Cape Peninsula University of Technology

Prehospital management of pain in trauma patients presenting to the Emergency Medical Services in Gaborone, Botswana.

A Thesis submitted in partial fulfillment of the Master of Emergency Medical Care (MEMC), Department of Emergency Medical Sciences, Faculty of Health and Wellness Sciences,

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Declaration

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources).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 Cape Peninsula University of Technology or to any other institution for assessment or for any other purpose.

_____ Signature of student

Date: 14 March 2024

Dedication

This dissertation is dedicated to my late father, Mr Moonsamy Perumal who passed away on 17th September 1984 and to my family who stood beside me.

Acknowledgement

First and foremost, I must thank my family and loved ones for their limitless support and encouragement during this long and at times difficult journey. To my friends and close family, I would not have been able to achieve this without you.

I must also thank my supervisors, Dr Naidoo, and Mr. Matthews, for their unwavering support during this research, taking their time to read, advise and motivate me to accomplish my objective.

Lastly, I would like to thank Mrs. Claris Mahambo Siyamayambo for her contribution; your faith, support and good advice were instrumental in this dissertation's success.

Definition of terms

Advanced Life Support (ALS)

In the context of the study, ALS refers to the Paramedic registered as an Emergency Care Technician (ECT) with the Botswana Health Professions Council. These paramedics are qualified and licensed to perform a variety of advanced patient care interventions such as advanced airway, breathing and circulatory management and may administer a variety of pharmacological agents. However, there are a few key areas which require them to consult ECP prior to proceeding with an intervention (Ministry of health, 2013).

Analgesia

Is a medical state which refers to the absence of pain in response to stimulation which would normally be painful (Monteiro et al., 2022).

Anti-inflammatory drug

A type of medication that is used directly to minimize signs of inflammation such as redness, swelling or pain (Rahman et al, 2023; Setiadi & Karmawan, 2022).

Basic Life Support (BLS)

BLS refers to the Paramedic registered as an Emergency Medical Technician (Basic) with the Botswana Health Professions Council. These paramedics are qualified and licensed to perform a variety of basic patient care interventions such as airway management, breathing and circulatory management and may administer a few pharmacological agents (Ministry of health, 2013).

Botswana Health Professions Council

The Botswana Health Professions Council (BHPC) is the statutory body regulating healthcare standards, practice, and healthcare education in Botswana, including all pre-hospital care (Segwagwe, 2019; Ministry of health, 2013).

Emergency Care Practitioner (ECP)

The Emergency Care Practitioner (according to BHPC) is a provider that has completed a professional Bachelor's Degree in Emergency Medical Care and is qualified and licensed to, in addition to the scope of the ALS Provider; administer further pharmacological agents, most notably induction, paralytic and fibrinolytic agents (Ministry of health, 2013).

Emergency Medical Technician

These are clinicians, trained to respond quickly to emergency situations regarding medical issues, traumatic injuries, and accident scenes (Sadat, Khodayarian & Vafaeenasab, 2022; Ministry of Health, 2013).

Emergency Medical Service (EMS)

Refers to a comprehensive system which deals with the arrangements of personnel, facilities, and equipment for effective, coordinated, and timely delivery of health and safety services to victim of sudden illness or injury (Mitropoulos et al., 2021; Ministry of Health, 2013).

Endorphins

Endorphins are polypeptides, which are natural chemicals that are produced by the pituitary gland and central nervous system which act as analgesics as they interact with the receptors in the brain that reduce perception of pain (Mannem et al., 2022).

Health Care Workers

A practitioner or assistant who delivers care and services to the sick and ailing either directly as doctors and nurses or indirectly as aides, helpers, laboratory technicians or even medical waste handlers (Kracoff et al., 2022).

Management

A process of controlling or dealing with things or people (Daft & Marcic, 2022).

Numerical Rating Scale

Numerical Rating Scale (NRS) is any scale which renders a quantitative symbolization of an attribute. This type of scale is used by presenting the respondent with an ordered set from which to choose from example 1 to 10 (Alsbrook, 2022; Carr, 2022).

Oligoanalgesia

Insufficient analgesia or insufficient treatment of acute pain (Ferri et al., 2022; Monteiro & Simon, 2022).

Opiate/opioid

A class of drugs that binds to Opioid receptors in the brain and the spinal cord (Gerona & French, 2022).

Pain tolerance

An individual's ability to withstand pain stimulus before classic response of the sympathetic nervous system (Khadka, Bhattarai & Nepal, 2022).

Paramedic

Globally, the term 'Paramedic' is accepted as indicating any pre-hospital emergency care provider. For the purposes of this document/research the term "paramedic" will be used to refer to the Critical Care Assistant, National Diploma Emergency Medical Care and BTech Emergency Medical Care graduates, as these are the scopes which allow for autonomy of practice within a pain management setting in Botswana (Aminizadeh et al., 2022; Ministry of Health, 2013).

Practitioner

The term 'Practitioner' in the context of this study refers to all health care providers. These would include nurses, doctors, and paramedics, but do not exclude other allied health care providers (Powers et al., 2020).

First Responders

A firefighter or police officer whose employment requires them to be first on the scene of an incident. These are people whose job is to respond immediately (first) when there is an accident or emergency (Moss, 2021).

Traumatic Pain

For this study, traumatic pain will refer to pain resulting from an external insult to the musculoskeletal system in the acute setting (George & Johns, 2020).

Sedation

Techniques of medications used to calm nervous system excitement (Akram et al., 2019).

Visual Analog scale

The Visual Analog scale is a visual scale in which the patient indicates the pain intensity by making a pencil mark on a piece of paper along a 100mm line. The patient does not need to numerate or verbalize but does need to be alert and able to hold a pen. It acts as a permanent record. (Byrom et al., 2022).

Abbreviations

ALS – Advanced Life Support

BEMS – Boitekanelo Emergency Medical Service

BHPC – Botswana Health Professions Council

EA – Emergency Assist

ED – Emergency Department

EHR – Electronic Health Record

EMT -Emergency Medical Technicians

HCW – Health Care Workers

MRI – Medical Rescue International

MVA – Motor Vehicle Accident

NRS – Numeric Rating Scale

Abstract

This study aimed to establish a general description of pain management practice in prehospital pain management in trauma patients by an urban public sector EMS system in Botswana. The study sought to determine the different types of traumatic conditions presented to the Emergency Medical Services in Gaborone, Botswana; to establish how pain in trauma patients presenting to the Emergency Medical Services in Gaborone, Botswana is managed and to analyze the factors that influence how pain is managed in traumatic patients presenting to the EMS in Gaborone, Botswana. This research study employed a retrospective descriptive research design targeting trauma patients treated by the Botswana Ministry of Health EMS personnel under Provincial EMS for the period 01 January 2018 to 31 December 2018 in Gaborone. A census of 954 Patient Report Forms (PRFs) medical records was selected based on different types of traumas recorded on the PRF, presenting complaints, provisional diagnosis, and treatment or even drug administered. This research established that 62% of the EMS personnel had a basic EMT qualification followed by 22% with an EMT-A qualification, 12% with an advanced nursing qualification and 4% have an ECP qualification. However, most of the cases (71%) had no records for initial pain scores and 98.9% had no record at all about their second pain assessment after being handled by the EMS personnel. Only Diazepam 5mg, Midazalom, and Panado stat were clearly stated as administered to very few patients (0.3%) with a few others (9.7%) being said to have been given unspecified analgesia including different concentrations of Morphine. In addition, this research established that EMS practitioners rarely if ever administer analgesia to trauma patients.

This research established that EMS records do not document the conduct of pain assessment and therefore do not adequately acknowledge the pain in trauma patients. The factors associated with traumatic injuries sustained and the related pain management practices, levels of consciousness, and time taken from the scene to the hospital of admission were assessed. The acceptable standard of care is that pain should be relieved. Inadequate practice may result in partial analgesia or poor handling of injuries resulting in further pain or complications. It is recommended that EMS personnel prioritise and document pain assessment and management including measuring pain, documenting pain quality, and administering analgesia to trauma patients with evaluation. The EMS practitioners should be conscientious of pain assessment and management for medical surveillance. Further research may be conducted to assess the capacity to implement pain management.

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Chapter 1 Introduction

1.1 Introduction

1.1.1 Botswana EMS system

Botswanan EMS consists of nurses, EMTs, healthcare assistants, and drivers who are in different significant towns and villages. Government ambulances transport people who are in emergency cases mostly in villages (Mamalelala et al., 2023). The Botswana government EMS has a challenge of qualified personnel such that pre-hospital care is provided by general nurses who provide ambulance care only (Mamalelala et al., 2023; Elder et al., 2022). At the same time, there are no clear standards of practice for the Botswana EMS personnel. It is important to note that prehospital care in Botswana is provided by both private and state operated services located throughout Botswana. The staff and structures used by both private and state operated pre-hospital emergency services are similar regarding the qualification of personnel, ambulances, and Paramedic response units. The ground unit ambulances provide most of the care in the pre-hospital setting while a limited number of fixed wing services operate in Botswana. The prehospital setting suffers from a resource and skills shortage as seen with other industries in Botswana which is evident in the public sector (Wallis, Garach & Kropman, 2008).

All EMS protocols require "mandatory assessment of both the presence and severity of pain, use of reliable tools for the assessment of pain, indications and contraindications for prehospital pain management, non-pharmacologic interventions for pain management, pharmacologic interventions for pain management, mandatory patient monitoring and documentation before and after analgesic administration, transferal of relevant patient care information to receiving medical personnel and quality improvement and close medical oversight to ensure the appropriate use of prehospital pain management" (Schwerin & Mohney, 2021). Botswanan EMS provides prehospital emergency medical care (Trauma cases) and undertakes inter-hospital transfers. The Botswana Ministry of Health EMS, Medical Rescue International EMS, Emergency Assist EMS, and Rescue One EMS comprises of a variety of HCW that consists of Nurses, EMT's–Basic/Advanced and First Responders. The various HCW have different scopes of practice to administer appropriate analgesia.

Internationally, modern EMS provide sophisticated out-of-hospital and mobile health care to patients on a wide spectrum of acuity (Hanson, 2022; McCarthy, Patel & Spain, 2020). In

Botswana, the EMS provides primary emergency medical care (in Medical and Trauma cases) in the prehospital setting to all acuity levels, followed by transfer to hospitals. EMS also undertakes inter-hospital transfers. Sophisticated applications, such as community paramedicine, are not provided.

In Botswana, the EMS system comprises three levels of clinical practice which include basic, intermediate, and advanced life support provision. All providers are registered with the BHPC as supervised practitioners, except for the ALS providers who fall under the category of independent practice. This implies that ALS providers are required to make clinical decisions independently. The EMS is managed at national level and there is national standardization of policies and procedures both in the provincial and the private sector EMS systems. Although both private and public EMS exist in Botswana, all EMS providers must still conform to the regulations set out by the BHPC for paramedics or EMS providers.

Pain management depends on qualification, attitudes, culture, and experiences of the EMS personnel (Arabena et al, 2020; Japar 2012). In this regard, Japar (2012) indicated that in Malaysia different ethnic groups and diverse cultural beliefs may have varying perceptions and preferences. Pain management in emergency medical services (EMS) can indeed be influenced by various factors, including the qualifications, attitudes, culture, and experiences of EMS personnel (Sanjana et al., 2023). However, these factors can vary significantly from country to country. In Botswana like other developing countries there may be a shortage of highly trained EMS personnel (Achaliwie et al., 2023). In addition, the authors indicated that in Botswana, Kenya, and Ghana, the EMS personnel's approach to pain may be influenced by cultural beliefs and attitudes. Traditional healing practices and perceptions of pain may affect the administration of analgesics. In the case of Botswana, its multicultural society may have different cultural beliefs about pain and how it should be treated. Talking about experience, shortages of skilled EMS personnel in Botswana may have varying levels of experience in dealing with pain, especially in rural and remote areas. Limited resources can also impact their ability to provide effective pain relief. In addition, gender and age of the EMS personnel also influence their attitudes towards pain management (Ahmadi et al., 2023).

The BHPC has included in their scope of practice the use of Entonox, Morphine Sulphate (Opiod Analgesic) for the purposes of providing pain relief to patients that require it (HPCSA, 2018). In this regard, the Botswana Health Professions Council (BHPC) published a pain

management protocol in 2014 which is a document which provides guidelines to paramedics in their work environment. The Paramedic BHPC protocol is a document which provides a continuous process of observation and evaluation of sick and injured people while administering analgesia guided by the drug protocol listed in the guidelines. However, the Paramedic BHPC protocol does not provide information on which practitioners can give which drugs, and how many are registered.

The protocol describes a "paramedic as a provider of comprehensive advanced emergency medical care to the sick and injured people at their homes, accident scenes, workplaces, health facilities and other places and during transportation for definitive care". The protocol describes the work environment to include exposure to potentially dangerous materials and situations, unusual elements, extensive working hours and extreme physical conditions. In addition, it talks about delegated freedom to act including accepting responsibility and accountability over all patient care decisions and emergency care equipment. Furthermore, it provides guidelines on trauma management, handling of patients and a drug protocol which includes the rationale of using a variety of medications, action, side effects, dose, and route of administration. The protocol instructs the paramedics to help clinicians with administering of drugs, control of infection, emergency medical dispatch and general ambulance skills among others. Ambulance staff differ in their training and their capability to deliver analgesics (Siriwardena et al., 2019). Registered health professional paramedics can administer drugs such as paracetamol intravenously or according to Patient Group Directions, however, non-registered staff, for example, Emergency Medical Technicians (EMTs), are limited when it comes to drugs they can administer. Even though decisions about pain relief are determined by national guidance for ambulance services and their staff, such decisions are complicated in the prehospital setting due to differences in patients' beliefs and needs, and variations in ambulance staff access to care options, resources and training, risk tolerance or performance priorities.

1.2 Background of the study

Trauma has become one of the leading causes of death globally. People are confronted with various life threatening, simple, and complicated health situations at home, work or other places which may call for emergency pre-hospital care. Pre-hospital care refers to emergency medical services given to patients who are involved in life threatening health situations (Baraza & Oduor, 2022; Kingu, 2013). Prehospital care is offered by emergency medical services (EMS) responders, who are the first people to provide health care at the scene of disaster

(Hashtarkhani *et al*., 2021; Sorani et al., 2018). The authors elaborated that emergency services include examination, resuscitation, stabilizing or preventative processes that are done before and during the movement of a patient to health facilities. Thus, the EMS personnel are usually the first health professionals to be alerted in case of an emergency and they are quick to respond and attend to the scene where they assess the situation and decide on the needed resources, including medical resources.

EMS personnel are licenced or certified practitioners (Boland et al., 2018). In this regard, it has been explained that EMS personnel are licensed or certified practitioners who include "emergency medical transporters or dispatchers, emergency medical responders, emergency medical technicians, and paramedics" (Boland et al., 2018). EMS Should have a record of the emergency patients indicating "mechanism of injury, patient vital signs, obvious injury, current interventions, and patient's age and sex" (Kostiuk & Burns, 2021). Following this argument on emergency services, Usoro et al (2021) defined emergency patients as people who need emergency attention because of critical sicknesses, injuries, or being in helpless conditions. Emergency patients include trauma patients who are people who have suffered minor, serious, life-threatening, or potentially life-threatening physical injuries (Kostiuk & Burns, 2021). The authors further explained that trauma injuries may include blunt or penetrating wounds.

