PREVALENCE AND RISK FACTORS OF OCCUPATIONAL INJURIES AMONG EMERGENCY CARE PROVIDERS

A dissertation submitted in fulfilment of the requirements for the degree of Master of Health Sciences in Emergency Medical Care in the Faculty of Health Sciences at the Durban University of Technology

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June 2020

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DECLARATION OF ORIGINALITY

This is to certify that this work is entirely my own and not that of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Durban University of Technology or to any other institution for assessment or for any other purpose.

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ETHICAL CLEARANCE

This is to certify that the research studies which were conducted for the purposes of this dissertation were approved by the Institutional Research Ethics Committee (IREC) of the Durban University of Technology (DUT) in KwaZulu-Natal

Institutional Research Ethics Clearance Number: IREC157/18

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ABSTRACT

Introduction: Occupational injuries and diseases affect approximately 260 million people worldwide and kill nearly 2.3 million people per year. While paramedics and other healthcare workers (HCWs) are responsible for ensuring the health of others, their working environment is also considered to be one of the most hazardous environments.

Purpose: To describe the prevalence and risk factors associated with occupational injuries, as well as perceptions of both the mitigation and prevention of occupational injuries among paramedics working for KwaZulu-Natal (KZN) Emergency Medical Rescue Services (EMRS).

Methodology: The study adopted a quantitative, descriptive, cross-sectional approach. The study population comprised operational paramedics working for the KZN EMRS with a sample of 334 paramedics being drawn from a total of 2378 KZN EMRS paramedics. The study was conducted in five of the eleven districts in KZN. The data collection methods used included a closed ended questionnaire and a document review. The data which had been collected was analysed using Stata version 15. The Pearson chi-squared test was used to test for associations between any two categorical variables and, in instances, where Pearson chi-squared test was invalid Fisher's exact test was used. A p-value of less than 0.05 was considered to be statistically significant.

Results: Two of the five districts provided the required information for reviewing the records. A total of 36 injuries were reported in the two districts between 2011 and 2018. The reported injuries included injuries from motor vehicle accidents (61%), musculoskeletal injuries (16.7%), needle-stick injuries (13.9%), accidental surgical blade cuts (5.6%) and assault injuries (2.8%). A total of 152 survey questionnaires were completed and returned – a 45% response rate. The findings from the self-administered questionnaire revealed 25 (16.5%) unreported injuries which included musculoskeletal injuries (48%, n = 12), needle-stick injuries (48%, n = 12), and one (1) (4%) assault-related injuries. A further 49 (32.2%) injuries which had resulted in medical attention being sought included musculoskeletal injuries (55.1%, n = 27), injuries due to motor vehicle accidents (44.9%, n = 22), needle-stick injuries (26.5%,

n = 13) and assault-related injuries (8.2%, n = 4). Overall, 59 (38.8%) paramedics had experienced occupational injuries (both reported and unreported). The paramedics' perceived risk factors for occupational injuries included high speed driving (87.5%, n = 133), violent members of society (87.5%, n = 133), heavy objects and patient lifting (86.2%, n = 131), physical exhaustion (78.3%, n = 119), hazardous material (77%, n = 117), and temperature extremes (73%, n = 111). In addition, the paramedics' perceptions regarding occupational injury prevention revealed the following precautions, namely, avoiding high speed driving (79.6%, n = 121), specific positioning during equipment and patient lifting (63.8%, n = 97), avoiding chaotic scenes (61.8%, n = 94) and avoiding working longer hours (49.3%, n = 75).

Conclusion: While it may be anticipated that information regarding occupational injuries suffered by paramedics would not be public knowledge, access to this information for purposes of research that aim to establish mitigation and prevention strategies, should be subjected to fewer challenges. From the data that was available, paramedics from KZN EMRS experienced multiple types of occupational injuries from a variety of injury sources. These injuries could be a result of both, the nature of the work and environment in which paramedics operate. However, further research is necessary to identify and validate these findings, as well as presented strategies required to minimise the rates of occupational injury among paramedics working for KZN EMRS.

ACKNOWLEDGEMENTS

To my supervisors, Dr Kevin Govender and Dr Simpiwe Sobuwa. Thank you for your continual guidance and motivation throughout this project. Words cannot express how grateful I am for your counsel and support. I genuinely appreciate the diligence, generosity and help received from the both of you.

To Dr Fikile Nkwanyana who provided assistance with the data analysis, thank you.

To the Department of Health Research and Ethics Committee in KwaZulu-Natal Province. Thank you for granting the permission to conduct the study.

I also wish to thank all the paramedics from the KwaZulu-Natal Emergency Medical Rescue Services who took the time and effort to participate in the study.

I would also like to thank my colleagues for their support and motivation during this research process.

Thank you also to my family for all the support, love, understanding and encouragement.

Above all, I thank God for giving me strength and courage to endure this journey.

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LIST OF TERMS DEFINITION

Paramedics: Personnel who are registered on the paramedic register with the Health Professions Council of South Africa (HPCSA) under the auspices of the Professional Board for Emergency Care (PBEC) (Sobuwa & Christopher 2019). These individuals are deemed to be healthcare workers and they provide both pre-hospital care and the transportation of ill and injured patients to hospitals for further care (Binks 2011). For the purpose of this study the term paramedic includes all EMS personnel who are employed by the KZN EMRS and who are actively involved in patient care under the categories specified below (BLS, ILS, and ALS).

Basic Life Support (BLS): Emergency medical services personnel who are trained to provide basic medical care interventions including cardiopulmonary resuscitation, stopping bleeding and basic airway management (KwaZulu-Natal Department of Health 2001). They are registered with the HPCSA PBEC on the BAA register and are also known as basic ambulance assistants. For the purpose of this study, this term refers BLS practitioners who are employed by the KZN EMRS.

Intermediate Life Support (ILS): Emergency medical services personnel who are trained to provide intermediate medical interventions such as peripheral venous cannulation, defibrillation and needle chest decompression (KwaZulu-Natal Department of Health 2001). They are also known as ambulance emergency assistants and are registered on the AEA register with the HPCSA PBEC. For the purpose of this study this term refers to ILS practitioners who are employed by the KZN EMRS.

Advanced Life Support (ALS): Emergency medical services personnel who are trained to provide advanced medical interventions such as advanced airway management and advanced resuscitation (KwaZulu-Natal Department of Health 2001). For the purpose of this study this term refers to ALS trained practitioners who are employed by KZN EMRS and include persons registered with the HPCSA in the following categories: Emergency Care Technician, Paramedic and Emergency Care Practitioner.

Emergency Care Technician (ECT): Emergency medical services personnel who have obtained a mid-level, two year qualification in emergency medical care and who are registered as such with the Health Professions Council of South Africa in terms of the Health Professions Act (Sobuwa & Christopher 2019). For the purpose of this study this term refers to ECT individuals who are employed by KZN EMRS.

Emergency Medical Care: The evaluation, treatment and care of an ill or injured person in a situation in which such emergency evaluation, treatment and care are required, and the continuation of treatment and care during the transportation of such person to or between health facilities (Sobuwa & Christopher 2019).

Emergency Care Practitioner: Emergency medical services personnel who have obtained a Bachelor of Technology or a four year, undergraduate, emergency care qualification and registered as such with the Health Professions Council of South Africa under the auspices of the Professional Board for Emergency Care (Sobuwa & Christopher 2019). For the purpose of this study this term refers to emergency care practitioners who are employed by the KZN EMRS.

Emergency Medical Services (EMS): An organisation or body that is dedicated, staffed and equipped to operate an ambulance, medical rescue vehicle or medical response vehicle in order to offer emergency care (Sobuwa & Christopher 2019).

Risk Factor: Condition or behaviour that increases the likelihood of experiencing significant, adverse effects as a result of exposure to a particular hazard (Sehume 2016). For the purpose of this study this term refers to the likelihood that injury (physical, psychological or social) or disease will result from exposure to occupational hazards within both the pre-hospital environment and the overall healthcare sector.

Health Care Worker (HCW): Person engaged in direct patient care in either public or private health care settings (Sehume 2016). For the purpose of this study this term refers to all paramedical categories and all other in-hospital healthcare professionals.

STRUCTURE OF THE DISSERTATION

Chapter One introduces the study and provides the background to the study. This is done by giving an insight into the burden and repercussions of occupational injuries in the overall healthcare sector and then further narrowing this to focus directly on the EMS environment. The role of and the demand for paramedics in South Africa are discussed in the chapter, as are the general effects of occupational injuries as well as their anticipated effects on KZN EMS provision, taking into consideration the prevailing demand versus the supply of EMS services in KZN according to the statistics. This chapter further presents the purpose and objectives of the study.

Chapter Two presents the literature review which was conducted and which delved into the burden of occupational injuries at both the national and international levels. The chapter further outlines the occupational hazards that are found in the healthcare sector both nationally and internationally. The occupational hazards found in the EMS environment are then further explored. The chapter also provides summaries of previous studies that have been conducted on occupational injuries among paramedics internationally.

Chapter Three briefly explains the research paradigm used in the study based on its four dimensions, and further outlines the research design that was used for the study. The chapter also discusses the locational background to and setting of the study. Furthermore, the chapter also describes the target population, sampling approaches that were used, and the inclusion and exclusion criteria that were applied. The chapter also outlines the data collection tools as well as the data analysis approaches that were used as well as the ethical considerations that were observed.

Chapter Four presents the analysis of the study results which were obtained from the self-administered questionnaire and the review of injuries contained in the duty records. The chapter also presents the demographic data pertaining to the participants, occupational injury data (frequencies and distribution), and the narratives of the correlations that were conducted. Furthermore, occupational injury risk factors as perceived by the paramedics are presented in terms of distributions and correlations with the demographic profiles of the paramedics. Lastly, the chapter presents the paramedics' perceptions of available occupational injury preventive measures.

Chapter Five contains a discussion based on the findings from both the data collection tools (records review and self-administered questionnaires) which were used. This chapter correlates the study findings with the literature review in order to conduct an interpretive and deeper analysis so as to address the study's research objectives. The first part of the chapter discusses the findings from the review of injury contained in the duty records under relevant sections with sub-sections while the second part discusses the findings from the self-administered questionnaires.

Chapter Six presents a summary of the study results, discussion and literature review as well as reflections and conclusions drawn from these results, the discussion and the literature review. The study's limitations and recommendations based on the study findings are also presented.

A list of all references that were used and annexures are included at the end of the dissertation.

CHAPTER 1

INTRODUCTION

1.1. The purpose of the chapter

This chapter provides the background to and the reasons for conducting the study. This was done by briefly discussing the global burden and socio-economic repercussions associated with occupational injuries. In elaborating further, the chapter discusses occupational hazards and the resultant injuries in the overall healthcare sector. This is then further narrowed down to focus directly on the emergency medical services (EMS) profession which is the focal point of the study. The chapter also briefly clarifies the role played by paramedics in South Africa, in general, and in KwaZulu-Natal (KZN) province, in particular, and the possible impact of occupational injuries on the prevailing supply of and demand for EMS in the KZN province. The chapter also presents the research problem as well as the purpose and the main objectives of the study.

1.2. Global and local burden of occupational injuries

Occupational injuries and diseases affect more than 260 million people worldwide per year (World Health Organisation 2010) with about approximately 2.3 million of the 260 million dying. Of the 2.3 million who die approximately 318 000 people die due to occupational injuries while nearly 2.02 million die due to occupational diseases (Takala *et al.* 2014). First world countries are able to provide more comprehensive reports on occupational injuries and illnesses while such data is usually underreported in the developing countries, such as South Africa (Takala *et al*. 2014). Although more than 129 000 occupational injuries were reported between 2015 and 2016 in South Africa (Mafata & Lamati 2016), the reported number (>129 000) may not be a realistic representation of the occupational injuries that occurred during the time period. In fact, the extent of occupational injuries occurring per year may be underrated as a result of the poor reporting structure that exists in South Africa. Nonetheless, South Africa does have a system in place that endeavours to protect employees against workplace injuries.

1.3. The Occupational Health and Safety Act of 1993

In an effort to improve safety practices within the workplace, the South African Occupational Health and Safety Act (OHSA) of 1993 (Act no. 85 of 1993) mandates all organisations to ensure working environments with minimal risks for occupational injuries. This act aims to provide for the health and safety of persons at work, for the health and safety of persons in relation to the activities of persons at work and also to establish an advisory council for occupational health and safety (Occupational Health and Safety Act 1993). In addition, employees are required to take responsibility both for their own health and for the health of those around them by acting responsibly, reporting any hazards in their workplace, and complying with the health and safety measures in their work environment (Sehume 2016). It is extremely important that organisations and employees observe the safety recommendations in order to reduce the occurrence of occupational injuries and the associated repercussions.

1.4. Socio-economic consequences of occupational injuries

The occurrence of occupational injuries has repercussions that extend beyond the affected employee as they also tend to affect family members, community members and even the economy of a country as a whole (Kinoti 2010). Following an occupational injury multiple financial implications also occur, for example, loss of earning due to disability, job losses, salary costs, employee replacement costs, legal costs, costs to the medical insurers, and funeral costs if death has occurred (Lebeau *et al.* 2014). In the event of death as a result of an occupational injury, the families of the deceased employees may become impoverished (Sehume 2016). Occupational injuries and illnesses contribute to a loss of approximately 6% of the affected country's gross domestic product (Takala *et al*. 2014). In the South African context, this amounts to a loss of approximately R720 million in the annual gross domestic product (Statistics South Africa 2019).

At the time of this study South Africa was facing an unemployment rate of 29.1% (6.7 million people unemployed) while unemployment has been named among the contributors to the poverty and increasing crime rates in South Africa (Statistics South Africa 2020, Zizzamia 2018). Job losses due to occupational injuries may, therefore, exacerbate the rate of unemployment, increase the gross domestic product losses, and further worsen the poverty and crimes rate in South Africa. Of the 57% (3.3 billion people) worldwide employment rate, healthcare workers (HCWs) constitute 12%

(Ryder 2020). However, the healthcare industry is one of the occupations with the highest risk of occupational injuries due to the multiple occupational hazards that exist in the healthcare environment (Lekgothoane 2012).

1.5. Occupational hazards and occupational injuries among healthcare Workers (HCWs)

The main responsibility of HCWs is to enhance the health of individuals and populations in various settings (Sehume 2016). However, HCWs operate in an environment that is considered to be one of the most hazardous (Ndejjo *et al.* 2015). A wide range of occupational hazards are found in the healthcare sector, for example, biological hazards, chemical hazards, ergonomic hazards, and psychosocial hazards (Lekgothoane 2012, Sehume 2016). Common biological hazards found in the healthcare sector include bacteria, fungi and viral infections (human immunodeficiency virus (HIV) and the resultant tuberculosis (TB) (Manyele *et al.* 2008).

At the time of the study approximately 3% (170 000) of South Africans were infected with TB (World Health Organisation 2019) while approximately 13.1% (7.52 million people) were living with HIV (Rossouw *et al.* 2014). The high prevalence of TB and HIV infection among the general population in South Africa increases the risk of the transmission of TB and HIV to HCWs in the country when they provide healthcare services to infected persons (Grobler *et al.* 2016). Although the rate of spread of the Hepatitis B virus (HBV) is higher than that of HIV following an exposure to body fluids, the higher proportion (13.1%) of HIV-infected South Africans increases the risk of HIV transmission to HCWs during healthcare interventions in South Africa (Rossouw *et al.* 2014).

Chemical hazards have also been reported as one of the occupational hazards in the healthcare sector (Lekgothoane 2012) with chemotherapeutic drugs and latex rubber gloves constituting such chemical hazards of which the concomitant complications include reproductive risks and allergies respectively (McDiarmid 2006). Although it would appear that these hazards are less prevalent in the South African context, they cannot be ruled out. Ergonomic hazards are also among the very common occupational hazards in the healthcare sector (Sehume 2016) with activities such as load carrying (patient or equipment) and activities involving awkward postures and excessive force constituting such hazards in this sector (D'Arcy *et al.* 2011).

Musculoskeletal injuries are the predominant group of occupational injuries which HCWs experience as a result of exposure to ergonomic hazards (Amaro *et al*. 2018).

Unmanaged stresses, interpersonal violence, verbal abuse, threats, working alone, managerial maladministration, long working hours, shift work and overwork constitute psychosocial hazards (Lekgothoane 2012). Violence is one of the complex and dangerous psychosocial hazards faced by HCW. Intoxicants (drugs and alcohol) and psychiatric disorders are among the common contributors to the workplace violence to which HCWs are exposed (Chhabra 2016). While international HCWs experience workplace violence primarily from patients and their relatives (Pourshaikhian *et al*. 2016), HCWs in South Africa are at an increased risk of encountering violence instigated by criminals (Vincent-Lambert & Westwood 2019).

Occupational hazards have an impact on the physical, mental, and emotional well-being of HCWs (Okeafor & Alamina 2018). The consequences of occupational hazards include job dissatisfaction, absenteeism and increased staff turnover (Chhabra 2016). Thus, occupational hazards pose a threat to the South African healthcare system as they may result in the migration, staff turnover and early retirements of South African HCWs, which has a negative impact on health provision for South African society.

1.6. Occupational hazards and occupational injuries among paramedics

Paramedics are among the HCWs who are at the highest risk of occupational injuries due to the nature of their work environment (Prairie *et al.* 2017). Paramedics' tasks are usually risky while their health and safety are often affected by a variety of occupational hazards which pose threats to both their physical and psychological well-being (Conrad *et al.* 2008). Paramedics are called upon to respond to emergencies such as motor vehicle accidents, building and wildland fires, hazardous material spills, crimes, public disturbances, search and rescue as well as both natural and man-made disasters (Sofianopoulos *et al.* 2011). Thus, paramedics are exposed to a variety of occupational hazards which include, but are not limited to, motor vehicle accidents, assaults, extreme demands on their musculoskeletal systems, hazardous environments, temperature extremes, contact with hazardous and infectious materials, lengthy and erratic working hours, and mental stress (Reichard & Jackson 2010, Crill & Hostler 2005).

Paramedics are vulnerable to musculoskeletal injuries such as sprains, strains and back injuries as a result of their exposure to ergonomic hazards (Maguire *et al*. 2014). While musculoskeletal injuries are a leading cause of worker compensation claims, they are also one of the major causes of absenteeism among paramedics (Roberts *et al.* 2015). Needle-stick injuries are a further major type of occupational injuries among paramedics (Alhazmi *et al.* 2017). Factors such as long working hours, shift work and poorly controlled working environments expose paramedics to the risk of sustaining needle-stick injuries. The major complications associated with needle-stick injuries among paramedics include HIV, HBV and HCV infection (McDowall & Laher 2019). Paramedics are also at risk of encountering assault-related injuries while at work (Pourshaikhian *et al.* 2016). Various circumstances lead to violence and assault against paramedics, for example intoxicants (alcohol and drugs), anger associated with dissatisfaction with the paramedics' services among community members (patients and relatives) and criminal activities (Vincent-Lambert & Westwood 2019). While the workplace may contribute to physical injuries, it also has a huge impact on the psychological well-being of paramedics as it causes fear of future victimisation which may in turn have a significant negative impact on the paramedics' performance (Pourshaikhian *et al.* 2016).

Another significant cause of occupational injuries among paramedics is the fatigue that may occur for various reasons including circadian rhythm disturbances which lead to poor sleep quality, and the physical exhaustion resulting from overworking (Paterson *et al.* 2014). Fatigue has an adverse impact on the paramedics' performance and also increases the risks of driving errors as well as errors during patient care (Sofianopoulus *et al.* 2011). While fatigue is one of the main causes of motor vehicle accidents among paramedics, other factors such as high speed driving and driving in difficult terrain have also been reported (Holgate 2015). In fact, motor vehicle accidents are reportedly the highest contributor of morbidity and mortality among paramedics (Studnek & Fernandez 2008).

1.7. The prevailing need for versus supply of emergency medical services in KwaZulu-Natal

Paramedics are part of the healthcare system and they play an important role in the provision of the pre-hospital care and transportation of critically ill and injured patients

to hospitals for further care (Binks 2011). They are often the first point of contact between the patient and the health system (Williams-Claassen 2013). With the high incidence of interpersonal violence as well as pedestrian and animal related motor vehicle accidents, the need for paramedics in South Africa remains crucial (Govender 2010). At the time of the study KwaZulu-Natal (KZN) province, in particular, was facing high rates of injuries due to assaults (35.5%), accidental injuries (26.2%) and motor vehicle accidents (19.6%). These high rates are associated with the more than 100 000 trauma-related EMS calls per annum (KwaZulu-Natal Department of Health 2015). In addition, the population of KZN province is experiencing high rates of both communicable diseases, such as HIV-TB co-infection (70%), and non-communicable diseases such as hypertension, cancer and diabetes (63%). This provides an indication that, over and above responding to primary calls and mass casualty scenes, KZN paramedics have other notably high responsibilities which include inter-facility transfers and planned patient transportation (KwaZulu-Natal Department of Health 2015).

Paramedics of KZN are required to attend to approximately 1503 emergency calls per week per district, which amounts to approximately 107 cases per 12-hour shift (Finlayson 2017). In addition to the daily primary cases, KZN paramedics are also required to attend to more than 70 inter-facility transfers per day in a district (KwaZulu-Natal Department of Health 2015). The number of vehicles and EMS staff available are usually not sufficient to attend to the number of cases allocated per day, as is evident by both the failure to meet the required response times by KZN paramedics and the number of cases that are always outstanding at the beginning of every EMS shift in the province (Finlayson 2017). In addition, the population of KZN province totals more than 11 million while more than 9 million people do not have medical insurance and, thus, depend on the state for any form of medical treatment, including EMS (Finlayson 2017, Statistics South Africa 2019). In contrast, the number of paramedics employed by the KZN Emergency Medical Rescue Services (EMRS) is under 3000, thus making an ambulance to population ratio of 1: 48 660 which is far below the national target of 1:10 000 (KwaZulu-Natal Department of Health 2015).

It is a known fact that occupational injuries are associated with high employee turnover rates, shortened careers and reduced productivity (Maguire *et al.* 2005, Sehume 2016). It is, therefore, clear that, when the well-being of paramedics is negatively

affected, absenteeism is likely to occur with high absenteeism being associated with poor patient care and poor health outcomes (Lekgothoane 2012). At the time of the study the demand for paramedical services in the KZN province was exceeding the supply of such services. Consequently, occupational injuries among KZN paramedics may further reduce the human resources through absenteeism and staff turnover, thus causing a further burden on an already over-burdened health care system. As a result, it was deemed important to analyse the trends and extent of occupational injuries in paramedics in KZN so that informed decisions may be taken to address the problem.

1.8. Research purpose and objectives

The purpose of this study was to describe the prevalence and risk factors associated with occupational injuries among paramedics working in the KZN EMRS as well their perceptions of the mitigation and prevention of occupational injuries.

The main research objectives of the study included the following:

- To describe the prevalence of occupational types of injuries with regards to demographic profile (i.e. age, gender, occupation and workstation),
- To determine risk factors (e.g. exposure to hazardous material, crime and public disturbances and motor vehicle accidents during response to scenes) for occupational injuries with regard to demographic profile (i.e. age, gender, occupation and workstation), and
- To describe the paramedics' perceptions of mitigation and prevention of occupational injuries.

1.9. Conclusion

The foundation for this research project was presented in this chapter. The chapter outlined the introduction to and background information about the study as well as the problem statement. In addition, the research purpose and research objectives were explained and key definitions provided to ensure the intended understanding of the key terms used in the study. The next chapter contains a review of existing literature relevant to the study.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The aim of this chapter was to review existing literature on occupational injuries within the healthcare sector, with specific focus on the emergency medical services (EMS) environment. As indicated by Maree (2016), the main purpose of a literature review is a critical analysis of the literature, or research, related to a specific topic or research question in an attempt to establish a theoretical foundation for the intended study. The review in this chapter focused on existing literature on the occupational hazards found in the healthcare sector, in general, and in the EMS industry, in particular, the types of occupational injuries that are common among EMS personnel and, lastly, on the suggested strategies to mitigate the prevalent occupational injuries.

2.2. Search strategy

For the purposes of this literature review, a document search method, using various internet search engines, was used to identify and gather relevant studies and reports from international agencies such as the World Health Organization (WHO) and the International Labour Organization (ILO). In order to obtain sources with full text, the Durban University of Technology's research library SUMMON search database was utilised. The library was consulted to access research books, journals, Acts and Government reports, and scientific journal articles. The search included both local and international literature on occupational health and safety among HCWs. The researcher reviewed the gathered documents and here the review considered areas such as the legislative framework, occupational hazards in health care settings, occupational injuries among HCWs, as well as preventive and control measures that can be used to reduce workplace hazards in health care settings.

