng

Chairperson: Research and postgraduate committee

School of Health Care Sciences

ANNEXURE E

APPROVAL CERTIFICATE

Annexures

ANNEXURE E: APPROVAL CERTIFICATE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 03/20/2022.
- IORG #: IORG0001762 OMB No. 0990-0279 Approved for use through February 28, 2022 and Expires: 03/04/2023.

Faculty of Health Sciences **Research Ethics Committee**

16 September 2021

Approval Certificate

New Application

Dear Miss IC Motswagae

Ethics Reference No.: 211/2021

Title: the determination of the preparedness of the city of tshwane in addressing the health effects of climate change

The **New Application** as supported by documents received between 2021-05-13 and 202109-15 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2021-09-15 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 202209-16.
- Please remember to use your protocol number (211/2021) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

Annexures

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers

MBChB, MMed (Int), MPharmMed, PhD

Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of

Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African

Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

Research Ethics Committee
Room 4-60, Level 4, Tswelopele Building
University of Pretoria, Private Bag x323
Gezina 0031, South Africa
Tel +27 (0)12 356 3084
Email: deepeka.behari@up.ac.za
www.up.ac.za

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

ANNEXURE F

APPROVAL CERTIFICATE ANNUAL RENEWAL

ANNEXURE F: APPROVAL CERTIFICATE ANNUAL RENEWAL

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

Institution: The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 18 March 2022 and Expires 18 March 2027.
- IORG #: IORG0001762 OMB No. 0990-0278 Approved for use through August 31, 2023.

Faculty of Health Sciences **Research Ethics Committee**

12 August 2022

Approval Certificate

Annual Renewal

Dear Miss IC Motswagae,

Ethics Reference No.: 211/2021 – Line 2

Title: the determination of the preparedness of the city of tshwane in addressing the health effects of climate change

The **Annual Renewal** as supported by documents received between 2022-07-20 and 202208-10 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on 2022-08-10 as resolved by its quorate meeting.

Please note the following about your ethics approval:

- Renewal of ethics approval is valid for 1 year, subsequent annual renewal will become due on 2023-08-12.
- Please remember to use your protocol number (211/2021) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

Annexures

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

On behalf of the FHS REC, Dr R Sommers

MBChB, MMed (Int), MPharmMed, PhD

Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South

Research Ethics Committee
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www.up.ac.za

Fakulteit Gesondheidswetenskappe
Lefapha la Disaense tša Maphelo

African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

ANNEXURE G

APPLICATION LETTER TO THE CITY OF TSHWANE

ANNEXURE G: APPLICATION LETTER TO THE CITY OF TSHWANE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Tshwane House (City of Tshwane

Headquarters & Council Chamber)

320 Madiba Street

Pretoria Central

Pretoria

0084

Dr Savage Road

Prinshof Campus

Pretoria

0083

Dear Sir

RE: OBTAINING PERMISSION TO CONDUCT RESEARCH IN THE CITY OF TSHWANE.

This letter is an appeal to request for permission for a Masters Student currently enrolled at the University of Pretoria, to conduct a study in City of Tshwane local municipality. The title of the study is: THE DETERMINATION OF THE PREPAREDNESS OF THE CITY OF THSWANE IN ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE. A

Quantitative, Descriptive research design will be used for the purpose of this study. The significance of the study findings is to offer a recommendation for climate preparedness planning and provide evidence for a strategic approach to building adaptive capacity to address the health effects. The study will reveal challenges that may need to be addressed to make efforts of addressing health effects of climate changes more effective. Findings will inform community engagement, outreach, education, and communication programming on addressing the health effects brought on by climatic changes.

Annexures

The study population will be readily available personnel of city of Tshwane local municipality, from different category of staff. The Staff members included will be clerical staff, data capture, supervisor and managers.

In this study an online survey will be used. The researcher will write an email invitation to the six points of the City of Tshwane to invite the participants to be part of the study. The email will include the contact details of the researcher so that those who are interested can contact the researcher directly for the online survey.

The survey should take about 25-30minutes to complete, the format will allow the participants to be able to save their responses and resume to it at later stage if need be. Three reminder messages will be sent via email at points 10 days, three weeks, and 4 weeks following the reintroduction with notification of the survey closing date. The survey should close six weeks after opening.

The findings gathered from the survey will be analysed, and the results will be represented in the writing of an article, that can be used as a tool of knowledge to better address the health effects brought on by climatic changes.

The researcher kindly ask for your permission on obtaining the data and using the local municipalities of City of Tshwane. Please respond to the letter with a written letter of approval that will be sent to Ethics Committee.