In addition, Rosenman et al. (2019) highlighted that at the point of disaster or an emergency, trauma examination involves gathering of information, establishment of the trauma team, and preparation of equipment. The authors indicated that at the point of arrival at the scene by the EMS personnel to attend to a trauma patient, the team start by stabilizing the patient through a primary survey which may lead to a secondary survey when there is no evidence of further complications. According to Palmer (2022) and Sawalha (2020) handling of an emergency involves different stages from mitigation, preparedness, response, and recovery. This is supported by Munjal et al. (2022) who indicated that emergency care usually begins by an emergency call to a dispatch center where air and ground ambulances including EMS personnel go to the emergency scene where they assess, treat, and take the patients to available and relevant health care facilities.

The assessment of the patient at the scene of accident or disaster is done for the purposes of assessing the nature of any injury or illness and set priorities for the care required including providing prehospital management of pain in trauma patients (Lindbeck et al., 2021). The

authors elaborated that pain management refers to the processes and procedures that are followed to alleviate and handle the intensity of pain experienced by a person over time. Pain can be defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" (Scholz et al., 2019). Pain results from nerve stimulation and has both physical and emotional components (Colloca et al., 2017). Pain can either be localized, as in an injury or illness or more diffuse, as in other medical disorders and it can be either acute or chronic. The primary goal of pain treatment is to return the patient to normal function (Koppenaal et al., 2022).

Thus, Anne et al. (2021) revealed that in the EMS environment, analgesia is used for alleviating pain. Furthermore, Puntillo, Giglio & Varrassi (2021) described analgesia as drugs or medications used to provide pain relief. The authors alluded that analgesia is used together with medical procedures to reduce pain in patients. There are different types and forms of analgesia, and they are administered in different ways such as oral, rectal, parenteral, topical, nasal, neuraxial, transdermal including intravenous routes (Casely & Laycock, 2022; Zielińska et al., 2022). The authors indicated that analgesics are classified into two main categories which are anti-inflammatory analgesics and opioids. This agrees with D’Arcy et al. (2021) and Huang & Lin (2021) who listed different types of analgesia to include “analgesic combinations, narcotic analgesic combinations, miscellaneous analgesics, antimigraine agents, calcitonin gene-related peptide (CGRP) inhibitors, cox-2 inhibitors, nonsteroidal anti-inflammatory drugs, opioids (narcotic analgesics) and salicylates”.

There are several barriers to effective administration of analgesia including insufficient knowledge about opioids, provider attitudes and training, regulatory barriers, negative attitudes toward prescribing opioids, poor pain-assessment skills, patients’ cultural attitudes, insurance coverage, geographic barriers, and magnitude of the situation (Bit-Lian & Bakar 2021). Similarly, it was established those challenges in assessing pain, poor inter-professional associations, stress and anxiety, drug-seeking behaviours and several other factors are some of the barriers to administration of analgesia (Teoh et al., 2022). As such, it was highlighted that believing in the importance of analgesic administration, training in administration of analgesics, and agency leadership are some of the enablers of analgesic administration. In addition, specific guidelines and legislation should be put in place to guide different EMS personnel in different countries or locations (Whitley et al., 2017).

The Botswana Ministry of Health EMS, Medical Rescue International (MRI) EMS, Emergency Assist EMS, Boitekanelo Emergency Medical Service (BEMS) and Rescue One EMS employs various Health Care Workers (HCW) such as Nurses, EMT –Basic/Advanced and First Responders. Different HCW have different scopes of practice to administer appropriate analgesia. Botswana faces a very high burden of road traffic accidents, and this is being managed by the MVA Fund who make payments to the EMS providers that deal with prehospital trauma.

In Botswana, morphine has not been available for use by Advanced Emergency Medical Technicians to administer appropriate analgesia. This has made this study relevant as it seeks to consider using available options of other non-opioid analgesics. Studies show that patients consistently receive inadequate doses or no pain control during their interaction with the medical community (Paris & Phrampus, 2016). Pain management is an important part of managing a patient in an EMS environment. It is important because it helps to reduce pain in the patient according to the patient's condition and to improve the quality of emergency care before hospitalization. Prehospital administration of analgesia can be inadequate and can result in patients experiencing oligo-analgesia, or under-treated pain (Patrick et al., 2022). The relief of pain and suffering should be a priority in a prehospital setting and adequate administration of analgesia should be the goal to avoid adverse psychological and physiological consequences (Lourens et al., 2019).

A policy was issued by the American College of Emergency Physicians in 2015 recommending that all ALS-capable EMS systems should provide analgesia and sedation in conjunction with Medical Officers direction and quality improvement programs (Phrampus & Paris, 2016). It was argued that there are several pain assessment methods in the prehospital setting which can be used in pain management, and these include Numeric Rating Scale (NRS), Visual Analogue Scale (VAS) and Verbal Descriptor Scale (VDS) (Jeschke et al., 2020). In discussing these, the author talked about the Onset of pain, Quality of Pain, Provoking factors of the pain, Radiation of the pain, Severity of the pain and Time sequence of the pain (OPQRST) as a pain assessment mnemonic for pain diagnostics. This is a helpful mnemonic (memory device) used by EMTs, paramedics, including nurses, medical assistants, and other allied health professionals, for establishing about a patient’s pain complaint. However, Colbeck (2016) proposed an evidence-based procedure (RSVP3- Radiation, Similarity, Variation, Pleuritic, Positional, Palpation) for

pain assessment to replace other procedures including the OPQRST which the author said they are non-diagnostically sensitive. In addition, the verbal analog scale also evaluates the patient's pain with the score being from zero to ten and with zero being no pain and ten being the worst pain of their life as stated by Phrampus & Paris (2016).

1.2.1. Characteristics of prehospital pain management

The provision of pain relief is nuanced by patient age, gender, and race. Children and Adolescents had less documentation of pain assessment and received less analgesia interventions in comparison to adults (Dahllöf & Lichterman, 2022). Older adults were less likely to receive pain treatment, however older women with severe pain received treatment in comparison to younger women (Timothy et al., 2013)**.** Caucasians are more likely than African American or Hispanics to receive prehospital analgesia for blunt trauma injuries (Megann et al., 2013). This study was done in the United States of America, and it was used to examine the association of sex, age, race and pain severity with analgesia administration for blunt trauma in the prehospital setting. The sample size was 6398 blunt trauma cases and significance of the study noted that Caucasians received more prehospital analgesia than African Americans or Hispanics. Paramedics who spend more time with the patients ask for a pain score and are those who are most likely to receive analgesia. This study is relevant because the more time a Paramedic spends with a patient and for whom a pain score is recorded, they are most likely to receive analgesia.

Botswana has an emerging EMS, and little is known about prehospital pain management within the EMS setting. In fact, Cox, Masunge, & Geduld (2020) reporting on emergency medicine registrars highlighted that the first EMS specialists in Botswana graduated in 2018 supporting the need for intensive and extensive training of the EMS providers in the nation. Literature on prehospital pain management is slowly expanding. There is, however, no literature available on pain management in Botswanan EMS. This study becomes of significance in this case as it seeks to provide a description of analgesia in EMS in Botswana.

This study is focused on investigating pain associated with trauma only. This is because trauma is a major cause of death and disability the world over according to Elder et al. (2022). The authors added that trauma is overwhelming in low and middle-income countries due to the lack of resources, pre-hospital care, and nurse training and Botswana is not an exception. In addition, WHO (2023) revealed that the Botswana EMS has been lagging in the areas of

emergency preparedness and response plans resulting in many people suffering from traumatic pain. Following these challenges, WHO has collaborated with the Botswana government allowing WHO to conduct Basic Emergency Care (BEC) training sessions all over Botswana since 2022. In this regard, WHO (2023) reported that 181 BEC providers and seven master trainers have been trained since 2022.

The researcher is a paramedic who regularly encounters trauma patients who are not adequately treated with analgesia and agrees with WHO's concern about the preparedness of EMS in Botswana to manage pain from trauma. To this end, this study focuses on pain from trauma. Traumatic pain is prevalent in Botswana, regularly documented, and by focusing on traumatic pain this study addresses an identified need.

There are different types of EMS all over the world including government EMS, voluntary EMS, private ambulance services, and hospital-based emergency services (Ulintz et al., 2023). Modern paramedicine or out-of-hospital care provided by paramedics/EMTs working in ambulance services/EMS internationally include emergency ambulance services, community paramedicine services, mobile intensive care paramedics, critical care paramedics, and emergency medical responders (Williams et al., 2021). The authors added that globally paramedicine is a domain of practice and health profession that specialises across a range of settings including, but not limited to, emergency and primary care. Moreover, paramedics work in a variety of clinical settings such as emergency medical services, ambulance services, hospitals, and clinics as well as non-clinical roles, such as education, leadership, public health, and research (Oskvarek et al., 2023). Paramedics possess complex knowledge and skills, a broad scope of practice, and are an essential part of the healthcare system. Depending on location, paramedics may practice under medical direction or independently, often in unscheduled, unpredictable, or dynamic settings (Juhrmann et al., 2023; Makrides et al., 2023).

1.3 Problem statement

The WHO highlighted the lack of preparedness to manage traumatic pain, and the government responded with emergency care training. However, there is still a dearth of information of the type, severity and extent of traumatic pain facing the Emergency Medical Services in Botswana. There is no information of how trauma patients are treated by the Botswana Ministry of Health EMS personnel under Provincial EMS in Botswana and no analysis is available for this group. There is very limited information about how prehospital pain in trauma patients is

being managed. The quality of the documentation for pain management during prehospital care by Emergency Medical Services in Gaborone, Botswana, is unknown. Thus, such information warrants the desired analysis in this study to ascertain how the EMS personnel are managing and documenting pain of patients in their care before hospital admission.

1.4 Aim and objectives

1.4.1 Aim

This study aims to describe prehospital pain management of trauma patients in Gaborone, Botswana?

1.4.2 Specific objectives

- To determine the different types of traumatic conditions presented to the Emergency Medical Services in Gaborone, Botswana.
- To establish how pain in trauma patients presenting to the Emergency Medical Services in Gaborone, Botswana is managed.
- To analyse the factors that influence how pain is managed in traumatic patients presenting to the EMS in Gaborone, Botswana.

1.5. Research questions

- What types of traumatic conditions presented to the Emergency Medical Services in Gaborone, Botswana?
- How is pain in trauma patients presenting to the Emergency Medical Services in Gaborone, Botswana managed?
- What are the factors that influence how pain is managed in traumatic patients presenting to the EMS in Gaborone, Botswana?

1.6 Significance of the study

The findings of this study might be significant to the Botswana EMS personnel, medical practitioners, the ministry of health and welfare, the government, policy makers and the public. The findings may be significant to the Botswana EMS personnel as it gives them information about their practices which may call for revision and improvement of what is currently being done in the field. Pain documentation is part of pain assessment which helps pain management in trauma patients, and this is important for the EMS personnel to know and implement appropriate practices. Thus, the findings of this study may EMS personnel to make changes in their practices or seek proper resources for efficient pain management. The importance of this

study is to provide knowledge that may assist EMS Managers, 997 EMS personnel and other EMS personnel in Botswana and around the world to implement appropriate interventions to control EMSs.

In addition, decision making by medical practitioners in the clinics or hospitals is guided by the documentation that is presented to them by the EMS personnel. This implies that the findings of this study may help the clinicians in making decisions of how best to help the patients that are presented to them by the EMS personnel. This study may also give the clinicians information about the EMS practices which helps them as they receive patients from the EMS whose pain management history may be missing or incomplete.

The findings of this research may also be of great importance to the ministry of health and wellness, the government and policy makers as it provides information about the missing links between the EMS personnel and the clinicians. It shows how the EMS are managing pain in trauma patients and whether their practices are beneficial to the patients. It is important for the ministry of health and wellness in Botswana especially the Botswana health professions council to understand the EMS personnel practices and see their compliance levels to set guidelines. This may help to establish where the problems are so that all the key stakeholders can come together and help the situation.

1.7 Limitations and delimitations

1. The public EMS (997) provides services in the towns and cities of Gaborone, Mochudi, Lobatse, Mahalapye, Palapye, Phikwe, Francistown, Maun and Kasane. This study is limited to the city of Gaborone.
2. The study is limited to the public EMS (997) and does not consider the private EMS operating in the country.
3. The study only considers ground-based ambulances and does not address the aeromedical environment.
4. The emergency services provide out of hospital, intra-hospital, and inter-hospital treatment, and these data are included.

1.8 Chapter summary

This research was vital for the future of prehospital management of pain in Botswana. No study has been done concerning prehospital management of pain in trauma patients presented to the

Emergency Medical Services in Gaborone, Botswana. It informs on analgesia practices and medical reporting.

Chapter 2 Literature review

2.1 Introduction

This chapter provides a consolidated discussion of literature related to this study. Pain is a common occurrence amongst the injured or critically ill. Discomfort and pain are also induced by the movement of the vehicle, thermal transitions, uneven road surface, noise and even the nature of the prehospital environment may hinder the EMS personnel from conducting adequate pain assessments. Evidence in literature highlights the fact that acute pain in the prehospital environment remains poorly managed (Vincent -Lambert et al., 2015). The chapter provides a detailed analysis of characteristics of pain management practices, problems of pain management in emergency department, and barriers to treatment of pain in the emergency department. The chapter also discusses suboptimal prehospital analgesia administration, prehospital analgesia administration documentation, opioid versus non-opioids in prehospital pain management, and prehospital effectiveness of pain reduction. The chapter is concluded by a chapter summary.

2.2 Characteristics of pain management practices

Pain management in prehospital settings involves unique challenges and considerations due to the urgent nature of the situations (Whitley et al. (2023); Ferri et al., 2022; Lourens et al., 2021; Mota et al., 2019). As such, they highlighted some characteristics specific to pain management practices in prehospital settings including limited resources, trauma considerations, knowledge of opioid use, and the use or lack of focused pain management protocols. There is a need for rapid assessment of the patient's condition by the EMS personnel to ascertain the severity and type of pain (Wennberg et al., 2020). Time is important in prehospital, and prompt evaluation helps in determining appropriate interventions. Following the same argument, McCarthy et al. (2020) and Mehmood et al. (2018) alluded that EMS providers often work in environments where resources, including medications and equipment, may be limited compared to a hospital setting. Working with limited resources requires adaptability and creativity in managing pain effectively.

On another hand many EMS calls involve trauma and managing pain in trauma patients requires a thorough understanding of the injury mechanism (McDermott et al., 2021). This implies that prehospital personnel need to be adequately equipped in terms of knowledge, skills, and medical resources for them to be effective. There are concerns about opioid use and potential adverse effects as EMS practitioners may employ opioid-sparing approaches, such as non-opioid analgesics, regional anesthesia techniques, or other non-pharmacological methods

(Padhi, 2023). However, Mota et al. (2019) attributed this to the availability or non-availability of focused pain management protocols. In this case, some EMS systems have specific pain management protocols designed to guide providers in the prehospital setting. These protocols may outline the use of certain medications, doses, and administration routes. According to Dúason et al. (2021), there is a need for effective communication between the prehospital personnel and the receiving hospitals to ensure continuity of care. This includes conveying information about the patient's pain management, interventions performed, and medications administered.

Prehospital staff needs to have appropriate training and expertise in various pain management techniques, including the use of analgesics and non-pharmacological interventions (Whitley et al., 2023; Ferri et al., 2022). Continuous education is necessary to keep providers updated on best practices. Accurate and detailed documentation is essential in the prehospital setting, and it is a skill that needs to be acquired by all practitioners in the field (Voskens et al., 2018). This includes documenting the pain assessment, interventions performed, and the patient's response to treatment. Clear documentation promotes continuity of care upon handover to hospital staff. Moreso, EMS providers must adhere to ethical principles, including respect for patient autonomy and beneficence (Kumar et al., 2023). The goal is to alleviate pain while ensuring the safety and stability of the patient during transport to a healthcare facility. Pain management involves assessing and understanding the magnitude of the pain (Finnerup, 2019). Pain assessment involves asking the patient about the gravity of the pain which helps to establish the type of pain and identifying the location of the pain. Magnitude of pain and its location helps to determine the extent to which the patient is suffering and determining the required management including medications that can be used. Pain presents itself in varying “dimensions from acute and simple to chronic and challenging.” In this regard, precise and organized pain management is needed to ascertain that appropriate diagnosis is done to establish the most efficient pain alleviation plan for patients presenting with pain (Brennan, Lohman & Gwyther, 2019).

