THE PROFILING OF MORBIDITY AND MORTALITY AT KIMBERLEY MILITARY SICKBAY IN SOUTH AFRICA, 2010-2019

By

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DEDICATION

In the memory of my favourite aunt Tshenuwani Portia Makhavhu

DECLARATION

I declare that **THE PROFILING OF MORBIDITY AND MORTALITY AT KIMBERLEY MILITARY SICKBAY IN SOUTH AFRICA, 2010-2019** hereby submitted to the University of Limpopo, for the degree of **MASTERS IN PUBLIC HEALTH** has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

Musiiwa Makhavhu 30/09/2021

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ABSTRACT

Background: Military jobs have in general put different and higher demands on the individual compared to most civilian jobs. Therefore, the nation's armed forces depend on men and women who are fit, healthy, and able to perform at their peak on or off the battlefield however, potential recruits are not immune to the health problems that affect the rest of the population, and the impact on military readiness is substantial. The measurement of morbidity and mortality is important for several reasons and the resulting data provide a basis for generating hypotheses related to the aetiology of diseases; for determining the effectiveness of both preventive and treatment efforts; and for evaluating needs for specific health services, both clinical and preventive.

Methodology: The aim of this study is to profile the mortality and morbidity in Kimberley Military Sickbay. A cross-sectional descriptive study design was used to help address the research question posed in this study. A retrospective quantitative research method was used because of its advantages and a link to the research purpose. The data was extracted from the military health database and 156 008 records were reviewed to investigate the profile of morbidity and mortality in Kimberly Military Sickbay, South Africa.

Results: The mean age of the participants was 33.6 ±15.7 years, ranging from 1 year to 98 years old. Majority of the medical records were in the age group 24 – 44 years at 46.2% followed by those in age groups 45 – 64 years, 18 – 24 years, 0 – 9 years and 10 – 17 years at 25.4%, 11.6%, 10.4% and 4.9% respectively. The least medical records were in the age group 65 years and above at 1.5%. Most of records represented males at 57% and females at 43%. Race distribution of the medical records at Kimberly Military Sickbay showed that majority of medical records were for Blacks at 58.5% followed by Coloured, Whites and Asians at 26.2%, 14.3% and 1.0% respectively.

Morbidity was recorded to be 11 564 in 2010 then increased to 12 067 in 2011. This decreased to 10 918, 8 665 and 8 593 in 2012, 2013 and 2014 respectively. Then morbidity increased from 11 417 in 2015 to 12 541 in 2019. Mortality was high in 2018 at 24.5% followed by 2019, 2010, 2015 and 2-17 at 19.1%, 16.5%, 13.3% and 11.8% respectively. The data shows that the highest ranking morbidity for all ages was upper respiratory infections followed by Injuries, pains malaise and fatigue; HIV/AIDS while Influenza & pneumonia ranked number ten (10). In age group 18 – 24 years the highest ranking morbidity was Injuries, pains malaise and fatigue followed by psychological evaluations and psychiatric conditions; upper respiratory tract infection and Influenza & pneumonia ranked number ten (10) as in all ages. HIV/AIDS ranked highest in age group 25 – 44 years followed by upper respiratory tract infection and Injuries, pains malaise and fatigue while Cellulitis, Dermatitis, fungal and skin infections ranked number ten (10). In age group 45 – 65 years the highest ranking morbidity was fevers followed by Blood and immune system conditions; cerebrovascular disease while Digestive tract conditions ranked number ten (10)

The association of demographics with mortality revealed that older people (25 years and above) were 5.5 more likely to die as compared to younger people (≤ 24) at p-value= 0.001. Males were 2.7 times more likely to die as compared to women at p-value= 0.001 while Coloured were 0.8 times less likely to die as compared to Blacks at p-value= 0.001 and Whites were 1.3 times more likely to die as compared to Blacks at p-value= 0.001 and lastly Asians were 0.1 less likely to die as compared to Blacks at p-value= 0.001

Conclusion: This study gives a brief description of the health profile of patients attending the military training at Kimberley over a period. This knowledge would help in planning health services to meet the patient's needs and help in training health staff. Many diseases have seasonal variation and the burden of these diseases can be reduce by steps taken by the health planners and manager beforehand and through implementation of surveillance program. This study concluded that the demographics of most soldiers were males as it is believed

that soldiers must be fit and aggressive. It also revealed that the morbidity and mortality of soldiers in the base are in most cases the same as the other countries due to other studies done previously. The association of demographics with mortality shows that older people (25 years and above) were 5.5 more likely to die as compared to younger people (≤ 24) at p-value= 0.001. Males were 2.7 times more likely to die as compared to women at p-value= 0.001.

Key concepts: Profiling, morbidity and mortality

Table of Contents Page No

Definition of concepts

Burden of disease: impact of health problem as measured by financial cost, mortality, morbidity or other indicators (Ali et al., 2015)**.** For this study it meant the health impact among financial effects, mortality, and morbidity in the Defence Force among soldiers.

Morbidity: Refers to having a disease or symptom of disease or to the amount of disease within a population (Ali et al., 2015). In the context if this study, morbidity meant military patients having diagnosed of medical condition which affects their lifestyle at their working environment or in their daily lifestyle notified at the Kimberly Sick Bay.

Mortality: Refers to the state of being subject to death or the number of people who die (Ali et al., 2015). In the context of this study, morbidity referred to deaths, which have been notified at the Kimberly Sick Bay.

Profiling: Data profiling is the set of activities and processes to determine the metadata about a given dataset (Abedjan, Golab & Naumann, 2015). In the context of this study, profiling referred to the analysis of the diagnosis made to determine morbidity and the causes of deaths (mortality) from the database of Kimberly Sickbay.

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
AU	African Union
CAR	Central African Republic
CDC	Centre for chronic disease
DOD	Department of Defence
HCT	HIV Counselling and Testing
HIV	Human Immunodeficiency Virus
HLS	Healthy Lifestyle
HSE	Healthy Soldier Effect
IMCI	Integrated Management of Childhood Illnesses
KDF	Kenya Defence Force
MDGs	Millennium Development Goals
NCDs	Non-Communicable Diseases
NGOs	Non-Governmental Organisations
NHI	National Health Insurance
OUA	Operation United Assistance

PHC	Primary Health Care
PMTCT	Prevention of Mother to Child Transmission
PTSD	Post Traumatic Stress Disease
RMNCH	Reproductive, Maternal, New born and Child Health
SANDF	South African National Defence Force
SD	Standard Deviation
TB	Tuberculosis
UHC	Universal Health Coverage
UN	United Nations
USAID	United State Agency for International Development
WHO	World Health Organisation
YLLS	Years of Life Lost

1. CHAPTER ONE: INTRODUCTION

1.1. Introduction

In comparison to most civilian employment, military jobs place different and higher demands on individuals (Petersson, 2020). Deploying to areas all over the world and being exposed to conflict are two of the military's distinctive features. A country's deployment could include entering a battle zone, providing humanitarian help, evacuating members, restoring peace, or increasing security. During deployment, both military combatants and peacekeepers face a high rate of traumatic events. For peacekeepers, these events include gunfire and shelling, participation in dangerous patrols, the risk of combat-related injuries, witnessing large-scale violence, and rejection by the local population (Petersson, 2020).

Transport-related deaths, poisoning, and drug-related deaths are all examples of external-cause mortality. Veterans have an increased risk of suicide after discharge; depression, posttraumatic stress disorder (PTSD), as well as being wounded by hostile forces, appear to heighten this risk (Lief et al, 2016). When returning home from combat or deployment, it's common to have to adjust to a new environment with spouses and dependents. Reintegration is the process of returning to civilian life in some instances (Redmond et al., 2015).

The military workplace in the United States of America (USA) is a unique environment in which military members and their families have different experiences than civilians. Military soldiers and their families face psychosocial issues as a result of their demanding jobs, but they show tenacity (Kimerling et al., 2016). Mental health conditions, including substance use disorders, mood and anxiety disorders, post-traumatic stress disorder (PTSD) (Shepherd-Banigan, Kelley, Katon, Curry, Goldstein, Brancu, Wagner, Fecteau, Workgroup & Van Houtven, 2017), and schizophrenia are reliably associated with suicide risk among Veterans and recent-era service members in Afghanistan and Iraq (Kimerling et al., 2016).

Armed forces' personnel in South East Asia and Sub-Saharan Africa traditionally remain exposed to this volatile malarial situation as they usually need to operate in malaria endemic areas. Members of Bangladesh Armed Forces operate in endemic areas of both home and Africa because of their deployment in hilly areas at home and

peace keeping missions in Africa. Not surprisingly, they need to travel between different endemic regions (Amin, 2020). Military population in sub-Saharan Africa are known to have unique risk factors for STIs and HIV – for example deployments, being away from loved ones for long periods of time, attitude changes needed to survive combat that influence their sexual behaviour choices (Joint United Nations Programme on HIV/AIDS. 2011). A surge in HIV/AIDS prevalence in Sudan is a real concern as troops demobilize, displaced persons return home from years of dislocation, and commercial traffic from areas of higher HIV rates increases (Courtney, Goco, Woja, Farris, Cummiskey, Smith, Makuach & Chun, 2017). The military workplace in the United States (USA) is unlike any other. Malaria takes centre stage in most military deployments in African countries, but there are other diseases that continue to be a problem throughout African military operations. Hepatitis E and dengue fever are examples.

During the apartheid era in South Africa, all school-leaving white men were issued a mandatory call-up to national military duty in the South African Defence Force for a period of 25 years (Edlmann, 2014). Soldiers in South Africa confront occupational dangers including as trauma from life-threatening situations while deployed to other African war zones, injuries and death, active combat, and human error. As a result, it's no wonder that members of the South African National Defence Force (SANDF) are vulnerable to trauma (Shoshani & Slone, 2016; Mashatola & Bester, 2020). This study will examine the morbidity and mortality rates at the Kimberley Military Sickbay in South Africa in this context.

1.2. Problem statement

Measurement of morbidity and mortality is important for several reasons, and the resulting data can be used to generate hypotheses about disease aetiology, determine the effectiveness of both preventive and treatment efforts, and assess the need for specific clinical and preventive health services (Forouzanfar, Sepanlou, Shahraz, Dicker, Naghavi, Pourmalek, Mokdad, Lozano, Vos, Asadi-Lari, & Sayyari 2014). Soldiers serving in required duty live in a hostile environment, with less clarity about the future and a higher risk of mortality and illness. Terrorist organizations view them as favored targets even on their journey home and back to base (Nesser & Stenersen, 2014). As they are deployed to other war-zone areas, South African soldiers encounter

a variety of life-threatening scenarios, including risks, injuries, infections, and even death (Shoshani & Slone, 2016; Mashatola & Bester, 2020).

Northern Cape Province is a military combat training unit. Soldiers, their spouses, dependents, and military veterans make up this military community. It has not been scientifically done to examine the distribution of disease in connection to time, place, and geography, as well as the characteristics of individuals or persons, using a typical epidemiological technique. There are a variety of disorders that the military community brings to Kimberley Sickbay to report. As a result, the goal of this study is to look into the mortality and morbidity of diseases that are well-defined and reasonably easy to diagnose at Kimberley Sickbay.

1.3. Literature review

The literature review was undertaken, and the process followed during this review of the literature was thematic. This means that small aspects of profile of morbidity and mortality were organized into five themes, namely:

- The global morbidity and mortality in military bases
- Morbidity and mortality in military bases of African countries
- Morbidity and mortality South African National Defence Force
- Public Health intervention to reduce morbidity and mortality in the military

1.4. Purpose of the study

1.4.1. Aim of the study

The aim of this study is to profile the mortality and morbidity in Kimberley Military Sickbay.

1.4.2. Objectives of the study

- To describe the demographic characteristics of patients records in Kimberley Military Sickbay database
- To determine the trends on diseases reported n Kimberley Military Sickbay database
- To determine the trends on causes of deaths reported in Kimberley Military Sickbay database

- To determine the association of demographics with mortality at Kimberley Military Sickbay.

1.5. RESEARCH QUESTION

- What is the profile of diseases leading to morbidity and mortality at Kimberley Military Sickbay?