Kind regards

MCUR student

Itireleng Motswage 0716828322

Email: itirelengmotswagae@gmail.com

ANNEXURE H

APPROVAL LETTER FROM CITY OF TSHWANE

ANNEXURE H: APPROVAL LETTER FROM CITY OF TSHWANE

CITY OF TSHWANE
IGNITING EXCELLENCE

City Strategy and Organizational Performance

Room CSP22 | Ground Floor, West Wing, Block D | Tshwane House | 320 Madiba Street | Pretoria | 0002
PO Box 440 | Pretoria | 0001
Tel: 012 358 5198
Email: AlbertusV2@tshwane.gov.za | www.tshwane.gov.za | www.facebook.com/CityOf Tshwane

My ref: **Research Permission/Motswagae**
Contact person: **Pearl Maponya**
Section/Unit: **Knowledge Management**

Tel: 012 358 4559
Email: PearlMap3@tshwane.gov.za
Date 13 January 2022

Ms Itireleng Motswagae
30 Orange Str
Unit 6 Acrohof
The Orchards
Akasia
0084

Ms Motswagae

RE: DETERMINING THE PREPAREDNESS OF ADDRESSING THE HEALTH EFFECTS OF CLIMATE CHANGE IN THE CITY OF TSHWANE

Permission is hereby granted to Ms Itireleng Motswagae, Master of Nursing Education degree candidate at the University of Pretoria (UP), to conduct research in the City of Tshwane Metropolitan Municipality.

It is noted that the aim of the study is to determine the measures put in place by the City of Tshwane on addressing the health effects of climate changes. The City of Tshwane further notes that all ethical aspects of the research will be covered within the provisions of UP Research Ethics Policy. You will be required to sign a confidentiality agreement with the City of Tshwane prior to conducting research.

Relevant information required for the purpose of the research project will be made available as per applicable laws and regulations. The City of Tshwane is not liable to cover the costs of the research. Upon completion of the research study, it would be appreciated that the findings in the form of a report and or presentation be shared with the City of Tshwane.

Yours faithfully,

PEARL MAPONYA (Ms.)
DIRECTOR: KNOWLEDGE MANAGEMENT

City Strategy and Organisational Performance • Stadstrategie en Organisatoriese Prestasie • Lefapha la Thulaganyo ya Tiro le Togamaano ya Toropokgolo • UmNyango wezokuSebenza namaQhinga aHleliweko kaMasipala • Kgoro ya Leanopeakanyo la Toropokgolo le Bodiragatši bja Mmasepala • Muhasho wa Vhupulani ha Dorobo khulwane na Mashumele • Ndzawulo ya Maqhinga ya Dorobakulu na Matirhele ya Masipala • Umnyango Wezeqhinga Ledolobha Nokusebenza Kwesikhungo

ANNEXURE I

LETTER FROM BIOSTATISTICIAN

ANNEXURE I: LETTER FROM BIOSTATISTICIAN

AGRICULTURAL RESEARCH COUNCIL

BIOMETRY

PO Box 8783, Pretoria, 0001 South Africa
Phone: (012) 427 9811 Fax: (012) 427 9743 (Int: +27 21)
E-mail: NgwaneC@arc.agric.za • Web site:
www.arc.agric.za

Letter of clearance

This letter confirms that **Itireleng Motswagae** (student no. **11141035**) studying at the University of Pretoria discussed the project titled **The determination of the preparedness of addressing the health effects of climate change in the city of Tshwane** with **Cynthia Boitumelo Ngwane** (a statistician working for Biometry at Agricultural Research Council).

I hereby confirm that I assisted the student with determining the sample size, sampling method, data collection, data analysis, validity and reliability methods. The student will also be assisted with data analysis and interpretation of the results. The content validity and the internal consistency of the instrument will be determined using Lawshe (1975) and Cronbach's alpha (1951), respectively. The data analysis tool to be used to achieve the study objectives will be Chi-squared test for equal proportions and association, while Crammers V test will be used to determine the strength of the association. All data will be analysed using SAS statistical software package (9.2).

Name Cynthia Boitumelo Ngwane **Date** 24 August 2020

Signature _____

AGRICULTURAL RESEARCH COUNCIL
P.O. BOX/POSBUS 8783
24 AUG 2020
PRETORIA • 0001
LANDBOUNAVORSINGSRAAD

ANNEXURE J

LETTER FROM EDITOR

Annexures

22 January 2023
Pretoria, South Africa

To whom it may concern,

I hereby confirm that I undertook the technical editing for the research proposal:
The Determination of the Preparedness of the City of Tshwane in Addressing the Health Effects of Climate Change
by Itireleng Confidence Motswagae, student no. 11141035

Cillié Swart BA (Harvard) MBA (Kuehne)
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Itireleng Confidence Motswagae