Specific keywords and/or key sentences that were likely to represent particular biomedical concepts referred to as Medical Subject Headings (MeSH) were used to search and retrieve information relating to the focus area of the study. These MeSH labels listed in table 2.1, were used across several interfaces including; Google Scholar, Science Direct, PubMed, Nexus and Ebscohost. Other sources searched included sites of the South African Government (e.g. Department of Health), and

Statistics South Africa. Databases managed and updated by South African institutions of higher learning including the Durban University of Technology and the University of KwaZulu-Natal were also searched in order to obtain the unpublished studies (grey literature) that had been conducted as part of Master's and Doctoral studies. The key search words and sentences that were used are presented in table 2.1.

Table 2.1: MeSH terms

Emergency medical technicians
Epidemiology of occupational injuries among healthcare providers
Violence against healthcare personnel
Occupational injuries among paramedics
Emergency medical technicians and traffic collisions
Occupational injuries among emergency care personnel
Occupational injuries among healthcare workers
Global burden of occupational injuries
Economic burden of occupational injuries
Occupational injuries in Southern African paramedics
Risks of occupational injuries in paramedics
Occupational injury prevention strategies
Musculoskeletal injuries in paramedics
Assault on paramedics
Violence against paramedics
Needle-stick injuries in paramedics
Burden of HIV in South Africa
Effects of fatigue on paramedics' performance

2.3. Occupational health and safety in South Africa

The South African Occupational Health and Safety Act (OHSA), 1993 (Act no. 85 of 1993) affirms that each employer has a responsibility to bring about and maintain a work environment that is safe and without risks to the health and safety of the workers. The main objectives of this act include provision for the health and safety of persons at work, the health and safety of persons in relation to the use of plant and machinery;

the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; the establishment of an advisory council for occupational health and safety and provision for matters connected herewith (Occupational Health and Safety Act No. 85 of 1993).

In order to achieve its objectives, this act directs employers to ensure the display of a written and signed occupational health and safety policy for employees; provision of safe and good working machinery; elimination of hazards and risks during and beyond working processes; supply of personal protective equipment and identification of hazards, articles and substances produced in relation to work processes. On the other hand, employees also have a duty to take responsibility for their health and that of those around them by acting responsibly, reporting any hazards near either them or other employees and complying with the health and safety measures of their work environment (Occupational Health and Safety Act No. 85 of 1993).

More than 260 million people are affected by occupational injuries and diseases worldwide per year. This is associated with an average of three lost workdays per casualty and more than two million deaths each year (World Health Organisation, 2010). During the 2015/2016 financial year, approximately 129 170 compensation fund claims were lodged in South African as a result of occupational injuries and diseases (Mafata & Lamati 2016). While first world countries usually provide comprehensive reports on occupational injuries and illnesses, developing countries, such as South Africa, usually underreport the extent of occupational injuries (Takala *et al*. 2014). Thus, the reported number in the developing countries could be significantly less than the actual workplace injuries that occurred in the said time period. Occupational injuries (both fatal and non-fatal) place a tremendous burden on workers and their families as well the economy and society (Concha-Barrientos *et al.* 2005). The next section discusses the socio-economic consequences of occupational injuries.

2.4. Socio-economic consequences of occupational injuries

Occupational injuries are a significant public health issue that extends beyond the boundaries of the worker who has been directly affected. In addition to affecting the injured worker, the occurrence of an occupational injury also affects the co-workers of

the injured worker, the family members, other members of the community and even the country's economy at large (Kinoti 2010, Manyele *et al.* 2008). The burden of both occupational injuries and diseases is often particularly severe in instances where the death or disability occurs in the case of an employee who is the primary income earner in his/her household because the impact of such death or disability will extend to the family and often the community at large. Such repercussions may include the descent into poverty of the family and even the community, especially in developing countries, and, on a broader scale, the advent of negative economic development in the affected countries (Sehume 2016).

Occupational injury repercussions also affect other entities such as medical care providers, insurance administrators and, in some instances, legal administrators. In addition, the impact on these entities is often associated with reduced productivity which in turn may affect the economy (Dembe 2001). According to Lebeau *et al.* (2014), the costs of occupational injuries may be grouped into the following three (3) categories, namely, direct cost, indirect cost and human cost. In their study Lebeau *et al.* (2014) highlight the costs arising from occupational injuries, for example, medical costs, funeral costs in instances where death has occurred as a result of an occupational injury, salary costs, productivity losses, administrative costs as well as the costs of pain and suffering.

Recent statistics indicate that 29.1% (6.7 million) of the economically active (aged between 15 and 64 years) South Africans are unemployed (Statistics South Africa 2019). Unemployment is a major contributor to the poverty and higher crime rates in South Africa (Zizzamia 2018). Furthermore, the majority of working individuals in South Africa bear the burden of supporting numerous dependants in their families although they often earn very little in relation to the cost of living. The economic impact of unemployment in South Africa is evident in both the declining gross domestic product and the increase in transfer payments by the government, such as social grants. However, in the long term this is unsustainable and increases government expenditure (Malakwane 2012). It is, therefore, clear that morbidity and/or mortality due to occupational injuries may be associated with major socio-economic repercussions on the South African population.

Worldwide HCWs represent 12% of the working population. However, they operate within an environment which is considered to be one of the most hazardous working environments (Ndejjo *et al.* 2015). The primary responsibility of HCWs is to enhance the health of individuals and populations in various settings (Lekgothoane 2012). On the other hand, the HCWs' work involves permanent contact with patients, chemicals and specific procedures which constantly expose them to the risks of occupational injuries and diseases. It is, therefore, essential that, in order to safeguard the HCWs, the occupational injury risk factors must be discovered, quantified and, where possible, minimised within their working environment (Manyele *et al.* 2008). The next section discusses the occupational hazards which are found in the healthcare environment.

2.5. Risks of occupational injuries among healthcare workers

The National Health Act, 2003 (Act No. 61 of 2003) aims to protect HCWs from occupational hazards and the resultant injuries. According to section 20 of the National Health Act, HCWs should be provided with a work environment with minimal injury and disease transmission risks. The act further states that HCWs may refuse to render health services to individuals who are physically, verbally and/or sexually abusive towards them (National Health Act No. 61 of 2003). However; as is the case in many other occupations, the healthcare industry is also characterised by a wide range of occupational hazards which expose the HCWs to the risk of occupational injuries. Some of the occupational hazards within the healthcare sector (table 2.2) include biological, chemical, ergonomic and psychosocial hazards (Lekgothoane 2012, Sehume 2016). These occupational hazards are discussed in the subsections below.

Table 2. 2: Occupational hazards found in the health care sector

Hazard category	Examples	Health effects
Physical hazards Agents or physical forms of energy	Radiation, lasers, noise, extreme temperatures, electrical energy.	Thermal or chemical burns, hearing loss, cancer, physical and psychological trauma.
Chemical hazards Chemical substances that are potentially toxic, including medications, solutions and gases	Disinfectants, cleaning products and sterilants such as ethylene oxide, formaldehyde; drugs, waste anaesthetic gases, hazardous anticancer drugs.	Eye and skin irritation, asthma, allergy, dermatitis, end organ damage, cancer reproductive effects
Biological hazards Infectious agents such as bacteria, viruses, fungi, or parasites which may be transmitted by blood borne contacts, contaminated body secretions, needle-stick injuries or via airborne spread.	HIV, Hepatitis B and C, Influenza, MERS, SARS	HIV and AIDS, TB, hepatitis, liver cancer and other diseases.
Mechanical hazards Factors in the work environment that may cause or lead to musculoskeletal injuries, strains, or discomfort. Awkward postures, lifting excessive weight, and other factors causing musculoskeletal strains.	Lifting and moving patients, tripping and slipping, fall hazards	Musculoskeletal disorders, back and upper injuries, repetitive strain injuries.
Psychosocial stressors Stressful work climates, threats of physical violence, work organisation, shift work.	Workplace threats, bullying, physical violence, and unsafe unit design	Physical injuries, psychological stress.

Source: McDiarmid (2014).

2.5.1. Biological hazards

Biological hazards originate from hazardous biological agents which are described as the main causative agents of healthcare occupational diseases. These agents are defined as “any disease causing microbes which result in infections, allergy, toxicity and any form of ill-health that affects HCWs” (Sehume 2016). The most common hazardous biological agents include bacteria, viruses and fungi which are parasites

that are transmitted through contact with infected patients or contaminated body secretions or fluids. These may either be airborne, for example, tuberculosis (TB), or blood borne, for example, the human immunodeficiency virus (HIV) (Manyele *et al.* 2008).

At the time of the study approximately 3% (170 000) of South Africans were infected with TB (World Health Organisation 2019). The majority of TB cases in the developing countries, including South Africa, are found in hospitals while more than 50% of the HCWs in these countries are suspected of carrying the dormant TB (Lekgothoane 2012). Approximately 1.4% of the HCWs in South Africa are reported to have confirmed TB infection, while nearly 80% are carrying the latent TB. Among the HCWs in South Africa, TB is the third most commonly reported occupational disease (Grobler *et al.* 2016). Factors such as poor TB prevention measures in South African health institutions, over-crowded healthcare facilities, and insufficiently ventilated facilities increase the risk of TB infection among South African HCWs. Furthermore, the higher prevalence of HIV infection among South African HCWs increases the risk of TB-HIV co-infection. TB infection among HCWs often contributes to absenteeism, morbidity and mortality. These events are associated with the weakening of the already over-burdened South African healthcare system (Grobler *et al.* 2016).

The three high risk, blood-borne pathogens which commonly affect HCWs include Hepatitis B infection, Hepatitis C infection and HIV infection. Statistics at the time of the study indicated that approximately 13.1% (7.52 million people) of South Africans were living with HIV. This therefore increases the risk of HIV infection among HCWs (Statistics South Africa 2019). Hepatitis B has the highest risk of infection among the blood borne pathogens (30%), followed by Hepatitis C (1–2%) and, lastly, HIV infection (0.3%). However, due to the higher prevalence of HIV infection in the South African population, the estimated HIV infection (17.9%) among HCWs is higher than that of Hepatitis B (0.2 – 16%) and Hepatitis C infection (2.4%) (Rossouw *et al.* 2014). In an effort to reduce the rate of infection with blood borne pathogens among HCWs, most healthcare facilities recommend that standard universal precautions (figure 2.1) should always be followed, regardless of the perception of risk in relation to the procedure and/or the patient (Rossouw *et al*. 2014).The high HIV infection rate among HCWs may be associated with factors such as psychological stress (fear of

discrimination and/or stigmatisation), low morale, burnout, absenteeism, poor motivation and poor performance. Furthermore, the higher perception of the HIV infection risk may cause HCWs to migrate to either non-health professions or international health institutions with better pay and better working conditions. Such circumstances eventually lead to the depletion of human resource and the weakening of the health system (Ndejjo *et al*. 2015).

Barrier precautions – Wear gloves when:

- In contact with blood and body fluids, mucous membranes, or non-intact skin of all patients.
- Handling items or surfaces soiled with blood or body fluids
- Preforming venipuncture and other vascular access procedures
- Double gloves for all invasive procedures
- Change gloves during long procedures and after contact with each patient.
- Wear masks, protective eyewear and face shield when performing procedures that are more likely to generate droplets of blood or body fluids

Hand washing – Wash hands and other skin surfaces:

- Immediately and thoroughly if contaminated with blood or other body fluids directly after gloves are removed.

Preventing sharps injuries

- Do not recap, remove from disposable syringes, or manipulate needles by hand. Immediately place all disposable syringes and sharp items in puncture resistant containers for disposal.

Minimizing mouth-to-mouth resuscitation

- Equip all areas where resuscitation is likely to be performed with mouthpieces, resuscitation bags and other ventilation devices.

Healthcare workers with exudation lesions or weeping dermatitis

- Refrain from patient care and handling patient care equipment until the condition resolves.

Figure 2. 1: Standard universal precautions for protection against biological hazards (Rossouw *et al.* 2014)

2.5.2. Chemical hazards

Chemical hazards in the healthcare industry include the commonly used detergents, disinfectants, antiseptics and other cleaning material, latex rubber gloves and toxic drugs in health care workplaces that may potentially be dangerous to those who come into contact with them (Sehume 2016, Lekgothoane 2012). Exposure to these agents may inadvertently pose threats to HCWs such as allergic reactions. Latex allergy is a growing problem among healthcare workers with prevalence rates of 10% and reactions ranging from local contact dermatitis to systemic reactions and anaphylaxis (Manyele *et al.* 2008, Sehume 2016). Other agents that constitute chemical hazards include chemotherapeutic agents which have been found to be genotoxic and which pose reproductive risks (McDiarmid 2006). Although some studies (McDiarmid 2014, Izadi & Piruznia 2017, Sehume 2016, Lekgothoane 2012) have highlighted the potential adverse effects associated with chemical hazards that are present in the healthcare sector, there are fewer studies showing the prevalence and effects of chemical hazards among HCWs. A study conducted by Ndejjo *et al.* (2015) indicated that chemical hazards were one of the 10% (n = 20) “other” non-biological hazards to which HCWs in Uganda are exposed. The study did not, however, provide specific details relating to the prevalence of chemical hazards alone. Another study (comprising 1099 paramedics) was conducted by Bridgewater *et al.* (2006) with the following four main objectives, namely, to determine the incidence of latex allergy; to consider possible factors associated with the development of latex allergy; to compare the characteristics of the surveyed groups; and to reinforce the development of an educational programme. The study discovered various latex related complications, including atopy (14.9%, n = 164), hand dermatitis (9.4%, n = 103), and latex allergy (6.4%, n = 70). Although actual statistics regarding the exposure to chemical hazards of HCWs have not been established, the World Health Organisation (2018) has, however, indicated that the repercussions associated with chemical hazards include morbidity and immigration among HCWs which eventually lead to workforce shortages and which adversely affect the provision of health care.

2.5.3. Ergonomic hazards

The ergonomic hazards found in the healthcare industry include factors such as load carrying, excessive force, awkward posture and heavy lifting (Sehume 2016). These hazards commonly occur in situations where HCWs are involved in the manual handling of sick, obese and immobile patients who require lifting, turning and transferring with the HCWs having to adopt awkward postures in order to carry out the necessary procedures (D'Arcy *et al*. 2011). Musculoskeletal injuries make up the predominant group of occupational injuries which HCWs experience as a result of their exposure to ergonomic hazards (Amaro *et al.* 2018). The factors which contribute to musculoskeletal injuries may be divided into extrinsic and intrinsic factors. Examples of extrinsic factors include tasks which require manual handling, lifting heavy loads and inadequate support infrastructure while the intrinsic factors include low job satisfaction, the age of the HCWs and the body size variations of the HCWs (Kumalo 2014).

A study conducted by Ngan *et al.* (2010) established that musculoskeletal injuries made up 83% (n = 944) of occupational injuries among Columbian HCWs while the majority of such injuries occurred as a result of awkward postures, slips and falls (25%). A study conducted by Hamid *et al.* (2018) indicated that, among the ergonomic hazards reported by HCWs in Pakistan, the most common included muscle aches and sprains (76.5%), elbow/wrist/neck pain (56%), body posture issues (56%), excessive stretching of muscles (67.5%) and bending/ twisting at work (55.5%). Musculoskeletal injuries are not immediately apparent and they may take days, months or even years of exposure before the worker is affected (Burton 2010). Musculoskeletal injuries are associated with the prolonged absenteeism from work which is associated with reduced productivity (Ngan *et al*. 2010). Other repercussions of musculoskeletal injuries include increased disability, increased costs to the employer, pain and suffering as well as wage losses on the part of the affected employee (Aljerian *et al.* 2018). The costs associated with musculoskeletal injuries include both direct and indirect costs, such as periods of incapacity to work due to illness, hiring and training new employees during periods of absence of existing employees, and the adverse effects on production and the quality of work (Amaro *et al.* 2018). These are all extremely undesirable considering the prevailing demand versus supply issues facing healthcare services in South Africa.

2.5.4. Psychosocial and physical hazards

Unmanaged stresses, negative interpersonal relations, verbal abuse, threats, working alone, management maladministration, long working hours, shift work and overwork all constitute psychosocial hazards (Lekgothoane 2012). A study conducted by Ndejjo *et al.* (2015) found that psychosocial hazards (physical, psychological, sexual and verbal abuse) constituted 10% of the occupational hazards encountered by HCWs in Uganda. Violence is one of the complex and dangerous psychosocial hazards faced by HCWs while intoxicants (drugs and alcohol), and psychiatric disorders are among the common contributors to workplace violence experienced by HCWs (Chhabra 2016).

Psychosocial hazards (particularly violence) are common in the healthcare sector in South Africa. The following examples of incidences relating to violence against both in-hospital and out-of-hospital HCWs were reported in South Africa in 2019. On 29 June 2019, three men were reported to have entered a hospital in Johannesburg City in search of a man whom they had earlier assaulted and injured. This incidence resulted in damages to the property and the intimidation of HCWs (Fambisa 2019). Another incident was reported in KwaZulu-Natal when two men entered a clinic in the early hours of the morning (about 03h00) and fled with valuable items including computers, a microwave and a television (KwaZulu-Natal Health Department 2019). On 26 June 2019 a reported robbery at gunpoint took place when paramedics responded to an emergency in Soweto in Gauteng while, on the same day, a similar incidence took place in the Phoenix area in KwaZulu-Natal (Monama 2019). In mid-June 2019 there were other reports of fake EMS calls made in the City of Cape Town and, upon arrival at the reported scene, two female paramedics were sexually assaulted (Monama 2019). These are just a few of the incidences that have occurred and which indicate the extremely hazardous work environment in the healthcare industry in South Africa.

Psychosocial hazards have an impact on the physical, mental and emotional well-being of HCWs (Okeafor & Alamina 2018). The repercussions of psychosocial hazards include low job satisfaction, absenteeism and high staff turnover, poor quality control of work, poor work relations and emotional exhaustion (Chhabra 2016). It is, therefore, clear that these hazards pose a threat to the South African healthcare system as they

may result in increased staff turnover and also adversely affect the provision of health to the South African people.

2.6. Risks of occupational injuries among paramedics

Paramedics are among the HCWs who are at the highest risk of occupational injuries due to the nature of their work. The role of paramedics in the health systems is the provision of pre-hospital emergency care and the transportation of critically ill and injured patients to healthcare facilities. With the high rates of trauma and the increasing burden of communicable diseases in South Africa, paramedics remain an essential part of the healthcare system (Binks 2011). The paramedics' tasks are usually hazardous and their health and safety are generally affected by a variety of occupational hazards which pose threats to both their physical and their psychological well-being (Sehume 2016). Paramedical interventions are usually carried out by teams comprising two paramedics and require a high degree of physical and mental effort under varying environmental conditions (Conrad *et al*. 2008).

Paramedics respond to emergencies such as motor vehicle accidents, building and wildfires, hazardous material spills, crimes, public disturbances, search and rescue operations, natural and man-made disasters. Paramedics are, therefore, during their interventions, exposed to a variety of occupational hazards which include, but are not limited to, motor vehicle accidents, assaults, extreme demands on their musculoskeletal systems, hazardous environments, temperature extremes, contact with hazardous and infectious materials, lengthy and erratic work hours, and stress (Reichard & Jackson 2010). Paramedics are often faced with difficult clinical cases and workloads that are physically, mentally and emotionally demanding. During their interventions, paramedics provide emergency care and, in 83% of situations, they evacuate patients on stretchers which involves the use of excessive physical efforts while lifting, pushing or pulling (Prairie *et al.* 2017). In addition, as a result of their erratic and usually busy hours of work, paramedics are also exposed to fatigue. This fatigue affects both mind and body and often results in paramedics not being able to function optimally. This may increase the risk of their causing accidents during driving and/or errors which may contribute to injuries while they perform their patient care duties (Sofianopoulos *et al.* 2011).

As previously mentioned, in the main an occupational injury event affects various areas in society, starting directly with the injured employee, then extending to family members and co-workers and, finally, the economy (Kinoti 2010). The occupational injuries suffered by paramedics may, therefore, be said to be associated with personal health consequences, high employee turnover rates, shortened career span and, ultimately, a reduction in the emergency medical services provided to society (Maguire *et al.* 2005). It is, therefore, important that occupational injuries among paramedics are prevented in order to maintain quality standards in the EMS provision to society. Occupational injuries are largely preventable by improvements aimed at making the work performed both safer and healthier. Thus, effective administrative policies, health and safety information, and education to promote safety attitudes and behaviours are needed worldwide (Concha-Barrientos *et al.* 2005).

The South African Occupational Health and Safety Act of 1993 aims to provide for the health and safety of persons at work. On the other hand, it is the responsibility of the employees to abide by the recommended safety measures in order to ensure their own safety as well as that of their colleagues and other personnel who may be either directly or indirectly affected by their operations. However, despite these directives, it is evident that the risks of occupational injuries continue to exist and workplace injuries still occur. The healthcare profession is no exception. The occupational hazards linked to the healthcare profession include, but are not limited to, biological hazards, chemical hazards, environmental hazards and psychosocial hazards. The prehospital milieu, in particular, poses increased risks of occupational injuries such as musculoskeletal injuries (for example, sprains and strains), assault-related injuries and exposure to harmful substances (for example, needle-stick injuries). The following section discusses specific occupational injuries that have been identified among the EMS personnel together with the risk factors as well as some prevention strategies that have been suggested by various researchers.

2.7. Previous studies on occupational injuries among paramedics

2.7.1. Musculoskeletal injuries

Musculoskeletal injuries comprise a wide range of conditions that affect tendons, muscles, ligaments, bones, peripheral nerves and blood vessels and often resulting in pain, discomfort and impaired mobility. The common end results of musculoskeletal

injuries include reduction in productivity, increased disability, increased costs to the employer, pain and suffering as well as a loss of wages for the affected employee (Aljerian *et al.* 2018, Maguire *et al*. 2014). Physical risk factors in respect of musculoskeletal injuries in EMS include awkward postures, repetitive motions, high force requirements, and extended reaching. Patient lifting places high physical demands on paramedics while other factors such as the uneven distribution of the body and unpredictable human behaviour during lifting are among the factors contributing to musculoskeletal injuries (Fisher & Wintermeyer 2012). During the transfer of patients from hospital beds to ambulance stretchers or vice versa, bed sheets are commonly used in order to drag the patients. However, this increases back loading and may result in potential injuries to the paramedics. Other awkward postures commonly occurring may be attributed to paramedics having to treat patients in confined ambulance compartments while the ambulance is in motion (Fisher & Wintermeyer 2012). Back injuries are extremely common among EMS and often result in lost work days and numerous worker compensation claims (Heick *et al.* 2009). The following discussion is based on three studies which compared occupational injury rates and types between EMS personnel and other healthcare workers.

Maguire *et al.* (2005) conducted a study which aimed to describe the epidemiology of occupational injuries among EMS personnel, calculate injury rates, and compare the findings with those pertaining to other occupational groups. This retrospective review of injury records demonstrated that sprains, strains, and tears were the leading causes of lost work days among EMS personnel. The study further indicated that the most frequent injuries were to the back and that, in the main, these back injuries were usually the result of patient lifting. Other factors which contributed to back injuries were falls and assault-related injuries. Roberts *et al.* (2015) investigated the occupational prevalence of musculoskeletal and mental injury among paramedics in comparison with other HCWs (nurses and social welfare professionals) using workers' compensation claims statistics. Their study demonstrated that paramedics' compensation claim rates were approximately five times higher than the rates for nurse professionals, carers, aides and social and welfare professionals. The study further indicated that musculoskeletal injuries accounted for more than half of all workers' compensation claims among the occupational groups. Reichard and Jackson (2010) conducted a study which characterised injuries among EMS personnel, fire

fighters, and police officials by using data from the National Electronic Injury Surveillance System for injuries treated in U.S. hospital emergency departments between 2000 and 2001. Their study demonstrated that the most common injuries among EMS personnel were sprains and strains (41%), followed by contusions and abrasions (13%). Sprains and strains often occurred to the lower trunk (49%) and frequently resulted from a task involving bodily motion (81%) while a few of the sprains and strains (8%) resulted from transportation incidents involving motorised road vehicles.

The findings from the studies above indicated that musculoskeletal injuries are common in the EMS profession (Roberts *et al.* 2015, Maguire *et al.* 2009, Fisher & Wintermeyer 2012, Reichard & Jackson 2010). Prairie *et al.* (2017) suggested the following strategies which may be used to reduce the frequency of musculoskeletal injuries during patient handling, for example, teamwork during patient stretcher handling, consistently giving clear signal in order to synchronise lifting among paramedics, avoiding lifting the stretcher with one hand, decreasing the lifting height of the patient and stretcher into the ambulance by changing the design of the ambulance and/or stretchers, avoiding holding additional equipment in one hand or on the shoulder during patient lifting, making attempts to minimise the slipperiness of the surface outside the ambulance, installation of visual and/or auditory feedback signals that will indicate once the ambulance stretcher has been secured on the safety system of the ambulance, and training paramedics on the factors which either facilitate or hinder their work.