1.6. RESEARCH METHODOLOGY

Research design is defined as type of inquiry within qualitative, quantitative and mixed methods approaches used to provide specific direction for designing research (Creswell, 2013). A cross-sectional descriptive study design was used to help address the research question posed in this study (Detels, Gulliford, Karim & Tan, 2015). According to Edmonds and Kenned (2012) The term "research design" refers to the style of inquiry used to provide particular direction for developing research in qualitative, quantitative, and mixed methods techniques (Creswell, 2013). To answer the research question stated in this study, a cross-sectional descriptive study methodology was adopted (Detels, Gulliford, Karim & Tan, 2015). Quantitative research, according to Edmonds and Kennedy (2012), is a type of educational research in which the researcher chooses what to study, asks specific, narrow questions, collects quantifiable data from participants, analyzes these numbers using statistics, and conducts the investigation in an unbiased, objective manner. Because of its benefits and connection to the research goal, a retrospective quantitative research approach was utilized. Data is collected at a single point in time in cross-sectional designs (Pilot & Beck 2017).According to Edmonds and Kennedy (2012), quantitative research is a type of educational research in which the researcher decides what to study; asks specific, narrow questions; collects quantifiable data from participants; analyses these numbers using statistics; and conducts the inquiry in an unbiased, objective manner. A retrospective quantitative research method was used because of its advantages and a link to the research purpose. Cross-sectional designs involve the collection of data at one point in time (Pilot & Beck 2017). A detailed methodology section which includes the research method and research design; research setting; study

population; data collection; pilot study; bias; validity; reliability; data analysis and Ethical considerations will be presented in chapter 3 below.

1.7 SIGNIFICANCE OF STUDY

The lack of detailed epidemiological information on mortality and morbidity in the military population of South Africa, the Kimberly Military Sickbay in particular has hampers opportunities for prevention programs. The study findings will assist in development of preventative strategies to prevent or reduce mortality and morbidity in military. The understanding of which diseases are most contributing to morbidity and mortality will assist in the formulation of policies planning the health of service members following deployments to areas of military conflict.

2. CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

Armed services rely on men and women who are physically fit, healthy, and capable of performing at their best on and off the battlefield. Active duty military people (service members) and potential recruits are not immune to the same health issues that afflict the rest of the US population, and the consequences have a significant impact on military readiness (CDC, 2018).

Chronic diseases such as heart disease, cancer, and type 2 diabetes are the leading causes of death, disability, and health-care costs in the United States. The majority of the blame can be attributed to a few common risk behaviours: Poor eating habits, such as a lack of fruits and vegetables, as well as a high sodium and saturated fat intake. A lack of physical exercise and Tobacco use and exposure to second hand smoke. Binge drinking and other forms of overindulgence in alcoholic beverages also contribute to chronic diseases occurrence. Adolescents are more likely to engage in these activities, which become more common and serious as they enter young adulthood. The Centres for Disease Control and Prevention (CDC) provides funding for prevention and health promotion (National Centre for Chronic Diseases).

2.2. The global morbidity and mortality in military bases

Since 2011, the number of individuals murdered in wars has increased, owing mostly to the increased level of conflict in the Middle East (WHO, 2014). The number of people killed in conflicts in 2015 is projected to be similar to or even higher than in 1990. According to estimates, at least 17 wars killed over 1000 people in 2014, compared to 15 in 2013. The continuous violence in Afghanistan, Iraq, and Syria has resulted in a huge number of conflict-related deaths, accounting for around two-thirds of all global combat deaths in 2014. Nigeria's ongoing conflicts were the fourth worst in the world, with the number of people killed more than tripling from the previous year as the Boko Haram insurgency raged. During the last stages of World War I, an influenza outbreak occurred, and it quickly spread to a big military camp 300 miles distant, where thousands of young recruits were being mobilized to join the allied troops in Europe. These and hundreds of thousands of brother squaddies in many similar camps around the country had been imprisoned up waiting for their mobilization during a very cold winter and in overcrowded, under-heated circumstances, where

they clung together for warmth (Ashton, J., 2020). In the United States, there are 2.1 million active military personnel and 21 million living veterans. Although they were healthier when they joined the military than the general population, veterans likely to be of equal or better health in the long run.

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2.3. Morbidity and mortality in military bases of African countries

As of January 13, 2015, the current Ebola outbreak in West Africa had resulted in over 21,373 cases and 8,468 deaths. Under the guidance of the United States Agency for International Development (USAID), the Department of Defence (DoD) has deployed roughly 3,000 personnel to Liberia to train Liberian and international health workers to manage the Ebola virus epidemic (Military medicine, 2015). Malaria takes centre stage in the majority of deployments to Africa. In Somalia, 112 instances of malaria were discovered in 106 Marines. Hepatitis E and dengue fever have also been linked to military activities in Somalia. Those deploying in support of OUA (Operation United Assistance), such as in Liberia, Somalia, and West Africa, are at a high risk of contracting infectious diseases, as well as being exposed to dangerous bacteria.

A high PTSD prevalence rate of 56% was reported among the Lord's Resistance Army child recruits in Uganda. Participation in armed groups was found to be associated with exposure to extreme violence and a higher frequency of trauma exposure and mental illness among abductees compared to their non-abducted peers living through

the same conflict (Muldoon, Muzaaya, Betancourt, Ajok, Akello, Petruf, Nguyen, Baines & Shannon, 2014). Lower prevalence rates were however reported among Nigerian Army peace-keeping force veterans in Sierra Leone at 22% and 26% of the South African National Defence Force peace-keeping force veterans in Rwanda (Winter, Brown, Goins & Mason, 2015). An increasing hypertensive disease trend among Kenyan Defence Forces (KDF) consistent with other military personnel globally was reported and most military personnel are generally under a lot of pressure and work-related stress, which have been implicated for their biologically negative effects and mental strain (Mundan, Muiva & Kimani, 2013). Infections such as HIV and syphilis are frequent among military troops in Sub-Saharan Africa, posing a threat to combat readiness and putting a strain on the military health care system (Audrey Djibo, Sahr, Allen McCutchan, Jain, Araneta, Brodine & Shaffer, 2017).

2.4. The morbidity and mortality in the South African National Defence Force

Because recent statistics on disease and mortality in the South African Defence Force is scarce, some of the information below may be out of date. In a cross-sectional study conducted among personnel of the South African National Defence Force (SANDF) at Lenz Military Base in South Africa, obesity was found to be widespread in 42.1 percent of women and 35.7 percent of men, with 31 percent of males overweight compared to 26.3 percent of women (Ngoepe, 2019). The most common traumatic incidents for members of the SANDF were the sudden, unexpected loss of someone close to them (55 percent), physical attack (43%), transportation accidents (43%), and combat exposure (43%). (39.9 percent). Approximately 81 percent of service members stated they had been exposed to at least one of the following:

Due to a lack of recent data on disease and mortality in the South African Defence Force, some of the information below may be outdated. In a cross-sectional study conducted among personnel of the South African National Defence Force (SANDF) at Lenz Military Base in South Africa, obesity was observed in 42.1 percent of women and 35.7 percent of males, with 31 percent of men overweight compared to 26.3 percent of women (Ngoepe, 2019). Physical assault (43 percent), transportation accidents (43 percent), and combat exposure were the most prevalent traumatic experiences among members of the SANDF (39.9 percent). Approximately 81 percent

of service personnel stated that they had been exposed to at least one form of radiation.

2.5. The impact of morbidity and mortality in the South African National Defence Force

Military training facilities, operating theatres, and the strenuous activities that took place in such environments were all one-of-a-kind. Military personnel who live and operate in these surroundings are at a high risk of contracting and spreading a range of respiratory diseases. While these usually cause only minor symptoms, severe disease can result in considerable morbidity and, in rare cases, mortality. Epidemic outbreaks among military personnel have the potential to disrupt training schedules and operational performance (O'Shea & Wilson, 2013). Individual soldier's clinical sequelae can have an impact on the Service's operational effectiveness, both immediately after the episode, such as interruption or termination of training or mission, immediate treatment and casualty evacuation requirements, acute loss of manpower, and later, such as contribution to chronic undermining, external threats.

According to Defence records, 40 South African soldiers have been killed since the country began supplying troops and equipment to African Union (AU) and United Nations (UN) continental peacekeeping and peace support missions, with the number rising to nearly 80 when including those killed in Lesotho and the Central African Republic (CAR). The ill-fated Battle for Bangui in the CAR in March 2013, which saw 15 elite soldiers killed and another 27 wounded in a fierce combat that saw hundreds of Seleka rebels slain, was the single largest loss of life suffered by South African forces deployed continentally since independence. Other common causes of death in peacekeeping missions include scorpion attacks, drownings, and fallen trees. Peacekeeping is a risky job and a risky concept.

2.6. Factors associated with morbidity and mortality.

Morbidity and mortality in military bases are associated with several factors which amongst others include Posttraumatic stress disorder (PTSD), obstructive sleep apnoea (OSA) (Pompili, Sher, Serafini, Forte, Innamorati, Dominici & Lester et al., 2013; Caldwell, Knapik & Lieberman, 2017), education, treatment fatigue, and the

psychosocial context of the patient (Marconi, Grandits, Weintrob, Chun, Landrum, Ganesan & Okulicz et al., 2010). In a study conducted in Iraq and Afghanistan, Traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD) were found to be associated with blats. In this study, TBI was found to be a risk factor for the later development of neurodegenerative diseases in which cognitive impairment is prominent putting veterans at risk for disorders including Alzheimer's disease and chronic traumatic encephalopathy (Elder, G.A., 2015). In a study conducted in America, military sexual trauma (MST) amongst veterans was associated with elevated rates mental health conditions and non-fatal suicide attempts. The veterans who report MST were at greater age-adjusted risk for suicide attempts and self-injury, as well as the mental health conditions that are also risk factors for suicide (Kimerling, Makin-Byrd, Louzon, Ignacio & McCarthy, 2016). Education, treatment fatigue, and the patient's psychosocial context are all linked to morbidity and mortality on military bases (Marconi, Grandits, Weintrob, Chun, Landrum, Ganesan & Okulicz et al., 2010). Traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD) were linked to blats in a study conducted in Iraq and Afghanistan. TBI was discovered to be a risk factor for the later development of neurodegenerative diseases characterized by cognitive impairment, putting veterans at risk for conditions such as Alzheimer's disease and chronic traumatic encephalopathy (Elder, G.A., 2015).

2.7. Public Health intervention to reduce morbidity and mortality in the military

Suicide is a primary cause of death in young adults around the world, and it is also the greatest cause of death in the military during times of peace. While the exact causes are unknown, depression and alcoholism appear to be more relevant than military issues like deployment. As a result, effective suicide prevention in both civilian and military populations necessitates the identification of factors that contribute to suicide (Shelef, Tatsa-Laur, Derazne, Mann & Fruchter, 2016). It is vital to develop an understanding of how suicide risk factors change by gender in order to appropriately adapt suicide prevention activities and programs. While recent failed relationships were shown to be more strongly linked to suicides, mental health diagnoses were found to be more strongly linked to suicide attempts in military populations. As a result, in order to appropriately address this issue,

Every soldier should be entitled to an annual medical check to prevent and limit the occurrence of cardiovascular diseases (CD), which should include standard physical tests such as weight, height, urine, and blood pressure (Majercková, 2015). Injury might result in limited service or non-duty days during deployments, which has a direct impact on unit and mission preparedness. As a result, it's critical to figure out what causes non-battle injuries so that prevention techniques can be devised (Patel, Hauret, Taylor & Jones, 2017). This could be accomplished through the use of a surveillance system that focuses on injuries that necessitate medical air evacuation. Deployment injury surveillance is critical for the military to track injury patterns, analyse the impact of injuries on unit preparedness, and discover non-battle injury causes that could be avoided.

3. CHAPTER THREE: RESEARCH METHODOLOGY

The following section will concentrate on research design, research setting, study population, data collection, pilot study, bias, validity, reliability, data analysis and Ethical considerations.