Following the issue of pain assessment, Mortazavi (2018) indicated that there are unidimensional and multidimensional pain assessment tools that can be employed to ascertain one’s pain and manage it appropriately. In this regard, Tomlinson & Reynolds (2018) indicated that there are different types of pain scales which can be used for pain assessments, and these include numerical rating scales which use numbers to assess pain, visual analog scales which use pictures to describe pain levels and categorical scales which use a combination of words

with either numbers, colors, or position on the body. Pain assessment is a very important aspect of pain management as several authors including Craig et al. (2020) and Brennan, Carr & Cousins (2007) alluded to the fact that pain control is a human rights issue which is legal and can be taken to the courts of law if not handled appropriately.

Furthermore, upon establishing that a patient is suffering from pain, it is important to understand the type of pain a patient is suffering from. According to Cohen, Vase & Hooten (2021) pain can be classified as acute pain, chronic pain, neuropathic pain, nociceptive pain, and radicular pain. In addition, Scholz et al. (2019) highlighted that pain is also categorized according to the mechanism of injury that causes it. In most cases, in the context of EMS, the EMS personnel mostly deal with acute pain which can be explained as a short period pain due to sudden injuries and temporary illnesses (Uwaezuoke et al., 2018). The authors elaborated that acute pain usually gets better as the injury heals or the illness gets less. However, if acute pain is not treated it can transform to chronic pain with time which can bring about unpleasant physical and psychological effects and social and economic costs of untreated pain (Noroozian et al., 2018). Following this argument, Taylor & Wilson (2020) argued that though acute pain teams have been established across the globe, there has been a challenge of alleviating acute pain in medical management as the issue has been more verbal than practical. Also, the authors indicated that in the case where pain is alleviated, it is not perfectly done. When people are in pain, they need analgesics for a short period of time which can be extended if the pain persists (Brennan, Lohman & Gwyther, 2019). The authors further elaborated that pain relief is more of a human right and can be legalized if one is not given an opportunity for pain relief. In fact, Hunt et al. (2018) supported the point of view that pain alleviation is a worldwide issue that healthcare practitioners, including the EMS personnel, have a social responsibility to handle pain.

Furthermore, pain management practices include giving out medications and conducting other procedures that help to alleviate pain in people suffering from different injuries (Hsu et al., 2019). The authors elaborated that there are various kinds of pain that people suffer from, and they require different treatment options including medicinal and non-medicinal options. Furthermore, there are variations of strategies that can be employed to manage pain including by EMS personnel (Zhou, Liu & Nie, 2021). Following this argument Wartan (2022) indicated that pain can be handled using pain drugs, physical and psychological remedies. Blondell, Azadfard & Wisniewski (2013) highlighted that some medications are not sufficient on their own, thus they must be combined as there is no one medication that can be said to be superior

to the other. Considering pain management, Samah et al. (2022) and Provenzano, Kamal & Giannetti (2018) indicated that there are stages of handling pain which include the use of nonopioid analgesics followed by weak opioids and adjuvant agents then strong opioids and adjuvant agents and the final stage may involve nerve blocks.

Prehospital analgesia emerged to relieve pain in the 1860's (Ballas, 2021). Furthermore, in the 1970's, prehospital opioids were established and viewed as an excellent analgesic for moderate to severe pain. Morphine sulphate is a popular and known drug which has been taken as the gold standard against which all other drugs are measured (Vincent-Lambert and de Kock, 2015). The classification of analgesics is based on the description of the degree of pain a patient is suffering from, and these include "acetaminophen, nonsteroidal anti-inflammatory drugs, antidepressants, antiepileptics, local anesthetics, and opioids" (Milani & Davis, 2022; DA & Davis, 2020). The authors explained these medications as "nonopioid analgesic agents and opioid analgesic agents." In addition, opioid agents, are powerful pain alleviating drugs that include "oxycodone, hydrocodone, and morphine, among others." These drugs can result in death if an overdose is taken.

However, O'Connor et al. (2020) and Clauw et al. (2019) argued that though there are various drugs to handle pain, acute pain is adaptive and is usually for short periods of time making it a challenge to manage sometimes because of its protective nature. In addition, Glare, Aubrey & Myles (2019) alluded that it has been universally confirmed that worldwide, pain management is a challenge due to several reasons including legal, attitudes, qualifications, cultural and reasons due to local systems or structures. More so, Duff & Anderson (2017) indicated that pain can be managed without using drugs but using non-medical strategies including slings, dressings, collars, immobilization, splints, and appropriate positioning. This was confirmed by Berben et al. (2011) who supported the idea that non-medical pain treatments include wound dressing, application of splints and immobilizing bandages among other things. These non-medical remedies can be used together with physical and psychological remedies like counselling, massaging, exercising and several other strategies that help to alleviate pain in an injured person. In addition, Wartan (2022) alluded that pain management and treatment may include a combination of drugs and the physical and psychological remedies or a combination of different drugs and either physical or psychological remedies. At the same time, Zilliox (2017) indicated that pain management involves the use of a combination of treatment options to relieve pain. This is because the patient's anxiety levels may increase as they continue to feel pain in any part of their body. In the EMS set up, pain management by the paramedics is

handed over to the health facilities at the point of admission to make sure that pain management continues (Lindbeck et al., 2021). The authors elaborated that it is the responsibility of the EMS personnel to assess the patient's pain and hand over documented information about pain assessment to the admitting medical facility. This is very important as documentation of the interventions or medications administered and the associated change in vital signs and pain scores is essential to show patient trends through the cycle of care. Appropriate pain management is a fundamental aspect of patient care, such that all practitioners working in the EMS should aim to become highly skilled in the accurate assessment, diagnosis, and management of pain in the prehospital setting (Dang & Stafseth, 2023).

2.2 Challenges of pain management in emergency department

The common problem that has been pressing in the pain management in emergency departments is the under-treatment of pain which is known as "oligoanalgesia". In support of this, "failure to acknowledge pain, failure to assess initial pain, failure to have pain management guidelines in the emergency department, failure to document pain and to assess treatment adequacy, and failure to meet patient's expectations" have been stated as some of the problems of pain management in the emergency department (Ugwu, 2020; Michaelides & Zis, 2019). Furthermore, Supples et al. (2022) explained that physicians' practice differences have also resulted in oligoanalgesia, which is a factor that is often ignored in the examination of prehospital pain control. As follows are causes of oligoanalgesia which have been one of the pressing problems facing the emergency department.

2.2.1 Failure to acknowledge pain.

Failure to acknowledge pain in patients is one of the major problems of pain management in the emergency department according to Abdolrazaghnejad et al. (2018) and Lenssen, Krockauer, Beckers, et al. (2017). A retrospective chart assessment by Wilson and Pendleton was one of the first research discussing the problem of oligoanalgesia in the EMS. Of the 198 individuals assessed in the research, 56% of individuals did not receive analgesic medication while sleeping in the emergency room; 69% waited for more than one hour before getting analgesic medication, and 42% waited for more than two hours. Of those receiving analgesics, less than ideal analgesic doses were obtained by 32 percent. Five years ago, Lewis and colleagues released a retrospective survey of 401 patients treated for severe bone fractures in eight emergency departments, showing that only 121 (30%) patients received analgesia and showed that emergency doctors failed to recognize and handle pain.

2.2.2 Failure to assess initial pain

The assessment of pain within the ED is poor despite multiple studies on implementation of various pain assessment scales. The factors that directly influence ED physician's assessment of pain include physician's skepticism, the validity of patient's self-report of pain, tries to typify pain competence, and immediate identification of pain rather than immediate treatment. In 2000, a study by Guru and Dubinsky evaluating the perception of pain within the ED showed that physicians and nurses gave lower pain ratings than the patients and no pain scale assessments were utilized when reviewing patient's charts.

Recent pointers, including Gregory & McGowan (2016), as well as (Joint Commission on Accreditation of Healthcare Organization) JCAHO and Approved Continuous Examination Program (ACEP) clinical policies on pain management highlighted the need of the assessment of pain for all patients presenting to the ED and mandate that pain assessment be recorded within the patient's medical history by employing a pain scale. In 2004, Horatio Nelson and colleagues evaluated the advantages of getting mandated pain scales within the ED for analgesic administration. Five hundred and twenty-one encounters were reviewed before the implementation of the pain scale and 479 encounters were reviewed once the introduction of pain scale was done. The findings revealed that analgesic use increased significantly from 25% to 36%, and analgesics were quickly given to patients after the pain scale was introduced: 113 minutes vs 152 minutes. Analgesic use correlates with pain severity. In 2020, Sargos and colleagues showed that by including a pain scale into the medical records, proportion of patients with documentation of pain assessment increased from forty-one to fifty-seven. Due to the absence of objective measures, the practitioner should rely on the patient to produce key data on the localization, quality, and severity of the pain. However, children, particularly young ones, represent an honest example of being "too young to want physiological condition.

2.2.3 Failure to implement pain management guidelines and protocols

In 1996, Goodacre and Roden (1996) showed that introduction of the pain protocols within the ED reduced the share of patients with unsatisfactory physiological condition from ninety-one to sixty-nine percent and raised the employment of endogenous analgesia, from nine to thirty seventh percent. A retrospective chart analysis by Somers et al. (2001) evaluated 262 children and showed that implementation of a pain protocol improved the quantity of youngsters who received physiological condition among half-hour of sorting. In addition, Admassie et al.

(2022) reported on the barriers to pain management being high because of lack of pain management guidelines at the emergency department in Amhara region referral hospitals, Northwest, in Ethiopia in 2021. The authors added that the lack of pain management guidelines is worsened by lack of experience of the emergency nurses.

Moreover, Vincent-Lambert et al., (2015) investigated the use of morphine sulphate by South African paramedics for prehospital pain management in comparison to their practices to existing guidelines and literature. The authors conducted an Internet based survey to document and describe the participant's use of morphine for the management of acute pain. A total of 60 South African paramedics responded to this survey and the results showed that participants were overly cautious of potential adverse effect associated with administration of morphine. The dose was calculated correctly according to the patient's weight. The authors also noticed that most participants were not administering morphine as a bolus but rather in titrated doses resulting in a delay or failure to achieve therapeutic levels thereby resulting in ineffective and delayed pain management. The authors recommend a more clearly defined protocol to be developed to guide the use of morphine sulphate by paramedics. In this regard, Vlahaki et al. (2016) also concurred that pain management guidelines are barriers to effective care, and that shared guidelines, together with training, and implementation would help improve the patient's journey.

2.2.4 Failure to document pain

In 2003, Eder and associates assessed the documentation of pain in the ED by doctors and medical attendants by review examination of 261 graphs. Introductory pain appraisals were available in 94% of the graphs, however a pain scale was utilized for just 23% of the patients. Ensuing the administration of analgesics, just 39% of the documents had pain documented and a pain scale was utilized just 19% of the time. After the treatment, medical caretakers were multiple times bound to report pain than doctors (30% versus 16%).

An issue of ill-advised documentation of pain among pediatric patients is especially obvious in newborn children and little children. By looking over 24,707 visits to the ED with excruciating conditions in a time of three years, just 44.5% of visits had archived pain scores with consequent examination demonstrating the more youthful age to be the most vulnerable gathering (Reavis, 2022).

2.2.5 Failure to meet patients' expectations

One of the urgent factors in overseeing pain in ED is to address patient's issues and to fulfill their desires. Emergency department patients have exceptionally exclusive standards for relief from discomfort, a lot higher than those with postoperative agony do. Fosnocht and associates found that most ED patients expect a mean help with discomfort of 72%; about 18% of patients anticipate 100% relief from discomfort. Emergency department patients expect help with discomfort as quickly as time permits after entry. The mean desire for time to pain relieving organization for ED patients is 23 minutes, contrasted with genuine interim with pain relieving organization of 78 minutes. In a pain review of 68 quick track patients, Blank and associates demonstrated that 60% of the patients returned home with more pain than they were eager to acknowledge; 51% of the patients were offered something for agony, in any case, just 50% of them said the help with discomfort was satisfactory. Worrying about the patients' pain is as significant as giving the absence of pain itself. To emphasize this, in the previously mentioned investigation by Fosnocht and partners, 45% of ED patients in pain got pain medicine, yet 70% revealed that their requirements for relief from discomfort were met at release. In an examination by Nicol and Ashton-Cleary assessing the reasons patients do not take analgesics before landing to EMS, the most well-known reason was that patients disliked taking tablets. This information in this section reflects that in most cases there is a failure to meet patients' expectations of relieving pain in the ED or during pre-hospital management.

2.3 Barriers to treatment of pain in the emergency department

There are several hindrances that preclude ED practitioners from providing legitimate pain control in the emergency department. This was confirmed by Motov & Khan (2008) who indicated that the challenges that hinder the emergency physicians from providing appropriate pain control include ethnic and racial bias, gender bias, age bias, inadequate knowledge, and formal training in acute pain management, opiophobia, the emergency department, and the emergency department culture. At the same time, Abdolrazaghnejad et al. (2018) alluded that factor such as race, age, sex, ability to express pain, underlying illness, physician awareness, and fear of complications can prevent proper pain control in patients. There are numerous barriers to adequate pain management including a lack of knowledge, inadequate assessment, and treatment, as well as organizational factors, together with system and regulatory obstacles (Cascella et al., 2022).

Barriers due to the system, nurses, staff, physicians, and patients also hinder health care professionals from attaining optimal pain management according to Rababa et al. (2023). These barriers include a lack of clearly defined standards and protocols for pain management. Another is limited access to analgesics and pain specialists. Barriers related to the staff include lack of adequate knowledge and skills, and teamwork whilst false concerns about overdosing and addiction are also examples of barriers related to physicians. Patient-related factors include being reluctant to take analgesics, being afraid of side effects and fear of addiction. Dealing with patients who go against the EMS practices is difficult, especially if it has to do with the patients` beliefs and if they need to give consent. Nurses, within a pediatric setting, have also identified the problem of insufficient orders, especially before performing procedures, and not enough time to pre-medicate patients before procedures. When it comes to an emergency setting, overwhelming attention is often given to acute serious conditions, leaving pain management as less of a priority. In addition, Teoh et al. (2022) categorizes these barriers into patient factors, medical directive factors and Paramedic factors.

2.3.1 Ethnic and racial inclination

Ethnicity and race have been significant influences in setting up the rules and arrangements toward pain in the ED. The developing collection of writing and 20 years of broad research report that patients who are a piece of racial or ethnic minorities are continually being under-assessed and undertreated for their difficult conditions in the ED. Most of the information about ethnicity and race originates from investigations of grown-up patients introduced to ED with painful conditions, however some proof exists for the pediatric populace.

In 1993, Todd and partners studied whether Hispanic patients with secluded long-bone cracks were less inclined to get analgesics in the ED contrasted with comparable non-Hispanic white patients. In an ensuing report led in 1994, Todd and associates endeavored to decide if doctor evaluations of pain seriousness are impacted by patient ethnicity. In this forthcoming associate examination, in the wake of assessing 138 non-Hispanic white and 69 Hispanic patients with horrible wounds to furthest points, no distinctions were found between non-Hispanic white and Hispanic patients in their pain appraisals. This finding reveals that pain is pain and it cannot be distinguished according to ethnicity. These findings reflect that people from different ethnic groups suffer pain in the same way.