2.7.2. Needle-stick injuries

Needle-stick injuries are extremely common in EMS worldwide (Alhazmi *et al.* 2018). Reichard and Jackson (2010) reported 21% of needle-stick injuries among EMS personnel in the United States. Needle-stick injuries are defined as puncture wounds to the skin or mucous membrane with unsterilized and/or contaminated objects (McDowall & Laher 2019). Paramedics are constantly exposed to blood in their work and this is associated with the increased risk of exposure to infectious diseases (Alhazmi *et al.* 2018). The risk of needle-stick injuries in the EMS is aggravated by factors such as long working hours, shift work, uncontrolled working environments and treating patients in the back of a moving vehicle (Alhazmi *et al.* 2018). The three major

concerns associated with needle-stick injuries include HIV infection, Hepatitis B infection and Hepatitis C infection. Although the Hepatitis infection risk is higher than that of HIV following a needle stick injury, the high rates of HIV infection in the South African population increases the risk of contracting HIV infection over Hepatitis (Rossouw *et al.* 2014). This is, therefore, the reason why the majority of post exposure prophylaxis protocols tend to focus more on HIV than on Hepatitis in South Africa (McDowall & Laher 2019). The findings from two studies that recently investigated the knowledge and practices of EMS personnel as well as the prevalence of needle-stick injuries among EMS personnel are discussed below.

Alhazmi *et al.* (2018) conducted a cross-sectional study that aimed to assess the knowledge of EMS personnel regarding needle-stick injuries, and the practice of standard precautions among EMS personnel. The study found that 18% (n = 45) of the EMS personnel had been previously exposed to needle-stick injuries within the 12 months preceding the study. It further emerged from the study that the age and years of experience of the EMS personnel were associated with needle-stick injuries with the older, more experienced personnel and also personnel with a higher certification level reporting more needle-stick injuries in the preceding 12 months. However, the reasons for this finding were not identified. The study also discovered that female EMS personnel were more prone to exposure to needle-stick injuries, specifically in urban areas, although there was no indication of a gender difference in rural areas regarding increased needle-stick injuries.

McDowall and Laher (2019) conducted a study comprising 240 EMS personnel with the aim of investigating the cumulative incidence, knowledge, attitudes, and practices pertaining to needle-stick injuries among a selected group of EMS personnel in Johannesburg. The study revealed that 26.3% (n = 63) of the participants had previously sustained at least one needle-stick injury. The study also identified that 4.3% (n = 3) of the needle-stick injury victims had not undergone testing for HIV within 72 hours following a needle-stick injury, while some had failed to comply with the recommended follow-up intervals (6 weeks and 4 months). The study further discovered that 17.1% (10) of the affected participants had not completed the recommended 28 day HIV post exposure prophylaxis regimen. The study also found that very few victims were tested for Hepatitis infection compared to HIV infection.

Although the exact reasons for the above findings that contributed to the issues above were unknown, the following were believed to be among the contributing factors – lack of awareness of Hepatitis B and C infections, guidelines that are more focused on HIV post exposure prophylaxis over Hepatitis B and C, and the adverse effects associated with HIV post exposure prophylaxis medication. In conclusion, therefore, McDowall and Laher (2019) recommended the development and implementation of practical-based educational programmes that would identify and rectify sub-optimal practices by EMS personnel in relation to needle-stick injuries.

2.7.3. Assault-related injuries

Workplace violence is defined as any incident in which a person is threatened or attacked at work under certain circumstances with workplace violence referring to an aggressive act that includes physical or verbal assault, insult and/or verbally intimidating behaviour that occur at work (Pourshaikhian *et al*. 2016). Physical violence refers to acts such as pushing, punching, kicking, grabbing, and/or any type of physical aggression while verbal violence includes acts such as annoying behaviours, emotional abuse and aggression (Pourshaikhian *et al*. 2016). While performing their duties, paramedics are sometimes exposed to violence which may be inflicted by patients, family members and/or bystanders (Mechem *et al.* 2002).

South African paramedics are often required to respond to incidents where they assist the victims of crime and violence. In some instances, the paramedics arrive on such scenes before the arrival of the police and the situation remains unpredictable. Operating in such potentially hostile environments places paramedics at an increased risk of becoming the victims of crime and violence (Vincent-Lambert & Westwood 2019). The physical abuse encountered by paramedics is usually as a result of their interactions with patients and bystanders (Holgate 2015). However, in addition to the abuse arising from their interactions with patients and bystanders, paramedics may experience physical abuse as a result of violent behaviour on the part of criminals. Paramedics may be easily targeted by criminals as they are usually unarmed, they travel into high-crime areas and they often enter these areas after dark. They may, therefore, be attacked by criminals who wish to steal items such as valuable medical equipment, drugs, cell phones and electronic tablets (Vincent-Lambert & Westwood 2019). Such acts of violence may result in injuries to paramedics. This is often followed

by a fear of future victimisation which is an occupational stressor that may affect both the performance and general well-being of paramedics. This fear may also have a negative impact on employee retention as some paramedics may leave the profession due to their concerns about their personal safety (Mechem *et al.* 2002). The following discussion reports on the findings of three studies which investigated the prevalence, contributing factors and mitigating strategies in relation to the assault injuries suffered by paramedics.

Mechem *et al.* 2002 conducted a study which aimed at determining the nature and frequency of injuries resulting from assaults on paramedics and firefighters in a large, fire department-based EMS system. Their descriptive study involved a retrospective analysis of an occupational injury database whereby all injury reports involving assaults from 1996 to 1998 were reviewed. The study indicated that 79.5% (n = 35) of the assault cases involved paramedics, and 20.5% (n = 9) involved firefighters. The study further discovered that 93.2% (n = 41) of injuries occurred during patient care activities. The following were the most common types of injuries due to assault, namely, contusions (35.7%), strains/sprains (17.9%), and scratches (12.5%).

Holgate (2015) conducted a study which aimed to assess the perceptions of South African paramedics regarding their personal and patient safety in the EMS environment. The study utilised a prospective, quantitative, internet-based survey design. A total of 158 responses were deemed eligible for the analysis which was performed. The majority (57%; n = 89) of the paramedics who participated in the study were employed in the urban ground ambulance services. The findings of the study indicated that 56% (n = 88) of the paramedics had been assaulted while at work and that the majority of those assaulted were male paramedics (66%, n = 58). The study further discovered that physical abuse (45.5%, n = 25) and verbal abuse (20%, n = 11) were the commonly reported types of abuse among paramedics. The commonly reported forms of abuse (both physical and verbal) cited in the study included swearing, spitting, biting and stabbing, either in a violent situation or because the patient was behaviourally challenged. In the reported violence cases the perpetrators were patients (67.3%, n = 37), bystanders (18.2%, n = 10) and colleagues (9.1%, n = 5).

A further study was conducted by Pourshaikhian *et al*. (2016) to review the literature on violence against EMS personnel. The results of the study showed that various types violence directed at EMS had previously been documented. The documented types of violence included physical violence (79%), verbal abuse (82%) and sexual harassment (28%). In the majority of cases it was found that the patients and their relatives were the perpetrators of violence against EMS personnel and that men were more exposed to violence compared to women. The results of the study also revealed that, in most cases, women were more exposed to sexual assault. The study further highlighted that violence against EMS personnel was underreported as most employees believed it was either insignificant or that it was part of their job. Other factors associated with the underreporting included the fear of being judged negatively by their managers and the fear of revenge. The study further discovered that violence against EMS personnel was associated with various complications such as physical injury, post-traumatic stress disorder and decreased job satisfaction which have an impact on patient care.

Pourshaikhian *et al*. (2016) further discovered that the shortage or lack of formal education on workplace violence was among the major contributors to violence against EMS personnel. This violence often followed delayed response times which had angered the patients and/or family members, drug or alcohol abuse, and/or psychological disorders. Other predisposing factors were the absence of police officers at the scene, occurrence of death, and a lack of skills or incompetency on the part of the EMS personnel. Accordingly, in order to reduce EMS workplace violence, Pourshaikhian *et al*. (2016) recommended the following, namely, the establishment of formal guidelines or training programmes to reduce and control workplace violence in the EMS, legislation and appropriate laws to protect on duty EMS personnel, public education on the duties of EMS personnel and the improvement of response times.

2.7.4. Effects of fatigue

Fatigue on the part of paramedics occurs due to three primary causes, namely, sleep/wake history, circadian factors, and task related factors (Paterson *et al.* 2014). The circadian rhythm regulates various physiological functions such as the ability to initiate and maintain sleep in a 24 hour cycle. The circadian rhythm suggests that one should be awake during the day and asleep during the night. This pattern is influenced by the secretion of the melatonin hormone (sleep regulating hormone) which is

increased during the night and reduced during the day. Thus, an awake period that occurs during the physiologically sleeping period (night) is often characterised by impaired functioning and fatigue. However, shift work contributes to changes in the sleeping pattern of an individual (e.g. working at night and sleeping during the day), and these changes are usually associated with prolonged awake periods and shortened sleep periods of up to four hours. This is also associated with sleep difficulties during the day as a result of the decreased melatonin secretion. Poor sleep quality during the day is then associated with fatigue (during night duty) and impaired functioning on the part of paramedics (Sofianopoulus *et al.* 2011, Paterson *et al.* 2014).

Paramedics' tasks include, but are not limited to, high speed driving, drug calculations and drug administration, patient communication, and patient lifting. Such tasks are both physically and psychologically challenging and the demands placed on paramedics by these tasks may further exacerbate their fatigue and negatively affect their alertness, vigilance, concentration, judgement, mood and performance (Ramey *et al.* 2019). The resultant effects of fatigue on the part of paramedics may be characterised by the impairment of memory, problem solving and decision-making, driving errors and accidents, and injuries to paramedics and others persons (patients and accompanying relatives). Other issues associated with paramedics' fatigue include burnout, attrition, sick leave, work disability and health complaints such as headaches, gastrointestinal illnesses, depression, anxiety, and stress. It is, therefore, important that paramedics have sufficient recovery time as well restorative rest and sleep to enable them to perform their tasks methodically, confidently, and responsibly, thus ensuring patient and personal safety (Sofianopoulos *et al.* 2011).

Paterson *et al.* (2014) conducted a qualitative study to determine the factors that paramedics recognise as contributing to their fatigue. The following six factors were identified, namely, working time, insufficient sleep, high workload, health and well-being of paramedics, work–life balance, and working environment. The majority of the paramedics cited working night shifts as one of the common causes of fatigue with some also adding that working night shift beyond their finish time would translate into reduced sleeping time and fatigue. Insufficient sleep was also among the factors that contributed to their fatigue. The factors that were commonly listed as the causes of insufficient sleep included insomnia despite fatigue, not enough rest periods between

shifts, changes in the circadian rhythm, lack of sleep quality, inadequate sleep facilities and/or the home environment not being conducive to sleep. Furthermore, high workloads due to understaffing were identified as contributors to the paramedics' fatigue while the health and well-being factors that were said to be associated with fatigue included dietary factors such as alcohol consumption, poor nutrition and physical inactivity. The environmental factors mentioned included working in rural areas and exposure to hot temperatures, while the work–life balance factors included family and study commitments which affected the paramedics' resting periods.

Sofianopoulos *et al.* (2011) conducted a study to investigate the impact of shift work on physical fatigue, sleep and psychological factors among Australian paramedics. The study included 60 participants, of whom the majority were male (77%, n = 46). The study found that 92% (n = 55) of the paramedics reported that they had experienced fatigue in the 6 months preceding the study with 88% (n = 53) indicating that this had affected their performance at work. Furthermore, 30% (n = 18) of the paramedics had excessive experienced daytime sleepiness while 10% (n = 6) mentioned being dangerously sleepy. The study also indicated that 48% (n = 29) of the paramedics reported that they had nodded off or fallen asleep whilst driving. Furthermore, 68% (n = 41) of the paramedics were found to be suffering poor quality sleep, while 21 % (n = 13) of paramedics were at high risk of sleep apnoea. This study further revealed that 27% (n = 16) of paramedics were suffering from mild depression while 10% (n = 6) were suffering from moderate depression.

2.7.5. Motor vehicle accidents

Paramedics perform a variety of duties that put them at risk for both fatal and nonfatal occupational injuries and illnesses. One of the major occupational risks to which paramedics are exposed the risk of motor vehicle accidents (Reichard & Jackson 2010). Paramedics in South Africa are expected to respond to life-threatening emergency calls within 15 minutes in urban sectors and within 40 minutes in rural environments (Stein *et al.* 2015). While attempting to achieve this expedient response time the need for speed may expose paramedics to the possibility of motor vehicle accidents as a result of emergency responses in difficult terrain and adverse weather conditions (Holgate 2015). Paramedics complete various shift configurations including day, afternoon and night shifts and rotating rosters, all of which interfere with any

consistency in the individuals' sleep quality and natural circadian rhythm (Sofianopolous *et al.* 2011). Fatigue and sleep disturbance may also compromise the effectiveness of paramedics and their performance and, as a result, place them at risk of motor vehicle accidents (Studnek & Fernandez 2008). The section below contains summaries of three studies which reported on motor vehicle accidents in which paramedics are involved.

Studnek and Fernandez (2008) conducted a study which explored the hypothesis that demographic and work-related characteristics were associated with the involvement in ambulance crashes of paramedics in the US. The study included 1 297 paramedics. A total of 111 (8.6%) of the participants reported that they had been involved in an ambulance accident in the 12 months preceding the study. Specifically, 14.9% of the participants who reported sleep problems had been involved in an accident as compared to only 7.5% of those who were experiencing sleep problems. Although none of the specific categories of call volume reached statistical significance, the variable itself confounded the relationship between age, sleep problems, and ambulance crashes. Specifically, for every five-year decrease in age, the likelihood of involvement in an ambulance crash increased (p = 001) while the participants who reported having experienced sleep problems within the 12 months preceding the study also had an increased likelihood of being involved in an ambulance accident (p = 0.042).

Yaylaci and Karcioglu (2016) investigated the causes and characteristics of work related injuries among paramedics in western Turkey. The most common cause of work related injuries, as reported by the paramedics, was motor vehicle accidents (31.9%). The study further found that, in the main, the motor vehicle accidents occurred due to collisions with other vehicles (39.7%) and collisions with other objects (20.6%). In case of motor vehicle accidents, the paramedics were asked whether they themselves had been injured or whether a member of the crew or third parties had been injured in the accident. It emerged that a total of six people (one paramedic and 5 other persons) had died and 18 had been injured (eight paramedics and 10 other people) in these motor vehicle accidents.

Sanddal *et al.* (2010) summarised the findings from ambulance accidents for the time period from May 2007 to May 2009 in US. A total of 466 ambulances crashes had

been reported during this time period. Of these, 358 (76.8%) had resulted in injuries to persons inside or outside of the ambulance while 79 accidents had resulted in fatalities to persons inside or outside of the ambulance. Persons inside the ambulance included prehospital personnel, patients or the family members of patients being transported while persons outside of the ambulance included those in other vehicles, pedestrians, and bystanders. A total of 99 deaths had resulted from these fatal crashes.

2.8. Conclusion

The findings from this literature review indicated that there are various types of occupational injuries experienced by paramedics worldwide. Musculoskeletal injuries are the most common occupational injuries among paramedics and usually result from the following factors, namely, awkward postures, repetitive motions and patient and equipment handling. Paramedics also experience needle-stick injuries because of their working long hours, shift work and working in an uncontrolled environment. The major repercussions of needle-stick injuries include infection with HIV, HBV, and HCV. The higher prevalence of HIV infection in South Africa increases the risk of HIV infection for paramedics in this country. Paramedics also experience workplace violence that emanates from patients, family members and/or bystanders. In addition, South African paramedics are at increased risk of encountering workplace violence due to the high crime rates in South Africa. The literature also suggests that paramedics often experience fatigue which may result in driving errors and accidents, patient care errors, and personal health complications. Motor vehicle accidents are also common in paramedics and often result from high speed driving, fatigue, and adverse weather conditions. The repercussions of occupational injuries include disability, lost working days, reduced productivity, decreased job satisfaction and high staff turnover rates. In spite of the increasing research on occupational injuries among paramedics in high-income countries, it would appear that little research on this topic has been conducted in South Africa. Furthermore, there has never been a descriptive analysis that examined the prevalence, associated risk factors, trends and the profile of injuries among paramedics in South Africa. This information is, however, important in the development of contextually relevant and profession specific strategies aimed at mitigating and addressing occupational injuries.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

Research methodology refers to overall steps, procedures, arrangements, and mechanics pertaining to a given study (Sehume 2016). Following from this definition, this chapter briefly explains the research paradigm, based on its four dimensions, which underpinned the study and further outlines the research design that was used for the purposes of the study. The chapter further discusses the locational background and setting of the study. The chapter also provides a description of the target population, sampling techniques that were used, and the inclusion and exclusion criteria. This chapter also outlines the data collection tools and data analysis approaches that were utilised in the study. Finally, the ethical dilemmas that were taken into consideration during the study are discussed.

3.2. Research paradigm

A research paradigm refers to a basic belief system and theoretical framework with assumptions about ontology, epistemology, methodology and methods – the four (4) dimensions of a research paradigm (Kivunja & Kuyini 2017). Ontology refers to the researcher's beliefs about the nature of reality and this determines the way in which the researcher will gather the requisite knowledge and then communicate the acquired knowledge (epistemology). The epistemology will then guide the methodological approach that is to be used in the study and the methods of data collection and data analysis utilised. There are three research paradigms that are widely used, namely, positivism, interpretivism and critical theory (Rehman & Alharti 2016). Positivism and interpretivism utilise different ontological approaches with positivists believing in one reality and one truth whereas interpretivists believe in multiple realities. Positivism is, thus, associated with quantitative research approaches while interpretivists use qualitative research approaches as they seek to understand phenomena from multiple perspectives (Kelly & Bunniss 2009). Critical theorists believe that reality is shaped by cultural, political, ethnic, gender and religious factors which interact with each other to create a social system. Critical research is therefore considered to be of high quality

if it takes into account the political, cultural, ethnic and gender antecedents of the situation (Rehman & Alharti 2016).

Determining the research question and setting out the research objectives guides a researcher in choosing the most suitable research approach. Three commonly used approaches include the following – quantitative research design, qualitative research design and mixed methods design. Each research design is best suited to a specific type of data, for example; the quantitative design and qualitative design work well with numerical and textual data respectively whereas the mixed methods design is preferred when both numerical and textual types of data are involved (Williams 2007). In this study the researcher looked at the following three (3) main objectives which, in summary, included (1) describing the prevalence of occupational injuries among KZN paramedics, (2) determining the risk factors for occupational injuries and, (3) describing the paramedics' perceptions of occupational injuries. Once these objectives had been set out, it was established that a descriptive quantitative design would be the most suitable approach for the purposes of this study. This was in line with the assertion of Maree (2016) that quantitative research approaches are preferred in studies which aim to identify characteristics, frequencies, trends, correlations and categories.

In order to ensure good quality reporting of observational studies, in 2004 a collective of epidemiologists, methodologists, statisticians, researchers and journal editors developed relevant guidelines, namely, Strengthening the Reporting of Observational studies in Epidemiology (STROBE) (Rothwell & Bhatia 2007). The STROBE guidelines were designed to help researchers to adequately present their observational studies (detailing what was planned, what was done, what was found, and what was concluded) while also enabling the journal editors, reviewers and readers to critically appraise studies (Cuschieri 2019). Accordingly, for the write-up of this thesis, the STROBE guidelines were followed (see annexure K).

3.3. Study setting

One of the general functions of provincial departments in South Africa is the provision of provincial health services, including emergency medical services and forensic pathology. South Africa comprises nine (9) provinces and each province is required by both the constitution and the National Health Act to ensure the provision of such healthcare services (National Health Act 2004). At the time of the study, the researcher was based in KZN province in the City of Durban. As a result, the KZN province was selected for the purpose of this study to ensure minimal time and financial costs as well as easy access to the research site. The map of KZN province and its 11 districts, as well as the location of KZN province within South Africa are depicted in figure 3.1 and figure 3.2 respectively.

The researcher was granted permission by the KZN Health Research Department to conduct the study in the KZN EMRS which is the provincial ambulance service of the KZN province in South Africa. The province is situated on the eastern coast of South Africa, bordered by the Indian Ocean to the east and the Drakensberg, which separates it from Lesotho, to the west. It shares borders with the Eastern Cape in the south, Free State and Lesotho in the west, Mpumalanga in the north west, and Swaziland and Mozambique in the north. The KZN province comprises 1 metropole, 11 districts and 50 municipalities. Of the 50 municipalities four (4) of them have been declared as rural development nodes of which two were randomly chosen as part of the study. The population of KZN was estimated to be above 11 million in 2019 (KwaZulu-Natal Department of Health Strategic Plan 2015-2019).

Figure 3. 1: Map of KZN province and its provincial districts (KwaZulu-Natal Department of Health 2015).

Figure 3. 2: Map displaying location of KZN province within South Africa (KwaZulu-Natal Department of Health 2015).

3.4. Study population and sample

Paramedics working for the KZN EMRS made up the study population. For the purpose of this study, the term paramedic was used as an umbrella for all emergency medical services personnel with various qualifications ranging from Basic Life Support (BLS) to an Emergency Care Practitioner (ECP) (see definition of terms for each qualification). At the time of the data collection, there was a total of 2378 operational paramedics in all the eleven (11) districts of KZN (see table 3.1 for qualification distribution). Time and cost limitations usually make it impossible for researchers to study the entire population of interest (Maree 2016). Sampling is, therefore, required in order to ensure appropriate representation of the population from which the sample is drawn and, thus, that the results obtained will be a relatively true reflection of the entire population. Sample sizes vary depending on the population size. There are different methods (such as rule of thumbs and formulae) that may be used to calculate the sample size. For the purpose of this study, the sample size was calculated using the online software Creative Research Systems (The survey system 2018). Using 5 as the margin of error and a 95% confidence interval, it was established that a sample of 334 paramedics would be required for this study.

Out of the eleven districts, a simple random sampling method was used to select five districts where the study would be conducted. Simple random sampling was used to ensure that all members or components of the population had an equal opportunity of being drawn into the study (Maree, 2016). For the purpose of this study, all eleven districts were allocated random numbers (i.e. districts one to eleven). Five of these numbers were randomly handpicked for inclusion in the study. Table 3.1 below depicts the number of operational paramedics in the 11 KZN districts categorised by qualifications.

Table 3.1: Number of operational paramedics per qualification.

Qualification	**Quantity**	**Grand total in KZN (*inclusive of all qualifications*)**
Basic life support (BLS)	1484	
Intermediate life support (ILS)	790	
Emergency care technician (ECT)	22	
Advanced life support (ALS) – *Includes critical care assistants and National Diploma in Emergency Medical Care*	75	
Emergency care practitioners (ECP)	7	2378

3.5. Inclusion and exclusion criteria

When conducting a survey, it is important to ensure that the study subjects demonstrate similar characteristics. A study group that is too heterogeneous would make it difficult for the researcher to obtain accurate results from the study. It is, therefore, important that a researcher identifies the characteristics that are required in the study in order to be able to accurately include eligible candidates in his/her study (Patino & Ferreira 2018). The operations in EMS include various units such as call centres, primary response units, medical rescue units, planned patient transport units and inter-facility transfer units. The study only included all paramedics who were actively involved in patient care. This resulted in the preclusion of paramedics who were assigned to call centres only and without a history of having been involved in patient care while employed by the KZN EMRS. Exclusion criteria are generally described as characteristics that disqualify prospective subjects from inclusion in a study (Meline 2006). The study also excluded EMS employees who did not have any of the pre-specified paramedical qualifications, paramedics who were not employed by KZN EMRS, persons with any of the required paramedic qualifications but working in call centres and persons who submitted incomplete questionnaires.