3.1. Research Design

The research method is the theoretical, philosophical, and data analytic perspective. The method can be quantitative, qualitative, or mixed (e.g., a quantitative method and qualitative method) Edmonds & Kennedy (2012). According to Edmonds and Kennedy (2012), quantitative research is a type of educational research in which the researcher decides what to study; asks specific, narrow questions; collects quantifiable data from participants; analyses these numbers using statistics; and conducts the inquiry in an unbiased, objective manner. For this research a retrospective quantitative research method was used because they are cheaper as data have already been collected and they lack bias because the outcome of current interest was not the original for data to be collected. They form a link to the research purpose. Cross-sectional designs involve the collection of data at one point in time (Pilot & Beck 2017). These researches are relatively cheap and less time-consuming than other types of research. They allow collection of data from a large pool of subject and comparison of defences between groups.

3.2. Research setting

The study settings are the more specific places where data collection occurs. In some cases, the setting and the site are the same, as when the selected site is a large hospital, and information is collected exclusively within that setting (Pilot & Beck, 2017) this research was carried out in Kimberley Military Sickbay in Northern Cape Province in South Africa, because that's where the soldiers, their dependents and military veterans sick reports when they need medical assistance. Kimberley Military Sickbay is found in Northern Province, Sol Plaatjie Local Municipality in South Africa and is situated in General van der Spuy Road and Florence street Diskobolos. See Fig 3.1 below showing the area map of the research site.

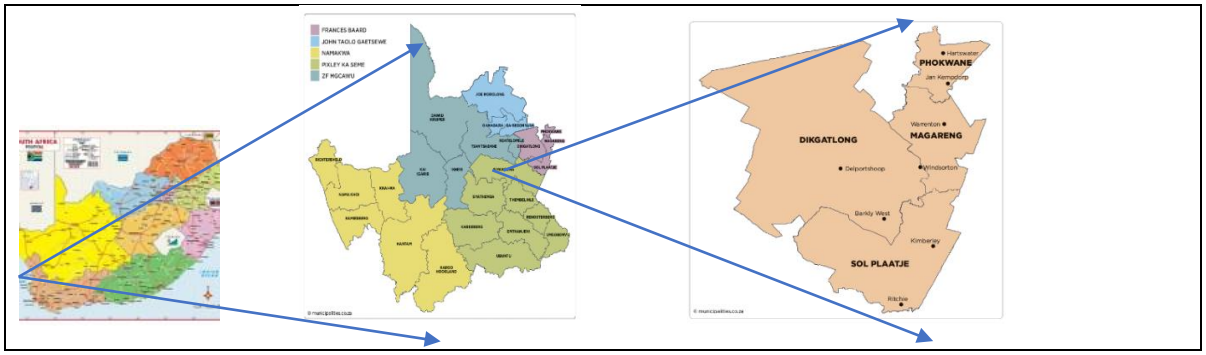


Figure 3.1: Area map of research site

3.3. Study population

The study population is defined as the potential respondents of interest or as the entire aggregation of cases in which a researcher is interested (Pilot & Beck, 2017). The population in this study was all the patients records which have been captured in a database from the Kimberley Military Sickbay from 2010 to 2019 which were 156 008 patient records.

3.4. Sampling and sample size

The sample method involves taking a representative selection of the population and using the data collected as research information. It has also been described as a representative "taste" of a group (Singh, 2015). In the current study, non-probability sampling was used which is a sampling procedure that does not bid a basis for any opinion of probability that elements in the universe will have a chance to be included in the study sample (Singh, 2015; Etikan, & Bala, 2017). In this study, a Total Population Sampling (TPS) was used which is a technique where the entire population that meet the criteria (e.g. specific skill set, experience, etc.) are included in the research being conducted (Etikan et al., 2016). Therefore, all patients' records 2010 to 2019, which met the criteria, were included in this study. This sampling method made it possible to get deep insights into the phenomenon, which we were interested in and with such wide coverage of the population of interest, there was a reduced risk of missing potential insights from records that are not included.

3.4.1. Inclusion criteria

The current study included all patient's records which have been captured in the database at Kimberley Military Sickbay from 2010 to 2019.

3.4.2. Exclusion criteria

All patient's records, which have been captured in the database at Kimberley Military Sickbay from 2010 to 2019 and having deemed to have incomplete information were excluded in the study. The key variable, which were considered for a record to be incomplete, was missing diagnosis.

3.5. Data collection

The current study used secondary data that had already been collected through primary sources and made readily available for researchers to use for their own research (Rahi, 2017). It is a type of data that has already been collected in the past which has been captured in the database at Kimberley Military Sickbay. The data was collected by using a self-designed data extraction tool (see annexure 3) which was developed through reading the literature to get suitable variables to answer the research question and objectives. The tool covered the following variables: age, gender, educational status, marital status, occupation/job category, year and month of diagnosis, diagnosis and outcome. The data was collected from the database and extracted into an excel spreadsheet then data cleaning began looking at the missing key variables.

3.6. Data analysis

The extracted data was double checked by researcher and the supervisor for quality assurance purposes before being analysed. The STATA statistical software version 12 for Windows (STATA Corporation, College Station, Texas) was used for data analysis.

3.6.1 Frequency distributions

Frequencies were used to display distributions of the variables as they provide a good overall picture of a large set of grouped data into different classes. This was used to determine the characteristics of the study sample and, subsequently, to estimate morbidity and mortality in the study population.

3.6.2 Logistic regression

Univariate regression analysis was done to determine the association between age, gender and race with mortality. Univariate regression analysis is a type of regression analysis used to distinguish the distribution of a dependent variable from the distribution of several independent variables. A dependent variable is a variable which depends on the independent variables and is an outcome or result of the influence of the independent variable. An independent variable is defined as a variable which probably causes, influences or affects outcomes (Creswell, 2013). The dependent variable was mortality and the independent variables were gender, age and race.

3.7. Bias

Bias is a major concern in designing a study because it can threaten the study's validity and trustworthiness. In general, a bias is an influence that produces a distortion in the study results. Selection bias will be minimized by following the inclusion criteria which will be used to select the patient's records from the database during the study period. The data extraction tool will aid in addressing the possibility of missing data obtained from a patient's records. To address unavoidable bias, the researcher adhered to the research methodology and engaged with a statistician to check the data analysis in order to ensure that the data analysed will be a true reflection of the data gathered from the database.

3.8. Validity

Validity is defined as the extent to which an instrument measures what it asserts to measure (Taherdoost, 2016). Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Robson, 2011). In the current study, content validity which is defined as "the degree to which items in an instrument reflect the content universe to which the instrument will be generalized" was applied. The judgemental approach to establish content validity in the current study involved literature reviews and then followed-up by evaluation by supervisors in order to facilitate validation.

3.9. Reliability

Taherdoost (2016) defines reliability as a measurement that produces consistent results with equal values. It assesses a study's consistency, precision, repeatability, and trustworthiness. It reveals how bias-free (error-free) it is, and so ensures consistent measurement across time and across the various elements in the instruments (the observed scores). Reliability will be maintained in this study by removing patient records that are incomplete or contain mistakes. The current study's reliability was preserved by guaranteeing that the data extraction tool was not changed. Furthermore, the use of the data extraction tool was piloted on 10% of the sample before it was utilized to guarantee that it measures what it claims to measure. The patient's records used in the pilot were not be included in the final data analysis

3.10 Ethical consideration

Ethics is the branch of philosophy that deals with moral issues, including questions about what is right (or wrong) to do and other intangibles, such as whether the intentions behind an action determine its goodness, or whether the actual outcome is what is important (Koski, 2017). The current study addressed the ethical issues such as the approval to conduct the study, principles of justice, consent for participation, autonomy, confidentiality, privacy and minimizing harm.

3.10.1 Ethical approval

The study proposal was presented at the Department of Public Health University of Limpopo then sent to the School of Healthcare Sciences and Faculty of Health Sciences for further review before it was sent to Turfloop Research Ethics Committee (TREC) at University of Limpopo for ethical clearance.

3.10.2 Permission to conduct the study

The approved proposal together with the TREC certificate were sent to the officer Commanding of Kimberley Military Sickbay in Northern Cape Province, Defence intelligence of the SANDF, the Sargent General of the SANDF and 1 Military Hospital research ethic committee to prove that the study has been ethically approved and permission was granted to conduct the study.

3.10.3 Principle of Justice

The principle of justice could be described as the moral obligation to act on the basis of fair adjudication between competing claims. As such, it is linked to fairness, entitlement and equality. In the current study, data collection procedures supported the spirit of existing research ethics in South Africa.

3.10.4 Consent form for participation

The current study used secondary data and therefore, patient consent forms were not necessary. This was covered by the Promotion of Access to Information Act (PAIA) (Ashukem, 2019). The authority to use the military data was approved by the Sargent General of the defence force.

3.10.5 Autonomy and Confidentiality

The unique codes were allocated to patients records to maintain autonomy and confidentiality. The personal identifiers were deleted from the received database and the records will be kept in a safe place where only accessible to the researcher

3.10.6 Privacy

Privacy was maintained during collection of data, where the researcher ensured that all records obtained were kept safe and not accessible to anyone except the research team (researcher and the supervisor).

3.10.7 Harm

No harm was experienced as the current study used secondary data from the database at Kimberley Military Sickbay.

4 CHAPTER 4: RESULTS

4.1 Introduction

This chapter describes the analysis of the data and the interpretation of the research findings, which were guided by the research question posed in the study. The data was analysed to investigate the profile of morbidity and mortality in Kimberly Military Sickbay, South Africa. The data was extracted from the military health database and a total of 156 008 records were reviewed.

4.2 Data management and analysis

After the data collection process was finalized, the completed database was securely stored. The information was captured on a Microsoft Excel spreadsheet then stored on a compact disc for confidentiality and privacy reasons. The secondary data is readily accessible and will be kept by the research for a minimum of 3 years after the completion of the study. Descriptive statistical analysis was undertaken using the STATA statistical software version 12 for Windows (STATA Corporation, College Station, Texas) in order to identify frequencies and percentages of answers to the research questions. The statistical significance of the relationships between the selected variables was determined using the t-test. The level of significance was set at 0.05.

The data was cleaned with an aim to remove irrelevant values and to get rid of duplicate values or records such as the patient's files which had repeats for collection of chronic medications or review of their medical conditions. The medical records without diagnosis were also deleted. This resulted in the final database having a total of 111 535 which were used in the writing on this research report.

4.3 Research results

4.3.1 *Socio-demographic characteristics*

Figure 4.1 below presents the age distribution of the medical records used in this study. The mean age of the participants was 33.6 ±15.7 years, ranging from 1 year to 98 years old. Majority of the medical records were in the age group 24 – 44 years at 46.2% followed by those in age groups 45 – 64 years, 18 – 24 years, 0 – 9 years and 10 – 17

years at 25.4%, 11.6%, 10.4% and 4.9% respectively. The least medical records were in the age group 65 years and above at 1.5%.