In 2002, Fuentes *et al* led a review companion investigation of grown-up patients in the ED to decide if nonwhite patients with long-bone breaks were less inclined to get analgesics than

white patients with comparable wounds. Indeed, even after stratification for sexual orientation, bone broke, and requirement for decrease there were no errors toward diminished analgesic administration in any ethnic/racial gathering.

In 2003, Tamayo-Sarver *et al* assessed the connections between race or ethnicity and attractive social qualities on doctors' choices to recommend narcotic analgesics. The outcomes demonstrated that for 53% of taking part doctors, tolerant race or ethnicity had no impact on their medicine of narcotics upon release. Yen and partners in 2003 dissected information from the National Hospital Ambulatory Medical Care Survey for 1992 through 1998 by assessing the utilization of analgesics among children of various races and ethnicities with secluded long bone breaks in EDs. One thousand and thirty patient records were assessed and no distinction in pain relieving medicine was found between the African American and Hispanic children contrasted and non-Hispanic white children with long bone fractures in the EDs.

An examination led by Pletcher and associates endeavored to decide if any critical changes happened in directing narcotic analgesia in the ED and whether racial or ethnic inconsistencies in endorsing narcotics in the ED have diminished from 1995 to 2005.The outcomes demonstrated that white patients with pain were bound to get narcotic pain medicine (31%) than African American (23%), Hispanic (24%), or Asian/Other (28%), separately. Variations were progressively conspicuous in patients with extreme agony, long-bone cracks, and nephrolithiasis just as among kids.

An observational examination by Bijur and associates (2008) assessing 345 patients with long bone breaks demonstrated that 74% of Hispanic (95% certainty interim [CI] = 67% to 80%), 66% of African American (95% CI = 57% to 75%), and 69% (95% CI = 57% to 78%) of white patients got narcotic analgesics. What is more, there were no critical contrasts to administrate treatment, in doses of analgesics, during the analgesics were given, or in the adjustments in pain. In brief, this section demonstrated that different ethnic groups suffer from pain and no significant differences in pain in different ethnic groups could be detected.

2.3.2 Gender bias

Another significant issue that influences satisfactory pain management in the ED is sexual orientation related analgesia. While sex physiology and pharmacogenomics are outside the extent of this paper, there are various examinations that have assessed the impacts of sexual orientation inclination on accepting appropriate analgesia in the ED. Gender can be a factor in

how pain management is approached in EMS (Karmelić et al., 2023). In this regard, Wankhade (2016) highlighted that biases and stereotypes about how women and men experience, and express pain can influence how EMS practitioners assess and manage pain. In addition, because of differences in communication between men and women, this can lead to misunderstandings and impact the assessment of pain severity. Ultimately, addressing gender-related barriers to pain management in EMS requires a multi-faceted approach that combines education, training, cultural awareness, and a commitment to providing equitable care to all patients, regardless of their gender (Steven & Redfern, 2017). Raftery and associates exhibited that female patients announced more pain and were seen by providers to have more pain than male patients in the ED. Female patients additionally got more pain medication and more grounded analgesics amongst the patients overviewed, females receive more analgesia in the ED than men (74% versus 64%). In any case, no distinction was noted between sexes in two-point pain decrease in the ED, in the recurrence of pain management, and in the measure of intravenous analgesics.

2.3.3 Age bias

Contrasts in the arrangement of sufficient analgesia in the ED exist among various age gatherings, especially among the old. In 1996, Jones and associates recommended that age could be a hazard factor for conveying insufficient analgesia in the ED. This review assessment of 231 patients found that 66% of older patients receive analgesia contrasted with 80% of their more youthful partners. Furthermore, older patients possessed a progressively drawn out hanging tight energy for conveyance of agony drugs, had noteworthy under dosing of pain management, and got fewer narcotic analgesics.

Lee and partners' pilot study estimated that old patients with intense undifferentiated stomach pain who were female, non-Caucasian, or of cutting-edge age would have delays in the administration of analgesia in contrast with their individual partners. Be that as it may, the creators did not discover a relationship between propelling age, sexual orientation, or ethnicity and deferrals in administration of analgesia relieving specialists in older patients.

Cavalieri and partners depicted a few additional elements that influence pain management of older patients in the ED: difficulties to appropriate assessment of pain, under-giving an account of the piece of patients, atypical indications of pain in the old, a requirement for expanded valuation for the pharmacokinetic and pharmacodynamics changes related with maturing, and confusions about resistance and dependence on narcotics.

2.3.4 Inadequate knowledge and formal training of ED physicians in acute pain management

The potential reasons for the gaps in emergency physicians' clinical learning of pain management includes a lack of formal instructing of pain management in restorative schools, a hesitance of set up doctors to change their training designs; and a bias toward the utilization of narcotic analgesics in the ED. Pain management is a subject that isn't educated inside most medicinal school programs. The treatment of intense pain, particularly in the ED, is never given a theme for formal instructing. One of the most challenging obstacles to effective pain management in the ED or any clinical setting is changing the practice patterns of established physicians as opposed to newer physicians. (Motov & Khan, 2008; Kamper et al., 2020). A study conducted by Marquee and colleagues showed that physicians gave significantly lower pain ratings than patients both on arrival and at discharge (Motov & Khan, 2008). The extent of "miscalibration" was greater with expert than novice physicians. Despite nationwide accepted practice guidelines on managing painful conditions such as chest pain and back pain, studies by Lewis and Di Iorio have shown very poor compliance with these guidelines and minimal changes in practice behavior among working physicians. Owusu-Ofori et al., (2023) and Pellegrino, Di Iorio, et al. (2022) concurred that there were observations that there may be poor compliance with pain management guidelines and minimal changes in practice behavior among working physicians, and this is not unique to EMS. Such challenges are often encountered in healthcare when implementing guidelines and best practices.

2.3.5 Opiophobia in emergency department

Opiophobia is the preference against the utilization and remedy of narcotic analgesics. The after effect of this is patients do not get appropriate analgesics or get them in deficient measurements and they leave the ED in pain and without remedies for narcotic analgesics. Many working ED doctors have noteworthy opiophobia, show absence of legitimate information about narcotic analgesics, and have negative perspectives about patients requiring narcotics. Potential causes incorporate, however are not restricted to administrative and permitting concerns; doubt of "sedate chasing" conduct; worries of compulsion or reliance; absence of development or progression of consideration; and dread of veiling side effects of an intense disease. In 2003, Neighbor and partners, in a review companion of 540 diagrams at a level I trauma center, demonstrated that an aggregate of 258 (47.8%) patients got intravenous narcotic absence of pain within three hours of ED entry. Kelly and associates demonstrated

that by empowering attendants to start narcotic analgesia before medicinal evaluation by doctors for chosen painful conditions, the middle time to first pain relieving portion diminished from 57 minutes to 31 minutes. In 2007, Bijur and partners demonstrated that intravenous morphine at 0.1 mg/kg was not compelling for controlling serious pain in a larger part of patients. The outcomes demonstrated that of 119 patients, 67% of the patients who got intravenous morphine at 0.1 mg/kg announced an under half decline in agony. The mean age was 42 years, and the mean pain score was 10.

All in all, it is basic for ED doctors to be specialists in pain management, and they should give it their best shot to ease human enduring by treating patients' intense pain. Be that as it may, they additionally should be comfortable with the evaluation of unusual practices in patients with pain and comprehend the idea of equalization in the hazard and advantage.

2.3.6 The emergency department culture

Culture conflicts are normal in the ED among the patients and providers and among patients and their families (Al Owad et al., 2022). The authors added that the providers' inability to speak with patients in their local dialects, quiet newness to the human services framework, lack of insurance, and narrow mindedness to painful long holding up times make patients so disappointed that even the hypothetical plausibility of opportune, proficient, and sufficient pain management appears to be ridiculous. Also, stereotyping and bias with respect to the ED doctors and doubt and disappointment with respect to the patients, when consolidated, make imposing obstructions to fruitful treatment of pain in the ED.

2.4 Suboptimal prehospital analgesia administration

Suboptimal prehospital analgesia administration refers to situations where pain relief is not provided adequately or effectively to individuals in need before they arrive at a hospital or healthcare facility (Teoh et al., 2022). This can happen for various reasons, and its a concerning issue because pain management is an essential aspect of patient care, and delays or inadequate treatment can lead to increased suffering and potential complications. This could Suboptimal prehospital analgesia administration can be due to a lack of education, non - availability of medications, controlled substance regulation or research associated with pain management that prevents the prehospital providers to achieve adequate pain assessment and management of the patient (Rybojad et al., 2023; Lourens et al., 2020). It is unethical to delay or not provide any pain relief to a patient in the prehospital environment (Parker et al., 2021). It also involves

respect which involves action and not only a respectful attitude towards the patient. The medical personnel have a moral obligation of contributing to the well-being of a patient and to promote good once a patient has been brought to their attention. In addition, each person is equal worth, and everyone is entitled to receive necessary care. This means prehospital providers have an ethical obligation to try to provide benefits to their patients by taking their complaints in a serious manner by administering the appropriate analgesia.

Factors that can contribute to suboptimal prehospital analgesia administration include inadequate training, fear of using opioids, limited medication options, inadequate pain assessment, patient's allergies or medical history, delays in providing analgesia, communication issues between EMS personnel and patients, lack of well-defined protocols or guidelines, unwillingness of patients to take analgesia, fear of the legal and ethical implications of pain management decisions, and limited resources (Teoh et al., 2023; Lourens, 2020; Fabbri et al., 2023). Rutkowska et al (2015) assessed the implementation of recommendations for prehospital management of pain for injured children that were provided by various health care centers that were admitted to the Maria Konopnicka Memorial University Teaching Hospital No.4 in Lodz for a one-year period. Health care centers provided prehospital treatment to 21% of the injured children. EMS personnel accounted for 42.7% of treatment in comparison to a primary health care physician who administered 28.1% of treatment. A total of 489 out of 1493 patients met the criteria for analgesia and 159 patients were given analgesia. The authors concluded that despite the training of the medical staff, provision of analgesia for children with traumatic injuries was inadequate. Samuel et al. (2015) did a study to analyze the available evidence in prehospital pain management of injured children for a 20-year period. The level of evidence available for the safety and efficacy of pharmacological interventions was questioned for prehospital pediatric patients requiring analgesia for traumatic injuries. It was concluded that the current level of evidence is insufficient to assess the safety profile of analgesics. The findings of the study suggest that analgesic treatment of injured children in the prehospital setting is suboptimal. All the information in this section shows that it is essential to address these issues through continuous training of the EMS practitioners, developing protocols and guidelines to guide the EMS personnel, and establish communication between EMS personnel, patients, and their families.

2.5 Prehospital analgesia administration documentation

A retrospective database study to elucidate pain treatment with analgesics in a prehospital trauma population in Odense, Denmark for a two-year period was conducted by Hebsqaad et al., (2016). 985 cases were analyzed and NRS was only documented in only one case. 787 patients experienced no pain or mild pain, whilst 168 patients experienced severe pain. A total of 130 patients were treated with opioid analgesic or ketamine whilst no pharmacological intervention was documented in 30 cases. The authors concluded that the effect of opioid analgesia was documented in only one patient that was involved in trauma whereas there were 17% of patients that experienced severe pain. However, Lindbeck et al. (2021) indicated that it is the duty of the EMS personnel to assess and monitor the patient's pain during their care and hand over documented information about pain assessment to the admitting medical facility. This means that the EMS practitioners should give a full report of a patient's pain progression from the time they meet a patient, and it should be recorded including the analgesia administered to the patient on the way to the health facility. To explain, Gerhardt et al. (2016) mentioned that the evaluation of pain and followed by administration of analgesia are significant practices that are used to ascertain the quality of emergency medical services care which should be documented and analyzed for better pain alleviation. In addition, the authors elaborated that prehospital pain evaluation, treatment, and documentation are significant and necessary for performance improvement in the EMS environment. Supporting this, Schauer et al. (2019) revealed that the documentation of prehospital analgesia administration by US forces from 2007 through 2016 showed an improvement of use of other analgesic drugs in comparison to the use of Morphine. The significance of documentation of analgesia administration during pre-hospital care as its absence limits further effective treatment of pain in trauma patients was emphasized by De Rocquigny et al. (2020). The authors indicated that accurate documentation of analgesics treatment given to trauma patients help the admitting medical practitioners to make correct decisions of further treatment and ascertain progress of healing of the patient.

2.6 Opioid versus non-opioids in prehospital pain management

A systematic review was conducted by Dijkstra et al., (2014) to identify effective and safe initial pharmacological pain interventions for trauma patients with acute pain in the prehospital context in the Netherlands. The results showed that Paracetamol (both orally and intravenously) and opioids (morphine and fentanyl) proved to be effective whilst non-steroidal anti-inflammatory drugs (NSAIDs) showed mixed results and is not recommended for use in the prehospital context. It was suggested that these results could be used for the development of an

evidence based pharmacological pain management algorithm to support the provision of adequate pain management in the prehospital environment.

The EMS in Botswana is made up of nurses, EMTs, healthcare assistants, and drivers who are in different significant towns and villages (Mamalelala et al., 2023). The authors added that government ambulances transport people who are in emergency cases mostly in villages. The Botswana government EMS has a challenge of qualified personnel such that pre-hospital care is provided by general nurses who provide ambulance care only (Mamalelala et al., 2023; Elder et al., 2022). At the same time, there are no clear standards of practice for the Botswana EMS personnel.

Though there is a shortage of medical and human resources in EMS Botswana, Mamalelala et al. (2023) revealed that the EMTs are usually the first responders to emergency calls, and they provide initial assessment, basic life support, and essential care to stabilize patients. The EMTs in Botswana handle a wide range of medical emergencies, and trauma cases, and they provide emergency medical services before hospital submission. In addition, there are paramedics who provide advanced life support as they are regarded to be highly trained when compared to EMTs. The paramedics can administer analgesia and offer other critical interventions. In Botswana, the EMTs and the paramedics work together (Mamalelala et al., 2023). However, Botha et al. (2021) indicated that the health professions council of South Africa (HPCSA) has established health practice guidelines (HPGs) which guide their highly trained and skilled EMS professionals. In this regard, the authors demonstrated that the EMS professionals in South Africa do well in the field when compared to the Botswana EMS practitioners who lack skilled people and training in the field. In South Africa, there are student basic life support providers, intermediate life support students and advanced life support paramedic students who only perform professional duties under a relevant supervisor. Evidence presented in this section influences how opioids and non-opioids are administered during prehospital management of patients. In agreement, Friesgaard et al. (2022) and Landers & Powell (2021) concurred that Acetaminophen and nonsteroidal anti-inflammatory drugs alleviate pain just like opioids and may cause lesser side effects. Combining non-opioids and opioids may be more effective in pain handling than using opioids only. This is because, according to Vahedi et al. (2019) opioids are slow at relieving pain unlike non-opioids which are quicker and more effective meaning the two complement each other with non-opioids being quicker and opioids taking over from the non-opioids. If morphine does not adequately relieve pain, changing to ketamine may be more effective and more quickly reduce pain than giving additional morphine.

2.7 Prehospital effectiveness of pain reduction

To evaluate the effectiveness of pain reduction, Haske et al., (2014) con a retrospective analysis measured by a recognized assessment scale and the safety of analgesia with ketamine and midazolam administered by paramedics in Germany. A total of 528 patients were administered analgesia by paramedics, trauma was the most common indicator for the administration of analgesia. Serious complications were not observed after administration of analgesia, and this resulted in a highly significant reduction in pain scores. Supporting this, Sobieraj et al. (2020) highlighted that if used appropriately and correct doses and combinations are given, prehospital care can be effective for pain reduction. The authors elaborated that a combination of an opioid and ketamine has the ability of reducing acute pain better than an opioid. However, individual side effects are not specifically known. The authors further elaborated that in the case where morphine is insufficient at the beginning, ketamine may be a better alternative which can alleviate pain much quicker instead of providing additional morphine. Similarly, Mahshidfar et al. (2019) found that ketamine offers secure and efficient pain relief. From the literature in this section, it is evident that prehospital care can alleviate pain if practiced correctly by adopting appropriate drugs in their correct proportions.