3.6. Data collection

The study used two methods of data collection, namely, a closed ended questionnaire and a document review. The questionnaires were administered using a drop-and-pick method in terms of which they were physically delivered by the researcher to the relevant EMRS stations. In the process the researcher briefly explained to the potential participants how they were to complete the questionnaires. The researcher was aware of the possible limitations of using a drop-and-pick method, for example, low response rates, lack of control of the conditions in which questionnaires would be completed, lack of assistance in cases where the respondents may have required clarity regarding the questionnaire, possibilities of respondents asking someone else to answer on their behalf and the requirement that the respondents be literate. In an effort to mitigate these limitations, the researcher sent two (2) reminders via the various station managers to encourage participation in the study, the individual completion of the questionnaire was encouraged and information letters and questionnaires were written in two (2) of the most widely spoken languages in KZN, namely, IsiZulu and English. For the purposes of the record review, documents pertaining to injury on duty were obtained from the human resources departments of the selected districts. The aim of the document review was to determine the types and number of injuries which had been previously reported by paramedics from the selected districts. Shift rotation at the EMRS takes place in such a way that the paramedics are on duty for two days and two nights and then off duty for four days. The number of groups or shifts varied per EMS station, depending on the station's location and district. Accordingly, a maximum of one month was specified for the participants to fill in the questionnaires in order to allow all the different shifts an equal chance of participating in the study.

3.7. Reliability and validity of the data collection tool

Prior to the commencement of the data collection, a pilot study was conducted to test the appropriateness of the research questionnaire using 10% (30 paramedics) of the sample. The 10% sample that was used in the pilot study did not form part of the actual study. According to (Van Teijlingen & Hundley 2002, Connelly 2008) pilot studies usually provide a warning about where the main research project could fail and whether the proposed research instrument or methods are inappropriate and/or

complicated. The authors further suggest that 10% of the study sample may be used in a pilot study.

The first version of the questionnaire was piloted on 1st December 2018. It was distributed to 30 paramedics as the sampled population of paramedics identified for the study comprised 334 participants. All 30 of the paramedics were purposively selected by the researcher as they were known to be candidates with rich information, experienced in the SA EMS and also capable of providing valuable input and feedback. This was done so that the research instrument could be critically appraised with the emphasis on its validity and reliability. The instrument was also peer reviewed and critiqued by the Durban University of Technology's Faculty of Health Sciences Research Committee which includes researchers with expertise in instrument development, a statistician and the study supervisors, who were considered to be experts in the field of research and in the EMS in South Africa.

Of the 30 questionnaires distributed, 27 only were completed in full and returned. The participants found that the time required to return the questionnaires was too long and that it should be a maximum of two weeks and not an entire month. Some of the participants (3/27) had requested that the questionnaire be emailed to them although the majority (24/27) of the participants had preferred hardcopies as they indicated that their access to computers was limited and also that downloading and completing an online questionnaire was a laborious process requiring much time, effort and a higher level of computer skills than they possessed. The response rate, the positive comments and the lack of feedback on how to change or improve the questionnaire resulted in it not being amended or changed in anyway.

3.8. Data analysis

The data which were collected was entered into a Microsoft Excel worksheet and analysed. Prior analysis, data cleaning and recapturing was performed by the researcher where necessary. The data was analysed using Stata version 15 (StataCorp 2017). Frequencies and percentages were used to summarise the categorical data while the Pearson chi-squared test was used to test for association between any two categorical variables. In instances where the Pearson chi-squared test was not valid (i.e. if the percentage of cells with the expected frequencies less

than five was above 20%), Fisher's exact test was used. A p-value of less than 0.05 was considered to be statistically significant.

3.9. Ethical considerations

Following the approval of the research proposal by the Faculty of Health Sciences Research Committee, ethical clearance to conduct the study was sought from the Durban University of Technology's (DUT) Institutional Research Ethics Committee (IREC157/18) before the study could be undertaken. This was granted. Gatekeeper permission was also granted by the KwaZulu-Natal Department of Health as well as the director of the KZN-EMRS. The study also required information from the Human Resources Department at the Department of Health as well as information on workers' compensation which contained personal information such as, but not limited to; names, age, and employee numbers. In order to ensure the anonymity and confidentiality of the participants throughout the research process, the personal information and/or details of the participants were not disclosed to anyone other than the researcher.

3.9.1. Principles of autonomy, beneficence and non-maleficence

Key ethical considerations in human research involve promoting the safety of the participants, minimising costs in relation to benefits, and accurately conveying information about the ethical considerations to potential participants. Informing the participants about the ethical considerations pertaining to research may have a meaningful impact on both the data quality and data validity by affecting the way in which the participants engage with the study procedures. Furthermore, positive experiences on the part of the participants may increase their willingness to participate in other studies in future and promote word-of-mouth encouragement to other potential participants. Two sets of ethical principles in human research include autonomy and respect for persons and beneficence and non-maleficence. Autonomy involves due recognition of the independence and capabilities of individuals. In addition, autonomy acknowledges the need for the protection of persons with diminished independence while also fully allowing individuals to enact their own decisions and choices. The major focus related to autonomy is an individual's capacity to consent to the research. Decisional capacity typically refers to the ability to understand factual information, appreciate the implications of the information about the study, manipulate such

information, and communicate choice (Newman & Kaloupek 2009). Prior to the commencement of the study, information letters were distributed to all the potential participants. To ensure informed choices on their part, the information letters provided the participants with the following crucial information, namely, a brief background to and the purpose of the study, main objectives of the study, research procedure, risks and discomforts that the study may cause the participants, and the potential benefits of the study.

Beneficence aims to optimise the potential benefits of research and is used to weigh up the reasonableness of the costs (for example, inconvenience, and discomfort) and potential risks to participants whereas its companion principle, non-maleficence, aims to minimise the potential for harm and injury to the participants. The principles of beneficence and non-maleficence oblige researchers to maximise potential benefits whilst minimising possible risks, and to do no harm to their participants (Newman & Kaloupek 2009). Although this study would not be of any individual benefit to the participants, it was hoped that the results of the study would contribute to knowledge development through journal publications pertaining to the EMS profession in South Africa and that this would increase the awareness of occupational injuries among South African paramedics. Accordingly, potential participants were informed through the information letters about the importance of their participation in the study and its possible contribution to the EMS profession. The potential participants were also informed that their participation in the study would be completely voluntary and that they were free to withdraw from the study at any time without facing any consequences.

3.10. Conclusion

This study was a descriptive, quantitative study which aimed to describe the prevalence and risk factors in relation to occupational injuries among paramedics, and their perceptions of the mitigation of occupational injuries in their profession. The study was conducted in KZN province. Its target population included operational paramedics employed by the KZN provincial EMS. The study was conducted with the permission of the DUT Research Ethics Committee and the Research Department of the KZN provincial health department. The next chapter presents and interprets the study findings in relation to its main aim and the research objectives.

CHAPTER 4

RESULTS

4.1. Introduction

This chapter presents the results of the study, as well as the analysis and interpretation of such results. The demographic data obtained from the self-administered questionnaire are discussed under the following categories; workstation, age groups, gender, qualifications, work experience, location and EMS primary task. The chapter also presents the findings of the analysis of the data that was obtained from the record review under the gender and qualifications categories. The occupational injury data from the record review is also presented under the injury type and injury frequency categories. In addition, the chapter also focuses on the occupational injury data that was obtained from the self-administered questionnaires. This occupational injury data is presented in terms of injury distribution, reported injuries and unreported injuries. The chapter further presents the correlations that were between the following variables; injury versus demographic profile, injury type versus demographic profile, and injury type versus EMS task. The occupational injuries as perceived by the paramedics are presented in terms of distributions. The correlation findings between the perceived risk factors, demographic profile and EMS task are also presented. Finally, the chapter outlines the paramedics' perceptions of occupational injury preventive measures.

4.2. Demographic data: Self-administered questionnaire

A total of 152 survey questionnaires were completed and returned at the end of the data collection period – a 45% response rate. The reasons for the attrition rate of 55% were unknown although such reasons may have included a reluctance on the part of the paramedics to participate in the study because of their desire to avoid paperwork (filling in questionnaire) and also a perceived lack of insight into the research topic. The participant distribution according to district revealed that 27.6% of the participants came from the uMgungundlovu district, 25% were came from the uGu district, 18.4% from the Sisonke district, 16.5% from the ILembe district and 12.5% from the EThekwini. Table 4.1 presents the number of participants per district.

Table 4.1: Distribution per district.

District	Frequency	Percentage
uMgungundlovu district	42	27.6%
uGu district	38	25%
Sisonke district	28	18.4%
ILembe district	25	16.5%
eThekwini district	19	12.5%

The age distribution revealed that the majority of the participants (25%) were between the ages of 31 and 35 years, 22.4% were between 36 and 40 years, 19.7% were between 41 to 45 years, 17.8% were between 46 to 50 years, 8.6% were between 51 to 55 years, 4.6% were between 20 to 30 years and 2% were between 56 to 60 years. The age distribution of the participants is represented in table 4.2.

Table 4.2: Distribution per age group.

Age group	Frequency	Percentage
31-35 years old	38	25%
36-40 years old	34	22.4%
41-45 years old	30	19.7%
46-50 years old	27	17.8%
51-55 years old	13	8.5%
20-30 years old	7	4.6%
56-60 years old	3	2%

The participant distribution per gender revealed that the majority of the participants (75%) were male and 23% were female. It also emerged that 2% did not want to disclose their gender. The gender distribution is displayed in table 4.3.

Table 4.3: Gender distribution.

Gender	Frequency	Percentage
Male	114	75%
Female	35	23%
Did not want to disclose gender	3	2%

The majority (54%) of the participants were ILS qualified and 33.6% were BLS qualified. Other qualifications were represented as follows; ECP (4.6%), ECT (4.6%), CCA (2.6%) and National Diploma (0.7%). Table 4.4 represents the qualifications distribution.

Table 4.4: Qualifications distribution.

Qualification	Frequency	Percentage
Intermediate Life Support (ILS)	82	54%
Basic Life Support (BLS)	51	33.6%
Emergency Care Technician (ECT)	7	4.6%
Emergency Care Practitioner (ECP)	7	4.6%
Critical Care Assistant (CCA)	4	2.6%
National Diploma (NDip)	1	0.7%

The majority (73%) of the participants had more than ten years of experience as paramedics, 12.5% had seven to ten years' experience, 8.6% had five to seven years' experience, 5.3% had three to five years' experience and 0.7% had one to three years' experience. The participants' number of years of experience are presented in table 4.5.

Table 4.5: Number of years of experience distribution.

Experience	Frequency	Percentage
Above ten years	111	73%
Seven to ten years	19	12.5%
Five to seven years	13	8.6%
Three to five years	8	5.3%
One to three years	1	0.7%

In terms of their regional allocation the majority (56.6%) of the participants covered both rural and urban areas, 38% covered rural areas only and a small percentage (5.3%) covered urban areas only. Table 4.6 presents the participants' allocation by area.

Table 4.6: Participants' allocation by area

Area setting	Frequency	Percentage
Both urban and rural settings/areas.	86	56.6%
Rural setting/area	58	38.3%
Urban setting/area	8	5.3%

Table 4.7 presents the participants' task distribution. The majority (97.4%) of the participants were allocated to primary response and the provision of medical interventions, 80.3% had to conduct inter-hospital transfers as their primary task, while 27 (17.8%) participants only were allocated to medical rescue, involving primarily the Jaws of Life. The percentages in this section do not total 100% as the participants were allowed to select more than one option.

Table 4.7: Task allocation for participants.

EMS Task	Frequency	Percentage
Primary response and providing medical interventions to patients	148	97.4%
Undertaking inter-hospital transfers	122	80.3%
Medical rescue, involving primarily the use of the jaws of life	27	17.8%

The following section discusses the demographic and occupational injury data that was obtained from the records review

4.3. Records review

4.3.1. Demographic data: Records review

Of the five (5) EMS districts that were selected for the purposes of the study, only two (Sisonke District and uMgungundlovu District) provided the required information for the records review. UGu district, iLembe district and eThekwini district did not reply to numerous emails and telephone calls requesting them to furnish the required information. This will be discussed later as a limitation and also a delimitation of the study. The records reviews from the two districts that had responded to the formal request for information revealed information on occupational injuries as reported by EMS personnel between 2011 and 2018. No data were available for the years prior to 2011. A total of 36 injuries were reported between the years indicated for the two districts combined. Demographically, 24 (66.7%) of these reports applied to male employees while 12 (33.3%) were from female employees. Table 4.8 depicts the gender distribution of the data that was obtained from the injury on duty records.

Table 4.8: Gender distribution for reported injuries in Sisonke district and uMgungundlovu district.

Gender: Records review	Frequency	Percentage
Male	24	66.7%
Female	12	33.3%

Table 4.9 depicts the qualifications distribution in respect of the occupational injuries that were reported by paramedics in the Sisonke and uMgungundlovu districts. The majority of paramedics who reported injuries in the two districts were BLS qualified (41.7%), 33.3% were reported by ALS paramedics and 22.2% were reported by ILS paramedics. The records did not specify the categories of ALS paramedics who had reported occupational injuries in the two districts and, therefore, the ALS in this instance included the following EMS qualifications, namely, Emergency Care Technician, NDip Emergency Medical Care, Critical Care Assistant, BTech Emergency Medical Care and/or BHSc Emergency Medical Care.

Table 4.9: Qualification distribution for injuries reported in the Sisonke district and the uMgungundlovu district

Qualification: Records review	Frequency	Percentage
BLS	15	41.7%
ILS	12	33.3%
ALS	8	22.2%

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4.3.2. Occupational injury data: Records review

Table 4.10 presents the distribution of injury types reported in the Sisonke and uMgungundlovu districts. The majority of injuries reported in the Sisonke district and the uMgungundlovu district were motor vehicle accidents (61%) followed by musculoskeletal injuries (16.7%) and needle-stick injuries (13.9%). Other reported injuries included injuries due to accidental surgical blade cuts (5.6%) and assault-related injuries (2.8%).

Table 4.10: Types of injuries reported in the Sisonke district and the uMgungundlovu district.

Injury type: Records review	Frequency	Percentage
Motor vehicle accident	22	61%
Musculoskeletal injury	6	16.7%
Needle-stick injury	5	13.8%
Surgical blade cut	2	5.6%
Assault-related injury	1	2.8%

The following section contains a description of the occupational injury data that was obtained from the self-administered questionnaires.

4.4. Self-administered questionnaire

4.4.1. Occupational injury data

The findings from this study indicated that 16.5% (n = 25) of the occupational injuries experienced by paramedics were unreported. The majority of these unreported injuries were musculoskeletal injuries and needle-stick injuries (each 48%), while a smaller proportion of 1 (4%) was an injury due to assault. The distribution of the unreported injuries is presented in table 4.11.

Table 4.11: Distribution of unreported occupational injuries

Type of injury not reported	Frequency	Percentage
Musculoskeletal injuries	12	48%
Needle-stick injuries	12	48%
Assault injuries	1	4%

The findings from the study further indicated that 49 (32.2%) paramedics had experienced occupational injuries which had resulted in their seeking medical attention. The majority of these injuries which had result in the paramedics' seeking medical attention were musculoskeletal injuries (55.1%), followed by injuries due to motor vehicle accidents (44.9%). Other occupational injuries which had necessitated medical attention were needle-stick injuries (26.5%) and assault-related injuries

(8.2%). Table 4.12 depicts the distribution of injuries that had resulted in the paramedics seeking medical attention.

Table 4.12: Distribution of injuries that resulted in medical attention being sought.

Type of Injury resulting to medical attention being sought	Frequency	Percentage
Musculoskeletal injuries	27	55.1%
Motor vehicle accident	22	44.9%
Needle-stick injuries	13	26.5%
Assault injuries	4	8.2%

Overall, 38.8% of paramedics had suffered occupational injuries (both reported and unreported) while 21% of the paramedics had missed work for more than a day due to occupational injuries – See tables 4.13 and 4.14 respectively.

Table 4. 13: Number of paramedics who had experienced occupational injuries.

Experienced an occupational injury	Frequency	Percentage
Yes	59	38.8%
No	93	61.2%

Table 4.14: Number of paramedics who had missed work for more than a day due to an occupational injury.

Missed work for more than a day	Frequency	Percentage
Yes	32	21.2%
No	119	78.8%

The following section discusses the relationships between the occurrence of occupational injuries and the demographic profiles of the participants.

4.4.2. Occupational injury vs demographic profiles

Table 4.15 shows the p-values which were obtained when testing for associations between occupational injuries and the paramedics' demographics. A statistically significant association was found between occupational injuries and the district base of a paramedic (Chi-square = 12.46, p = 0.014), area or setting where a paramedic worked (Fishers exact, p < 0.001), and the qualification of a paramedic (Fishers exact, p = 0.034). The study also found that paramedics who worked in the uMgungundlovu district were more likely to experience occupational injuries (32.2%, n = 19), while the proportion of paramedics who experienced occupational injuries was lower in the Sisonke district compared to the other districts (10.7%, n = 3). The majority of paramedics who experienced occupational injuries were those covering both urban and rural areas (78%, n = 46), while paramedics who worked exclusively in urban settings were less likely to experience occupational injuries (1.7%, n = 1). Finally, paramedics who possessed an ILS qualification were more likely to experience occupational injuries (53.9%, n = 39) in comparison to those with other qualifications such as BLS and ALS.

Table 4.15: Injury vs demographic profile

Demographic	p-value
District	0.014
Age	0.184
Gender	0.469
Qualification	0.034
Experience	0.970
Area or setting	< 0.001

4.4.3. Type of injury versus demographic profile

Table 4.16 depicts the p-values which were obtained when testing for association between the types of occupational injuries and the paramedics' demographics. There was a statistically significant association between musculoskeletal injuries, district base of a paramedic (Pearson chi-square = 10.60, p = 0.031), and the area or setting where a paramedic worked (Pearson chi-square = 13.84, p = 0.001) with paramedics who worked in the uMgungundlovu district being more likely to experience

musculoskeletal injuries compared to those from other districts (36.4%, n = 12), whereas none of the paramedics from Sisonke had experienced musculoskeletal injuries. A higher proportion of paramedics who experienced musculoskeletal injuries were those who covered both rural and urban settings (32.6%, n = 28) while only 1 (3%) paramedic of those who worked exclusively in urban areas had suffered musculoskeletal injuries.

The proportions of paramedics who had experienced assault were not similar across the age groups. The association between assault and the age groups of paramedics was statistically significant (Fishers exact, p = 0.046) with paramedics above the age of 40 years being more likely to experience assault than paramedics between the age of 20 and 40 years.

The proportions of paramedics who experienced needle-stick injuries were not similar across either the areas or settings where the paramedics worked. The association between needle-stick injuries and the area or setting where the paramedics worked was statistically significant (Pearson chi-square = 8.57, p = 0.014) as the study found that the majority (85.71%, n = 18) of paramedics who had experienced needle-stick injuries covered both the rural and urban settings while none of the paramedics who worked in urban areas exclusively had experienced needle-stick injuries.

Table 4.16: Association between types of injuries and demographics.

Injury	Demographics	p-value
Motor vehicle accident	District	0.864
	Age	0.035
	Gender	1.00
	Qualification	0.303
	Experience	0.772
	Area or setting	0.107
Musculoskeletal injuries	District	0.031
	Age	0.289
	Gender	0.260
	Qualification	0.296
	Experience	0.800
	Area or setting	0.001
Assault injuries	District	0.818
	Age	0.046
	Gender	0.631
	Qualification	0.571
	Experience	1.00
	Area or setting	0.733
Needle-stick injuries	District	0.091
	Age	0.249
	Gender	0.862
	Qualification	< 0.001
	Experience	0.584
	Area or setting	0.014

4.4.4. Type of injury versus EMS task

Table 4.17 depicts the association between type of injury and EMS task. The association between experiencing needle-stick injuries and being involved in medical rescue was statistically significant (p = 0.015). The proportion of paramedics who had experienced needle-stick injuries was higher among those who were involved in

medical rescues involving the use of the Jaws of Life (29.6%) compared to those who were not involved in such medical rescues (10.4%).

Table 4.17: Association between occupational injury and EMS task.

Injuries	Tasks	p-value
Motor vehicle accident	Undertaking inter-hospital transfers	0.570
	Primarily responding and providing medical interventions to patients	1.00
	Medical rescue, involving primarily the use of the jaws of life	0.230
Musculoskeletal injuries	Undertaking inter-hospital transfers	0.082
	Primarily responding and providing medical interventions to patients	1.00
	Medical rescue, involving primarily the use of the jaws of life	0.271
Assault injuries	Undertaking inter-hospital transfers	1.00
	Primarily responding and providing medical interventions to patients	1.00
	Medical rescue, involving primarily the use of the jaws of life	0.586
Needle-stick injuries	Undertaking inter-hospital transfers	0.253
	Primarily responding and providing medical interventions to patients	0.092
	Medical rescue, involving primarily the use of the jaws of life	0.015

The following section provides a description of the perceived risk factors for occupational injuries and the relationships between perceived risk factors and the demographic profiles of the participants.

4.5. Perceived risk factors for occupational injuries

High speed driving (87.5%, n = 133) and violent members of society (87.5%, n = 133) were found to be the major risk factors for occupational injuries as perceived by the paramedics. Other factors seen by the paramedics as major risk factors for occupational injuries included the following; heavy objects and patient lifting (86.2%, n = 131), physical exhaustion (78.3%, n = 119), hazardous material (77%, n = 117), and temperature extremes (73%, n = 111) with fewer paramedics perceiving mental stress (3.3%, n = 5) and working excessively long hours (2%, n = 3) as risk factors for occupational injuries.

4.5.1. Perceived risk factors versus demographics

Table 4.18 shows the p-values which were obtained when testing for association between the perceived risk factors and demographics. The association between the district base of a paramedic and the perception that high speed driving was a risk factor for occupational injuries was statistically significant (Fishers exact, p = 0.020). All the paramedics (n = 28) who worked in the Sisonke district cited high speed driving as a risk factor for occupational injuries, while the perception of high speed driving as risk factor for occupational injuries was lower among the eThekwini based paramedics in comparison to those from other districts (n = 14).

There was a statistically significant association between the area or setting where paramedics were based and their perception of lifting heavy objects as a risk factor for occupational injuries (Pearson chi-square = 8.79, p = 0.012). The study also found that paramedics who covered both rural and urban settings constituted a greater proportion (60.3%, n = 79) of those who perceived lifting heavy objects and patients as a risk factor for occupational injuries with all eight of the paramedics who worked exclusively in urban areas citing lifting heavy objects as a risk factor for occupational injuries.

The association between the area or setting where the paramedics were based and their indication that violent members of society constituted a risk factor of occupational injuries was statistically significant (Pearson chi-square = 8.75, p = 0.013). Although a larger percentage (60.2%, n = 80) of the paramedics who perceived violent members of the society as a risk factor for occupational injuries covered both rural and urban

areas, all the paramedics (n = 8) who worked exclusively in urban areas mentioned violent members of society as a risk factor for occupational injuries.

The association between the district where a paramedic worked and the perception that temperature extremes constituted a risk factor for occupational injuries was statistically significant (Pearson chi-square = 14.10, p = 0.007). In addition, the proportion of paramedics who indicated extreme temperatures as a risk factor for occupational injuries was higher among those who worked in the uMgungundlovu district compared to those who worked in the other districts (34%, n = 38).

Table 4.18: Association between perceived risk factors and demographics.

Perceived risk	Demographics	p-value
High speed driving	District	0.020
	Age	0.483
	Gender	1
	Qualification	0.334
	Experience	0.205
	Area or setting	0.498
Lifting of heavy objects and patient lifting	District	0.084
	Age	0.925
	Gender	1
	Qualification	1
	Experience	1
	Area or setting	0.012
Violent members of society, including patients	District	0.008
	Age	0.996
	Gender	1
	Qualification	0.906
	Experience	0.831
	Area or setting	0.013

Physical exhaustion	District	0.033
	Age	0.316
	Gender	0.755
	Qualification	0.890
	Experience	0.255
	Area or setting	0.173
Working an excessive number of hours	District	0.405
	Age	0.482
	Gender	0.188
	Qualification	1
	Experience	1
	Area or setting	0.135
Hazardous materials	District	0.012
	Age	0.388
	Gender	0.351
	Qualification	0.288
	Experience	0.067
	Area or setting	0.153
Temperature extremes	District	0.007
	Age	0.315
	Gender	0.014
	Qualification	0.671
	Experience	0.569
	Area or setting	< 0.001
Mental stress	District	0.610
	Age	0.524
	Gender	0.173
	Qualification	0.822
	Experience	1
	Area or setting	0.538

4.5.2. Perceived risk versus EMS task

Table 4.19 presents the p-values which were obtained when testing for association between perceived risk factors and EMS task. There was a statistically significant relationship between the primary task of a paramedic and the perception that high speed driving was a risk factor for occupational injuries a (Fishers exact, p = 0.006). In addition, the paramedics who were involved in primary response and the provision of medical interventions 89.2% (n = 132) were the most likely to perceive high speed driving as a risk factor for occupational injuries in comparison to those who performed other tasks such as medical rescue using the jaws of life and inter-facility transfers.