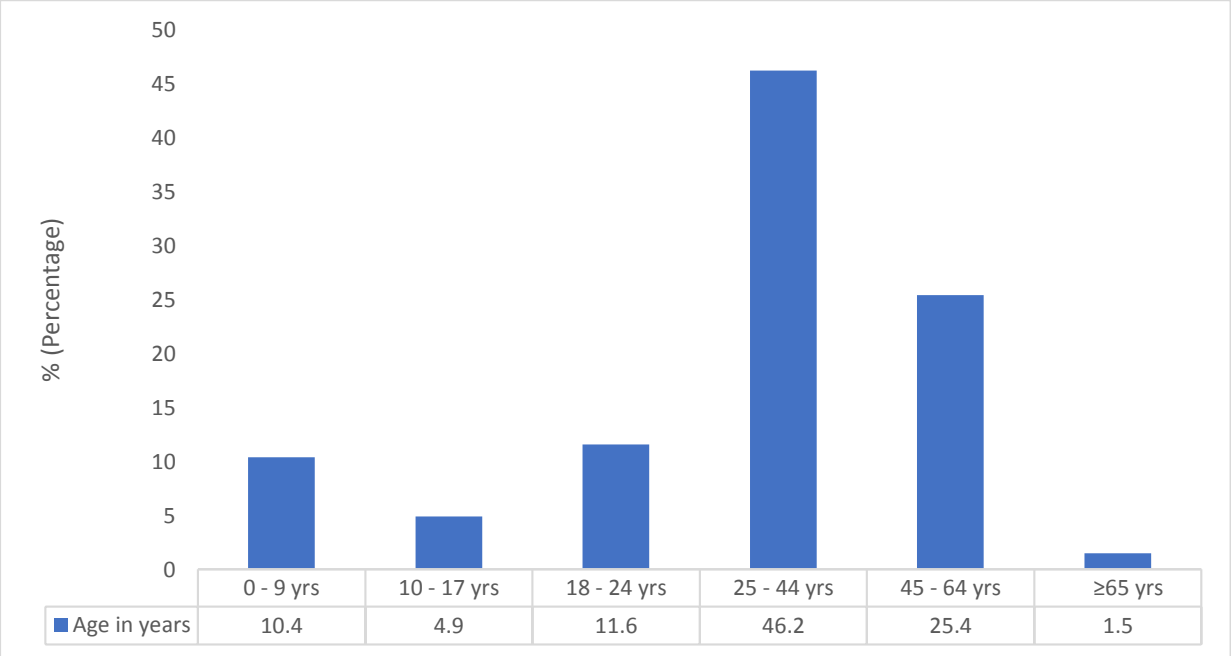


Figure 4.1: Age distribution of the medical records retrieved in years 2010 - 2019

Figure 4.2 below illustrate the gender distribution of the medical records at Kimberly Military Sickbay showing that 57% were males.

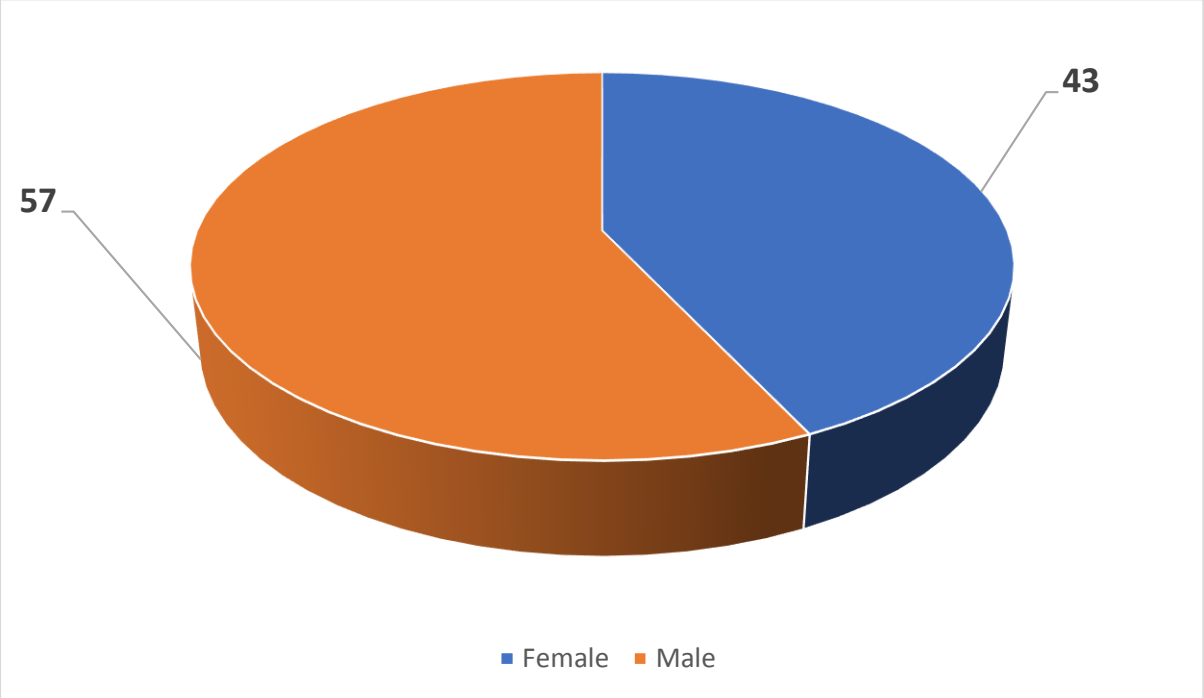


Figure 4.2: Gender distribution of the medical records retrieved 2010 - 2019

Table 4.1 below presents the distribution of retrieved medical records by gender stratified by age group. There was a statistical significance difference between gender in relation to age distributions at *p-value<0.001*. In females there has been an increase in age from 5.9% in age group 10 – 17 years to 49.9% in age group 35 – 44 years then declined to 16.4% and 1.6% in age groups 45 – 64 years and 65 years and above respectively. A similar trend has been noted in males.

Table 4.1 the distribution of retrieved medical records by gender stratified by age group

	Age group in years						*P-value*
	0 - 9 years	10 - 17 years	18 - 24 years	25 - 44 years	45 - 64 years	≥65 years	
Gender							
Female	5 512 (11.6)	2 772 (5.9)	6 940 (14.7)	23 642 (49.9)	7 747 (16.4)	771 (1.6)	<0.001
Male	6 027 (9.5)	2 598 (4.1)	5 864 (9.3)	27 471 (43.5)	20 299 (32.1)	929 (1.5)	

Figure 4.3 below illustrate the race distribution of the medical records at Kimberly Military Sickbay showing that majority of medical records were for Blacks at 58.5% followed by Coloured, Whites and Asians at 26.2%, 14.3% and 1.0% respectively.

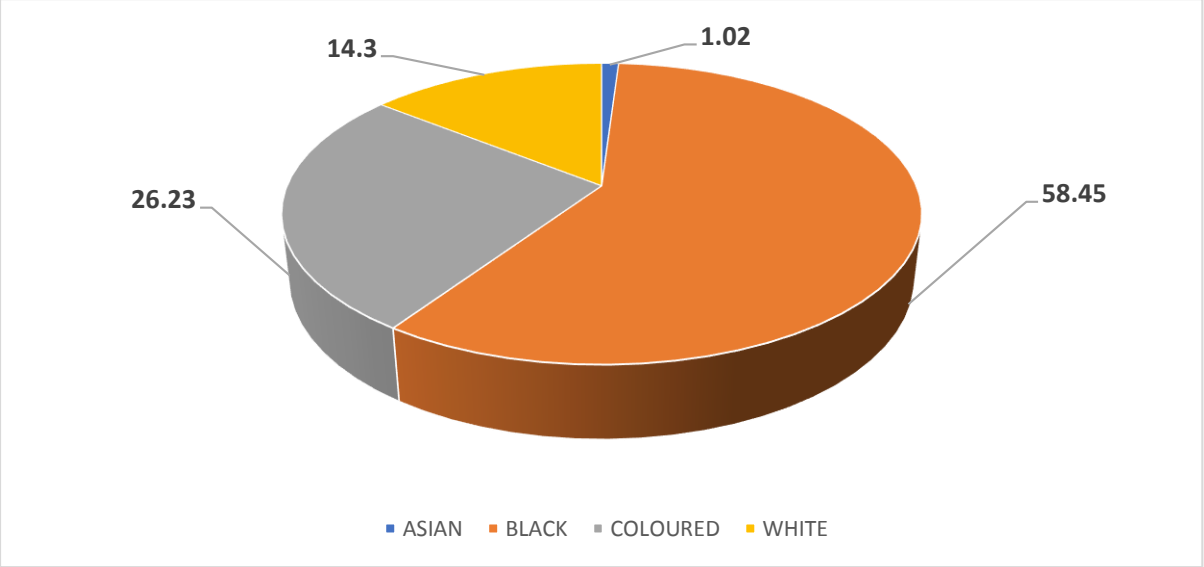


Figure 4.3: Race distribution of the medical records retrieved 2010 – 2019

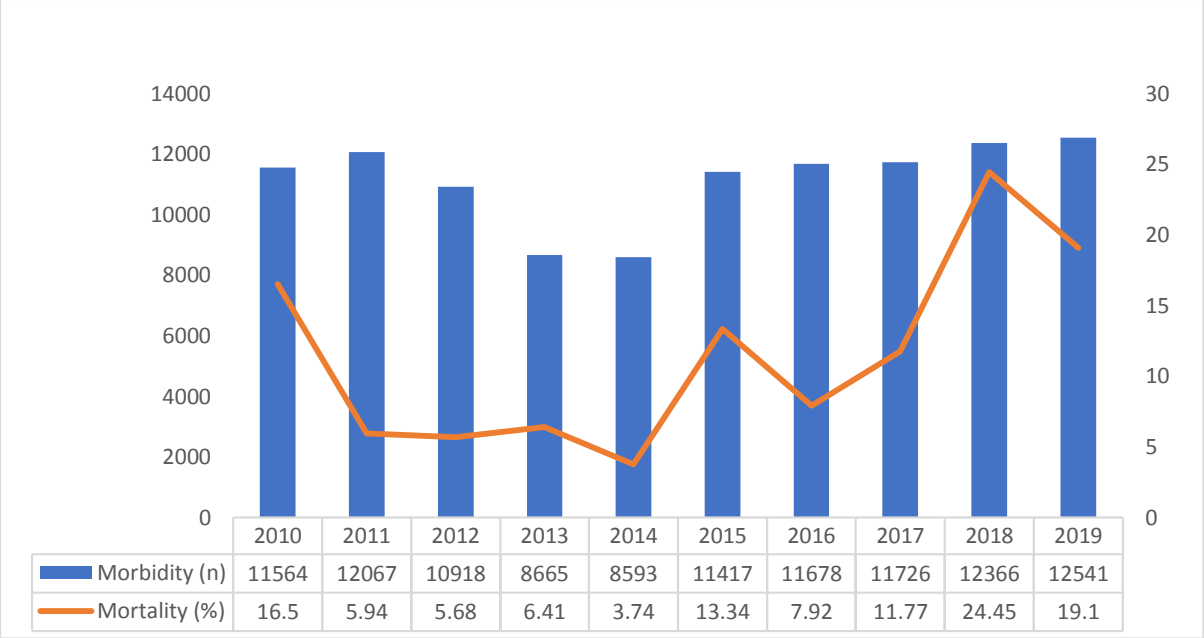
Table 4.2 below presents the distribution of retrieved medical records by race stratified by age group. There was a statistical significance difference between races in relation to age distribution at *p-value<0.001*.

Table 4.2 the distribution of retrieved medical records by gender and race stratified by age group

	Age group in years						*P-value*
	0 - 9 years	10 - 17 years	18 - 24 years	25 - 44 years	45 - 64 years	≥65 years	
Race							
Asian	71 (6.3)	37 (3.3)	566 (50.0)	357 (31.5)	101 (8.9)	0 (0.0)	
Black	6 431 (9.9)	2 112 (3.3)	8 934 (13.8)	32 398 (50.0)	14 715 (22.7)	190 (0.3)	<0.001
Coloured	3 400 (11.7)	1 957 (6.8)	2 612 (9.0)	12 490 (43.1)	8 300 (28.7)	204 (0.7)	
White	1 637 (10.4)	1 254 (8.0)	692 (4.4)	5 868 (37.4)	4 920 (31.4)	1 306 (8.3)	

4.3.2 *Morbidity and mortality at Kimberly Military Sickbay, 2010 - 2019*

Figure 4.4 presents the morbidity and mortality at Kimberly Sickbay from the year 2010 – 2019. Morbidity was recorded to be 11 564 in 2010 then increased to 12 067 in 2011. This decreased to 10 918, 8 665 and 8 593 in 2012, 2013 and 2014 respectively. Then morbidity increased from 11 417 in 2015 to 12 541 in 2019. Mortality was high in 2018 at 24.5% followed by 2019, 2010, 2015 and 2-17 at 19.1%, 16.5%, 13.3% and 11.8% respectively.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Morbidity (n)	11564	12067	10918	8665	8593	11417	11678	11726	12366	12541
Mortality (%)	16.5	5.94	5.68	6.41	3.74	13.34	7.92	11.77	24.45	19.1

Figure 4.4: The overall morbidity and mortality at Kimberly Sickbay 2010 - 2019

The categories of morbidity at Kimberly Military Sickbay revealed that majority of the consultations were due to communicable, maternal, neonatal and nutritional diseases at 55.4% followed by non-communicable diseases, behavioural risk factors and metabolic risk factors at 24.8% while injuries were at 15.2%. The least consultations were due to depression, stress, anxiety and mental disorder at 4.5% as presented in Figure 4.5 below.