The effectiveness of prehospital pain reduction is paramount in EMS and patient care as it is the goal of prehospital care before the patient reaches a healthcare facility. However, pain reduction is influenced by several factors including pain assessment, time taken to attend to the patient and availability or non-availability of analgesia, medication options, the patient's comfort and cooperation, how the medication is administered, whether accurate dosing and titration of pain medication are done, regular monitoring and reassessment of the patient's pain, patient safety and potential adverse effects, and documentation of the prehospital pain for continuity of care after facility admission. Effective prehospital pain reduction requires continuous training and education for EMS practitioners, having several options to help the patients, availability of protocols and guidelines, and access to pain assessment tools. Effective pain management is a fundamental aspect of patient care, and optimizing prehospital pain reduction is essential for improving patient outcomes and comfort.

2.8 Chapter summary

This chapter presented a detailed review of the literature related to the study. The literature review was guided by the research objectives, problem statement and the aim of the research. The discussion included challenges of pain management in emergency department, barriers to treatment of pain in the emergency department, Botswana EMS system, and the characteristics of pain management practices of EMS practitioners during the management of trauma patients.

Chapter 3 Research Methodology

3.1. Introduction

This chapter presents the methodology to be used to conduct the study. It lays out the research settings and study design, study population, inclusion and exclusion criteria and sampling method. It also consists of data collection procedure, data analysis, limitations, and ethical considerations.

3.2 Study Design

A research design is a roadmap that guides the collection and analysis of data on specific variables required to address a given research problem (Ranganathan & Aggarwal, 2018). In addition, Ranganathan & Aggarwal (2018) and Martin, Chapman, Rahman, et al. (2014) agreed that retrospective research involves the use of results of interest that have already happened in every research participant by the time recruitment of participants is done, and the data are gathered from records or through cross examination of participants to remember exposures. Furthermore, Friberg & Rognås (2018) highlighted that in such research, there is usually no follow-up of participants to verify why certain actions or decisions were taken which can be a disadvantage. This research study employed a retrospective descriptive research design. A retrospective descriptive research design was adopted to guide an investigation of how trauma patients are treated by the Botswana Ministry of Health EMS personnel under Provincial EMS in Botswana. The medical records of the Ministry of Health EMS were used. A retrospective study does not involve the challenges of recruitment and data collection which make prospective studies difficult and is less time-consuming as well as less expensive. (Ranganathan & Aggarwal, 2018 and Arens et al.,2017). This database was accessible, whereas prospective data collection may have required adaptation of documentation and training of staff, which was not possible in context, and with the time constraints present in the research. For the purposes of characterizing trauma patients involved in prehospital pain management within the Ministry of Health in Botswana, data was extracted from the Botswana Ministry of Health EMS physical Patient Report Forms (PRF).

3.2 Research Setting

The study took place in Gaborone, the capital city of Botswana with a population of 231,626 based on the 2011 census, about 10% of the total population of Botswana (Botswana statistics Report, 2018). There are five (5) emergency medical services in Gaborone including the Government EMS (997). The research was based on data collected from the Government EMS.

The paramedics capture clinical notes manually on paper Patient Report Forms (PRFs) which are handed in at the station and identifying details (case numbers) are captured on an electronic indexing system. The papers are archived while the electronic index records allow one to retrieve the paper records from the archive.

3.4 Study population

The study population should be clearly defined in any research and Perkins, et al. (2020) and Howe & Robinson (2018) agreed that a target population refers to the entire group of subjects or items under study where inference can be done from findings of a studied sample. The target population of this research were trauma patients managed by Botswana Ministry of health ambulances. This was composed of medical records of trauma patients treated by the Botswana Ministry of Health EMS personnel under Provincial EMS in Botswana for the period 01 January 2018 to 31 December 2018 in Gaborone, Botswana. These patients were identified by looking at the Patient Report Form (PRF) from the Botswana Ministry of Health EMS. This was done by identifying different types of traumas recorded on the PRF, presenting complaint, provisional diagnosis, and treatment or even drug administered. Thus, a total of 954 relevant cases were identified and constituted the study population. This information was attained by physically checking with the concerned offices in Gaborone, Botswana.

The specific variables that were extracted from the PRFs included date, patient age (years), gender, weight (kg), MOI, GCS, initial pain score, type and dose of analgesia administered (mg), pain score 2, injuries sustained, diagnosis, treatment, geographical location, time from call to scene (minutes), time from scene to hospital (minutes) and qualification of providers.

3.5 Sampling Procedure

Sampling refers to the process of identifying the research participants (Taherdoost, 2016). Sampling can be classified as probability and non-probability sampling. The author elaborated that probability sampling involves random processes where the research subjects are allocated known probabilities. In addition, Pierce et al. (2020) indicated that random sampling eliminates sampling bias there by helping to validate the sample. More so, the authors explained that randomizing helps to generalise the research findings. On the contrary, non-probability sampling is linked to non-random sampling which does not account for any probability allocation resulting in high chances of sampling bias (Malik, Sheikh & Yousaf, 2022). In non-probability sampling, the sample is selected based on a non-random criterion, and not every member of the population has a chance of being selected. In addition, Elfil & Negida (2017)

explained that probability sampling allocates known probability to each research participants whilst non-probability is not concerned about probabilities but just identifying participants who meet the needs of a particular research.

Thus, in conducting retrospective study, sampling refers to the method by which study cases or records are selected from the target population or database (Ploussard et al., 2020). However, Grove & Gray (2018) alluded that getting a random sample is complicated in nursing research, thus most researchers resort to non-random sampling. In addition, Bhuyan, Dua & Kothari (2016) indicated that the three commonly used sampling methods in retrospective study are convenience, quota, and systematic sampling. The electronic indexing system, contained in a spreadsheet, allows all records of a specific type to be retrieved. There was a significant risk that not all paper PRFs were included in the indexing system due to inefficiencies with the administrative and logistics systems. The retrieved Patient Report Forms (PRFs) were inspected to confirm they were of the correct case type. This was done for the period of 12 months that is from January 1st, 2018, to December 31st, 2018[1]. It is important to note that the November records were not available in the department at the time of the research.

This research adopted census sampling where the required information was collected from every PRF of the eligible trauma cases identified over a specific period (January 2018 to December 2018) provided by the EMS department at the Ministry of Health and Wellness (MOH/W). The researcher extracted all PRFs which had sufficient information needed to address the research objectives. The PRFs were identified as having sufficient information if they had records indicating the variables listed in Section 3.4 in the last paragraph. To ensure all trauma cases were included, the researcher also inspected each PRF contained in the paper archive for inclusion. This was to mitigate the risk that not all PRFs had been captured in the indexing system. Thus, after getting an authorization letter from MOH/W, the researcher went to the MOH/W offices and inspected the paper archive containing the PRFs for the City of Gaborone, spanning the study period. Information from included PRFs were entered into a spreadsheet (Microsoft Excel, Redmond California). A total of 954 (N=954) were included, representing the entire population of trauma cases for which records were available.

3.6 Inclusion Criteria

The research consisted of medical records of trauma patients treated by Ministry of Health EMS personnel from January 2018 to December 2018. The records should include individual patient characteristics assessed, including age, sex, diagnosis, injuries sustained, drug and dose of analgesia given.

3.7 Exclusion Criteria

Medical, obstetric patients and all trauma patients that fall outside the period from January to December 2018 were excluded.

3.8 Sample size

Alvi (2016) defined a sample as a small group of people chosen from a population for research purposes. As this research used census methodology, no sample size calculation was performed. For the purposes of this research, all trauma patients' paper PRFs in Botswana EMS which satisfied the inclusion criteria were identified and sorted according to date and month. The identified PRFs were systematically analyzed and extracted from all patients presenting the required data. Some of the PRFs had a lot of missing information whilst the others have reasonable missing information. It is important to note that most of the PRFs collected and systematically sorted for extraction from the Botswana Provincial EMS had missing information.

3.9 Measures

The records from Botswana EMS are stored as paper PRFs. With approval from the Ministry of Health EMS institutional review board, individual patient characteristics were assessed, including age, sex, diagnosis, injuries sustained, drug and dose of analgesia given.

3.10 Data collection tool

Observational checklist was used to extract trauma information from patients' files. The observational checklist included date, patient age (years), gender, weight (kg), MOI, GCS, pain score 1, analgesia administered (mg), pain score 2, injuries sustained, diagnosis, treatment, geographical location, time from call to scene (minutes), time from scene to hospital (minutes) and qualification of providers (See Appendix 1). Gregory & Radovinsky (2012) posit that patient medical records provide a wealth of information needed for clinical research and they are seen as a primary source of retrospective data. The scholar highlighted that a researcher in clinical research can use a data extraction tool that has been prepared to extract patients'

information which may be difficult to obtain through prospective research. In this research, the data extraction tool was developed based on the research objectives and the research problem. The variables which address the research objectives, and the research problems were identified from patients' records kept by the Botswana Ministry of Health EMS.

Eleven variables were created for this study: (1) age, (2) gender (3) race, (4) weight of the patient measured in kilograms (5) whether the pain score was assessed and recorded (6) analgesia given or non-pharmacological methods (7) if a second pain score was documented (8) injuries sustained (9) diagnosis (10) geographical location (11) time from scene to hospital arrival.

3.10.1 Reliability and validity of the data collection tool

As put across by Mohajan (2017), reliability and validity are necessary to assure the integrity and quality of a formulated research measurement instrument. The author elaborated that reliability looks at how much a research tool can be trusted to collect the intended information. At the same time, Bajpai (2014) explained the reliability of a research instrument as the ability of the instrument to provide stable findings. Supporting Bajpai (2014), Campos, da Silva Oliveira, Feitoza & Cattuzzo (2017) added that reliability of an instrument looks at the consistency, stability, and repeatability of research findings in a different environment. Thus, to prove the reliability of the instrument, the researcher consulted several literature sources, consulted with the research supervisor and a statistician to validate the research tool.

In addition, the researcher created an extraction tool using a spreadsheet (Microsoft Excel, Microsoft Corporation, Redmond California) and this was checked for its validity. In the context of a data extraction tool in a retrospective study, checking for face and content validity is crucial to ensure that the tool is measuring what it intends to measure and that the extracted data are relevant and representative. Thus, in this case the researcher also sought feedback from some of the officers in the Botswana EMS to make sure that the data extraction tool was soliciting for required information to address the research objectives and problem statement of the study. This involved checking whether the research tool was good at measuring what it was intended to measure as guided by Yoshida, Matsushima, Wakabayashi et al. (2017). In the same line of thought, Bajpai (2014) mentioned that the validity of a research tool talks about how truthful the data will be when it is collected using the research tool. It was important to check if the designed data collection tool was able to collect true information which can address

the objectives and the research problem. So, the research supervisors (Dr Naidoo and Mr. Matthews) helped by checking for face and content validity. That is, according to Campos et al. (2017) the research supervisors were able to assess and approve the structure of the research instrument and to verify if the questions were enough to generate all the needed information about the research. In other words, face validity looks at the structure of the tool and content validity looks at how much the given questions will be able to generate the required information needed to complete the research. Literature review was also used to ensure that the data extraction tool aligns with established theories, concepts, or findings in the literature. This helps establish the content validity by ensuring that the tool measures what it intends to measure in the context of existing knowledge (Boateng et al., 2018). The research instrument was adapted based on recommendations from the research team members and the statistician.

The revised instrument was piloted in January of 2018. In conjunction with Gaborone EMS, and with permission of the director of Gaborone sample data was extracted from patient care records in the last two weeks of January. The completed data extraction form was compared with the records and checked for accuracy by two independent verifiers, who were EMS officers designated by the head of Gaborone EMS. The verifying officers checked the collected data against the research records and again verified against the available online database. A few errors were noted which included writing two observations in the same cell or repeating an observation in the same cell. Minor adjustments were made by deleting one of the observations and positioning it accordingly or where the observation was repeated in the same cell, the extra one was deleted. Then, the researcher discussed the pilot findings with the verifying officers, corrected the errors in agreement and the research tool was approved by the researcher and the Ministry of health records personnel and it was rendered fit for collecting the intended data.

3.11 Data collection Procedure

After all the important communications were done the researcher used the observational checklist to extract information on trauma cases from patients' files from January – December 2018. An observational checklist was chosen because it was presented to each respondent in the same way and the results obtained would easily objectively compare. Observational checklists are also less expensive, and it offers greater anonymity. Lastly, a trained research assistant was selected to help the researcher during data collection activities.

It is important to note that the PRFs were only accessed on site for capturing and returned to their original storage place in the EMS offices. This was made easy by the involvement of the research assistant. The research assistant was trained through the process of data extraction during the pilot study and the research assistant was taught about research ethics and signed an agreement and confidentiality form. During the actual exercise, the research assistant worked together with the researcher in reading out the records, recording them on the extraction tool and verifying the records. Thus, the research assistant was involved in the identification of errors.

3.12 Cleaning/Preparing data

The original PRFs are stored as paper copies in the archive. The paper copies are stored in files in the archive according to the months of the year. Data cleaning and preparation included implementing the recommendations and corrections established during data extraction and consultations mentioned earlier. Data were analyzed using IBM SPSS Statistics version 25. Patient names were replaced with unique identifiers and date of birth was converted to age in years using an excel document.

3.13 Data Management

Data were collected at the EMS office and no PRFs were taken out of EMS. The data were de-identified by eliminating or not mentioning the patients' names but by allocating a five-digit number or code to each selected PRFs. In other words, PRFs were given unique identification numbers. Data extracted were handled in a way that ensured the integrity of data to address the concerns related to confidentiality, security, and preservation of research data. Data extracted were stored in personal laptops which have passwords known only by the researcher. Spreadsheets and electronic documents containing data were also password protected. To ensure that the data are protected, virus protection was always being updated to preserve vulnerability of data. Also, to preserve the data, there was archiving of valuable results in OneDrive since it can be accessed anytime anywhere if internet is available. The OneDrive was password protected and only the researcher had access to it.

3.14 Data analysis

IBM SPSS Statistics version 25.0 was used for data capturing and statistical analyses. Descriptive statistics were presented as the percentage, mean, and standard deviation. Inferential statistics included the Chi-squared test and Pearson correlation coefficient or t-test were computed where necessary. The Chi-square tests are used to assess the existence of

relationships between any two categorical variables and the Pearson correlation coefficient or t-test are used to assess the linear relationships between any two or more continuous variables (Muhammad et al., 2023; Seeram, 2019). The test results are said to be significant if the p-value is less than 0.05 when conducting the test at 5% level of significance. Frequency and percentages were used to quantify various types of injuries, analgesic drugs used in emergency care and other variables of interest. The chi-squared test was used to assess the association between non-numeric variables (categorical variables) such as demographic characteristics and prehospital management of trauma patients and Pearson correlation coefficient was used to assess the association between quantitative variables. Variables significantly associated with either pain assessment or demographic would be established. The 95% confidence interval (CI) was used, and statistical significance was defined as $P < 0.05$. In other words, tests were conducted at 5% level of significance and the null hypotheses of no relationships were rejected when the test p-values were less than 0.05.

3.15 Ethical considerations

Ethical approval was obtained from the Human Research Ethics Committee of the Faculty of Health and Wellness, Cape Peninsula University of Technology (CPUT/HW-REC 2020/H01).