The relationship between the primary task of a paramedic and the perception of lifting heavy objects and patients as a risk factor for occupational injuries was statistically significant (Fishers exact, p = 0.002) while the paramedics (n = 111) who undertook inter-hospital transfers were more likely to perceive the lifting of heavy objects and patients as a risk factor of occupational injuries (91%) in comparison to those involved in other tasks (medical rescue and primary response).

There was a statistically significant relationship between the task of a paramedic and the perception of violent members of the society, including patients, as a risk factor for occupational injuries (Fishers exact, p = .001). A majority of the paramedics (92.6%, n = 113) who undertook inter-hospital transfers indicated that violent members of society, including patients, were a risk factor of occupational injuries while approximately 66.7% (n = 20) of the paramedics who performed other tasks (i.e. primary response and medical rescue) cited violent members of society as a risk factor.

There was a statistically significant relationship between the paramedics' primary task and the perception of physical exhaustion as a risk factor for occupational injuries (Pearson = 4.92, p = 0.027). The proportion of paramedics who perceived physical exhaustion as a risk factor was higher among those who were involved in undertaking inter-hospital transfers (82%, n = 100) compared to those who performed other tasks such as primary response and medical rescue using the jaws of life (63.3%, n = 19).

There was a statistically significant relationship between the paramedics' primary task and the perception of hazardous material as a risk factor for occupational injuries

(Fishers exact, p = 0.038). A higher proportion (78.4%, n = 116) of the paramedics who were involved in primary response and the provision of medical interventions perceived hazardous material as a risk factor for occupational injuries compared to those who performed other tasks such as inter-facility transfers and medical rescue using the jaws of life (25%, n = 1).

There was a statistically significant relationship between the paramedics' task and the perception of extreme temperatures as a risk factor for occupational injuries (Pearson = 4.19, p = 0.041). The proportion of paramedics who perceived working under extreme temperature as a risk factor was higher among those who provided medical rescue involving the jaws of life (88.9%, n = 24) compared to those who were involved in other tasks such as primary response, the provision of medical intervention and inter-facility transfers.

Table 4.19: Association between perceived risk factors and EMS task.

Injuries	Tasks	p-value
High speed driving	Undertaking inter-hospital transfers	0.214
	Primary response and providing medical interventions to patients	0.006
	Medical rescue, involving primarily the use of the jaws of life	0.529
Lifting of heavy objects land patient lifting	Undertaking inter-hospital transfers	0.002
	Primary response and providing medical interventions to patients	1
	Medical rescue, involving primarily the use of the jaws of life	1
Violent members of society, including patients	Undertaking inter-hospital transfers	0.001
	Primary response and providing medical interventions to patients	0.417

	Medical rescue, involving primarily the use of the jaws of life	0.199
Physical exhaustion	Undertaking inter-hospital transfers	0.027
	Primary response and providing medical interventions to patients	0.206
	Medical rescue, involving primarily the use of the jaws of life	0.141
Working an excessive number of hours	Undertaking inter-hospital transfers	0.100
	Primary response and providing medical interventions to patients	1
	Medical rescue, involving primarily the use of the jaws of life	1
Hazardous materials	Undertaking inter-hospital transfers	0.134
	Primary response and providing medical interventions to patients	0.038
	Medical rescue, involving primarily the use of the jaws of life	0.264
Temperature extremes	Undertaking inter-hospital transfers	0.381
	Primary response and providing medical interventions to patients	0.060
	Medical rescue, involving primarily the use of the jaws of life	0.041
Mental stress	Undertaking inter-hospital transfers	1
	Primary response and providing medical interventions to patients	1
	Medical rescue, involving primarily the use of the jaws of life	0.586

The following section contains a description of the findings relating to the paramedics' perceptions regarding the prevention of occupational injuries.

4.6. Perceptions of paramedics regarding measures to prevent occupational injuries

A majority of the paramedics (n = 121) cited avoiding high speed driving while responding to scenes as the main measure to prevent occupational injuries (79.6%) while 63.8% (n = 97) of the paramedics believed that specific positioning during equipment and patient lifting may prevent injury occurrence and 61.8% (n = 94) mentioned avoiding chaotic scenes may prevent violence-related occupational injuries. Other occupational injury preventive measures indicated by the paramedics included avoiding working an excessive number of hours (49.3%, n = 75), avoiding physically overworking (7.9%, n = 12), and protection against all weather conditions (5.9%, n = 9). Table 4.20 presents the occupational injury preventive measures as perceived by the paramedics.

Table 4.20: Perceived occupational injury preventive measures.

Perceived measures to prevent occupational injuries	Frequency	Percentage
Avoiding high speed driving while responding to scenes	121	79.6%
Specific positioning during the lifting of heavy equipment and patient lifting	97	63.8%
Avoiding chaotic scenes where violence might arise	94	61.8%
Avoiding physically overworking	12	7.9%
Avoiding working excessive hours where possible.	75	49.3%
Full protection against all types of weather conditions such as excessive heat or extremely cold temperatures.	9	5.9%

4.7. Conclusion

This chapter presented the analysis of the study results. The variables presented and discussed in this chapter included the demographic data and occupational injury data that were obtained from the records review and the self-administered questionnaires. The correlation findings pertaining to the various variables were also presented and explained. In addition, the chapter also outlined the paramedics' perceptions regarding occupational injury preventative measures. The next chapter presents a discussion of the results that were obtained.

CHAPTER 5

DISCUSSION

5.1. Introduction

The preceding chapter presented the findings from both the review of documents on occupational injury as contained in the duty records and from the participant administered questionnaires. This chapter correlates these findings with the findings from the literature review in order to conduct an interpretive and deeper analysis in an attempt to address the study's research objectives. As stated in Chapter 1 (section 1.3), the research objectives included the following, namely, to describe the prevalence of occupational types of injuries with regards to demographic profile (i.e. age, gender, occupation and workstation), to determine the risk factors (e.g. exposure to hazardous materials, crime, public disturbances and motor vehicle accidents during emergency response) for occupational injuries with regard to demographic profile (i.e. age, gender, occupation and workstation), and to describe the paramedics' perceptions regarding the mitigation and prevention of occupational injuries.

5.2. Injury per the duty records review

Of the five districts that were chosen, only two (Sisonke district and the uMgungundlovu district) were able to provide data relating to injury on duty incidents among paramedics. This research project was conducted with the aim of fulfilling the requirements for a Master's degree in Emergency Medical Care for which the researcher (student) was given a maximum of three years in which to complete the study. As a result, logistical, financial and time limitations precluded the study being delayed and, thus, it was not possible to extend the time period for the data collection any further. The record review was intended to realise part of objective one of the study while a self-administered questionnaire was intended to realise all three of the study objectives. The information received from the two districts was, therefore, deemed to be sufficient for the purposes of the study although this did preclude generalisation of the study results to the all KZN paramedics. Combined, the two districts provided data on a total of 36 occupational injuries that were reported between 2011 and 2018.

5.2.1. Demographic data: Injury on duty records review

Approximately 66.7% (n = 24) of the reported injuries had been reported by male paramedics and 33.3% (12) by female paramedics. These findings are consistent with the results of a study conducted by Reichard *et al.* (2017) which revealed that, of the total number of injuries (n = 89 100) experienced by EMS workers between 2010 and 2014 in the US, 67% (n = 59 900) had been reported by male EMS workers. The researchers linked this finding to the general gender distribution of EMS employees which had revealed that 75% of the staff were male employees. Although the gender distribution of the KZN EMRS was unknown to the researcher, it was, however, speculated that the increased prevalence of injuries among male paramedics was a result of the fact that the majority of the paramedic workforce is predominantly male-dominated as indicated by Crowe *et al.* (2020) in a study which focused on gender distribution of EMS employees in US. Such distribution was also found in a study conducted by Sobuwa (2018) which focused on academic success among Bachelor of Emergency Medical Care students in South Africa. Majority of participants in Sobuwa's study were male student paramedics (n=97, 55%). Thus it would be presumed that the number of graduating male paramedics exceeds female paramedics and thus leading to increased male paramedics in South Africa.

The majority of the employees who reported injuries in the two districts were BLS paramedics (41.7%), followed by ALS paramedics (33.3%) and ILS paramedics (22.2%). The BLS providers constitute more than 70% of the emergency care providers registered with the Health Professions Council of South Africa's Professional Board of Emergency Care and, thus, it follows that the majority of paramedics employed by the respective EMS agencies would be BLS paramedics. Moreover, at the time of the study the BLS paramedics constituted 62% (n = 1484) of all the KZN EMRS operational paramedics. Accordingly, this finding was not surprising in view of the workforce distribution at the KZN EMRS.

5.2.2. Motor vehicle accidents: Injury on duty records review

The study revealed that, of the total of 36 occupational injuries that emerged during the review of the injury on duty records in the Sisonke district and the uMgungundlovu district, the majority of the injuries reported were due to motor vehicle accidents (61%, n = 22). These findings are consistent with results of a study conducted by Yaylaci and

Karcioglu (2016) which also discovered that motor vehicle accidents were the leading cause of work related injuries among paramedics in Western Turkey (31.9%, n = 52) compared to other types of occupational injuries (i.e. needle-stick injuries, blood and body fluids exposure, and other sharps injuries). A study by Studnek and Fernandez (2008) also established that injuries due to motor vehicle accidents were a leading cause of occupational injuries among paramedics in the United States (8.6%, n = 111). These results are not altogether surprising given the high speeds at which paramedics drive in order to reach the scene as quickly as possible. South Africa has a high morbidity and mortality rate from road traffic accidents which cost the economy approximately R164 billion per annum. Road traffic accidents are also the leading cause of deaths among people aged between 5 and 29 years (Nel 2019). Factors including, but not limited to, high speed driving, perilous roads, and inclement weather increase the risk of involvement in motor vehicle accidents among paramedics (Studnek & Fernandez 2008). The Sisonke district is mainly a rural area while the uMgungundlovu district comprises both urban and rural areas. Paramedics from these two districts are, therefore, in all likelihood, exposed to the hazardous roads which are a feature of rural areas. Wet roads (in both rural and urban setting) and high speed driving may also be among the reasons for the motor vehicle accidents among the paramedics of the Sisonke and uMgungundlovu districts.

5.2.3. Musculoskeletal injuries: Injury on duty records review

Musculoskeletal injuries were the second most common type of occupational injury that emerged from the review of paramedics' injuries as contained in the duty records of the Sisonke district and uMgungundlovu district (16.7%, n = 6). A study conducted by Roberts *et al.* (2015) also identified musculoskeletal injuries as one of the most common occupational injury types among paramedics. In their investigation, Roberts *et al.* (2015) established that paramedics had submitted more workers' compensation claims due to musculoskeletal injuries compared to other HCWs such as nurses and social welfare professionals. Similar findings were obtained by Reichard and Jackson (2010) who identified musculoskeletal injuries, such as sprains, strains and lower back injuries, as the most common occupational injuries among paramedics. Musculoskeletal injuries are associated with medical and worker replacement costs for EMS employers while they also result in psychosocial, psychological and wage loss problems for EMS employees, specifically operational paramedics (Fisher &

Wintermeyer 2012). Factors which contribute to musculoskeletal injuries among paramedics include, but are not limited to, manual handling of sick, obese and immobile patients who require lifting, turning and transferring, awkward postures, repetitive motions, and the lifting of heavy equipment (D'Arcy *et al*. 2011). The repercussions of musculoskeletal injuries among KZN paramedics and the risk factors for musculoskeletal occupational injuries are further discussed later in this chapter.

5.2.4. Needle-stick injuries: Injury on duty records review

Needle-stick injuries were also among the occupational injuries identified during the review of injury as contained in the duty records of the Sisonke district and uMgungundlovu district (13.9%, n = 5). A study conducted by Yaylaci and Karcioglu (2016) also reported needle-stick injuries as one of the common occupational injuries (16%, n = 26) among paramedics in Turkey. In their investigation, Yaylaci and Karcioglu (2010) also established that needle-stick injuries among paramedics commonly occurred during intravenous line procedures inside cruising ambulances. A study conducted by Reichard and Jackson (2010) also reported that needle-stick injuries constituted 21% (n = 4500) of all the occupational injuries reported by EMS personnel in the United States between 2000 and 2001. Needle-stick injuries are defined as puncture wounds to the skin or mucous membrane with unsterilized and/or contaminated objects (McDowall & Laher, 2019). Needle-stick injuries are common among paramedics worldwide (Alhazmi *et al.* 2018). Factors that increase the risk of needle-stick injuries in the EMS occupation include, but are not limited to, working long hours, shift work and uncontrolled working environments (Alhazmi *et al.* 2018). Needle-stick injuries, their risk factors, and their implications among KZN paramedics are discussed later in this chapter.

5.3. Self-administered questionnaire

As per the questionnaire, the findings from the study revealed that 25 (16.5%) occupational injuries suffered by the KZN paramedics were unreported. Furthermore the study revealed that 49 (32.2%) of the KZN paramedics had experienced occupational injuries which had resulted in their seeking medical attention. Overall, 52 (38.8%) of the KZN paramedics had experienced occupational injuries (both reported and unreported). This section discusses the occupational injury data (both reported and unreported) that was obtained from the self-administered questionnaires. The

occupational injuries discussed in this section include musculoskeletal injuries, injuries due to motor vehicle accidents, needle-stick injuries, and injuries due to assault.

5.3.1. Musculoskeletal injuries

5.3.1.1. Reported musculoskeletal injuries

The findings from the study revealed that musculoskeletal injuries were the leading occupational injury type among KZN paramedics, as reported in the self-administered questionnaires with musculoskeletal injuries forming the greater proportion of both reported (55.1%, n = 27) and unreported (48%, n = 12) occupational injuries among the KZN paramedics. These findings are consistent with the results of a study by Roberts *et al.* (2015) which indicated that musculoskeletal injuries were common among both paramedics and other HCWs. In their study, Roberts *et al.* (2015) further discovered that musculoskeletal injuries among HCWs (including paramedics) were associated with the highest claims from the workers' compensation fund. Kumalo (2014) also found a higher than average prevalence of musculoskeletal injuries among nurses (77%, n = 178). Furthermore a study conducted by Sehume (2016) on eight hospitals in Tshwane (Gauteng Province) discovered that musculoskeletal injuries (particularly low back injuries) were considered one of the common injuries among HCWs (4.4%, n = 22).

This study did not reveal any statistically significant association between the number of years of service of paramedics and their experiencing musculoskeletal injuries. However, it was noted that the increase in the number of years of service resulted in the increased occurrence of musculoskeletal injuries. Moreover, a majority (n = 23, 69.7%) of the paramedics who reported experiencing musculoskeletal injuries were those with more than ten years of service. This finding is consistent with the results of a study by Shafiezadeh (2011) which showed an increase in the occurrence of musculoskeletal disorders with increasing years of service among HCWs. Aljerian *et al.* (2018) also found a statistically significant association between the years of service of HCWs and the occurrence of musculoskeletal disorders with the HCWs with more years of service being affected primarily by musculoskeletal disorders. The researcher in this study speculated that this relationship was due to the many years of exposure to activities such as patient lifting, carrying equipment and awkward postures due to the duty demands of paramedics. It was, thus, not surprising that paramedics with more years of service were more affected by musculoskeletal injuries.

5.3.1.2. Unreported musculoskeletal injuries

The study also revealed that the majority (48%, n = 12) of musculoskeletal injuries experienced by KZN paramedics were unreported. These findings are consistent with the results of a study by Brown *et al.* (2005), which discovered that 582 (41%) of the musculoskeletal injuries experienced by nurses were unreported. Factors which have been found to be associated with the underreporting of musculoskeletal injuries among nurses include peer pressure not to report such injuries, fear of frustration with the workers' compensation procedures, fear of lack of support by management, and a lack of onsite, occupational and employee health services (Brown *et al*. 2005, Menzel 2008). Other reasons that may contribute to the underreporting of musculoskeletal injuries may be that nurses adapt and adjust to the pain that may be triggered by musculoskeletal injuries, and seek medical attention only if the condition becomes unbearable (Kumalo 2014). The reasons for the underreporting of musculoskeletal injuries among the KZN paramedics who participated in the study are unknown although they may be associated with various factors such as the desire to avoid filling in workers' compensation claims, a perceived lack of support from management, and a lack of understanding of the workers' compensation claims processes. Furthermore, musculoskeletal injuries are not immediately apparent and may take days, months or even years of exposure before the worker is affected (Burton 2010). This and the ability to endure pain that may not be severe during the early onset may be the reasons for the underreporting of musculoskeletal injuries among KZN paramedics.

5.3.1.3. Effects of masculinity on reporting of musculoskeletal injuries

The majority of the participants of this study were male paramedics (75%, n = 114). Men are known to be more unwilling and hesitant to seek help and use health services in comparison to women. This is often a result of the influence of sociocultural and biological factors (Smith *et al.* 2006). The social construction of masculinity has a significant impact on men's willingness to report health related issues. Stoicism and the suppression of emotion, for example, are values which are often associated with masculine gender role socialisation. This has led men to believe that they are supposed to endure pain and hardship without complaint (Meister 2010). Adherence to patriarchal masculine norms, such as superiority, independence, self-reliance and dominance, may also affect the men's willingness to seek help. In addition, men are also influenced by cultural stereotypes in respect of ignoring screening and preventive

health care, and to delay seeking help until symptoms manifest (Meister 2010, Smith *et al.* 2006). Thus, masculinity may be another significant reason associated with the underreporting of musculoskeletal injuries. In this respect it is important to note that, in the main, the EMS profession is dominated by male paramedics as was also evident in the gender distribution of the participants in this study.

5.3.1.4. Potential repercussions of musculoskeletal injuries

Musculoskeletal injuries are generally associated with adverse conditions such as pain, discomfort and impaired mobility while the usual outcome of musculoskeletal injuries include reduction in productivity, increased disability, increased costs to the employer and pain and suffering as well as wage loss for the affected employee (Aljerian *et al.* 2018, Maguire *et al*. 2005). The high rates of musculoskeletal injuries among the KZN paramedics who participated in this study may be associated with major complications such as lost work days, reduced productivity and knock-on effects to the provision of EMS provision in KZN. In severe cases this may also lead to wage loss and impoverishment for the families of the affected paramedics in KZN. The recently reported ambulance to population ratio in KZN was 1: 48 660 which is significantly less compared to the 1:10 000 recommended national norm. As a result, part of the KZN Department of Health's Strategic Plan (2015-2019) was to increase the number of daily operational ambulances from 212 to 550 by March 2020 in order to increase the response times in both urban and rural settings (KwaZulu-Natal Department of Health 2015). It follows that losing personnel due to work-related injuries would result in fewer available ambulances and reduced service delivery that may lead to increased morbidity and mortality in the province.

5.3.2. Needle-stick injuries

Needle-stick injuries emerged as the third most common occupational injury type that was reported by the KZN paramedics in the self-administered questionnaire (26.5%, n = 13). These results are consistent with the findings of a study conducted in South Africa by McDowall and Laher (2019) which discovered that 26.3% (n = 63) of paramedics had previously suffered needle-stick injuries. A further study conducted by Gershon *et al.* (2007) also discovered a higher prevalence of needle stick injuries among registered nurses (65%, n = 875). In addition, needle stick injuries among paramedics have been further reported by Reichard and Jackson (2010) (21%, n =

4500) and Alhazmi *et al.* (2018) (18%, n = 45). Three major concerns associated with needle-stick injuries include HIV infection, Hepatitis B infection and Hepatitis C infection. The Hepatitis infection risk is generally higher than that of HIV following a needle-stick injury (Rossouw *et al.* 2014). However, the high rates of HIV infection among the South African population (13.1%, n = 7.52 million) increase the risk of contracting HIV infection rather than Hepatitis. This has resulted in most of the post exposure prophylaxis protocols in South Africa focusing more on HIV than on Hepatitis (McDowall & Laher 2019).

It was, thus, surprising that 48% (n = 12) of the participants in this study revealed that they had failed to report their needle-stick injuries, given the high risk of HIV and Hepatitis infection in South Africa. A study conducted by Boden *et al.* (2015) also indicated the underreporting (20.5%, n = 16) of needle-stick injuries among US based hospital staff. Similarly, Gershon *et al.* (2007) reported that the needle-stick injuries suffered by registered nurses were either informally reported or completely unreported (34.1%, n = 44). Boden *et al.* (2015) evaluated the reasons that often contribute to the underreporting of needle-stick injuries among HCWs. The reported reasons included perceptions that the injury was not high risk and thinking that reporting took too much time (probably because taking the time to report such injuries conflicted with patient care responsibilities). Gershon *et al.* (2007) also discovered similar reasons and more such as a fear of the part of the nurses of getting into trouble with their line managers, lack of understanding of needle stick protocol, and confidentiality issues. Other cases of non-compliance with needle-stick injury protocol recommendations have also been reported by McDowall and Laher (2019), for example, failure to undergo HIV testing within the recommended 72 hours (4.3%, n = 3), failure to complete the recommended HIV post exposure prophylaxis (17.1%, n = 14), failure to test for Hepatitis B and Hepatitis C as well as failure to comply with the recommended follow-up intervals after exposure (6 weeks and 4 months).

However, the reasons for the underreporting of needle-stick injuries among the KZN paramedics who participated in study are unknown. It is, however, possible that they would have had similar reasons to those outlined in the studies mentioned above (Gershon *et al.* 2007, Boden *et al.* 2015), for example, a desire to avoid the long procedures associated with needle stick injury protocol, lack of understanding of the needle-stick injury policy, and assumptions that there few less infection risks.

Furthermore, this study did not establish whether the paramedics had taken the post exposure prophylaxis privately without reporting the needle-stick injury to their line managers. However, the researcher in this study was aware that some of the paramedics may have followed the HIV post exposure prophylaxis precautions privately, without reporting the needle-stick injury in their workplace.

This study also found an association between needle stick injuries and the qualifications of a paramedic ($p = 0.001$). The proportion of ILS paramedics who had experienced needle-stick injuries was higher compared to those paramedics with other qualifications (52.4%, $n = 11$). This study did not explore the events that had led to needle-stick injuries among the KZN paramedics who participated in the study. However; the main reason for this association was probably that, ILS paramedics are frequently required to perform peripheral intravenous cannulation during patient care. Peripheral intravenous cannulation is one of the capabilities of ILS paramedics that are stipulated by the Health Professions Council of South Africa's Professional Board for Emergency Care (Bester & Sobuwa 2014). Intravenous cannulation is not part of the scope of practice for BLS paramedics and, in addition, there were not sufficient ALS paramedics in the study sample to compare with the ILS paramedics. Nevertheless, BLS paramedics do assist with patient care and may be required to draw fluid from an intravenous bag which requires the handling of sharps, which exposes them to the possibility of needle-stick injuries. This was supported by the 9.5% ($n = 2$) of BLS paramedics in the study who had suffered needle-stick injuries.

The study also found an association between needle stick injury and involvement in medical rescue ($p = 0.015$). The proportion of paramedics who had experienced needle-stick injuries was higher amongst those who were involved in medical rescues involving the use of the Jaws of Life (29.63%) compared to those who performed other tasks (10.40%). Although the reasons for this association are unknown it may, however, be due to the awkward positions (i.e. during extrication of entrapped patients) that paramedics are required to adopt while performing certain procedures (intravenous cannulation, glucose testing, and intramuscular administration) which require the use of needles and where the patients' clinical circumstances warrant the urgent need for such procedures.

5.3.3. Injuries due to motor vehicle accidents

Injuries due to motor vehicle accidents were the second most common occupational injury type reported in the self-administered questionnaires by the KZN participants (44.9%, n = 22). In fact, motor vehicle accidents are one of the commonly reported occupational hazards among paramedics (Reichard & Jackson 2010, Studnek & Fernandez 2008). Factors such as high speed driving, fatigue, and sleep deprivation increase the risk of motor vehicle accidents among paramedics.

Fatigue is one of the factors that is frequently linked to the occurrence of motor vehicle accidents involving paramedics. Sofianopoulos *et al.* (2011) discovered that 92% (n = 55) of paramedics in Australia had experienced fatigue with 88% (n = 53) believing it had affected their performance at work. Paramedics often experience fatigue as a result of their erratic and usually busy hours of work. Fatigue affects both the paramedics' mind and body and often results in their not being able to function at their normal level of their abilities and may, therefore, increase the risk of their being involved in accidents when driving (Sofianopoulos *et al.* 2011, Ramey *et al*. 2019). Other factors, including high speed driving, perilous roads, and inclement weather conditions, also increase paramedics being involved in motor vehicle accidents (Studnek & Fernandez 2008). Fatigue is not uncommon in South African paramedics due to their increased workload as a result of higher healthcare (including EMS) services demands and shift work (KwaZulu-Natal Department of Health 2015). The researcher in this study, therefore, speculated that fatigue may be one of the reasons for the occurrence of motor vehicle accidents involving paramedics in KZN.