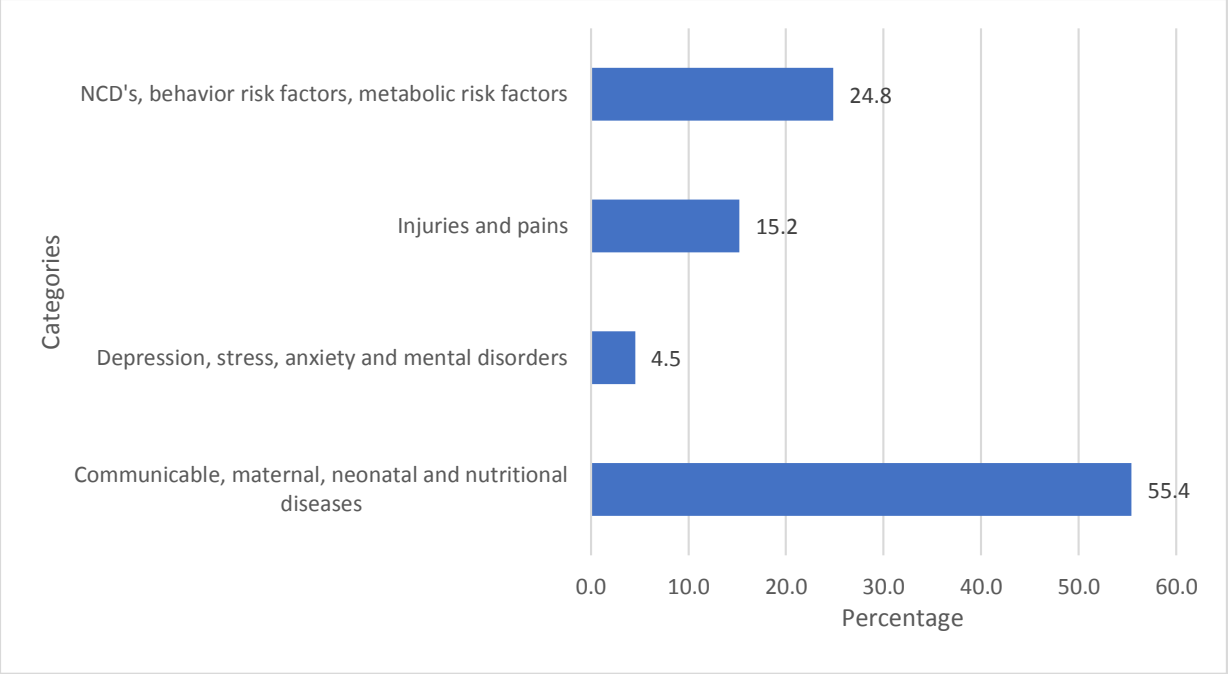


Figure 4.5: The categories of morbidity at Kimberly Military Sickbay for period 2010 – 2019

The categories of morbidity at Kimberly Military Sickbay revealed that consultations due to communicable, maternal, neonatal and nutritional diseases increased from 56% in 2010 to 68.1% in 2012 then dropped too significantly from 67.7% in 2013 to 39.5% in 2019. The consultations non-communicable diseases, behavioural risk factors and metabolic risk factors decreased from 25.3% in 2010 to 20.1% in 2013 then significantly increased to 28.9% in 2019. The consultations due to injuries decreased from 18.6% in 2010 to 15% in 2019 while the consultations due to depression, stress, anxiety and mental disorder increased from 0.2% in 2010 to 16.5% in 2019 as presented in Figure 4.6 below.

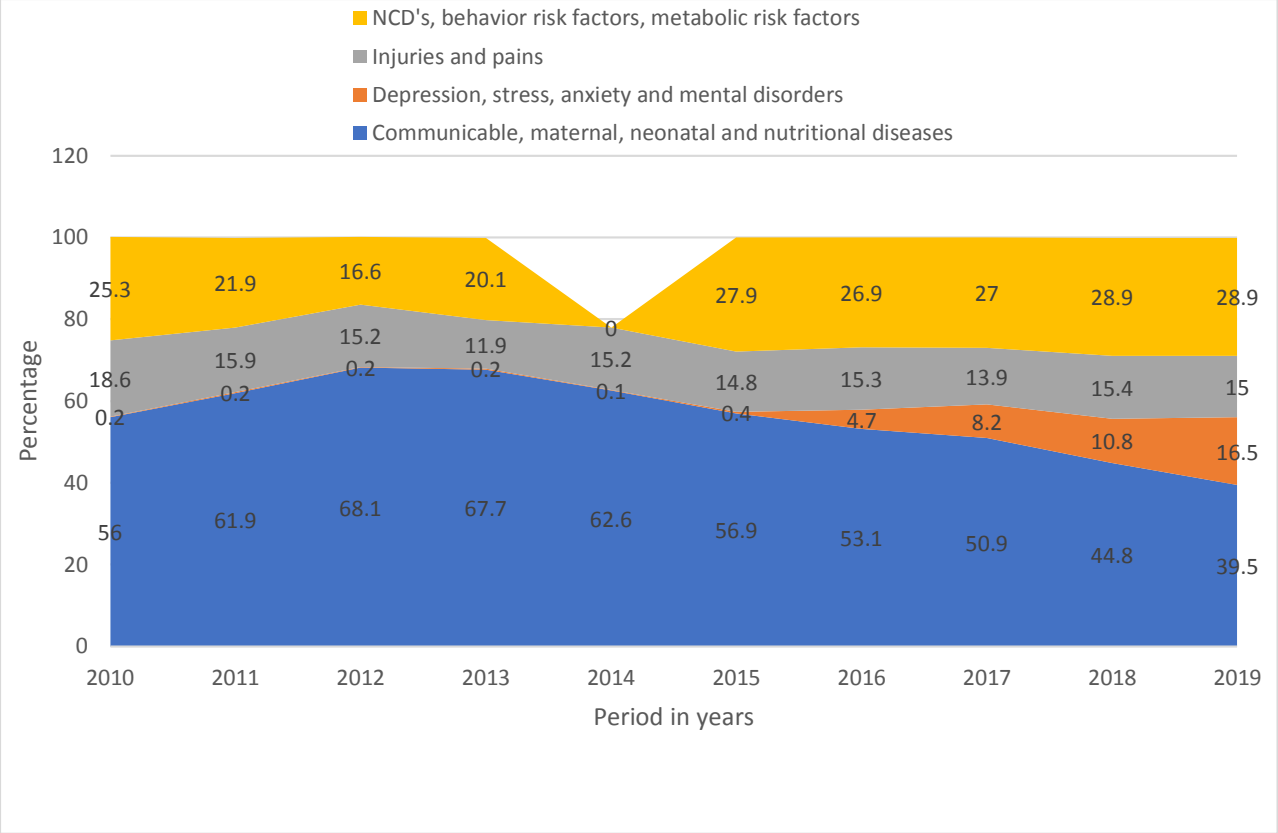


Figure 4.6: The categories of morbidity at Kimberly Military Sickbay by year for period 2010 – 2019

The top 10 leading causes of morbidity in Kimberly Military Sickbay of South Africa are presented in Table 4.3. The data shows that the highest-ranking morbidity for all ages was upper respiratory infections followed by Injuries, pains malaise and fatigue; HIV/AIDS while Influenza & pneumonia ranked number ten (10). In age group 18 – 24 years the highest-ranking morbidity was Injuries, pains malaise and fatigue followed by psychological evaluations and psychiatric conditions; upper respiratory tract infection and Influenza & pneumonia ranked number ten (10) as in all ages. HIV/AIDS ranked highest in age group 25 – 44 years followed by upper respiratory tract infection and Injuries, pains malaise and fatigue while Cellulitis, Dermatitis, fungal and skin infections ranked number ten (10). In age group 45 – 65 years the highest-ranking morbidity was fevers followed by Blood and immune system conditions; cerebrovascular disease while Digestive tract conditions ranked number ten (10) as presented in Table 4.4 below.

Table 4.3 Disease-specific morbidity at Kimberly Sickbay by age for all ages and age 18 – 24 years for period 2010 – 2019

	All Ages		
Diagnosis category	Number	Percent	Rank
All causes	111,536	100	
upper respiratory tract infection	16,647	14,93	1
Injuries, pains malaise and fatigue	13,891	12,45	2
HIV/AIDS	13,044	11,69	3
Ear, Nose and Throat infection	9,29	8,33	4
Cardiovascular conditions and risk factors	9,137	8,19	5
Digestive tract conditions	6,512	5,84	6
Lower respiratory tract infection	4,648	4,17	7
Depression, stress, anxiety and mental disorders	4,525	4,06	8
Cellulitis, Dermatitis, fungal and skin infections	4,173	3,74	9
Influenza & pneumonia	3,885	3,48	10
Eye conditions	2,661	2,39	11
Urinary tract infections	2,276	2,04	12
Psychological evaluations and psychiatric conditions	1,847	1,66	13
Brain disorders	1,807	1,62	14
Gynaecological conditions	1,327	1,19	15
Disease of the heart	713	0,64	
Cramps and spasms	622	0,56	
Blood and immune system conditions	299	0,27	
Breast disorders	165	0,15	
Cerebrovascular disease	161	0,14	
Arthritis and rheumatic diseases	111	0,1	
Fever	97	0,09	
Male reproductive conditions	84	0,08	
STI's	78	0,07	
Accidental ingestion and inhalation o,,	70	0,06	
Fertility, pregnancy and childbirth	47	0,04	
Surgery	12	0,01	
All other	13,407	12,02	

	Age 18 - 24 years		
Diagnosis category	Number	Percent	Rank
All causes	12,804	100	
Injuries, pains malaise and fatigue	2,11	16,48	1
Psychological evaluations and psychiatric conditions	1,747	13,64	2
Upper respiratory tract infection	1,399	10,93	3
Ear, Nose and Throat infection	846	6,61	4
Digestive tract conditions	715	5,58	5
Cellulitis, Dermatitis, fungal and skin infections	651	5,08	6
Depression, stress, anxiety and mental disorders	548	4,28	7
Urinary tract infections	452	3,53	8
Gynaecological conditions	365	2,85	9
Influenza & pneumonia	352	2,75	10
HIV/AIDS	343	2,68	11
Brain disorders	320	2,5	12
Eye conditions	292	2,28	13
Lower respiratory tract infection	285	2,23	14
Cardiovascular conditions and risk fa,,	241	1,88	15
Cramps and spasms	73	0,57	
Disease of the heart	65	0,51	
Blood and immune system conditions	48	0,37	
Breast disorders	28	0,22	
Arthritis and rheumatic diseases	19	0,15	
Accidental ingestion and inhalation o,,	16	0,12	
STI's	12	0,09	
Fertility, pregnancy and childbirth	5	0,04	
Fever	5	0,04	
Male reproductive conditions	5	0,04	
Cerebrovascular disease	2	0,02	
Surgery	1	0,01	
All other	1,859	14,52	

Table 4.4 Disease-specific morbidity at Kimberly Sickbay by age for age 25 – 44 years and 45 – 65 years for period 2010 – 2019