Appropriate ethical issues were adhered to. Prior to data collection activities, the researcher submitted an ethical approval letter from Ministry of Health/Wellness (MOH/W) to District Health Management Team (DHMT) and a confirmation letter to conduct the research was granted. The confirmation letter together with the ethical approval were sent to EMS department for data collection activities. The researcher then explained the purpose of the study to the head of EMS and intentions to collect data including the findings of piloting the research instrument. Prior to commencing any data collection, Patient's privacy, confidentiality, and respect for anonymity were guaranteed. All data were stored and secured according to requirements. No perceived harm, risk or hurt was anticipated from the study. No reference to individual results were made in any reports or publications based on the study results.

This research dealt with medical history or pain problems of trauma patients who were attended to by public EMS. This information was kept safely and confidentially by the researcher. Confidentiality and/or anonymity were assured by not using direct names of patients from PRFS and collected information was not shared with anyone who was not part of this research

in any way. No public discussions of patients' information were done. To protect patients' medical records from being leaked, the researcher kept the data in a locked form such that people needed access passwords to identify themselves before they could access the data. In other words, data were encrypted. Identification codes with numbers and letters were used to identify different practitioners and different qualifications. This helped to ascertain anonymity and make sure that personal information was protected. This was also assured by making the research assistant sign a consent form and agreeing to maintaining participants' information private and confidential.

3.16 Chapter summary

This chapter presented a comprehensive discussion of the research methodology that guided this research. The research setting was discussed in detail followed by the research design which is the retrospective descriptive research design, study population and the sampling procedures. In addition, the inclusion and exclusion criteria, sample size, measures and the data collection tools were also discussed in detail. In addition, a detailed presentation of the data collection procedures, data analysis and ethical considerations are presented.

Chapter 4 Data analysis, presentation, and interpretation of research findings

4.1 Introduction

This chapter presents a comprehensive description of data analysis and the findings of this study, The data analysis was based on a retrospective descriptive research design which guided an investigation of how trauma patients are treated by the Botswana Ministry of Health EMS personnel under Provincial EMS in Botswana. Out of all the recorded casualties making up the target population, a population of 954 participants were gathered by looking at the Patient Report Form (PRF). This was done for the period of 12 months that is from January 1st, 2018, to December 31st, 2018, excluding the November records, which were missing. Observational checklists were used to extract trauma information from patients' files. Qualifying patients were identified using the Botswana Ministry of Health EMS physical health records. Objectives were to determine the different types of traumatic conditions presented to the Emergency Medical Services in Gaborone, Botswana; to establish how pain in trauma patients presenting to the Emergency Medical Services in Gaborone, Botswana is managed; and to analyse the factors that influence how pain is managed in traumatic patients presenting to the EMS in Gaborone, Botswana.

There was some missing data, as this was retrospective data. Where data was missing, the respective field in the data extraction template was left blank. Some of the missing data is acknowledged in the data analysis chapter. However, there is limited information about missing data as the researcher could do nothing due to lack of explanation from the custodians of the data.

4.2 Data analysis

This section presents a detailed data analysis based on the gathered data. It discusses the demographic information of the identified participants and how they were treated for trauma by the Botswana Ministry of Health EMS personnel under Provincial EMS (997) in Botswana.

4.2.1 Participants' demographic information

This section discusses the demographic information of the research participants. It gives details about the number of trauma cases handled, ages, gender, and the weights of the research participants.

1.Trauma cases handled in 2018

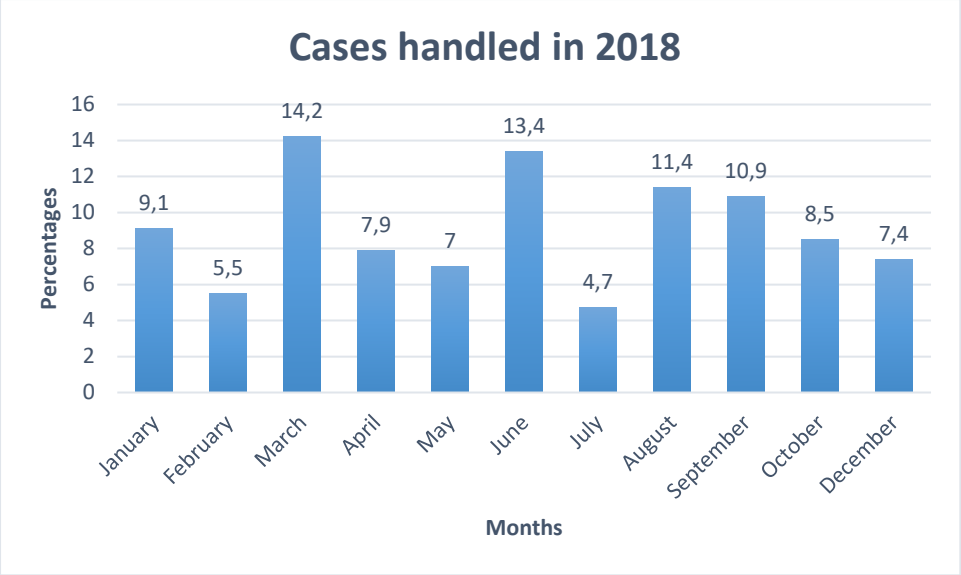

Figure 4.1 Trauma cases handled according to months in 2018

The bar chart in Figure 4.1 does not show any specific pattern except that the months with the lease cases had 4.7% (45) of the total cases and the ones with the highest number of cases contributed 14.2% (135) of the cases.

2. Ages of the research cases

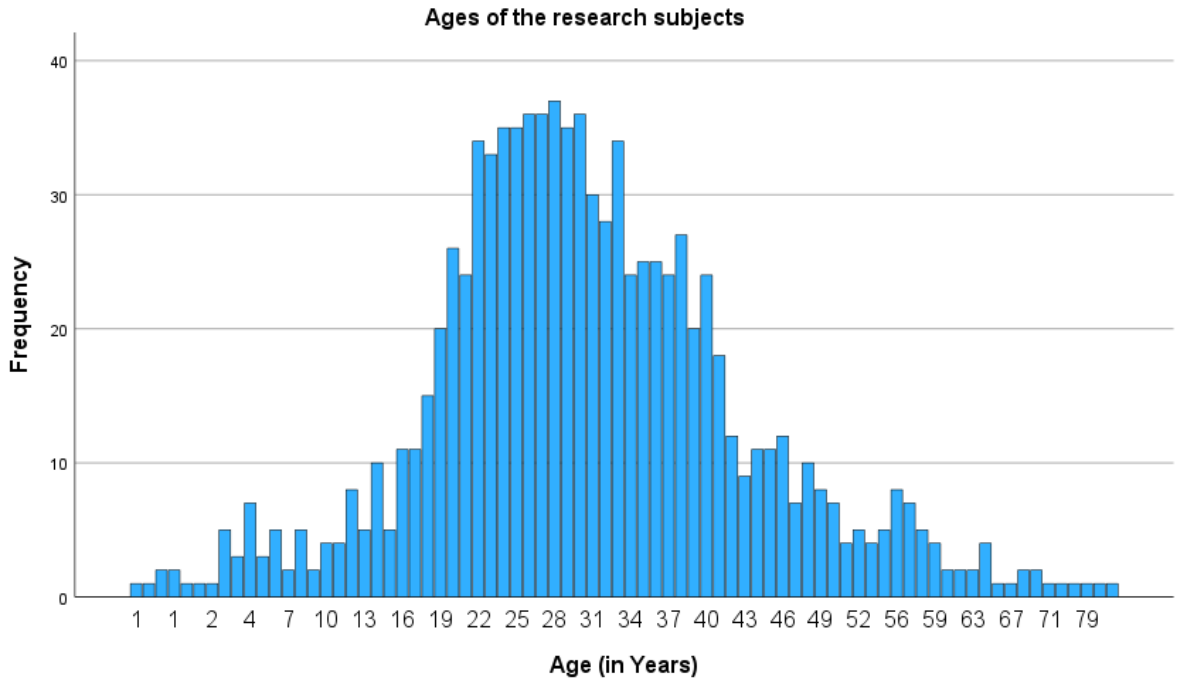

Figure 4.2 Age in years of the selected cases

Figure 4.2 shows that the ages of the cases were ranging from 0.5 years to 81 years with a range of 81 – 0.5 = 80.5 and a standard deviation of 23.6 years. The bar chart shows that the data are not symmetrical but positively skewed as shown by a long tail to the right with a mode of 28 years, a median of 35 years and a mean of 31 years. The data are clustered between 19 years and 41 years. This shows that most of the patients were mostly youths or young adults.

3. Gender of the cases

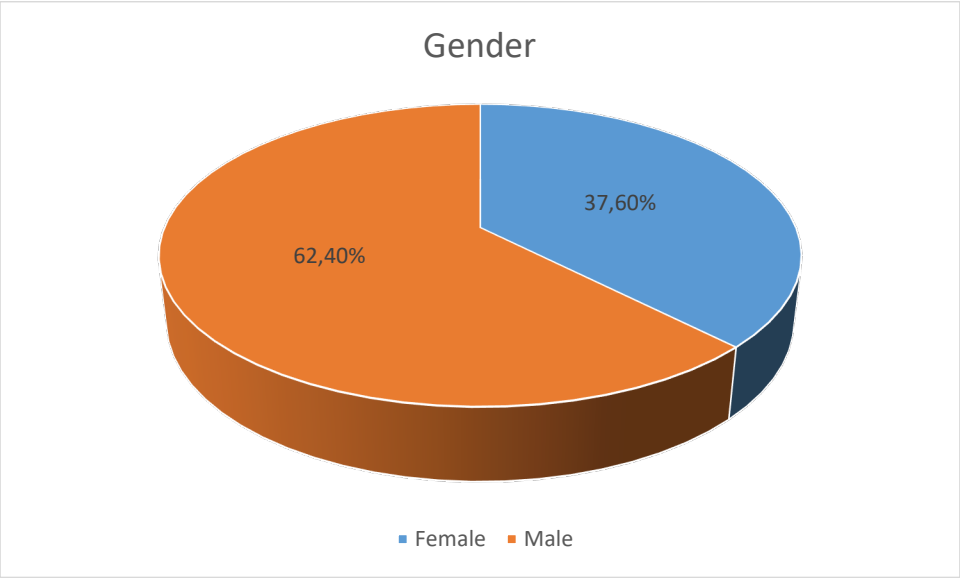

Figure 4.3 Gender of the cases

The pie chart in Figure 4.3 shows that most of the cases, 595 (62.4%) were males whilst the remaining 359 (37.6%) were females.

4. Weight of the cases

Table 4.1

Weight (kg)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	101	1	0.1	0.1	98.3
	15.9	1	0.1	0.1	98.4
	4	1	0.1	0.1	98.5
	40	1	0.1	0.1	98.6
	55	1	0.1	0.1	98.7
	60	2	0.2	0.2	99.0
	61	1	0.1	0.1	99.1
	64	1	0.1	0.1	99.2
	65	1	0.1	0.1	99.3
	70	1	0.1	0.1	99.4
	72	1	0.1	0.1	99.5
	75	2	0.2	0.2	99.7
	75kg	1	0.1	0.1	99.8
	82	1	0.1	0.1	99.9
	Missing	938	98.4	98.4	100.0
	Total	954	100.0	100.0	

Figure 4.1Weight of the cases

Out of 954 cases only 16 (1.6%) had their weights recorded as 4kg, 15.9kg, 40kg, 55kg, 61kg, 64kg,65kg, 70kg, 72kg, 82kg and 101kg. Each of the recorded weights contributed only 0.1% whilst 2 (0.2%) had a weight of 60kg, 3 (0.3%) had a weight of 75kg and the rest, 98.4% were not recorded (NR). These findings reflect that the paramedics were not recording the weight of the patients.

4.2.2 Handling and care of Trauma cases

This section looks at how the patients were treated for trauma by the Botswana Ministry of Health EMS personnel under Provincial EMS (997) in Botswana.

4.2.2.1 Mechanisms of injury of the cases

The mechanisms of injury were analysed as categories as shown in the bar chart below.

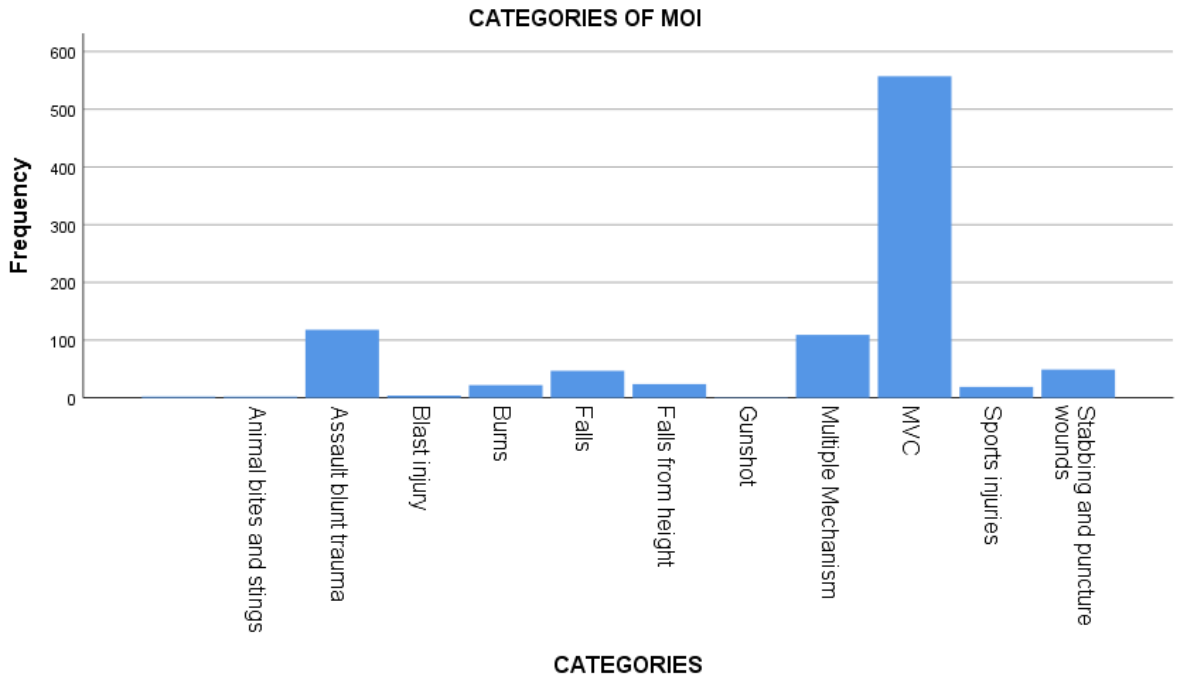

Figure 4.4 Categories of mechanisms of injury

The bar chart shows that the mechanisms of injury could be classified into different categories. Out of 954 cases, 557 (58.4%) were due to MVC - different types of accidents with cars followed by 118 (12.4%) cases which were due to assault blunt trauma, 109 (11.4%) cases which were due to multiple mechanisms- in the industry, in homes, gas cylinder explosions, electrocution, 49 (5.1%) cases were due to stabbing and puncture wounds, 47 (4.9%) cases were due to falls- falling objects on patients like gates and goalpost, 24 cases (2.5%) cases were due to falls from heights, 24 (2.5%) were cases due to burns - burns from boiling water whilst cooking and other sources of burns , 19 (2%) were due to sports injuries, 4 (0.4%) were due to blast injury, 2 (0.2%) cases were due to bites and stings - bitten by dogs, snake bites, and 1 (0.1%) was due to a gunshot. The mechanisms of Cases from MVC were more followed by assault cases. In addition, cases due to falling from heights or other falling were also contributing significantly to the proportions of the cases including other multiple mechanisms.