The study also revealed a statistically significant association between injuries due to motor vehicle accidents and age among the participants ($p = 0.035$). It emerged that a higher proportion of the younger paramedics had experienced injuries due to motor vehicle accidents compared to the older paramedics. These findings are consistent with the results of a study by Studnek and Fernandez (2008) which found a significant relationship between ambulance accidents and the ages of the paramedics involved. Specifically, they noted that, for every five year decrease in age, there was a higher likelihood of involvement in an ambulance accident being reported. This association was linked to the younger drivers having less experience in terms of operating larger and heavy vehicles at increased speed. This may also be the exact same reason for the higher prevalence of injuries due to motor vehicle accidents among the younger

KZN paramedics who participated in this study. Another possible contributor may be the fact that younger age groups are generally at an increased risk of being involved in motor vehicle accidents. This may be due to several factors including immaturity, inexperience in recognising risky situations, and risk-taking behaviour (Chokotho *et al*. 2012).

5.3.4. Injuries due to assault

The study revealed that injuries due to assault were less common among the KZN paramedics (8.2%, n = 4 reported and 4%, n = 1 unreported) as may have been supposed. However, these findings are not consistent with the results of a study conducted by Mechem *et al.* (2002) which indicated a higher percentage of assault-related injuries among paramedics compared to firefighters (79.5%, n = 35 vs 20.5%, n = 9). Using a prospective, quantitative, internet-based survey Holgate (2015) also conducted a study to assess the opinions of South African paramedics regarding their perceptions of personal and patient safety in the EMS environment. The study discovered that 56% (n = 88) of the paramedics had previously encountered assault while at work. The study comprised a total of 158 responses that were deemed eligible for analysis. The majority (57%; n = 89) of the paramedics who had participated in the study were employed by the Urban Ground Ambulance services. The limitations of self-selection bias and a low response rate (26.9%) were, however, noted in the study (158 responses vs the intended 610 responses).

A number of incidences relating to violence against EMS personnel have also been reported in the South African media (Thusi 2016, Fambisa 2019). Thus, the lower rates of such incidents revealed in this study may not be a true reflection of the actual prevalence of assault incidences among paramedics in KZN. The poor participation of KZN paramedics (e.g. non-involvement of paramedics with previous exposure to workplace violence) in this particular study may have distorted the results. On the other hand, it is possible that assault arising from verbal abuse was overlooked as a result of the paramedics considering it to be part of their job. Pourshaikhian *et al*. (2016) highlighted the following most common forms of violence against paramedics; physical violence (79%), verbal violence (82%), and sexual harassment (28%). Pourshaikhian *et al*. (2016) further reported that, in most cases, patients and their relatives perpetrate violence against EMS personnel. Holgate (2015) reported similar findings regarding the perpetrators of such violence (patients 67.3%, n = 37, bystanders 18.2%, n = 10,

and colleagues 9.1%, n = 5). Vincent-Lambert and Westwood (2019) and Fambisa (2019), however, reported incidents where violence had occurred as a result of paramedics being targeted by criminals in attempts to gain access to their valuable items (cell phones, medical equipment and drugs).

There was one case only of unreported assault among the participants. However, these results are inconsistent with the findings of a study conducted by Pourshaikhian *et al*. (2016) which indicated higher rates (38%) of the underreporting of workplace violence. They indicated that the underreporting of workplace violence among EMS personnel may be due to most employees believing either that it was insignificant or that it was part of their job. As mentioned previously, workplace violence may be either verbal or physical, or both. Therefore, it is possible that the higher incidences of underreporting indicated by Pourshaikhian *et al*. (2016) were more verbal assault rather than physical violence. However, this is not the case with the KZN paramedics as it is evident in the reports mentioned above (Holgate 2015, Fambisa 2019) that violence directed against South African paramedics is a serious problem. Again, the poor participation of the paramedics in KZN in this particular study may have influenced the results.

The study found a statistically significant association between being assaulted and the age groups of the paramedics ($p = 0.046$) with the paramedics above the age of 40 being more likely to experience assault in comparison to younger paramedics. These findings concur with the results of a study conducted by Malangu (2012) which revealed more assaults against HCWs above the age of 40 years in Limpopo. In contrast, a study conducted by Bigham *et al.* (2014) reported fewer assault cases among older paramedics compared to younger paramedics. The reasons for the greater number of assaults among younger paramedics were not explored although the researchers appeared to be of the opinion that this was due to the older paramedics being more aware of hostile environments in comparison to their younger counterparts. This study did not explore the reasons for the higher number of assault incidences among older paramedics in KZN although, as indicated and discussed by Malangu (2012), it may be possible that the perpetrators of violence perceive older paramedics as being more vulnerable to attack than the younger paramedics who may be able to defend themselves. Malangu (2012) found that 75.8% (n = 25) of the HCWs who were assaulted in Limpopo province were above the age of 40 and, as a result

they were often unable to defend themselves because of their possibly being frail, being alone with the perpetrators, and working at night. The next section discusses the risk factors for occupational injuries as perceived by the participants.

5.4. Perceived risk factors for occupational injuries

This section discusses the occupational injury risk factors as perceived by the participants. The risk factors discussed include high speed driving, violent members of society, the lifting of heavy objects and patient lifting, physical exhaustion, hazardous materials, and temperature extremes.

5.4.1. High speed driving

The study revealed that majority of the participants perceived high speed driving as a risk factor for occupational injuries (87.5%, n = 133). This perception was particularly prevalent among the paramedics (89.2%, n = 132) who were involved in primary response and the provision of medical interventions to patients in comparison to those who performed other EMS tasks (i.e. inter-facility transfers). This relationship was statistically significant (p = 0.006). High speed driving has been previously reported as one of the major risk factors for occupational injuries and is believed to be one of the factors contributing to motor vehicle accidents involving paramedics (Reichard & Jackson 2010, Studnek & Fernandez 2008, Yaylaci & Karcioglu 2016.

EMS personnel are expected to respond to any life-threatening emergency call within 5 to 15 minutes in urban environments and 40 minutes in rural environments. In an attempt to accomplish this expedient response time, the need for high speed driving may cause harm to others, especially through motor vehicle accidents which occur as a result of emergency responses in difficult terrain and harsh weather conditions (Holgate 2015). Response times are among the commonly used indicators used to measure EMS efficiency, particularly in relation to patients with life threatening conditions (Stein *et al.* 2015, Finlayson 2017). Thus, the perception that high speed driving is a risk factor for occupational injuries among the participants (particularly those involved in primary response) may be due to the pressure that comes with attempts to achieve the aforementioned response times. Furthermore, the recent ambulance to population ratio (1: 48660) may exacerbate the pressure associated with achieving the required response times among KZN paramedics (KwaZulu-Natal Department of Health 2015).

This study revealed a statistically significant association between the district base of a paramedic and the belief that high speed driving is a risk factor for occupational injuries (p = 0.020). All 28 of the paramedics who worked in the Sisonke district cited high speed driving as a risk factor for occupational injuries. Other reasons for this (in addition to the need to meet the required response times) may be the difficult terrain and harsh weather conditions which are a feature of the rural location of the Sisonke district.

5.4.2. Violent members of society

Violent members of the society were also perceived (87.5%, n = 133) as a major risk for occupational injuries by the KZN paramedics who participated in this study. The association between the area or setting where the paramedics were based and their perception that violent members of the society are a risk factor for occupational injuries was statistically significant (p = 0.013). All the paramedics (n = 8) who worked exclusively in urban areas cited violent members of the society as a risk factor for occupational injurie. South African paramedics commonly respond to incidents where they assist victims of crime and violence and, in some instances, they arrive on the scene before the police and, hence, the scene is often unpredictable. Paramedics are, therefore, at an increased risk of falling victim to crime and violence (Vincent-Lambert & Westwood 2019). Statistics South Africa (2019) reported various criminal offences which took place between 2018 and 2019 in South Africa. These included house breaking (13%, n = 2.2 million), home robbery (2.7%, n = 448 507), car theft (1.5%, n = 255 917), murder (0.32%, n = 159 506), and sexual offences (52 420). Given the crime rates in South Africa, it is not surprising that the participants perceived violent community members as a major risk factor for occupational injuries. This perception may also result in a fear of falling victim to violence from criminals or from members of the community where crime has been committed because the majority of community members (52%) in South Africa often use mob-justice measures to protect themselves against the perpetrators of crime (Statistics South Africa 2019). South African paramedics may, therefore, be affected by such activities (mob justice) while treating criminal suspects.

Although Holgate (2015) did not compare the location of paramedics (rural/urban) and assault incidences, only 9% (n = 14) of the paramedics in Holgate's (2015) study were based in rural areas while the majority were urban based (57%, n = 89). It may,

therefore, be presumed that the majority of paramedics who reported violence in the study were also urban based. Nicolson (2017) also reported that the majority of the reported criminal offences which took place in South Africa between 2016 and 2017 occurred in urban areas (70% car theft, 64% aggravated robberies, 58% residential robberies and 47% murders). Furthermore, the violent incidents reported by Thusi (2016) and Fambisa (2019) were in urban areas. This explains the higher perception of violent community members as a risk factor for occupational injuries among the urban-based paramedics.

This study found a significant relationship between the participants who were involved in inter-facility transfers and the perception that violent members of the community constituted a risk factor for occupational injuries ($p = 0.001$). This is rather an unusual and interesting finding as these paramedics are not in frequent contact with members of society. However, this association may be due to a lack of understanding of hostile situations as a result of less exposure to such environments as these paramedics are primarily involved in inter-facility transfers.

5.4.3. Lifting of heavy objects and patient lifting

The majority of the KZN paramedics who participated in the study perceived the lifting of heavy objects and patient lifting as a risk factor for occupational injuries (86.2%, $n = 131$). Furthermore, a higher percentage of those (91%, $n = 111$) who undertook inter-hospital transfers perceived the lifting of heavy objects, including lifting patients, as a risk factor for occupational injuries when compared to those who performed other tasks. This relationship was found to be statistically significant ($p = 0.002$). The musculoskeletal injuries reported in the studies by Algerian *et al.* (2018), Maguire *et al*. (2005) and Fisher and Wintermeyer (2012) were also associated with the lifting of heavy equipment and patient lifting. The lifting of heavy medical equipment and patient lifting place high physical demands on paramedics, while other factors such as the uneven distribution of the body and unpredictable human behaviour during lifting may exacerbate the problem (Fisher & Wintermeyer 2012). During their interventions, paramedics provide emergency care and, in the majority of cases, they have to evacuate patients on stretchers which involves the use of excessive physical effort while lifting, pushing or pulling (Prairie *et al.* 2017).

South African paramedics place an important role in the health systems in the provision of pre-hospital emergency care and the transportation of critically ill and injured patients to healthcare facilities (Binks 2011). On average there are 21 operational EMS vehicles per 12 hour shift in KZN, with an average of 107 cases per shift. Thus, each EMS vehicle is expected to attend to an average five cases per 12 hour shift, meaning that each case should be completed within 144 minutes. The 144 minutes per case, however, has been found to unachievable in KZN (Finlayson 2017). Higher case load demands may increase the physical demands on KZN paramedics and, hence; the perception of the lifting of heavy equipment and patient lifting as a risk factor for occupational injuries.

The reason for the higher perception of the lifting of heavy equipment and patient lifting as a risk factor for occupational injuries on the part of paramedics involved in inter-facility transfers is, in all likelihood, because their main task (inter-facility transfers) exposes them to lifting equipment and patients more than the paramedics who perform other tasks. Finlayson (2017) indicated an average of 79 inter-facility transfer cases per shift in KZN. However, the number of EMS vehicles designated for inter-facility transfers was less in relation to the number of cases the inter-facility transfer crew received per day. This would, therefore, suggest that the inter-facility transfer paramedics were overworked and also that higher physical demands were placed on them during patient transfers (loading and carrying). It should also be noted that the paramedics who performed other tasks (i.e. primary response) were exposed to other risk factors (high speed driving, violence and biological hazards) which were less common in the case of the paramedics who undertook inter-facility transfers. Thus, the lifting of heavy equipment and patient lifting may have been the only common risk factor among paramedics involved in inter-facility transfers. It, therefore, makes sense that the paramedics who were involved in inter-facility transfers viewed the lifting of heavy equipment and patient lifting as the major risk factor because this may have been the only common risk factor within their sphere of operations.

5.4.4. Physical exhaustion

The participants (78.3%, n = 111) also perceived physical exhaustion as a major risk factor for occupational injuries. Furthermore the proportion of paramedics who deemed physical exhaustion as a risk factor was higher among those who were involved in inter-hospital transfers (82%, n = 100) compared to those who performed

other tasks (63.3%). This relationship was found to be statistically significant (p = 0.027). Due to the nature of their work paramedics are often required to work lengthy and erratic hours and their workloads are also physically demanding (Reichard & Jackson 2010).

Under normal circumstances a person's sleeping pattern is regulated by the circadian rhythm. The circadian rhythm allows a person to sleep during the dark (night time) and be awake when it is light (day time). This is associated with increased melatonin secretion during the night and reduced secretion in the presence of light. However, in the case of shift workers (i.e. paramedics), the circadian rhythm is disturbed and this often results in difficulty in sleeping during the day (low melatonin secretion), as well as the consequent symptoms of fatigue and poor performance while on duty (night shift) due to a lack of restorative sleep (Sofianopoulos *et al.* 2011, Paterson *et al.* 2014). It is, therefore, understandable that the majority of the participants perceive physical exhaustion as a major risk factor for occupational injuries. Paramedics in KZN are exposed to shift work and they often work long hours and, thus, they are bound to experience physical exhaustion. In some instances, KZN paramedics are required to evacuate patients from difficult terrains and this also may contribute to physical exhaustion. The recently reported KZN ambulance to population ratio (1:48 660) (KwaZulu-Natal Department of Health 2015) also suggests higher than normal workloads among KZN paramedics which may also cause physical exhaustion. Finlayson (2017) discovered a higher demand for ambulance services in the uMgungundlovu Health District (1503 cases per week, and 107 cases per 12 hour shift) in relation to the available staff and EMS vehicles. This was associated with paramedics overworking in the uMgungundlovu district and, hence, the perception of physical exhaustion as a risk factor.

The reason for the higher perception of physical exhaustion as a risk factor for occupational injuries among paramedics who are involved in inter-facility transfers is unknown. However, concerns about the high demand (average 79 cases per day) for inter-facility transfers have been raised by paramedics in the uMgungundlovu district (Finlayson 2017) who reported an inability to complete the number of inter-facility transfer cases received per day in this district due to both the shortage of resources (staff and ambulances) and time constraints (Finlayson 2017). This is an indication

that the paramedics involved in inter-facility transfer are physically overworked and, hence, the perception of physical exhaustion as a risk factor for occupational injuries.

5.4.5. Hazardous materials

Hazardous materials were also perceived as a major risk factor for occupational injuries by the participants (77%, n = 117). The proportion of paramedics who cited hazardous materials as a risk factor was higher among those who provided primary response and medical interventions to patients (78.4%, n = 116) compared to those who performed other tasks (i.e. inter-facility transfers and medical rescue using the jaws of life) (25%). This relationship was found to be statistically significant (p = 0.038).

Exposure to hazardous substances is one of the occupational hazards for EMS personnel (Reichard & Jackson 2010, Yaylaci & Karcioglu 2016. Exposure to harmful substances is common among paramedics and often occur in the form of exposure to blood and body fluids, exposure to needle-stick and sharps injuries and exposure to chemicals (mainly latex from gloves) (Harthi & Rachman 2019). In addition, exposure to blood and body fluids commonly occurs when patients cough blood or body fluids into the faces of paramedics. Exposure to sharps and needle-stick injuries, and to blood and body fluids are associated with infection transmission (Harthi & Rachman 2019). The high prevalence of needle stick injuries among paramedics has been reported in previous studies (McDowall & Laher 2019, Alhazmi *et al.* 2018) including complications such as HIV infection, Hepatitis B infection and Hepatitis C infection. Bridgewater *et al.* (2006) also reported a 30.7% (n = 337) latex allergy among paramedics in Australia. The reported complications related to latex exposure include atopy (14.9%, n = 164), hand dermatitis (9.4%, n = 103), and latex allergy (6.4%, n = 70).

Paramedics are frequently required to administer intravenous fluids, intravenous medication, and intramuscular medication. This involves the use of sharps (needles) with these procedures sometimes having to be performed in poorly controlled environments. Paramedics are required to use gloves in order to protect themselves against possible exposure to body fluids and secretions. However, this also potentially exposes them to latex related complications (e.g. allergy). It is, therefore, not surprising that the participants perceived hazardous material as a risk factor for occupational injuries given the prevalence of exposure to harmful substances

(particularly blood borne) within the EMS environment. Furthermore, the majority of the participants involved in primary response and the provision of medical interventions perceived exposure to hazardous material as a risk factor for occupational injuries, given that they are frequently the first to be in contact with patients and they are required to initiate the majority of interventions (e.g. peripheral venous cannulations, and blood glucose tests).

5.4.6. Temperature extremes

Temperature extremes were perceived as major risk factors for occupational injuries by the participants (73%, n = 112). However, the proportions of paramedics who perceived working under extreme temperatures as a risk factor for occupational injuries were not similar across all the districts ($p = 0.007$) and was found to be higher among those who worked in the uMgungundlovu district compared to those working in other districts. In addition, the proportion of paramedics who perceived working under extreme temperature as a risk factor was higher among those who provided medical rescue involving the use of the jaws of life (88.9%, n = 24) compared to those who performed other tasks (69.60%). This relationship was found to be statistically significant ($p = 0.040$).

Due to the nature of their work paramedics are exposed to a variety of occupational hazards including temperature extremes (Reichard & Jackson 2010). Both hot and cold temperature extremes may prove challenging to both paramedics and other EMS personnel. Extremely cold temperatures increase the risk of hypothermia among paramedics and other EMS personnel while extremely hot temperatures may increase the risk of heat exhaustion among paramedics and other EMS personnel during the evacuation of patients under such weather conditions (US Fire Administration, 2008). It was, therefore, not unexpected that compared to paramedics who performed other tasks, a higher percentage of those involved in medical rescue operations involving the use of the jaws of life perceived temperature extremes as an occupational risk factor as they are highly exposed to temperature extremes during rescue operations.

Weather extremes (cold spells, heat waves, hail storms and drought) have all been reported in KZN province with the uMgungundlovu district as one of the regions affected (Hlahla & Hill 2018). Such weather extremes are due to the climate changes across South Africa and in KZN province, in particular, as a result of factors such as

the increased concentration of greenhouse gases, among others (Ellis 2019). Between 1978 and 2016, KZN has been reported as experiencing various weather extremes (Figure 5.1) which have had a significant impact on the population in the province (Hlahla & Hill 2018). Paramedics are usually the first to respond to such extreme climate events and are, therefore, exposed to weather extremes during their attempts to evacuate people who have been affected. It was, therefore, reasonable that the participants (including those in uMgungundlovu and neighbouring regions) cited temperature extremes as one of the major risk factors for occupational injuries.

Table 5. 1: Climate stressors and extreme weather events in KZN, from 1978 to 2016.

Date	Climate stressor	Details
February 12, 1978	Thunderstorm	At least 10 people were killed and hundreds left homeless after a severe thunderstorm. Damage was estimated at US$76,790 (US$1 = ZAR13.02) at the time
1982	Drought	Worst drought since the 1920s
February 4, 1986	Tornado	A tornado travelled 86 km from Pietermaritzburg to Ixopo
March 22, 1987	Flood	Heavy rains in Pietermaritzburg caused flooding
September 27, 1987	Flood	Flood described as the worst disaster ever to have struck KZN, leaving an estimated 388 people dead and 68,000 homeless. Homes were washed away, collapsed, or buried by mud and 14 bridges were washed away. The province was declared a disaster area, with a total damage estimated at US$253.4 million (US$1 = ZAR13.02)
October 30, 1989	Hailstorm	Hail destroyed fruit and vegetable crops to the value of US$383 951 (USD1 = ZAR13.02)
1991/1992	Drought	At the time, it was declared the worst drought in the 20th century
June 21, 1994	Fire	60 grass and bush fires were reported in Pietermaritzburg
August 6, 1995	Cold spell	A cold spell felt across South Africa resulted in snow falling in KZN, Western and Eastern Cape, Free State, and Gauteng
December 25, 1995	Flood	60 mm of rain fell in 30 min, causing the Msunduzi River, which runs through the centre of Pietermaritzburg, to burst its banks, with 130 fatalities. The region was declared a disaster area
July 1996	Cold spell	Large areas of the country experienced cold weather during July, leading to several deaths
August 4/5, 1996	Cold spell	Cold spell felt across South Africa
January 23, 1997	Thunderstorm	The storm uprooted trees and damaged electricity and telephone cables
April 20,1 1997	Flood	At least 100 people were left homeless in Pietermaritzburg

June 10, 1997	Cold spell	A cold spell resulted in unusually heavy snowfall in the Eastern Cape and KZN interior
February 2, 1999	Flood	Informal settlements were flooded and two people drowned
November 15, 1999	Floods	In Mpophomeni, 200 families were left homeless and at least one person drowned
August 23, 2003	Fire	Grass fires across KZN caused the deaths of six people
December 2003	Drought	Above-normal temperatures and below-normal summer rainfall caused widespread drought over most of the summer rainfall regions
January 11, 2004	Heat wave	A number of people reportedly suffered from dehydration and heat exhaustion and were hospitalized
January 16, 2004	Drought	Following the extreme dry conditions, the following provinces were declared disaster areas: KZN, North West, Mpumalanga, Free State, Eastern Cape, and Northern Cape
September 6-7, 2004	Cold spell	50 schools and a number of roads were closed as a result of the snow
November 22, 2004	Hailstorm	Buildings and crops were damaged by the golf-ball-sized hailstones
December 25, 2004	Hailstorm	80 families were left homeless after a hailstorm
January 3, 2005	Thunderstorm	Strong winds blew roofs off buildings and uprooted trees
September 23, 2005	Fire	Grass fires were reported across KZN, Free State, and Limpopo
January 27, 2007	Hailstorm	Heavy rain and hail were experienced across the KZN interior
February 17, 2007	Heat wave	Drought conditions prevail after a prolonged hot and dry summer season
November 27, 2011	Flood	Six people were killed and property damaged during the flood. Over 100 homes were flooded and damaged
February 6, 2015	Hailstorm	In what has been described as one of the worst hailstorms in three decades, golf and cricket-ball-sized hailstones damaged homes and cars in Pietermaritzburg. Some smashed through roof tiles, allowing for rain to enter the houses, causing severe water damage.
2015	Drought	With a total rainfall of 403 mm, 2015 was the driest year in South African history. Drought disaster was declared in five of the nine provinces in South Africa, including KZN and Free State which were the hardest hit. It was estimated that at least 2.7 million households were affected by this drought.
December 25, 2015	Heat wave	Temperatures reached 42°C in Pietermaritzburg. The public were advised to stay hydrated and avoid strenuous physical activity
March 16, 2016	Thunderstorm	A severe thunderstorm resulted in flash floods. Strong winds uprooted trees, collapsed walls, and flooded streets.
October 21, 2016	Hailstorm	Severe hailstorms in Pietermaritzburg

Source: Hlahla and Crill (2018).

The next section discusses the perceptions of KZN paramedics regarding measures to prevent occupational injuries.

5.5. Perceptions of paramedics regarding measures to prevent occupational injuries

This section discusses the perceptions of KZN paramedics regarding mitigation strategies for occupational injuries. The prevention strategies that are discussed include avoiding high speed driving during response to scenes, specific positioning during equipment and patient lifting, avoiding chaotic scenes with potential violence, and avoiding working excessively long hours and overworking physically.

5.5.1. Avoiding high speed driving while responding to scenes

A majority of the participants (79.6%, n = 121) cited avoiding high speed driving while responding to scenes as one of the measures to prevent occupational injuries. This is consistent with the earlier finding that a majority of the participants perceived high speed driving as a risk factor for occupational injuries (87.5%) and, hence, avoiding of high speed driving as a preventive measure. High speed driving has been widely reported as a risk factor for occupational injuries (particularly injuries due to motor vehicle accidents) among paramedics (Reichard & Jackson 2010). Other factors mentioned in this context include age and size of vehicle and vehicle design have been mentioned as contributing factors in relation to motor vehicle accidents among paramedics (Studnek & Fernandez 2008). Provincial EMS vehicles in KZN are designed in such a way that they are large and heavy (see figure 5.1) and may be difficult to operate at high speed. It is, therefore, suggested that KZN paramedics should avoid high speed driving in order to prevent the motor vehicle accidents that may occur due to difficulties in operating the EMS vehicles at high speeds.