	Age 25 - 44 years				Age 45 - 64 years		
Diagnosis category	Number	Percent	Rank	Diagnosis category	Number	Percent	Rank
All causes	51,113	100		All causes	28,046	100	
HIV/AIDS	8,025	15,7	1	Fever	4,703	16,77	1
upper respiratory tract infection	6,628	12,97	2	Blood and immune system conditions	4,517	16,11	2
Injuries, pains malaise and fatigue	6,567	12,85	3	Cerebrovascular disease	3,926	14	3
Ear, Nose and Throat infection	3,745	7,33	4	Surgery	3,409	12,16	4
cardiovascular conditions and risk factors	3,53	6,91	5	Eye conditions	1,631	5,82	5
Digestive tract conditions	3,087	6,04	6	Psychological evaluations and psychiatric conditions	1,307	4,66	6
Depression, stress, anxiety and mental disorders	2,452	4,8	7	Cellulitis, Dermatitis, fungal and skin infections	1,283	4,57	7
Lower respiratory tract infection	1,823	3,57	8	Influenza & pneumonia	974	3,47	8
Influenza & pneumonia	1,754	3,43	9	Breast disorders	755	2,69	9
Cellulitis, Dermatitis, fungal and skin infections	1,611	3,15	10	Digestive tract conditions	649	2,31	10
Urinary tract infections	1,197	2,34	11	Brain disorders	578	2,06	11
Eye conditions	1,149	2,25	12	Male reproductive conditions	430	1,53	12
Brain disorders	1,019	1,99	13	Ear, Nose and Throat infection	328	1,17	13
Gynaecological conditions	764	1,49	14	Urinary tract infections	228	0,81	14
Disease of the heart	367	0,72	15	Lower respiratory tract infection	179	0,64	15
Cramps and spasms	321	0,63		Cramps and spasms	119	0,42	
Blood and immune system conditions	110	0,22		Injuries, pains malaise and fatigue	53	0,19	
Breast disorders	80	0,16		Depression, stress, anxiety and mental disorders	49	0,17	
Cerebrovascular disease	75	0,15		cardiovascular conditions and risk factors	30	0,11	
Psychological evaluations and psychiatric conditions	62	0,12		upper respiratory tract infection	28	0,1	
Arthritis and rheumatic diseases	50	0,1		Arthritis and rheumatic diseases	29	0,1	
Fertility, pregnancy and childbirth	33	0,06		Fertility, pregnancy and childbirth	27	0,1	
STI's	32	0,06		HIV/AIDS	14	0,05	
Accidental ingestion and inhalation of poisonous sub	27	0,05		STI's	11	0,04	
Male reproductive conditions	20	0,04		Disease of the heart	6	0,02	
Fever	14	0,03		Accidental ingestion and inhalation of poisonous sub	2	0,01	
Surgery	8	0,02		Gynaecological conditions	1	0	
All other	6,563	12,84		All other	2,78	9,91	

The proportionate mortality by gender in Kimberly Military Sickbay of South Africa are presented in Tables 4.5 below. The data shows that mortality levels were high due to upper respiratory tract infections in females followed by Injuries, pains malaise and fatigue**;** digestive tract conditions while urinary tract infections ranked number ten (10). In males, highest mortalities were due to HIV/AIDS followed by cardiovascular conditions and risk factors; upper respiratory tract infections while depression, stress, anxiety and mental disorders ranked number ten (10).

Table 4.5: Proportionate mortality rankings at Kimberly Sickbay 2010 – 2019 stratified by gender

Rank	Females	Males
1	URTI **16.0**	HIV/AIDS **34.1**
2	Injuries, pains malaise and fatigue **14.7**	Cardiovascular conditions and risk factors **10.8**
3	Digestive tract conditions **9.7**	Injuries, pains malaise and fatigue **10.0**
4	ENT **8.1**	URTI **9.8**
5	Cardiovascular conditions and risk factors **6.1**	LRTI **4.9**
6	LRTI **5.9**	Digestive tract conditions **4.3**
7	Influenza & pneumonia **4.9**	ENT **3.4**
8	HIV/AIDS **4.5**	Influenza & pneumonia **2.9**
9	Depression, stress, anxiety and mental disorders **3.6**	Cellulitis, Dermatitis, fungal and skin infections **2.7**
10	UTI **3.5**	Depression, stress, anxiety and mental disorders **2.0**

The proportionate mortality by age group in Kimberly Military Sickbay of South Africa are presented in Tables 4.6 below. The data shows that mortality levels were high in all ages due to HIV/AIDS followed by urinary tract infections; Injuries, pains malaise and fatigue while depression, stress, anxiety and mental disorders ranked number ten (10). In age group 0 – 17 years, highest mortalities were due to urinary tract infections followed by cerebrovascular conditions; influenza and pneumonia while male reproductive conditions ranked number ten (10). In age group 18 – 24 years, upper

respiratory tract infections ranked highest followed by lower respiratory tract infections; influenza and pneumonia while urinary tract infections ranked fifth.

In age group 25 – 44 years, Injuries, pains malaise and fatigue ranked highest followed by upper respiratory tract infections while cardiovascular conditions and risk factors ranked number ten (10). HIV/AIDS has ranked the highest in age groups 45 – 64 years and 65 years and above. Cardiovascular conditions and risk factors ranked second and forth in age group 65 years and above and 45 – 64 years respectively. Digestive tract conditions ranked fifth in all ages, 25 – 44 years, 45 – 64 years and 65 years and above as presented in Table 4.6 below.

Table 4.6: Proportionate mortality rankings at Kimberly Military Sickbay 2010 – 2019 stratified by age group

Rank	All ages	Age 0 - 17 years	Age 18 - 24 years	Age 25 - 44 years	Age 45 - 64 years	≥ 65 years
1	HIV/AIDS **27.5**	UTI **30.8**	URTI **44.0**	Injuries, pains malaise and fatigue **19.4**	HIV/AIDS **20.5**	HIV/AIDS **42.5**
2	UTI **11.2**	Cerebrovascular **15.4**	LRTI **16.0**	URTI **12.1**	URTI **13.6**	Cardiovascular conditions and risk factors **11.2**
3	Injuries, pains malaise and fatigue **11.0**	Influenza & pneumonia **11.5**	Influenza & pneumonia 12.0	ENT **8.1**	Injuries, pains malaise and fatigue **11.9**	Injuries, pains malaise and fatigue **8.3**
4	Cardiovascular conditions and risk factors **9.8**	LRTI **11.5**	ENT **8.0**	Depression, stress, anxiety and mental disorders **7.3**	Cardiovascular conditions and risk factors **7.3**	URTI **7.9**
5	Digestive tract conditions **5.5**	Psychological evaluations and psychiatric conditions **11.5**	Cerebrovascular **4.0**	Digestive tract conditions 6.5	Digestive tract conditions **5.6**	Digestive tract conditions 5.3
6	LRTI **5.1**	Digestive tract conditions **7.7**	UTI **4.0**	Eye conditions **6.5**	LRTI **5.6**	LRTI **4.4**
7	ENT **4.4**	Cellulitis, Dermatitis, fungal and skin infections **3.9**		Influenza & pneumonia **5.7**	ENT **5.5**	ENT **3.2**
8	Influenza & pneumonia **3.3**	ENT **3.9**		Cellulitis, Dermatitis, fungal and skin infections **4.8**	Influenza & pneumonia **4.2**	Influenza & pneumonia **2.3**
9	Cellulitis, Dermatitis, fungal and skin infections **2.6**	Fever **3.9**		LRTI **2.4**	Cellulitis, Dermatitis, fungal and skin infections **3.1**	Cellulitis, Dermatitis, fungal and skin infections **1.8**
10	Depression, stress, anxiety and mental disorders **2.4**	Male reproductive **3.9**		Cardiovascular conditions and risk factors **2.4**	Depression, stress, anxiety and mental disorders **3.1**	UTI **1.5**

The association of demographics with mortality is presented in Table 4.7 below and it shows that older people (25 years and above) were 5.5 more likely to die as compared to younger people (≤ 24) at *p-value= 0.001*. Males were 2.7 times more likely to die as compared to women at *p-value= 0.001* while Coloured were 0.8 times less likely to die as compared to Blacks at *p-value= 0.001* and Whites were 1.3 times more likely to die as compared to Blacks at *p-value= 0.001* and lastly Asians were 0.1 less likely to die as compared to Blacks at *p-value= 0.001*

Table 4.7 Association of age, gender and race with mortality

	Univariate Logistic Regression	
Age in years	OR(95%CI)	p-value
≤ 24	Ref	
Older	5.5 (4.7 – 6.4)	<0.001
Age group in years		
≤ 17	Ref	
18 – 24	2.1 (1.2 – 3.6)	0.009
25 – 44	4.3 (2.8 – 6.6)	<0.001
45 – 64	10.4 (7.0 – 15.3)	<0.001
≥ 65	19.7 (13.4 – 29.1)	<0.001
Gender		
Females	Ref	
Males	2.7 (2.5 – 2.9)	<0.001
Race		
Black	Ref	
Coloured	0.8 (0.7 – 0.9)	<0.001
White	1.3 (1.2 – 1.4)	<0.001
Asian	0.1 (0.05 – 0.4)	<0.001

4.4 Conclusion

In this chapter, the results of the study were presented and interpreted. The next chapter discusses these findings and compares the findings of this study to the relevant literature.

5 CHAPTER 5: DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In the previous chapter, the findings of the current study were presented and interpreted. In this chapter, the results of this study are discussed and compared to the relevant literature to address the study objectives which are:

- To describe the demographic characteristics of patients records in Kimberley Military Sickbay database
- To determine the trends on diseases reported n Kimberley Military Sickbay database
- To determine the trends on causes of deaths reported n Kimberley Military Sickbay database
- To determine the association of demographics with mortality and morbidity at Kimberley Military Sickbay.

Therefore, this chapter will be divided into the following sub-sections:

- Introduction
- Socio-demographic characteristics of people living in military bases
- Morbidity and mortality in military bases
- Study limitations,
- Conclusion and recommendation.

5.2 Socio-demographics characteristics of people living in military bases

Taherdoost (2016) defines reliability as a measurement that produces consistent results with equal values. It assesses a study's consistency, precision, repeatability, and trustworthiness. It reveals how bias-free (error-free) it is, and so ensures consistent measurement across time and across the various elements in the instruments (the observed scores). The current study found that the majority of people living in the Kimberly Military Sickbay were males, which is consistent with a study conducted in the Hungarian Defence Forces' military population (Novák, Hornyák, Rázsó, Szalánczi, Juhász & Sótér et al., 2018). In Finland, the male-to-female ratio was also

found to be high (Otonkorpi-Lehtoranta, Leinonen, Nikkanen & Heiskanen, 2015). This is consistent with the idea that the military embraces all aspects of life.

Military families have a unique set of experiences that set them apart from families with caregivers who work in other fields. Military families face challenges such as family separation for training or deployment, frequent relocation, living abroad, and working in hazardous situations. Military families move about three times more frequently than civilian families, and their children switch schools an average of six to nine times between grades (Davis, Finke & Hickerson, 2016). Unfortunately, due to coding issues, the available study data did not enable for the analysis of military families to distinguish between soldiers and dependants. As a result, the study is estimating the overall morbidity and death of those who lived on the military base.

5.3 Morbidity and mortality in military bases

Military medical surveillance data can be used to determine the scope and causes of morbidity and death, as well as to identify potential preventative targets and track trends among military personnel (Jones, Canham-Chervak, Canada, Mitchener & Moore, 2010). Every soldier is entitled to an annual medical examination, which includes routine physical examinations such as weight, height, urine, and blood pressure readings. These medical tests are performed by the unit's medical service. Every other medical check is the same as the civilian sector's preventive medical check. A soldier consults the general practitioner if the annual check yields positive results. Military medics play an important part in this medical treatment by educating soldiers about healthy living and pushing them to take responsibility for their own lives.

Respiratory diseases are one of the most common health problems among service personnel assigned to contemporary military operations (Korzeniewski, Nitsch-Osuch, Konior & Lass, 2015). Upper respiratory tract

infections (URTI's) due to a variety of viral pathogens can incapacitate entire military units (Shanks & Marsh, 2021). The current study revealed that upper respiratory tract diseases were one of the most common health problems in Kimberly Military Sickbay, which concurs with a study, conducted among soldiers of the Polish Military Contingent deployed to Iraq and Afghanistan (Korzeniewski, Nitsch-Osuch, Konarski, Guzek, Prokop & Bieniuk, 2013). Military personnel fighting in contemporary battlefields as well as those participating in combat training are at risk of contracting respiratory infections (Abraham, Eick-Cost, Clark, Hu, Baird & DeFraites et al., 2014). Epidemiological studies have demonstrated that soldiers deployed to the harsh environment have higher rates of newly reported respiratory symptoms than non-deployers (Abraham et al., 2014; Korzeniewski et al., 2015). In the SANDF, the upper respiratory tract infections have respiratory infections also constitute a common cause of morbidity among adults like in the United States (Sanchez, Cooper, Myers, Cummings, Vest & Russell et al., 2015).