4.2.2.2 Places of injury of the cases

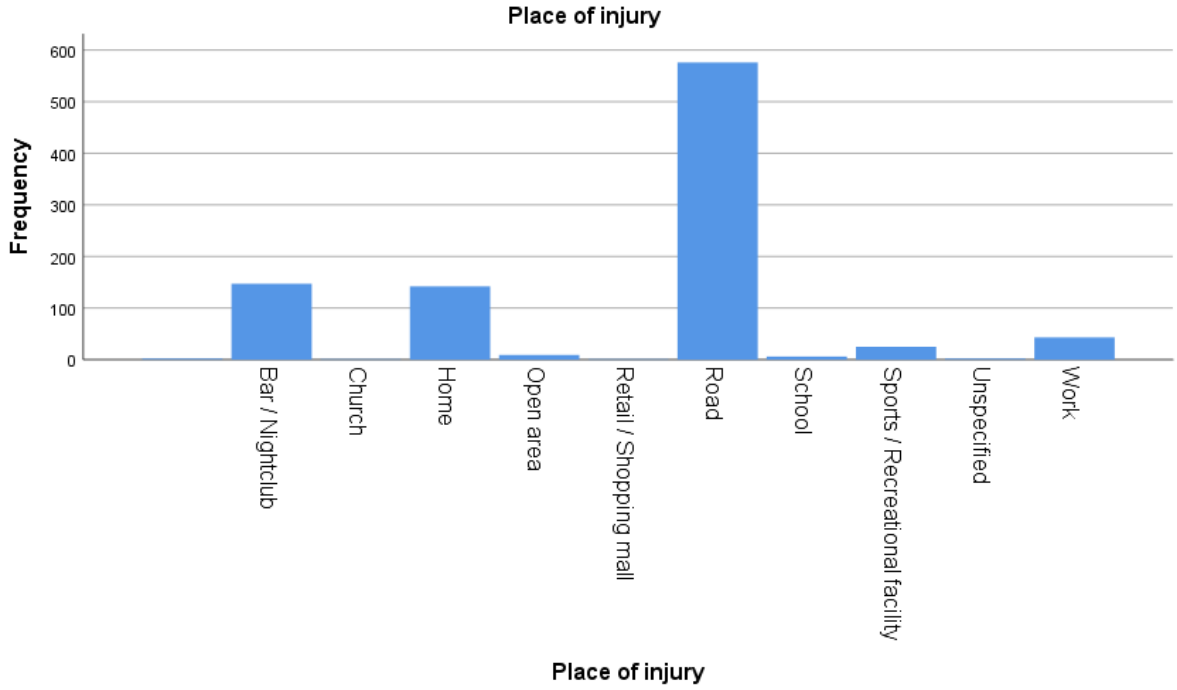

Figure 4.5 Place of injury

Figure 4.5 shows that the injuries occurred in different places or locations. Out of 954 cases, 576 (60.4%) cases occurred in the road, 147 (15.4%) cases occurred in bars / nightclubs, 142 (14.9%) cases occurred in homes, 43 (4.5%) occurred in the workplace, 25 (2.6%) cases occurred in sports / recreational facilities, 9 (0.9%) cases occurred in open areas, 6 (0.6%) cases occurred in schools, 4 (0.4%) cases were not specified where they took place whilst 1 (0.1%) occurred in a church and 1 (0.1%) occurred in retail / shopping mall. These findings reflect that the roads were the most common places of injuries followed by bars or nightclubs and homes.

4.2.2.3 The Glasgow coma scale (GCS)

Table 4.2 GCS

GCS			
		Frequency	Percent
Valid	3.0	3	0.3
	4.0	1	0.1
	5.0	1	0.1
	6.0	9	0.9
	7.0	3	0.3
	8.0	3	0.3
	9.0	3	0.3
	10.0	2	0.2
	11.0	3	0.3
	12.0	7	0.7
	13.0	6	0.6
	14.0	16	1.7
	15.0	893	93.6
	Total	950	99.6
Missing	System	4	0.4
	Total	954	100

Table 4.1 shows that 2% of the patients were in the severe category of GCS whilst 1.5% were in the moderate category and 96.2% were in the mild to fully awake category. These findings reflect that most of the patients observed in this study had mild GCS score or they were fully awake. However, 0.4% of the participants had no record for the GCS score.

4.2.2.4 Initial pain scores

Table 4.3 Pain scores

Pain score					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	4	,4	1,4	1,4
	1	2	,2	,7	2,2
	2	7	,7	2,5	4,7
	3	20	2,1	7,2	12,0
	4	21	2,2	7,6	19,6
	5	35	3,7	12,7	32,2
	6	36	3,8	13,0	45,3
	7	44	4,6	15,9	61,2
	8	46	4,8	16,7	77,9
	9	22	2,3	8,0	85,9
	10	39	4,1	14,1	100,0
	Total	276	28,9	100,0	
Missing	System	678	71,1		
Total		954	100,0		

Figure 4.6 shows the initial pain records that were taken at the point of getting or receiving the patient and it shows that 71% of the participants had no records for their pain scores. They were not recorded. Of those that were recorded 3.5% of the cases were in the no pain to mild pain categories whilst 14.3% were in the moderate pain category and 11.2% were in the severe pain category.

4.2.2.5 Analgesia administered to the patients

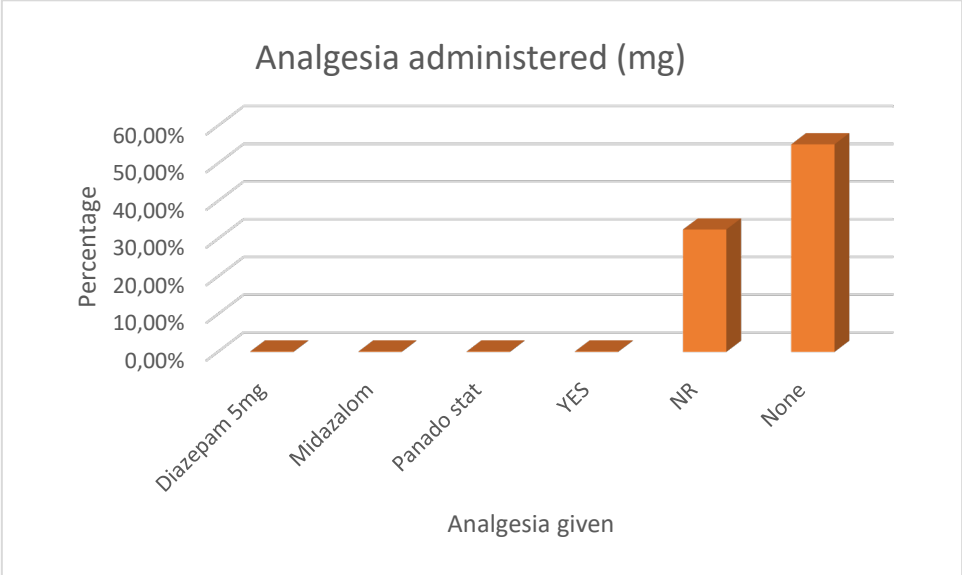

Figure 4.6 Analgesia administered (mg) to patients

Figure 4.6 revealed that 0.1% indicated that they were given Diazepam 5mg, whilst 0.1% were given Midazalom and only 0.1% were given Panado stat which is analgesic. In addition, 9.4% just indicated that they were given some analgesia, but it was not specified what it was whilst for 32.5% no record was made and for 57.8% no analgesia was administered. In most cases no pain relief is given to help the trauma patients being handled by the EMS in Gaborone. However, it is important to note that in some cases arm-slings, arresting of bleeding, dressings, cervical collars, C-spine immobilizations, cardboard splints, and comfortable positioning were administered but it was mostly at the point of admission.

4.2.2.6 Pain scores at the time of admission from the EMS

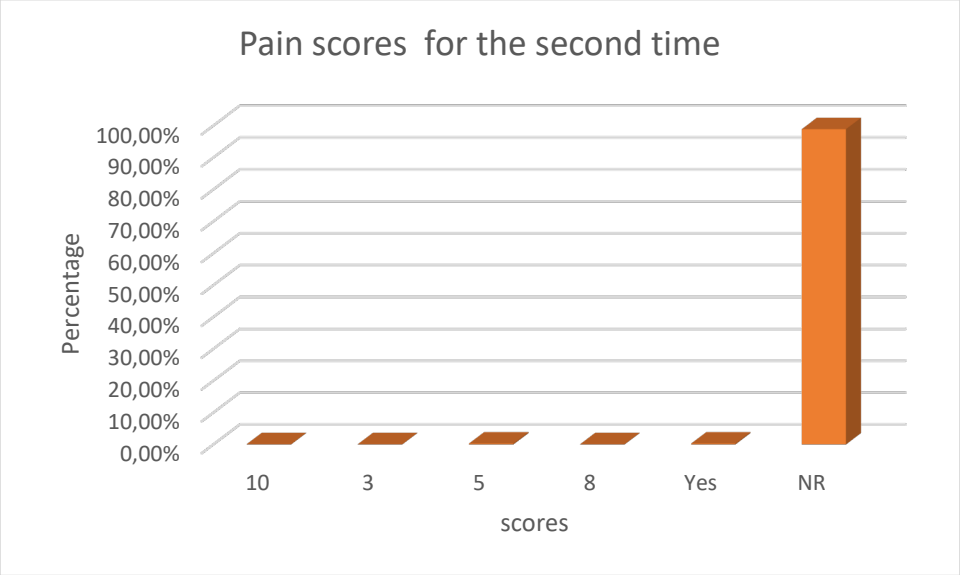

Figure 4.7 Pain scores taken for the second time from the patients

After transporting the patients to their place of admission, another pain assessment was done and the records revealed that 98.9% had no record at all about their second pain assessment after being handled by the EMS personnel whilst 0.1% had a pain score of 3, 0.3% had a pain score of 5, 0.1% had a pain score of 8 and another 0.1% had a pain score of 10. However, 0.3% indicated that a pain score was taken but it was not recorded. These results show that the pain assessment even reduced at the second assessment as compared to the first assessment where 71% had no record at all. Thus, compared with the records from the initial pain scores recorded, only 1.1% of the records had more than one pain score recorded.

4.2.2.7 Injuries sustained by the patients

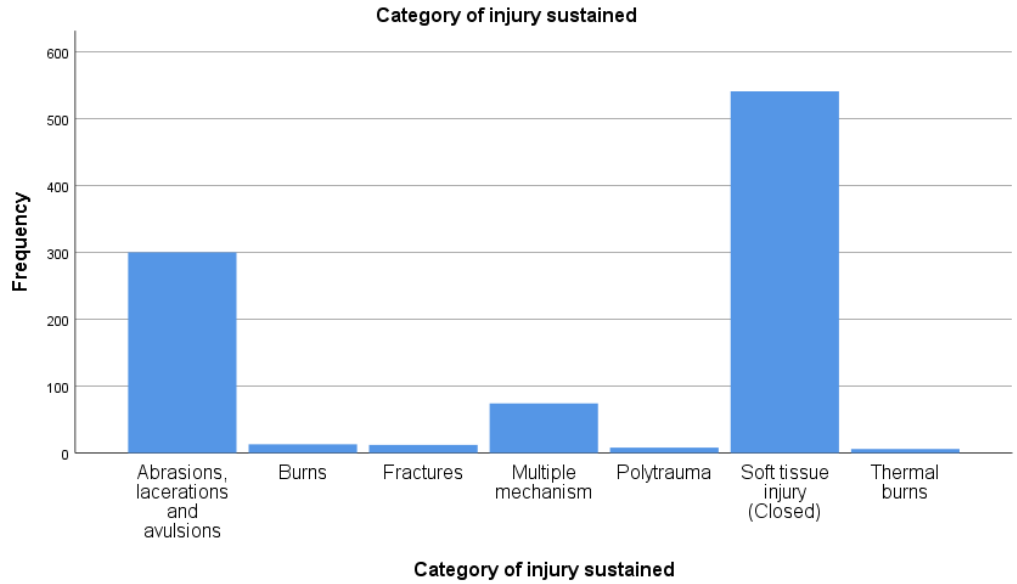

Figure 4.8 Injuries sustained by the research cases

Figure 4.8 shows that out of 954 cases, 300 (31.4%) of the cases sustained abrasions, lacerations and avulsions, 541 (56.7%) of the cases sustained soft tissue injuries (closed), 74 (7.8%) of the cases sustained multiple mechanism, 13 (1.4%) of the cases sustained burns, 12 (1.3%) of the cases sustained fractures, 10 (1.0%) of the cases sustained polytrauma and 6 (0.6%) of the cases sustained thermal burns. The patients who were handled by the EMS personnel suffered from different kinds of injuries as reflected on the bar chart in Figure 4.10. It is important to note that Figure 4.10 shows summary groups of the sustained injuries. Thus, the common injuries were soft tissue injuries (closed) and abrasions and swellings in different parts of the body including the whole body and pains from different parts of the body. In addition, the records also indicated that the patients suffered from several other traumatic situations shown in the Table 4.2:

Table 4.4 Other sustained injuries outside the identified categories

Injuries sustained			
		Frequency	Percent
	Inhalation injury	2	25
	Mark of rope on neck	1	12.5
	Near drowning	1	12.5
	Scorpion bite to right leg	1	12.5
	Shock	1	12.5
	Smoke inhalation	1	12.5
	Snake bite to left leg	1	12.2
	Total	8	100
a. Category of injury sustained = Etc			

Table 4.2 shows that the patients also suffered from inhalation injury, mark of rope on neck. near drowning, scorpion bite to right leg, shock, smoke inhalation and snake bite to left leg. However, the findings also showed that 1.4% of the patients suffered from deep lacerations in different parts of the body, 0.6% suffered electrocutions, 0.6% suffered epistaxis, 2.1% suffered fractures, 1.4% suffered hematomas to different body areas, 1.6% suffered injuries to different body parts and 0,6% suffered ingestion of different things. The records also revealed that some of the patients (1.6%) had no visible injuries, some (0.6%) had no complaints and others (1.3%) had no injuries at all.