Figure 5. 1: An image displaying the type, size, and structure of a vehicle that is currently being used by KZN EMRS (KwaZulu-Natal Department of Health 2019).

Sanddal *et al.* (2010) discovered that 11% (n = 51) of the ambulance accidents reported in US were due to bad road and weather conditions including rain, fog, whiteout/blizzard, wet, icy and slippery roads, and ice and snow. Bad weather conditions and poor road infrastructure (particularly the rural areas) are common in KZN. When coupled with vehicles that are not easy to operate at high speed, bad weather conditions and poor road infrastructure may increase the risk of errors during high speed driving (Hlahla & Hills 2018, Finlayson 2017). It was, therefore, not surprising that KZN paramedics tend to avoid high speed driving in order to prevent occupational injuries (particularly as a result of motor vehicle accidents). Figure 5.2 below depicts a KZN provincial EMS vehicle attending to a motor vehicle accident that had occurred in one of the rural areas in KZN. The roads in these rural areas are often gravel roads. Driving a KZN EMS vehicle (Figure 5.1 and Figure 5.2) at high speed on this type of the road may be challenging while such conditions may cause delays in response times and increase mortality.

Figure 5. 2: KZN provincial EMS vehicle (with old branding) attending to a motor vehicle accident in rural KZN on a gravel road (KwaZulu-Natal Department of Health 2014).

The expectation that paramedics should respond to life-threatening emergencies within 5 to 15 minutes in urban environments and 40 minutes in rural environments may be hugely affected by this preventive measure. The response times in KZN at the time of the study were poor due to various factors such as long distance responses in rural areas, poor road infrastructure (as seen above), vehicle shortages, and poor vehicle maintenance (Finlayson 2017). Accordingly, Finlayson (2017) recommended that the required vehicle and staffing resources should be determined based on a situational analysis per EMS base, and taking into consideration the caseload, terrain, population density and extent of the area deemed to be urban and rural. This would shorten the distances travelled during emergency response, improve the existing ambulance to population ratio, and eliminate the need for high speed driving during response to scenes for the KZN paramedics without adversely affecting the response times.

5.5.2. Specific positioning during heavy equipment or patient lifting

The study revealed that 97 (63.8%) of the participants believed that specific positioning during equipment and patient lifting is among the preventive measures for occupational injury occurrence. Heavy objects and patient lifting was perceived by the majority of the participants as a risk factor for occupational injuries (86.2%, n = 131) and, hence, the preventive measure. The lifting of heavy equipment and patient lifting have been named among the contributors to musculoskeletal injuries in the literature (Algerian *et al.* 2018, Maguire *et al*. 2005, Fisher & Wintermeyer 2012) while evacuating patients on stretchers has been mentioned (Prairie *et al.* 2017). The higher number of daily cases (inter-facility transfers and primary cases) in KZN reported by Finlayson (2017) suggests that KZN paramedics are physically overworked with this increasing their risk of musculoskeletal injuries. It is, therefore, recommended that they position themselves in a specific manner in an attempt to prevent musculoskeletal injuries during patient and/or equipment lifting.

Armstrong *et al.* (2019) highlighted that there is a need for interventions to reduce musculoskeletal injuries among paramedics while Algerian *et al.* (2018) suggested that manual handling techniques should be explained in order to reduce the risk of musculoskeletal injuries among paramedics. Strategies recommended by Prairie *et al*. (2017) to prevent the occurrence of musculoskeletal injuries among paramedics include teamwork during patient stretcher handling, giving clear signals in order to synchronise lifting among paramedics, avoiding lifting the stretcher with one hand, avoiding additional equipment in one hand or on the shoulder during patient lifting, and making attempts to minimise the slipperiness of the surface outside the ambulance. Shafiezadeh (2011) and Reichard *et al.* (2017) also recommended that paramedics should engage in exercise programmes in order to reduce the risk of musculoskeletal injuries and promote an efficient way of working. These and other strategies may be introduced among KZN paramedics to reduce the occurrence of injuries associated with heavy equipment lifting, and patient lifting.

5.5.3. Avoiding chaotic scenes where violence might arise

Approximately 61.8% (n = 94) of the participants indicated that avoiding chaotic scenes may prevent violence related occupational injuries. This is consistent with the earlier perception that violent members of the society (87.5%, n = 133) constituted a major risk for occupational injuries. South Africans are exposed to high levels of contact with violent crime. The drivers of crime in the country include poverty, unemployment, and unequal income distribution. As reported earlier, South African paramedics are often called upon to respond to incidents where they assist the victims of crime and violence and, in some instances, the police may not yet be present on the scene. This exposes South African paramedics to being targeted by criminals who wish to gain access to items such as valuable medical equipment, drugs, cell phones and electronic tablets (Vincent-Lambert & Westwood 2019). On the other hand, members of society may use aggression to prevent paramedics from treating criminal suspects in cases where mob justice occurred. It is, therefore, understandable that the participants were of the opinion that chaotic scenes with potential violence should be avoided.

A study conducted by Holgate (2015) in South Africa discovered a high prevalence of assault-related injuries among South African paramedics (56%, n = 88). Moreover, a number of incidences relating to violence against paramedics have been reported in the South African news media (Thusi 2016, Fambisa 2019). It is, therefore, important to devise strategies to prevent such incidents as they pose threats to EMS in the country. There are specific Hostile Environment Awareness Training programmes available for paramedics and security personnel, including law enforcement officers. Such programmes focus on developing the ability to assess situations, recognise specific risk factors and, where possible, avoid these risks. In South Africa, one course (i.e. Emergency Medical Support in Hostile Environments) is offered at ER24 (a private ambulance service with a national footprint). It is designed to address concerns related to violent crimes committed against the ER24. The aim of the course is to teach staff various skills, such as identifying hostile environments, how to deal with dangerous situations and how to mitigate the risks involved. The initiation of such training programmes may be of value to provincial EMS employees in KZN.

5.5.4. Avoiding overworking

The participants cited avoiding working an excessive number of hours as one of the perceived occupational injury preventive measures (49.34%) while a smaller percentage (7.89%, n = 12) of the participants believed that avoiding overworking physically may reduce the occurrence of occupational injuries. Physical exhaustion was among the perceived risk factors for occupational injuries among the participants (78.3%). It is, therefore, reasonable that KZN paramedics avoid working long hours and physical overwork in order to mitigate the occurrence of occupational injuries.

Fatigue is frequent among paramedics and it is one of the common causes of driving errors and motor vehicle accidents (Reichard & Jackson 2010). Paramedics experience fatigue as a result of their erratic and usually busy hours of work, which has an adverse impact on their ability to function optimally, resulting in errors in patient care (Sofianopoulos *et al.* 2011, Ramey *et al*. 2019). In addition, their sleeping patterns often change because of shift work, with these changes being associated with sleeping difficulties, fatigue and reduced performance among paramedics (Paterson *et al.* 2014). Fatigue among paramedics may lead to burnout, attrition, sick leave, work disability and health complaints. It is, therefore, clear that paramedics require sufficient recovery as well as restorative rest and sleep in order to perform their tasks effectively without jeopardising both the patients' safety and their own safety (Sofianopoulos *et al.* 2011).

Holgate's study (2015) reported on issues of fatigue and poor performance. The paramedics in Holgate's (2015) survey reported the following phenomena associated with fatigue, namely, diminished effectiveness when they are tired (68.2%), committing errors with potential harm to both patients and themselves (29.7%), and mishaps while handling patients (32%). High workloads among KZN paramedics and the demands for EMS service may make it impossible for KZN paramedics to avoid overworking. Thus, a recommendation by Finlayson (2017) that the allocation of EMS resources should be based on a situational analysis per EMS station may assist in this regard to reduce the workloads and associated fatigue among KZN paramedics.

5.6. Conclusion

This chapter discussed the findings of the study and measured these findings against the findings highlighted in the literature review. Motor vehicle accidents and musculoskeletal injuries were found to be the most common types of occupational injuries among the participants. These findings were consistent with the findings from international studies. The study also revealed that needle-stick injuries were common among the participants. Such results have also been observed in local and international studies. Although international studies report a higher prevalence of violence related injuries among paramedics, this was not consistent with the findings of this study. However, the reasons for this finding were not clear and may have been due to the poor participation of KZN paramedics in the study. The study also revealed that the participants have varying perceptions regarding the risk factors for occupational injuries depending on their demographic profile and this and other factors influenced methods they used to prevent the occurrence of occupational injuries.

The next chapter focuses on a summary of the study and discusses the conclusions, limitations and recommendations of the study.

CHAPTER 6

CONCLUSION

6.1. Introduction

This chapter presents the researcher's summary and discusses the conclusions drawn from the study results, discussion of the findings and the literature review. The chapter also presents the recommendations made by the researcher based on the study findings and, finally, the chapter presents the limitations and challenges encountered during the study.

6.2. Summary

Occupational injuries contribute to job dissatisfaction, poor performance and increased employee turnover rates (Pourshaikhian *et al*. 2016). The literature review revealed that the healthcare profession is characterised by numerous occupational hazards and a high risk of occupational injuries. The literature further indicated that, in addition to the occupational hazards encountered in the healthcare sector, there are additional occupational hazards that are specific to the emergency medical services (EMS) profession. The findings of this study have demonstrated that paramedics from KwaZulu-Natal (KZN) province who participated in the study were exposed to various occupational hazards and, thus, they were likely to experience multiple occupational injuries. Moreover, the frequency of occupational injuries has a potentially adverse impact on the provision of emergency medical services in KZN. Due to various factors, the participants expressed different perceptions regarding the risk factors for occupational injuries. The study findings demonstrated that the majority of paramedics from KZN province who were part of the study were seemingly aware of the risks of occupational injuries and, thus, they adhered to basic mitigation measures. However, the rate of the underreporting of needle-stick injuries among them was alarming considering the risks associated with such types of injuries.

In line with the three research objectives, the study successfully described the prevalence and risk factors associated with occupational injuries, and also perceptions regarding the mitigation and prevention of occupational injuries among paramedics employed in the KZN Emergency Medical Rescue Services (EMRS). The next sub-

sections summarise the findings of the study based on the three main research objectives.

6.3. Prevalence of occupational types of injuries with regards to demographic profile

The first objective of the study was to describe the prevalence of occupational types of injuries with regards to the demographic profile (i.e. age, gender, occupation and work station) of the paramedics who participated in the study. The findings pertaining to this objective were obtained from the review of both the records on injury on duty and the self-administered questionnaires. It emerged from the review of the injury on duty records that injuries due to motor vehicle accidents were the most prevalent occupational injuries among KZN paramedics, followed by musculoskeletal injuries, and needle-stick injuries. Such occupational injuries were more common among the basic life support (BLS) paramedics than the intermediate life support (ILS) paramedics and the advanced life support (ALS) paramedics. On the other hand, the findings from the self-administered questionnaires revealed that musculoskeletal injuries were the most common type of occupational injuries among the respondents, followed by injuries due to motor vehicle accidents, and needle-stick injuries. Finally, the study also revealed that, in contrast to the findings of other similar studies, injuries due to assault were less common among KZN paramedics.

The findings from the study revealed a statistically significant relationship between musculoskeletal injuries and the district in which the paramedics worked, showing a high likelihood of paramedics working in the uMgungundlovu district experiencing musculoskeletal injuries. Moreover, there was a statistically significant relationship between the age of a paramedic and the paramedic's sustaining a motor vehicle accident related occupational injury. Injuries due to motor vehicle accidents were more common among younger paramedics (20–40 years) than older paramedics (above 40 years). This relationship may be said to be a result of a lack of experience in operating EMS vehicles (mini-buses) at increased speed under challenging weather conditions and on bad roads, as well as the general presence of risk taking behaviours in people within the younger age range.

The study further revealed a statistically significant relationship between sustaining a needle-stick injury, the qualification of a paramedic and the paramedic's primary EMS task. Needle-stick injuries were more common among ILS paramedics and those involved in medical rescue, including the use of the jaws of life, compared to paramedics involved in other tasks. The researcher postulated that the frequent occurrence of needle-stick injuries among ILS paramedics is a result of them being frequently required to perform peripheral intravenous cannulation during patient care – one of their capabilities as stipulated by the Health Professions Council of South Africa Professional Board for Emergency Care. While injuries due to assault were found to be generally less common among KZN paramedics who were part of the study, the study results revealed that, in the main, such injuries affected older KZN paramedics (above 40 years of age) compared to younger paramedics (below 40 years of age). This was, presumably, a result of older paramedics being less able to defend themselves in various circumstances.

6.4. Perceived risk factors for occupational injuries with regards to demographic profile of paramedics

The second objective of the study was to determine the risk factors (e.g. exposure to hazardous materials, crime and public disturbances and motor vehicle accidents during emergency response) for occupational injuries with regard to the demographic profiles (i.e. age, gender, occupation and workstation) of the paramedics. This objective was realised through the administration of a self-administered questionnaire, which required the respondents to select their perceived risk factors from the listed occupational risks. The findings from the study revealed that high speed driving and violent members of society were perceived to be the major risk factors for occupational injuries by the participants, followed by the lifting of heavy objects and patient lifting, physical exhaustion, exposure to hazardous materials and temperature extremes.

This study revealed a statistically significant relationship between the district in which the paramedics worked, the paramedics' primary EMS task, and the perception that high speed driving was a risk factor for occupational injuries. This perception was more common among both the paramedics from the Sisonke district and those who were performing primary response as their main task. The researcher postulated that reasons for this relationship included the need for high speed driving in order to meet

response times, the shortage of EMS resources (EMS vehicles and EMS staff), and the fact that the Sisonke district was primarily a rural area. The perception of violent members of society as a risk factor for occupational injuries was higher among both the urban-based paramedics and those involved in inter-facility transfers as their main EMS task. This relationship was found to be statistically significant. The researcher linked the high prevalence of crime and violence in South Africa (with most of it occurring in urban areas) with this perception as expressed by the urban-based KZN paramedics.

The findings also demonstrated a higher perception of physical exhaustion and the lifting of heavy objects as well as patient lifting as risk factors for occupational injuries among those paramedics whose main tasks involved inter-facility transfers. The researcher associated such perceptions with the high case load demands prevalent in the KZN EMRS at the time of the study. The perception of the exposure to hazardous materials as one of the risk factors for occupational injuries was high among paramedics involved in primary response and the provision of medical interventions. This relationship was statistically significant. This relationship was presumably a result of the paramedics being frequently required to perform high risk interventions which expose them to the risk of contact with blood and other body fluids. The study further indicated a statistically significant relationship between the primary task of a paramedic and the perception of temperature extremes as a risk factor for occupational injuries. This perception was high among the paramedics who worked in the uMgungundlovu district and those involved in medical rescue using the Jaws of Life. The researcher linked this to the weather extremes that have affected KZN province in recent years and the sometimes unavoidable exposure to such weather conditions as a result of the paramedics' duty requirements.

6.5. Perceptions of paramedics regarding measures to prevent occupational injuries

The third objective of the study was to describe the paramedics' perceptions regarding the mitigation and prevention of occupational injuries. This objective was achieved through the self-administered questionnaire in which paramedics were required to select their perceived mitigation measures from a prescribed list. The study found that a majority of them perceived avoiding high speed driving while responding to scenes

as one of the measures to prevent occupational injuries. The researcher attributed this perception to the poor road infrastructure in KZN (particularly in the rural areas), adverse conditions and the design of the EMRS vehicles (mini buses) used in KZN. The study also found that during patient and equipment lifting, the paramedics adopted specific positions, such as a squat lift position, to protect themselves against musculoskeletal injuries. Another preventive measure for occupational injuries, as perceived by the paramedics, was avoiding chaotic scenes with the potential for violence occurring. The researcher attributed this perception to the prevalence of crime and violence in South Africa. The study also revealed that paramedics consider avoiding overworking as one of the measures that may be used to mitigate occupational injuries. The researcher believed that this preventive measure was to aid in the prevention of fatigue and its outcomes, for example, burnout, driving errors, and patient care errors.

6.6. RECOMMENDATIONS

It was apparent from the study that paramedics are affected by various forms of occupational hazards and the occupational injuries which stem from such hazards. While paramedics are at increased risk of occupational injuries globally, this phenomenon is particularly severe in South Africa (including KZN province) because of the additional risks (crime and violence, poor road infrastructure, need for high speed driving to meet response times and a shortage of resources) to which paramedics from the developed countries may not be exposed. Occupational hazards and occupational injuries may contribute to the EMS staff turnover, premature retirements and increased absenteeism as well as negatively affecting the paramedics' mental and physical well-being. Such events may have an adverse impact on the EMS human resources, as well as the provision of EMS to the community and may also contribute to increased morbidity and mortality among KZN society. Therefore, this study recommends specific practices and educational programmes that may be adopted to minimise occupational injuries among paramedics, especially paramedics in KZN.

6.6.1. Educational recommendations

The introduction of Hostile Environment Awareness Training programmes for KZN paramedics is recommended. The introduction of such programmes should assist in developing the paramedics' abilities to assess situations and recognise specific risk factors and, where possible, avoid these risks. Such programmes could teach various skills to KZN paramedics, such as identifying hostile environments, how to deal with dangerous situations and how to mitigate the risks involved. Occupational injury guidelines are available from the KZN Department of Health and they outline the procedures that should be followed in the event of an occupational injury (for example, needle-stick injury, musculoskeletal injury, etc.). However, the extent of the KZN paramedics' knowledge of such guidelines is not known while the poor reporting of occupational injuries (needle-sticks and musculoskeletal injuries) could indicate a below par understanding of these guidelines. Ongoing, in-service educational programmes are, therefore, recommended. In addition, the development and implementation of educational programmes based on practice are also recommended in order to identify and rectify poor practices on the part of KZN paramedics in relation to needle-stick injuries and musculoskeletal injuries. Further training programmes focusing on manual handling techniques are also recommended in order to minimise the incidence of musculoskeletal injuries among KZN paramedics.

6.6.2. Practice recommendations

It is believed that the expectation that paramedics should respond to life-threatening emergencies within 5 to 15 minutes in urban environments and 40 minutes in rural environments increases the urgency of high speed driving and, thus, increases the risk of motor vehicle accidents among KZN paramedics. Other factors such as long distance responses in rural areas, vehicle shortages and poor vehicle maintenance also exacerbate the risk for motor vehicle accidents among KZN paramedics (Finlayson 2017). As a result, the researcher recommends a graduated licencing system approach and also the allocation of EMS resources guided by a situational analysis.

6.6.2.1. Graduated licencing system

The introduction of a graduated licensing system with the goal of lessening the risk of the younger KZN paramedics being involved in motor vehicle accidents is recommended. The graduated licensing system is a three stage licensing system for novice drivers and comprises a learner's licence, a provisional licence and a full licence (Chokotho *et al*. 2012). Typically, an individual is eligible for employment as a paramedic at 18 years of age for as long he/she holds the required paramedical qualification. There are, however, additional requirements for such employment, for example, a driver's licence, and a professional driver's permit for carrying passengers which is attainable at the age of 21 years and over. However, while an individual may meet the minimum requirements of employment as a paramedic at the age of 21, individuals within this age group may lack experience in operating mini-buses, and this could increase the risk of younger paramedics causing and/or being involved in road accidents. Other factors which may aggravate this risk include driving in bad weather conditions, poor roads and driving at high speed. Accordingly, it is recommended that an approach similar to the graduated licensing system be used to decrease the incidence of age-related ambulance accidents with the younger paramedics being monitored as they gradually develop their advanced driving skills before they are allowed to drive alone, at high speed, and at night.

6.6.2.2. Allocation of EMS resources

Finlayson's (2017) recommendation that the allocation of required vehicle and staffing resources should be determined based on a situational analysis per EMS base, taking into consideration the caseload, terrain, population density and the extent to which the area is considered to either be urban or rural, is further restated in this study. This would assist in shortening the distances travelled during emergency responses, improve the existing ambulance to population ratio, and eliminate the need for KZN paramedics to drive at high speeds during response to scenes, thus decreasing the occurrence of motor vehicle accidents. Such resource allocation would also reduce the workload among the KZN paramedics and allow for adequate rest periods, thus eliminating fatigue and the associated driving errors and patient care errors.

6.6.2.3. Measures to reduce musculoskeletal injuries

The following practices to reduce musculoskeletal injuries among KZN paramedics are recommended. It is essential that teamwork during patient stretcher handling, and the giving of clear signals in order to synchronise lifting among paramedics are emphasised. Practices such as lifting the stretcher with one hand, and carrying additional equipment in one hand or on the shoulder during patient lifting must be discouraged among the KZN paramedics while, on the other hand, exercise programmes in order to both decrease the risks of musculoskeletal injuries and promote efficiency should be encouraged.

6.6.2.4. Sharps ergonomics

The provision of new technological devices, such as engineered devices used to protect against pricks by sharps or needles and training on the use of such devices is recommended in order to minimise the occurrence of needle-stick injuries among KZN paramedics.

6.6.2.5. Occupational health and safety records

It is recommended that the existing practice in relation to occupational injury records keeping is improved. Such improvement would assist in ascertaining trends in occupational injuries and monitoring of the extent of burden of occupational injuries in the KZN EMRS, thus enabling informed decisions in respect of addressing the issue of occupational injuries to be made.

6.6.3. Recommendations for further research

The EMS in South Africa would benefit from further studies focusing on larger samples that would describe the prevalence and risk factors for occupational injuries among paramedics. Furthermore, it is recommended that such research be conducted in more than one province or at a national level and also that it include private EMS personnel.

6.7. Limitations of the study

This study was confined to the KZN province only and, in addition, it was conducted in five of the eleven districts of the KZN province. Moreover, the number of paramedics (n = 152, 45%) who participated in the study limited the generalisation of the study

results to the entire population of KZN EMRS paramedics in KZN. Another challenge encountered by the researcher in relation to the review of the IOD records was the difficulties which the researcher encountered during attempts to obtain such records. This resulted in records from only two of the five districts in which the study was conducted being utilised.

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Annexure A: Letter of approval from Durban University of Technology Research Ethics Committee

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P.O Box 1334, Durban, South Africa, 4000

Tel: 031 373 2375
Email: lawshad@dut.ac.za
http://www.dut.ac.za/research_ethics

www.dut.ac.za

7 January 2019

Mr N G Chule
123 Palmiet Road
Care Estate
Durban
4091

Dear Mr Chule

Prevalence and risk factors of occupational injuries in paramedics in Kwa-Zulu Natal, South Africa

The Institutional Research Ethics Committee acknowledges receipt of your notification regarding the piloting of your data collection tool.

Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letter.

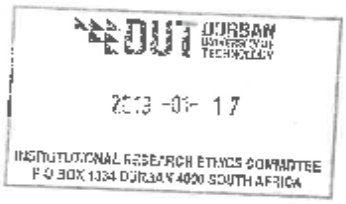
Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC SOP's.

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely,

Professor J K Adam
Chairperson: IREC



Annexure B: Letter of approval from the KwaZulu-Natal Department of Health Research and Ethics Committee

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Physical Address: 330 Langalibalele Street, Pietermaritburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3782
Email:
www.kznhealth.gov.za

DIRECTORATE:
Health Research & Knowledge Management

NHRD Ref: KZ_201902_009

Dear Mr NG Chule
DUT

Approval of research

1. The research proposal titled **'Prevalence and risk factors of occupational injuries in paramedics in KwaZulu Natal, South Africa'** was reviewed by the KwaZulu-Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at EMS stations/bases within EThekwini, iLembe, Sisonke, Ugu and uMgungundlovu District.

2. You are requested to take note of the following:
   a. Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.
   b. Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.
   c. Provide an interim progress report and final report (electronic and hard copies) when your research is complete to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 07/02/19

Fighting Disease, Fighting Poverty, Giving Hope

Annexure C: Letters to the head of the uGu district EMRS

Department of Health
Province of Kwazulu-Natal
Emergency Medical Services

11 February 2019

District Manager: Ugu district

COMMENCEMENT OF RESEARCH IN UGU DISTRICT

Dear EMS District Manager

I am a student at the Durban University of Technology (DUT), undertaking Master's Degree in Emergency Medical Care. The purpose of my study is to describe the prevalence and risk factors associated with occupational injuries suffered by paramedics working in KwaZulu-Natal (KZN) as well as their perceptions regarding the mitigation and prevention of such injuries. The title of the study is:

PREVALENCE AND RISK FACTORS OF OCCUPATIONAL INJURIES IN PARAMEDICS IN KWA-ZULU NATAL, SOUTH AFRICA.

Full approval and gatekeeper permission for the study has been provided by DUT [IREC 157/18] as well as the EMS Provincial Research Committee [KZ_201902_009] for the study, see attached. This letter is therefore to kindly advise you that data collection for the study will commence on 20th February 2019.