Another major health problem experienced by soldiers and military veterans are injuries, pains malaise and fatigue (Dyar, 2020). The current study findings revealed that injuries, pains malaise and fatigue were the highest cause of morbidity in age group 18 – 24 years and the second highest cause of morbidity in all ages. This concurs with findings from a study conducted in Israel Defense Forces as there was a high prevalence of penetrating trauma and most victims expired in the field (Scope, Farkash, Lynn, Abargel & Eldad, 2001; Glassberg, Nadler, Erlich, Klien, Kreiss & Kluger, 2014). In the current study injuries, pains malaise and fatigue highest cause of mortality in age group 25 – 44 years which also concurs with a study from U.S. Military as injuries were the biggest health problem of the military services (Jones et al., 2010). Mortality in military trauma is different from civilian trauma and injuries are common in military trainees and present a considerable threat to occupational fitness, deployability, and overall military readiness (Hughes, Foulis, Taylor, Guerriere, Walker & Hand et al., 2019). The current study findings support this as injuries, pains malaise and fatigue was the highest

cause mortality in age group 25 – 44 years and the highest cause morbidity in age group 18 – 24 years while this was the third highest cause of morbidity in age group 25 – 44 years.

Military personnel have higher HIV/AIDS prevalence than the general population. They tend to be young, single, sexually active and highly mobile and may stay away from their home (Igboanusi, Dahiru & Joshua, 2015). Generally, militaries are reluctant to divulge figures on HIV prevalence for security reasons. However, figures are believed to be high and the risky behaviour of military personnel compounded by the high HIV-1 sero-prevalence within this population has been a cause for concern Zimbabwe Defence Forces' (ZDF) (Duri, K., Stray-Pedersen, B. and Muller, F., 2013.) which is similar to the South African Defence Force as per findings of the current study as HIV/AIDS was found to be the most highest contributory to morbidity amongst age group 25 – 44 years and the highest contributory to mortality in all ages, Age 45 - 64 years and 65 years. The HIV epidemic within the Rwandan militaries may been believed to be influenced by factors or circumstances that are rare or absent among civilians for example rank, living away from family, deployments, attitude changes needed to survive and succeed during combat (Harbertson, Grillo, Zimulinda, Murego, Brodine & May et al., 2013). Among Nigerian military personnel (NMP), HIV prevalence has been reported to be higher than that of the general population, due to their mobile lifestyle and distance from their spouses while on United Nations peace-keeping mission (Ekong, 2006). Therefore, it is important to characterize and evaluate their HIV epidemic separately using instruments, which allow for comparison to the civilian population.

The mortality rate of men is generally higher than that of women, irrespective of the age group. Currently, a key concern for health care professionals is the prevalence of risk factors associated with cardiovascular disease and metabolic syndrome (Filho & D'Oliveira Jr, 2014). The current study findings support this as cardiovascular diseases and their risk factors were the highest

cause of morality among males in Kimberly Military Sickbay. In a study conducted among soldiers in Germany, it was found that majority of the soldiers were overweight or obese (Sammito & Niebel, 2014). The current study revealed that cardiovascular diseases and their risk factors are becoming a threat to the SANDF as this ranked fifth in both all ages and 25 – 44 years and this is similar to findings of a study conducted in Cameroon (Ngan, Belinga, Nlo'o, Roche, Goethals & Mandengue et al., 2020). The percentage of unsatisfactory blood pressure control was higher among soldiers below 40 years of age and the prevalence of overweight and obese soldiers increased with age in Poland. High and very high cardiovascular risk scores were observed in almost one-third of polish soldiers (Gielerak, Krzesiński, Piotrowicz, Murawski, Skrobowski & Stańczyk et al., 2020). In a study conducted at South African National Defence Force at Lenz Military Base it was found that Obesity prevalence was 42.1% and 35.7% for women and men respectively (Ngoepe, M.M., 2019). This is very high and concurs with the findings of the current study in relation to risk factors for NCD's

Influenza infection creates an immune response that protects against re-infection with the same virus, or from an antigenically similar strain of the virus. This is the principle behind seasonal influenza vaccines as natural immunity produced through infection is thought to produce a superior immune response compared to vaccination (Bogaert, 2015). The current study findings revealed that influenza and pneumonia were ranked seventh and eighth causes of mortality in females and males respectively. This is similar to the findings of other studies as influenza was amongst the causes of death among soldiers (Riggs & Cuff, 2013; Kushwaha, Kotwal, Biradar, Mahen, Kumar et al., 2019).

Gastrointestinal (GI) symptoms including abdominal pain, diarrhoea, constipation and nausea are common in soldiers in combat or high-pressure operational situations and often lead to compromised performance (Li, Kan, Lu, Cao, Wong & Keshavarzian et al., 2013). In the current study, digestive tract infections were also amongst the highest causes of morbidity and

mortality. There are many service members deployed to assist during civil wars and other violence related environments. These deployments have been strongly associated with an increased risk of mental health problems (Hoge, Grossman, Auchterlonie, Riviere, Milliken & Wilk, 2014). The current study revealed that the proportion of ear, nose and throat infections were amongst the highest which concurs with a study conducted in United States (Bauer, Larson, Moresco, Huntington, Walker & Richard, 2021). This could be dominated by gun-shooting deafness is the common terminology applied to sensorineural hearing loss caused by shooting firearms (Sataloff, Hawkshaw & Sataloff, 2010.) as soldiers deal with the gun shots sounds mostly in their environment from training to war.

Conclusion

The reduction of physical fitness due to the increasing number of cardiovascular risk factors is a serious problem, particularly because it happens in absence of manifest chronic diseases.

5.4 Limitations of study

The research is only conducted in Kimberley, so the findings cannot be generalized for the entire South Africa.

5.5 Recommendations

Based on the findings of this study, the following were recommended to the Depot NA authorities in particular and the military authorities in general in order to conduct similar research in different provinces, so that problems encountered could be overcome in specific ways, or that the research populations for future research be defined differently. To reduce respiratory disease in military units the following should be done:

- Avoid overcrowding
- Maintain proper ventilation, temperature, and humidity.
- Control dust.
- Make maximum use of sunlight.

- Immunize, where applicable.
- Practice proper oral hygiene.

Formulate Preventive Medicine Measures with the Mission in Mind. The military mission of a command is all-important; all preventive medicine measures for the command must be formulated with the following in mind.

- It is more reasonable to prevent disease than to treat it.
- When troops are training for or engaged in combat, however, health measures that interfere with military activity more than the condition, which they are designed to correct, are not feasible.
- Large-scale disease control measures must be practicable, simple, and capable of being performed in a short period
- Educate soldier to change their sexual behaviour especially men must learn to be faithful, practice safe sex when they are away from home on military missions to avoid STIs, HIV and AIDS related diseases
- Provide soldiers with some entertainments so that they don't get too bored and be involved in alcohol and drug abuse which will cause them to make accidents
- Make fitness exercise a norm at their home units so that they are physically fit and they don't start to do it at their combat or deployment area
- Resilience programmes must be prepared for pre and post training or deployment so that the soldiers can be prepared for the new environment they will be deployed and help them to adjust when they go back home.

5.6 Conclusion

This study gives a brief description of the health profile of patients attending the military training at Kimberley over a period. This knowledge would help in planning health services to meet the patient's needs and help in training health

staff. Many diseases have seasonal variation and the burden of these diseases can be reduce by steps taken by the health planners and manager beforehand and through implementation of surveillance program. This study concluded that the demographics of most soldiers were males as it is believed that soldiers must be fit and aggressive. It also revealed that the morbidity and mortality of soldiers in the base are in most cases the same as the other countries due to other studies done previously. The association of demographics with mortality shows that older people (25 years and above) were 5.5 more likely to die as compared to younger people (≤ 24) at p-value= 0.001. Males were 2.7 times more likely to die as compared to women at p-value= 0.001.

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Annexure 1: Approval from faculty of Health Sciences

University of Limpopo
Faculty of Health Sciences
Executive Dean
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 2149, Fax: (015) 268 2685, Email:kgakgabi.letsoalo@ul.ac.za

DATE: 29 JUNE 2020

NAME OF STUDENT: **MAKHAVHU M**
STUDENT NUMBER: **9707199**
DEPARTMENT: **PUBLIC HEALTH**
SCHOOL: **HEALTH CARE SCIENCES**
QUALIFICATION: **MPH**

Dear Student

FACULTY APPROVAL OF PROPOSAL (PROPOSAL NO. FHDC2020/4)

I have pleasure in informing you that your MPH proposal served at the Faculty Higher Degrees Meeting on the 11 JUNE 2020 and your title was approved as follows:

Approved Title: "The Analysis of Morbidity and Mortality at Kimberley Military Sickbay in South Africa 2010-2019".

Ethical Clearance	Tick One
Requires no ethical clearance Proceed with the study	
Requires ethical clearance (TREC) (apply online) Proceed with the study only after receipt of ethical clearance certificate	√

Yours faithfully

MR K.J Letsoalo

Chairperson

CC: **Supervisor: DR E Maimela**

Finding solutions for Africa

Annexure 2: Approval from Turfloop Research Ethics Committee (TREC)

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 21 October 2020

PROJECT NUMBER: TREC/299/2020: PG

PROJECT:

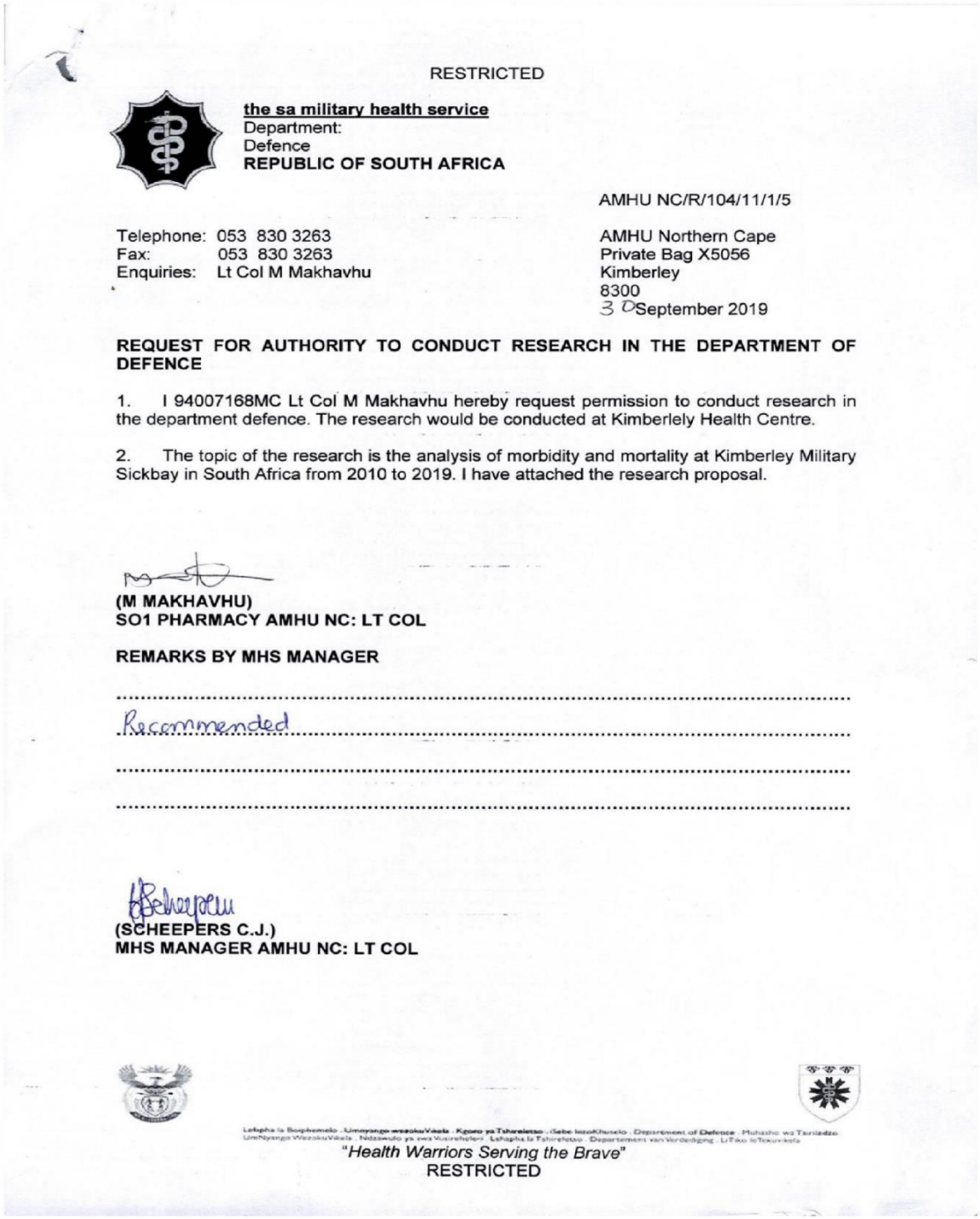
Title:	The Analysis of Morbidity and Mortality at Kimberley Military Sickbay in South Africa, 2010-2019
Researcher:	M Makhavhu
Supervisor:	Dr E Maimela
Co-Supervisor/s:	N/A
School:	Health Care Sciences
Degree:	Master of Public Health

PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE
The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**
ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**
iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

Finding solutions for Africa

Annexure 3: Approval to conduct research in the department of defence by Officer Commanding Area military Health Unit Northern Cape



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the sa military health service
Department:
Defence
REPUBLIC OF SOUTH AFRICA

AMHU NC/R/104/11/1/5

Telephone: 053 830 3263
Fax: 053 830 3263
Enquiries: Lt Col M Makhavhu

AMHU Northern Cape
Private Bag X5056
Kimberley
8300
30 September 2019

REQUEST FOR AUTHORITY TO CONDUCT RESEARCH IN THE DEPARTMENT OF DEFENCE

1. I 94007168MC Lt Col M Makhavhu hereby request permission to conduct research in the department defence. The research would be conducted at Kimberlely Health Centre.

2. The topic of the research is the analysis of morbidity and mortality at Kimberley Military Sickbay in South Africa from 2010 to 2019. I have attached the research proposal.

(M MAKHAVHU)
SO1 PHARMACY AMHU NC: LT COL

REMARKS BY MHS MANAGER

.....

Recommended

.....

.....

.....

(SCHEEPERS C.J.)
MHS MANAGER AMHU NC: LT COL

"Health Warriors Serving the Brave"
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REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN THE DEPARTMENT OF DEFENCE

REMARKS BY THE OFFICER COMMANDING

Recommended. this research may positively contribute towards improved health promotion / disease prevention programmes

(M.M. DELPORT)
OFFICER COMMANDING AREA MILITARY HEALTH UNIT NORTHERN CAPE: COL

DISTR

For Action

Dir CI (Attention: Brig Gen B Nqcobo)

For Info

Dir Pharmacy (Attention: Brig Gen T Kgasago)

File: AMHU NC/R/104/11/1/5

Annexure 4: Approval to conduct the study at Kimberley Military Sickbay in Northern Cape Province by the Sergeant General

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the sa military health service
Department:
Defence
REPUBLIC OF SOUTH AFRICA

SG(RESEARCH)/R/501/8/7

Telephone: (012) 671 5200
Facsimile: (012) 671 5185
Enquiries: Col J.H. Botha

Department of Defence
Office of the Surgeon General
(SAMHS Research Unit)
P/Bag X102
Centurion
0046
28 May 2021

REQUESTING APPROVAL TO GET ACCESS TO DATA: THE ANALYSES OF MORBIDITY AND MORTALITY AT KIMBERLEY MILITARY SICKBAY IN SOUTH AFRICA, 2010 – 2019.

Appendix A: Master Protocol dd February 2019
B: Feedback from 1 Mil Hosp Ethics Committee review of the protocol dd 14 January 2021.
C: Approval from University of Limpopo Ethics Clearance to conduct the study.
D: DI Approval to conduct the study dd 7 August 2020.

BACKGROUND

1. Lt Col M. Makhavhu SO1 Pharmacy at AMHU NC is busy with her Masters Degree in Public Health through the University of Limpopo.

2. Protocol: **The Analyses of Morbidity and Mortality at Kimberley Military Sickbay in South Africa, 2010 – 2019.**

3. This protocol was seen by the 1 Military Hospital Ethics Committee (See Appendix B) and also seen by Defence Intelligence. Defence intelligence and 1 Mil Hosp Research Ethics Committee both informed Lt Col M. Makhavhu as the Principal Investigator that the final research product must be submitted to both institutions for clearance before submission or publication can take place.

4. The SAMHS Research Unit (SRU) did discuss the protocol with SSO Medico legal. Col P.Brits was of the opinion that as long as the University of Limpopo, 1 Mil Hosp Research Ethics Committee and DI has given permission to proceed, Lt Col Makhavhu has to obtain written approval from the Surgeon General in accordance with the Promotion of Access to Information Act, Act 2 of 2000. Potentially sensitive information may only be made available against the signature of the Surgeon General.

RECOMMENDATION

5. SAMHS Research Unit is recommending that favourable consideration be granted to Lt Col M. Makhavhu as the Principal Investigator to proceed with the protocol on the grounds that compliance is assured with the requirements as stipulated by the 1 Military Hospital Research Ethics Committee and DI, respectively.

Lefapha la Bolphemelo . Umnyango wezoKuVikela . Kgoro ya Tshireletso . Setso sa Kgotlhoso . Department of Defence . Muhasho wa Tshitetezo . UmNyango WezoKuVikela . Ndzawulo ya swa Vusirheleri . Lefapha le Tshireletso . Departement van Verdediging . LiTiko leTekuvikela

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REQUESTING APPROVAL TO GET ACCESS TO DATA: THE ANALYSES OF MORBIDITY AND MORTALITY AT KIMBERLEY MILITARY SICKBAY IN SOUTH AFRICA, 2010 – 2019.

6. Your favourable consideration will be appreciated.

(J.H. BOTHA)
SSO RESEARCH: COL

COMMENTS: Recommended

Approved as instructed.

(N.P. MAPHAHA)
CHIEF DIRECTOR MILITARY HEALTH FORCE PREPARATION: MAJ GEN

COMMENTS: Approved

24/06/2021

(Z.W.S. DABULA)
SURGEON GENERAL: LT GEN

DISTR

For Action

OC AMHU NC (Att: Lt Col M. Makhavhu)

Internal

File

Annexure 5: Approval of Authority to conduct research in the Department of Defence by Defence Intelligence (DI)

RESTRICTED

defence intelligence
Department:
Defence
REPUBLIC OF SOUTH AFRICA

DI/DDS/R/202/3/7

Telephone: (012) - 0660
Fax: (012) -3263246
Enquiries: Col J. van Wyk

Defence Intelligence
Private Bag X337
Pretoria
0001
07 August 2020

AUTHORITY TO CONDUCT RESEARCH IN THE DEPARTMENT OF DEFENCE (DOD): LT COL M. MAKHAVHU

1. A telephonic discussion between Lt Col M. Makhavhu of the Area Military Health Unit in Northern Cape and WO1 K. Skweyiya of the Defence Intelligence (DI) on 03 August 2020, as well as a request letter AMHU NC/R/104/11/15 to conduct research in the DOD with the Research Proposal attached as per requirement is acknowledged.

2. Permission is hereby granted from a security perspective to Lt Col M. Makhavhu to conduct a research in the DOD on the topic entitled **"The Analysis of Morbidity and Mortality at Kimberly Military Sickbay in South Africa, 2010-2019,"** as a prerequisite for an attainment of a Master's Degree in Public Health under the auspices of the University of Limpopo as per request.

3. After the completion of the research, the final research product must be forwarded to Defence Intelligence (DI), Sub-Division Counter Intelligence (SDCI) for a final authorisation before it may be published or distributed to any entity outside the DOD.

4. Access to DOD information is however granted on condition that there is adherence to inter alia Section 104 of the Defence Act (Act 42 of 2002) pertaining to protection of DOD Classified Information and the consequences of noncompliance.

5. For your attention.

(T.G. BALOYI)
DIRECTORATE DEPARTMENTAL SECURITY: BRIG GEN
KS/KS (Lt Col M. Makhavhu)

DSTR

For Action

OC Area Military Health Unit Northern Cape (Attention: Lt Col M. Makhavhu)

Internal

File: DI/DDS/R/202/3/7

RESTRICTED

Annexure 6: Authority to conduct research at Kimberley Military Sickbay by the 1 military Hospital ethics committee

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1MH/302/6/03.11.2020

sa military health service
Department:
Defence
REPUBLIC OF SOUTH AFRICA

Telephone: 012 314 0013
Facsimile: 012 314 0013
Enquiries: Prof / Lt Col M.K. Baker

1 Military Hospital
Private Bag x 1023
Thaba Tshwane
0143
14 January 2021

CLINICAL TRIAL APPROVAL: 03.11.2020: "THE ANALYSIS OF MORBIDITY AND MORTALITY AT KIMBERLEY MILITARY SICKBAY IN SOUTH AFRICA, 2010-2019"

1. The 1 Military Hospital Research Ethics Committee (1MHREC) registered in South Africa with the National Health Research Ethics Council (NHREC) (REC-111208-019-RA) adhering to GCP/ICH and SA Clinical Trial guidelines, evaluated the above-mentioned protocol and additional documents.

2. The following documents were evaluated:

   a. Personalised Covering Letter from Investigator
   b. Research Proposal
   c. Data Capturing Sheet
   d. Permission to Access Patient Records from Officer Commanding Area Military Health Unit Northern Cape
   e. Letter of Assistance with Data Management
   f. Letter of Approval from Turfloop Research Ethics Committee University of Limpopo
   g. Permission Letter from Defence Intelligence to Conduct Research
   h. Updated Curricula Vitae:

      i. M. Makhavhu
      ii. E. Maimela
      iii. O.N. Motswage

3. The recommendations are: The study was ethically approved on 14 January 2021. The approved principal investigator is Lt Col. M. Makhavhu.

4. The study is granted research ethics approval for a period of 12 months. At the end of this period the Principal Investigator must apply for re-approval of the study. Failure to re-apply will result in approval expiring and data generated after the 12-month period, not being able to be included as part of the research project. Report backs are to be made to the 1MHREC annually, in the event of any serious adverse events and on completion or termination of the study. Should publications result from the study the relevant manuscripts will also need to be approved by Military Counter Intelligence. All funds generated through this research study must be paid into an approved Regimental Fund account.

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1MH/302/6/03.11.2020

5. The PI needs to ensure that all variations in the study title need to be known to all regulatory authorities, with assurance from the PI that all variations represent one and the same study.

6. The 1 MHREC wishes you success with the study.

(M.K BAKER)
CHAIRMAN 1 MILITARY HOSPITAL RESEARCH ETHICS COMMITTEE:
LT COL / PROF

DIST

For Action

Lt Col. M. Makhavhu

Annexure 7: Data collection tool

Year	Month	Age	Gender	Marital status	Educational level	Job category	Diagnosis	Outcome (Dead or Alive)

APPENDIX 8: Evidence of language editing

Tiyiselani & Rapetsoa scientific services

Article Publishing • Proof-reading • Editing

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Duplex Park No 5, Polokwane,
0699
Postnet Suite 179 • Private Bag X9307 • Polokwane •0700
Tel: 074 8666 914 or 072 190 2999 • Fax: 0864154022

Date: 27 September 2021

To Whom it May Concern

I hereby confirm that I have proof-read the document entitled: "**The profiling of morbidity and mortality at Kimberley Military Sickbay in South Africa, 2010-2019**" authored by Makhavhu MM with student number 9707199. The document has been edited and proofread for grammar, spelling, punctuation, overall style and logical flow. Considering the suggested changes that the author may or may not accept, at his/her discretion, each of us has our own unique voice as far as both spoken and written language is concerned. In my role as proof-reader, I try not to let my own "written voice" overshadow the voice of the author, while at the same time attempting to ensure a readable document.

Please refer any queries to me.

Rapetsoa DB