For the purpose of this study, I will require information from your records at the Human Resource (HR) Department which relates to occupational injuries. Please could you assist in forwarding all outstanding documentation through to the relevant HR department if not already done. Furthermore, I will be collecting data from selected personnel at the respective EMS stations within the district through a survey questionnaire. Would you be so kind as to communicate these dates to the respective base managers within your district.

UGu district – **(1) Delivery of questionnaires: 20/02/2019**

(2) Collection of completed questionnaires: 06/03/2019

Please feel free to contact me or the study supervisors should you require any more information.

Primary researcher

Names: Mr Ntuthuko Gift Chule – email: NtuthukoC1@dut.ac.za

Contact number: 078 303 0146 (Cell) & 031 373 5402 (Office)

Research supervisor

Name: Dr Kevin Govender – email: pregalathang@dut.ac.za

Contact number: 031 373 5611

Annexure D: Letter to the head of the Sisonke district EMRS

Department of Health
Province of Kwazulu-Natal
Emergency Medical Services

11 February 2019

District Manager: Sisonke District

COMMENCEMENT OF RESEARCH IN SISONKE DISTRICT

Dear EMS District Manager

I am a student at the Durban University of Technology (DUT), undertaking Master's Degree in Emergency Medical Care. The purpose of my study is to describe the prevalence and risk factors associated with occupational injuries suffered by paramedics working in KwaZulu-Natal (KZN) as well as their perceptions regarding the mitigation and prevention of such injuries. The title of the study is:

PREVALENCE AND RISK FACTORS OF OCCUPATIONAL INJURIES IN PARAMEDICS IN KWA-ZULU NATAL, SOUTH AFRICA.

Full approval and gatekeeper permission for the study has been provided by DUT [IREC 157/18] as well as the EMS Provincial Research Committee [KZ_201902_009] for the study, see attached. This letter is therefore to kindly advise you that data collection for the study will commence on 20th February 2019.

For the purpose of this study, I will require information from your records at the Human Resource (HR) Department which relates to occupational injuries. Please could you assist in forwarding all outstanding documentation through to the relevant HR department if not already done. Furthermore, I will be collecting data from selected personnel at the respective EMS stations within the district through a survey questionnaire. Would you be so kind as to communicate these dates to the respective base managers within your district.

Sisonke district – **(1) Delivery of questionnaires: 27/02/2019**

(2) Collection of completed questionnaires: 13/03/2019

Please feel free to contact me or the study supervisors should you require any more information.

Primary researcher

Names: Mr Ntuthuko Gift Chule – email: NtuthukoC1@dut.ac.za

Contact number: 078 303 0146 (Cell) & 031 373 5402 (Office)

Research supervisor

Name: Dr Kevin Govender – email: pregalathang@dut.ac.za

Contact number: 031 373 5611

Annexure E: Letter to the head of the iLembe district EMRS

Department of Health
Province of Kwazulu-Natal
Emergency Medical Services

11 February 2019

District Manager: ILembe district

COMMENCEMENT OF RESEARCH IN ILEMBE DISTRICT

Dear EMS District Manager

I am a student at the Durban University of Technology (DUT), undertaking Master's Degree in Emergency Medical Care. The purpose of my study is to describe the prevalence and risk factors associated with occupational injuries suffered by paramedics working in KwaZulu-Natal (KZN) as well as their perceptions regarding the mitigation and prevention of such injuries. The title of the study is:

PREVALENCE AND RISK FACTORS OF OCCUPATIONAL INJURIES IN PARAMEDICS IN KWA-ZULU NATAL, SOUTH AFRICA.

Full approval and gatekeeper permission for the study has been provided by DUT [IREC 157/18] as well as the EMS Provincial Research Committee [KZ_201902_009] for the study, see attached. This letter is therefore to kindly advise you that data collection for the study will commence on 20th February 2019.

For the purpose of this study, I will require information from your records at the Human Resource (HR) Department which relates to occupational injuries. Please could you assist in forwarding all outstanding documentation through to the relevant HR department if not already done. Furthermore, I will be collecting data from selected personnel at the respective EMS stations within the district through a survey questionnaire. Would you be so kind as to communicate these dates to the respective base managers within your district.

ILembe district – **(1) Delivery of questionnaires: 21/02/2019**

(2) Collection of completed questionnaires: 07/03/2019

Please feel free to contact me or the study supervisors should you require any more information.

Primary researcher

Names: Mr Ntuthuko Gift Chule – email: NtuthukoC1@dut.ac.za

Contact number: 078 303 0146 (Cell) & 031 373 5402 (Office)

Research supervisor

Name: Dr Kevin Govender – email: pregalathang@dut.ac.za

Contact number: 031 373 5611

Annexure F: Letter to the head of the eThekwini district EMRS

Department of Health
Province of Kwazulu-Natal
Emergency Medical Services

11 February 2019

District Manager: eThekwini district

COMMENCEMENT OF RESEARCH IN ETHEKWINI DISTRICT

Dear EMS District Manager

I am a student at the Durban University of Technology (DUT), undertaking Master's Degree in Emergency Medical Care. The purpose of my study is to describe the prevalence and risk factors associated with occupational injuries suffered by paramedics working in KwaZulu-Natal (KZN) as well as their perceptions regarding the mitigation and prevention of such injuries. The title of the study is:

PREVALENCE AND RISK FACTORS OF OCCUPATIONAL INJURIES IN PARAMEDICS IN KWA-ZULU NATAL, SOUTH AFRICA.

Full approval and gatekeeper permission for the study has been provided by DUT [IREC 157/18] as well as the EMS Provincial Research Committee [KZ_201902_009] for the study, see attached. This letter is therefore to kindly advise you that data collection for the study will commence on 20th February 2019.

For the purpose of this study, I will require information from your records at the Human Resource (HR) Department which relates to occupational injuries. Please could you assist in forwarding all outstanding documentation through to the relevant HR department if not already done. Furthermore, I will be collecting data from selected personnel at the respective EMS stations within the district through a survey questionnaire. Would you be so kind as to communicate these dates to the respective base managers within your district.

EThekwini district – **(1) Delivery of questionnaires: 28/02/2019**

(2) Collection of completed questionnaires: 14/03/2019

Please feel free to contact me or the study supervisors should you require any more information.

Primary researcher

Names: Mr Ntuthuko Gift Chule – email: NtuthukoC1@dut.ac.za

Contact number: 078 303 0146 (Cell) & 031 373 5402 (Office)

Research supervisor

Name: Dr Kevin Govender – email: pregalathang@dut.ac.za

Contact number: 031 373 5611

Annexure G: Letter to the head of the uMgungundlovu district EMRS

Department of Health
Province of Kwazulu-Natal
Emergency Medical Services

11 February 2019

District Manager: UMgungundlovu district

COMMENCEMENT OF RESEARCH IN UMGUNGUNDLOVU DISTRICT

Dear EMS District Manager

I am a student at the Durban University of Technology (DUT), undertaking Master's Degree in Emergency Medical Care. The purpose of my study is to describe the prevalence and risk factors associated with occupational injuries suffered by paramedics working in KwaZulu-Natal (KZN) as well as their perceptions regarding the mitigation and prevention of such injuries. The title of the study is:

PREVALENCE AND RISK FACTORS OF OCCUPATIONAL INJURIES IN PARAMEDICS IN KWA-ZULU NATAL, SOUTH AFRICA.

Full approval and gatekeeper permission for the study has been provided by DUT [IREC 157/18] as well as the EMS Provincial Research Committee [KZ_201902_009] for the study, see attached. This letter is therefore to kindly advise you that data collection for the study will commence on 20th February 2019.

For the purpose of this study, I will require information from your records at the Human Resource (HR) Department which relates to occupational injuries. Please could you assist in forwarding all outstanding documentation through to the relevant HR department if not already done. Furthermore, I will be collecting data from selected personnel at the respective EMS stations within the district through a survey questionnaire. Would you be so kind as to communicate these dates to the respective base managers within your district.

UMgungundlovu district – **(1) Delivery of questionnaires: 22/02/2019**

(2) Collection of completed questionnaires: 08/03/2019

Please feel free to contact me or the study supervisors should you require any more information.

Primary researcher

Names: Mr Ntuthuko Gift Chule – email: NtuthukoC1@dut.ac.za

Contact number: 078 303 0146 (Cell) & 031 373 5402 (Office)

Research supervisor

Name: Dr Kevin Govender – email: pregalathang@dut.ac.za

Contact number: 031 373 5611

Annexure H: Participants' information letter

LETTER OF INFORMATION

Title of the research study: Prevalence and risk factors of occupational injuries in paramedics in Kwa-Zulu Natal, South Africa

Principal investigator/s/researcher: Mr Ntuthuko Gift Chule: BhSc: Emergency Medical care

Co-investigator/s/supervisor/s: Dr Kevin Govender: PhD: Emergency Medicine

Brief introduction to and purpose of the study: According to Maguire *et al.* (2005: 2), paramedics are among the first responders to both natural and man-made disasters and are a crucial component of a nation's disaster response system. Studies carried out by Reichard & Jackson (2010); Crill and Hostler (2005) and Sofianopoulos *et al.* (2011) have indicated that EMS workers are at a high risk of occupational injuries. This is due to the nature of their work which includes the lifting of patients and heavy equipment, high speed driving during their response to emergency scenes, dealing with violent members of society, and the fatigue that may arise due to strenuous physical activities and sleep deprivation. Although there is documented research on occupational injuries, there are currently no studies that aim to describe the prevalence and risk factors of occupational injuries in paramedics in Kwa-Zulu Natal province

Purpose of the study

The purpose of this study is to describe the prevalence and risk factors associated with occupational injuries suffered by paramedics working in KZN as well their perceptions regarding the mitigation and prevention of such injuries. The objectives of this study are outlined below:

1. To describe the prevalence of occupational types of injuries with regards to the demographic profile (i.e. age, gender, occupation, and workstation) of paramedics;

2. To determine risk factors and outcomes of occupational injuries with regard to the demographic profile (i.e. age, gender, occupation, and workstation) of paramedics;

3. To describe paramedics' perceptions regarding the mitigation and prevention of occupational injuries.

Outline of the study procedures:

This study involves the administration of a questionnaire. No interventions or procedures will be involved. The participants will be required to fill in the questionnaire to the best of their knowledge and return it to the researcher within a provided period.

Inclusion criteria

- Only participants who are directly involved in patient care will be included in the study, namely, paramedics who work in response units and paramedics who are assigned to patient transportation vehicles and inter-facility transfer units.
-

Exclusion criteria

- EMS personnel who work in control centres and who have never been in the pre-hospital environment providing patient care and/or undertaking any EMS operations other than being in the control centre.
-

Risks or discomforts to the participant: Participants who have been exposed to occupational injuries may be affected by the study as filling in the questionnaire may bring back memories of trauma and discomfort.

Benefits:

- The study report may be published in a emergency medical care journal and publications
- The findings of this study should suggest ways of improving the existing knowledge of other occupational injuries in the South African (SA) Emergency Medical Services (EMS) and also identify or suggest strategies that may be beneficial in mitigating the occurrence of occupational injuries, thereby also reducing the outcomes associated with occupational injuries in the EMS in South Africa.

Reason/s why the participant may be withdrawn from the study: If the participant no longer wishes to continue his/her participation in the study.

Remuneration: None

Costs of the study: None

Confidentiality: Anonymity and confidentiality will be assured throughout the research process.

Research-related injury: No injuries are expected

Persons to contact in the event of any problems or queries:

Please contact the researcher on 0313735402, co-investigator/supervisor on 031 373 5611 or the Institutional Research Ethics administrator on 031 373 2900. Complaints may be reported to the Director: Research and Postgraduate Support, Prof S Moyo on 031 373 2577 or moyos@dut.ac.za

Annexure I: Participant consent form

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **Mr NTUTHUKO GIFT CHULE**, about the nature, conduct, benefits and risks of this study – Research Ethics Clearance Number: **IREC 157/18**.
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my gender, age, date of birth, initials and diagnosis will be anonymously processed in the study report.
- In view of the requirements of research, I agree that the data collected during this study may be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research and which may relate to my participation will be made available to me.

_____ _____ _____ _____

Full Name of Participant **Date** **Time** **Signature/Right Thumbprint**

I, **NTUTHUKO GIFT CHULE**, (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness (If applicable) **Date** **Signature**

_____ _____ _____

Full Name of Legal Guardian (If applicable) **Date** **Signature**

.

Annexure J: Self-administered questionnaire

Research questionnaire

Name of the researcher/ *Igama lomcwaningi*: Mr/uMnu. Ntuthuko Gift Chule
Supervisor: Dr/uDkt Kevin Govender
Contact details/ *Imininingwano yokuxhumana*: 0783030146/ 0313735203

Title of the Research Study/ *Isihloko so Cwaningo*: Prevalence and risk factors of occupational injuries in paramedics in Kwa-Zulu Natal (KZN), South Africa.
Ukuvama kanye nezimo ezibangela ukwenzeka kwezingozi zasemsebenzini kubasebenzi bezimo eziphuthumayo esifundazweni i-KwaZulu-Natal, eNingizimu Africa.

Instructions:

- This questionnaire aims to collect data on the incidence of and risk factors for occupational injuries with regards to the demographic profile of paramedics working in KZN.

  Leli phepha lemibuzo lihlose ukuhlinzeka ngemininingwano ngesibalo, kanye nezimo eziholela ekulimaleni kwabasebenzi bezimo eziohuthumayo ngokuqondene nesimo sezenhlalakahle eKZN.

- Please ensure that you have read the information letter and that you have have signed the consent form before completing this questionnaire.

  Sicela uqinisekise ukuthi ufunde incwadi yolwazi futhi usayine ifomu lokuvuma ngaphambi kokuqedela lemibuzo.

- Please answer all questions honestly and accurately by choosing your answer in the box or writing your answer in the space provided next to and/or below each question.

  Sicela uphendule yonke imibuzo ngokuthembeka nangendlela efanele ngokukhetha impendulo yakho ebhokisini noma ukubhala impendulo yakho esikhaleni esinikezwe eceleni futhi / noma ngaphansi kombuzo ngamunye.

1. **Please select the district where you are working in the KZN EMS.**

   Sicela ukhethe isifunda lapho usebenza khona eKZN-EMS.

a)	UGu district	
b)	ILembe district	
c)	UMgungundlovu district	
d)	EThekwini district	
e)	Sisonke district	

2. **Please indicate your age group.**

Sicela ukhethe iqembu lakho leminyaka.

a)	Below 20 years. ***Ngaphansi kweminyaka engama-20***	
b)	20-30 years. ***20-30 ubudala***	
c)	31-35 years. ***31-35 ubudala***	
d)	36-40 years. ***36-40 ubudala***	
e)	41-45 years. ***41-45 ubudala***	
f)	46-50 years. ***46-50 ubudala***	
g)	51-55 years. ***51-55 ubudala***	
h)	56-60 years. ***56-60 ubudala***	

3. **Please indicate your gender.**

Sicela ukhethe ubulili bakho

a)	Male ***Ungowesilisa***	
b)	Female ***Ungowesifazane***	
c)	Do not want to disclose ***Awuthandi ukudalula***	

4. **Please indicate your Emergency Medical Services (EMS) relevant qualification.**

Sicela ukhethe iziqu zakho ezifanele ezimayelana nomsebenzi wosizo oluphuthumayo.

a)	Basic Life Support (BLS)	
b)	Intermediate Life Support (ILS)	
c)	Critical Care Assistant (CCA)	
d)	Emergency Care Technician (ECT)	

e)	National Diploma (N.Dip)	
f)	B-Tech/BHsc EMC	
g)	M-Tech/MSc EMC	

5. **Please indicate the relevant number of years you have worked for the KZN EMS.**

Sicela ukhethe inombolo efanele yeminyaka osowuyibenze ngaphansi kwe-KZN-EMS.

a)	Less than one (1) year. ***Ngaphansi konyaka owodwa***	
b)	One (1) to three (3) years. ***Unyaka owodwa kuya kwemithathu***	
c)	Three (3) to five (5) years. ***Iminyaka emithathu kuya kwemihlanu***	
d)	Five (5) to seven (7) years. ***Iminyaka emihlanu kuya kweyisikhombisa***	
e)	Seven (7) to ten (10) years. ***Iminyaka eyisikhombisa kuya kweyishumi***	
f)	Above ten (10) years. ***Ngaphezu kweminyaka eyishumi***	

6. **Please indicate the relevant setting or area where you have worked while employed by the KZN EMS**.
Sicela ukhethe indawo osebenze kuyo ngaphansi kwe KZN-EMS.

a)	Rural setting/area. ***Indawo esemaphandleni***	
b)	Urban setting/area. ***Indawo yasemadolobheni***	
c)	Both urban and rural settings/areas. ***Kokubili emadolobheni nasemaphandleni***	

7. **Please indicate the relevant EMS task that is your primary role during your daily duties**. **You may select more than one.**

Sicela ukhethe umsebenzi ofanele we-EMS oyinhloko yakho ebalulekile emsebenzini wakho wansuku zonke. Ungakhetha ngaphezulu kweyodwa

a)	Undertaking inter-hospital transfers. ***Ukudlulisa abagulayo phakathi kwezibhedlela ezahlukene.***	

b)	Primary response and providing medical interventions to patients. ***Ukunikeza usizo lokuqala kwabagulayo noma abalimele.***	
c)	Medical rescue, involving primarily the use of the jaws of life. ***Utakulo olubandakanya kakhulu ukusetshenziswa kwe "Jaws of Life"***	
d)	All of the above. ***Konke lokhu okungaphezulu***	

8. **While working for the KZN EMS have you suffered an injury at work which you did not report?**

   Ngesikhathi usebenza ngaphansi kwe KZN-EMS uke waba nokulimala emsebenzini ongakubikanga?

d)	No. ***Cha***	
e)	Yes. ***Yebo***	

9. **If yes to number 8 above, please indicate the relevant type of injury/injuries that you suffered.**

   Uma impendulo yakho kungu-yebo kunombolo 8 ongenhla, khetha uhlobo olufanele lokulimala emsebenzini owake waba nako.

a)	Motor vehicle accident. Ingozi yemoto	
b)	Musculoskeletal injuries. Ukulimala kwamathambo	
c)	Injuries from jaws of life during medical rescue. ***Ukulimala ngesikhathi sotakulo lwabagulayo kusetshenziswa ama "Jaws of Life"***	
d)	Assault injuries. ***Ukulimala ngokuhlaselwa***	
e)	Needle-stick injuries. ***Ukulimala ngokuhkantshwa yinalithi***	
f)	Other. ***Okunye***	

10. **Specify any other injuries.** ***Cacisa mayelana nokunye ukulimala*** _____
    _____
    _____

11. **While working for the KZN EMS have you suffered an injury at work which resulted in your seeking medical attention?**

    Ngesikhathi usebenzela i-KZN-EMS uke wabhekana nokulimala emsebenzini okwaholela ekutheni ufune usizo lwezokwelapha?

f)	No. ***Cha***	

g)	Yes. ***Yebo***	

12. **If yes to number 10 above, please indicate the relevant type of injury/injuries that you suffered.**

    ***Uma impendulo yakho kungu-Yebo ku nombolo 10 ongenhla, sicela ukhethe uhlobo lokulimala owake waba nakho*.**

g)	Motor vehicle accident. ***Ingozi yemoto***	
h)	Musculoskeletal injuries. ***Ukulimala kwamathambo***	
i)	Injuries from jaws of life during medical rescue ***Ukulimala ngesikhathi sotakulo lapho kusetshenziswa khona "i-Jaws of Life"***	
j)	Assault injuries. ***Ukuhlaselwa ngokuhlaselwa***	
k)	Needle-stick injuries. ***Ukulimala ngokuhlantshwa yinalithi***	
l)	Other. ***Okunye***	

13. **Specify any other injuries.** ***Cacisa mayelana nokunye ukulimala*** _____
    _____
    _____

14. **While working for for KZN-EMS have you ever missed work for more than a day because of an occupational injury?**

    Ngesikhathi usebenzela i-KZN-EMS usuke wangaya emsebenzini iskhathi esingaphezu kosuku ngenxa yokulimala emsebenzini?

h)	No. ***Cha***	
i)	Yes. ***Yebo***	

15. **While working for the KZN EMS, have you undergone any training pertaining to occupational injuries?**

    Ngesikhathi usebenzela i-KZN-EMS, uke waqeqeshwa ngokuphathelene nokulimala emsebenzini?

j)	No. ***Cha***	
k)	Yes. ***Yebo***	

16. **Within your primary work area, please indicate the relevant risk factors are usually present and that you would classify as risk factors for occupational injuries. You may choose more than one (1).**

Endaweni osebenza kuyona kakhulu, sicela ukhethe izinto ezingaholela ekulimaleni ezijwayele ukuba khona njalo. Uvumelekile ukukhetha ngaphezu kokukodwa.

a)	High speed driving. ***Ukushayela ngejubane***	
b)	Lifting of heavy objects and patient lifting. ***Ukuphakamisa izinsizakusebenza ezesindayo okubalwa nokuphakamisa iziguli***.	
c)	Violent members of society, including patients. ***Udlame olubangwa amalungu omphakathi kanye neziguli***	
d)	Physical exhaustion. ***Ukukhathala ngokomzimba***	
e)	Working an excessive number of hours. ***Ukusebenza inani lamahora amamningi***	
f)	Hazardous materials. ***Ukusebenza phakathi kwezinto ezinobungozi***	
g)	Temperature extremes. ***Ukushisa noma ukuband ngokweqile***	
h)	Mental stress. ***Ukugqilazeka ngokomqondo***	
i)	Other. ***Okunye***	

17. **Specify any other risk factors.** ***Cacisa ngobunye ubungozi*** _____

_____

_____

_____

18. **Please indicate the relevant measures that you usually put into action (individually or used by all employees at your station) as a way of preventing occupational injuries. You may choose more than one (1) option.**

Sicela ukhethe izinyathelo ezifanele ozisebenzisayo (ngokuzenzekelayo noma ezisetshenziswa yibo bonke abasebenzi esiteshini sakho) njengendlela yokuvimbela ukulimala emsebenzini. Ungakhetha okungaphezu kokukodwa (1)

a)	Avoiding high speed driving while responding to scenes. ***Ukugwema ukushayela ngejubane uma uya ezindaweni zesehlakalo***	
b)	Specific positioning during the lifting of heavy equipment and/or patient lifting. ***Ukusebenzisa indlela ethize yokuma, uma uphakamisa izinto ezinesesindo noma iziguli.***	
c)	Avoiding chaotic scenes where violence might arise. ***Ukugwema izindawo zesehlakalo ezinomsindo nalapho kungase kuqubuke khona udlame.***	
d)	Avoiding overworking physically. ***Ukugwema ukusebenza ngokweqile***	

e)	Avoiding working excessively long hours where possible. ***Ukugwema ukusebenza amahora amaningi ngokweqile uma ikhona indlela.***	
f)	Always ensure you are fully protected against all types of weather conditions such as excessive heat or extremely cold temperatures. ***Ukuhlala uzivikele kuzona zonke izimo zezulu okungaba wukushisa ngokweqile noma ukubanda ngokweqile.***	
g)	Other. ***Okunye***	

Specify other strategies. ***Cacisa ngezinye izindlela*** _____

_____

_____

_____

_____

This is the end of the questionnaire. I want to take this opportunity to thank you again for agreeing to participate in this study. Your participation is very much appreciated and it is of great value. Once again, please be assured that your participation is strictly confidential. Nobody, including the researcher, will have the means of identifying you as the participant who has completed this questionnaire

Imibuzo iphhelela lapha. Ngifuna ukuthatha leli thuba ukukubonga futhi ngokuvuma ukubamba iqhaza kulolu cwaningo. Ukubamba kwakho iqhaza kubaluleke kakhulu. Ngiphinde futhi, ngiqiniseke ukuthi ukubamba iqhaza kwakho kuyimfihlo. Akekho, kuhlanganise nomcwaningi, ozoba nezindlela zokukukhomba njengomhlanganyeli othe wabamba iqhaza kulolucwaningo.

Annexure a: STROBE guidelines.

STROBE Statement – Checklist of items that should be included in the reports from ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background to and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study design	4	Present key elements of the study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) State the eligibility criteria, as well as the sources and methods used in the selection of the participants	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data was addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study, eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	

Descriptive data	14*	(a) Provide characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	
Main results	16	(*a*) Indicate unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorised	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done – eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias and/or imprecision. Discuss both direction and magnitude of any potential bias	
Interpretation	20	Provide a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	State the source of funding and the role of the funders in the present study and, if applicable, in the original study on which the present article is based	

*Give information separately for exposed and unexposed groups.

Note: An explanation and elaboration article discusses each checklist item and provides the methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available on www.strobe-statement.org.