4.2.2.8 Injuries sustained according to body regions

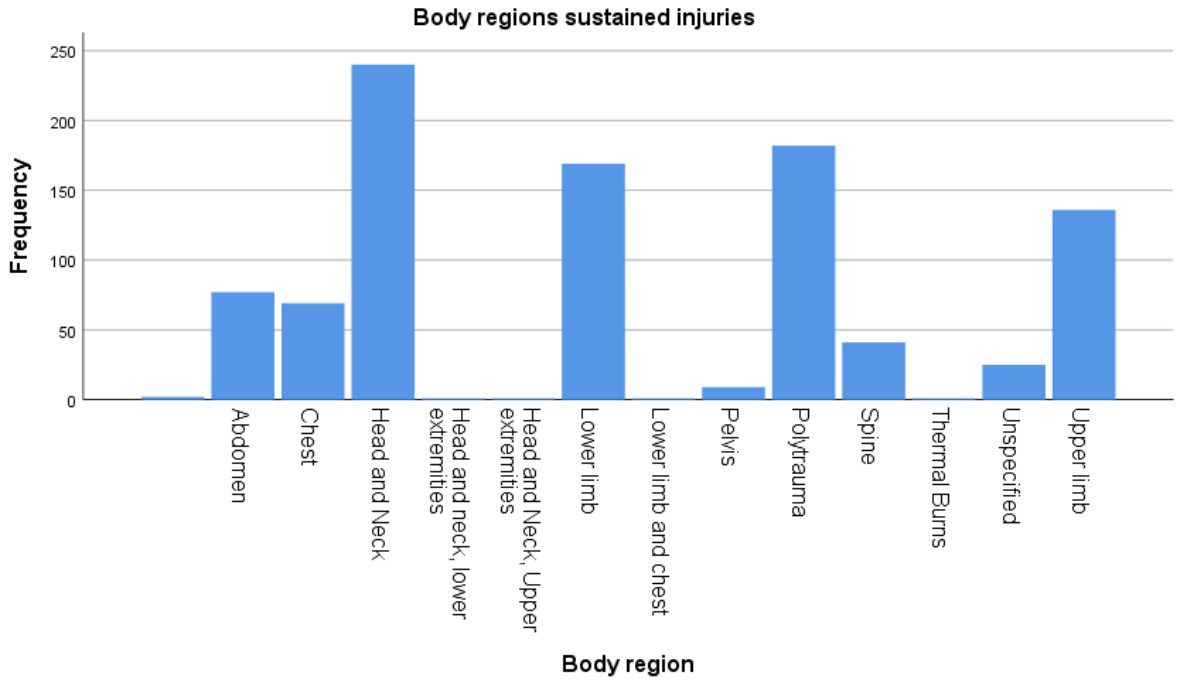

Figure 4.9 Injuries sustained according to body regions

The bar chart in Figure 4.9 shows that 240 (25.2%) cases had sustained injuries in the head and neck whilst 182 (19.1%) had polytrauma, 169 (17.7%) had sustained injuries in the lower limb, 136 (14.3%) had sustained injuries in the upper limb, 77 (8.1%) had sustained injuries in the abdomen, 69 (7.2%) had sustained injuries in the chest, 41 (4.3%) had sustained injuries in the spine, 25 (2.6%) were unspecified, 9 (0.9%) had sustained injuries in the pelvis, 1 (0.1%) had sustained injuries in the head and neck, lower extremities, 1 (0.1%) had sustained injuries in the head and neck, upper extremities, 1 (0.1%) had sustained injuries in the lower limb and chest and 1 (0.1%) had sustained thermal burns. These findings reflect that most of the cases had sustained injuries in the head and neck followed by polytrauma injuries including injuries in the lower limb and upper limb.

Furthermore, diagnosis of the patients revealed that the patients had suffered from dislocations and fractures being the most popular ones constituting 37% of the diagnoses including drug intoxication, drug overdose and epileptic attacks. In addition, unpacking the categories of injuries sustained according to body regions, the data analysis also revealed that the patients were also diagnosed of head injuries, internal bleeding, poisoning, shock, humerus fracture, lacerations and burns of different degrees especially second degree. Also, the patients were diagnosed of abdominal eviscerations, cerumol ingestion with vomiting, chest pains, headaches, dizziness, dog bites, drug ingestions, musculoskeletal injuries, pneumothorax, soft tissue injuries, tendon sprains, traumatic brain injuries, stab wounds, strangulation, polytrauma, paraffin ingestion and parasuicides. However, as in the pain records others had no complaints, no injuries, or no visible injuries. These diagnoses reveal that most of the patients were having painful situations which needed pain management to help them cope with their pain.

4.2.2.9 Treatments given to the patients at the point of admission

As the participants were being diagnosed, certain medications were prescribed to them which included one or combinations of two or three of different doses of the following:

Table 4.5 Treatments given to patients

Treatment	Frequency	Treatment	Frequency
IV NS 1000mls	131	Midazolam 10mg	2
Dressing	114	Lateral position	2
MRL 1000mls	110	Arrest bleeding	2
Diclofenac 75mg	39	Aspirin	2
Splint	38	Bilateral IV line and dressing	2
IV NACL 1000mls	29	Diazepam 10mg	2
O2	26	1/2 DD 200mls	1
Morphine 10mg	21	Bandaged	1
Paracetamol infusion	13	Bedoral 30mg	1
Immobilization	13	Benzyl Penicillin and Activate charcoal given at Clinic	1
Ketamine 100mg.	7	BVM	1
5% Dextrose 1000mls	5	Adrenaline 1ml	1
C - Collar	4	Cannulation failed	1
Comfortable position	4	FESO4	1
75mg Charcoal	3	Hyoscine 20mg IM	1
Sling	3	Metoclopramide 20mg	1
Panado	3	Ephedrine	1
Brufen	3	Prednisolone 10g @ Clinic	1
ETI	2	Voltaren massage	1

Table 4.3 shows that at the point of admission the patients were treated with several medications including Oxygen, Midazolam 10mg; Morphine 10mg, Ketamine 100mg; 1/2 Dextrose Darrows 200mls; 5% Dextrose 1000mls; Aspirin 300mg; Paracetamol infusion and Diclofenac 75mg. In addition, the patients were administered the following treatment: Arm-sling; Arresting of bleeding; Dressings, Cervical Collar, C-spine immobilization; Cardboard splint, and Comfortable positioning. The participants' records reveal that they were also treated

using Morphine 9mg, Ketamine 50mg, Midazolam 15mg infusion and Midazolam 6mg. Furthermore, others were treated using O2, Lateral positioning & IV fluid NACL, MRL 1000mls, Prednisolone 10g, Panado 5mls and Diclofenac 75mg. Also, Paracetamol 1000mg & IV Ringers 1000mls; Splinting, Ketamine 2ml; Voltaren massage; Wet sterile dressing; Wound cleansed and dressed.

However, only 256 of the patients had their treatments recorded and specified. The most popular treatments were IV NS 1000mls, dressing and MRL 1000mls, respectively. These findings reflect that the patients were in some form of pain though not severe as indicated by the individual doses administered at the point of collecting the patients and transporting them to the place of admission. For charts of the treatments according to MOI see appendix 1.

4.2.3 The variables associated with increased administration of analgesia

This section presents an analysis of the variables that were assessed to establish if they were associated with increased analgesia administration. In this regard, geographical location of the patients at the point of injury or collection by the personnel, time from call to the scene where the patient was taken from, Time from scene to hospital (minutes),

4.2.3.1 Geographical location of the patients at the point of injury or collection by the personnel

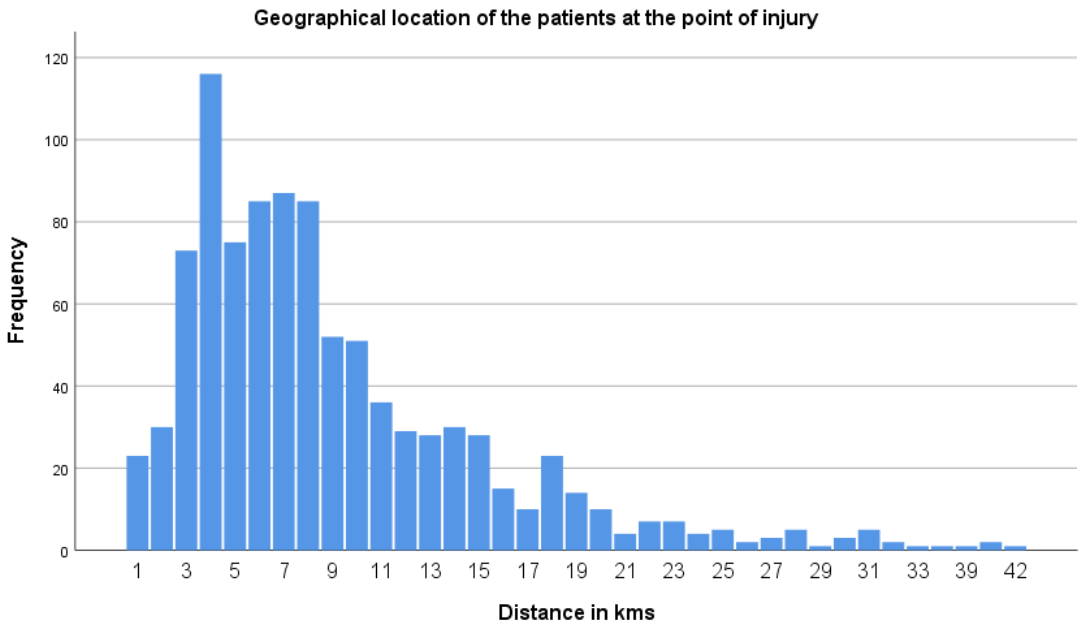

Figure 4.10 Geographical location of the patients at the point of injury or collection by the EMS personnel.

The bar chart shows that the cases that were handled by EMS personnel in Gaborone and its peripheries were within 1km to 42km radius. The patients' recorded information shows that the patients were taken from all over Gaborone and its peripheries. Of these geographical locations, Mogoditshane recorded the highest number of patients constituting 9% of the patients followed by Gabane with 5%, Block 8 with 5%, Mmopane with 3%, Old Naledi with 3%, Tlokweng with 3%, Tsolamosese with 3%, Metsimotlhabe with 3% and Maruapula with 3% and several other locations with 2% or less representations. This means that the patients were taken over very short distances and over some long distances within the boundaries of Gaborone and its peripheries.

Table 4.6 Location of the patients at the point of collection by the EMS personnel

Distance	Frequency	Percentage (%)
1 to 10	677	71
11 to 20	223	23.2
21 to 30	41	4.1
31 to 40	10	0.1
41+	3	1.6
	954	100

Table 4.4 shows that 677 (71%) cases were located within 1km to 10km, whilst 223 (23.2%) cases were located within 11km to 20km, 41 (4.1%) cases were located within 21km to 30km, 10 (0.1%) cases were located within 31km to 40km and 3 (1.6%) were located more than 40km away from the EMS personnel office. These findings reveal that the cases that were being attended by the EMS personnel may have needed analgesia as it took some time before the patients were surrendered for admission in clinics or hospitals. The distances had a mean distance of 9.04km, a median distance of 7km and a modal distance of 4km. These observations indicate that the cases were not very different from each other in terms of distance, and this was confirmed by a standard deviation of 6.4km. The maximum distance travelled by EMS to a case was 42km and the shortest distance was 1km giving a range of 41km. The range of 41km may imply that some of the patients were transported for longer distances which may be justified for need of analgesia.

4.2.3.2 Time from call to the scene where the patient was taken from

Table 4.7 Descriptive statistics for time from call to the scene where the patient was taken from

Mean	Median	Mode	Std. Deviation	Skewness	Kurtosis	Range	Minimum	Maximum
12.4	10	8	7.715	1.633	3.968	55	0	55

Table 4.5 shows that the time from call to the scene where the patient was taken from had a mean of 12.4 minutes, a median of 10 minutes and a mode of 8 minutes. The mean, mode and median are all different and the mean is greater than the median and the mode meaning that the data is positively skewed. This was confirmed by a skewness of one. 633.This means that there are more observations to the left of the mean than to the right. Positive skewness means that most of the time taken to go to the scene was less than the average time time taken to travel to the scene. This means that most of the journeys by EMS to the scene were less than 12.4 minutes. A kurtosis of 3.968 shows that the data follow a heavy tailed distribution meaning the data are not normally distributed. There are some extreme values which are bigger than most of the values. A range of 55 – 0 = 55 shows that the times taken to respond to a call by the EMS personnel are spread across a wide spectrum of zero minutes to an hour. This means that there are variations in the times which are confirmed by a standard deviation of 7.715. All these results support what is portrayed by the bar chart below in Figure 4.11.

Table 4.8

Correlations				
		Time from call to scene (minutes)	Time from scene to hospital (minutes)	Distance in kms
Time from call to scene (minutes)	Pearson Correlation	1	,331**	,329**
	Sig. (2-tailed)		<,001	<,001
	N	954	954	954
Time from scene to hospital (minutes)	Pearson Correlation	,331**	1	,992**
	Sig. (2-tailed)	<,001		<,001
	N	954	954	954
Distance in kms	Pearson Correlation	,329**	,992**	1
	Sig. (2-tailed)	<,001	<,001	
	N	954	954	954
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 4.8 shows that there is a correlation between distance travelled with the patients and the time taken by EMS to the scene and from the scene to the hospital. In brief, there are significant linear relationships between distance covered and time taken to cover the distance.

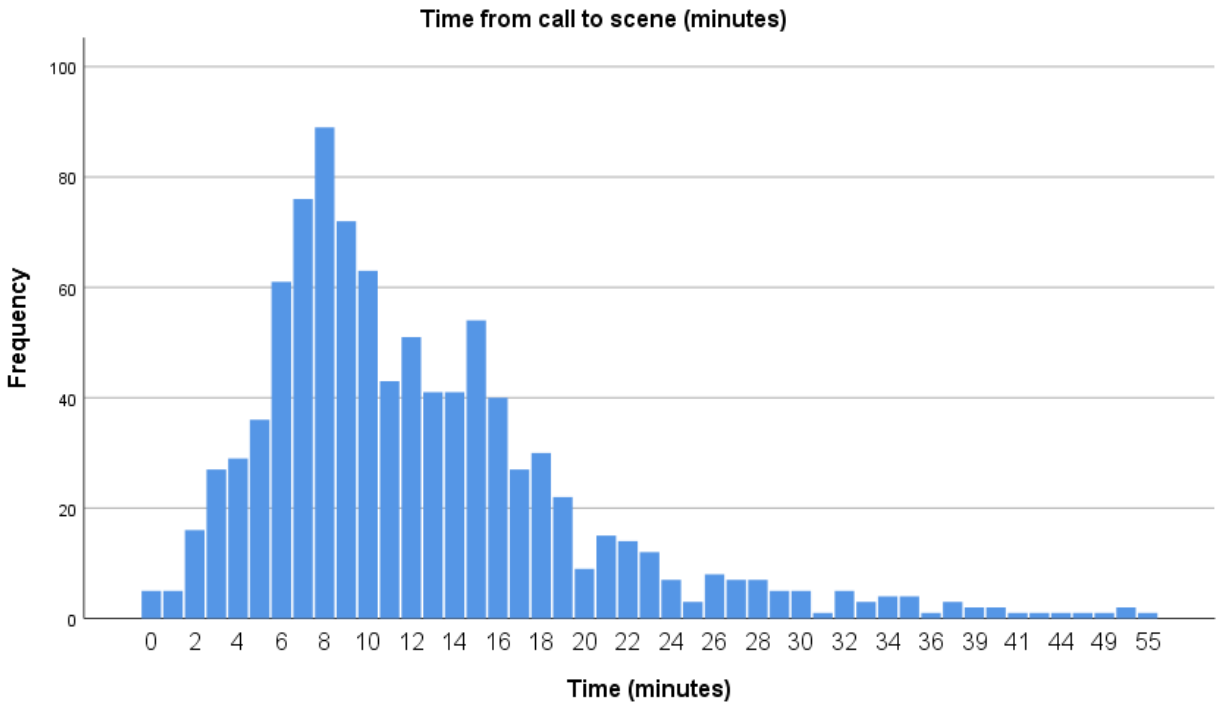

Figure 4.11 Time from call to the scene where the patient was taken from

The bar chart in Figure 4.11 shows that the data are positively skewed as shown by a long tail to the right. The bar chart reveals that for most areas within Gaborone, it took the EMS personnel 0 to 20 minutes to arrive at the scene where they were needed. However, in extreme cases the EMS personnel took almost an hour to respond to a call and be at the scene where the patient was.

4.2.3.3 Time from scene to hospital (minutes)

Table 4.6 Time from scene to hospital (minutes)

Mean	Median	Mode	Std. Deviation	Skewness	Kurtosis	Range	Minimum	Maximum
10.94	9	5	6.724	1.574	3.412	44	1	45

Table 4.6 shows that the time from scene to hospital where the patient was taken for admission had a mean of 10.94 minutes, a median of 9 minutes and a mode of 5 minutes. The mean, mode and median are all different and the mean is greater than the median and the mode meaning

that the data are positively skewed. This was confirmed by a skewness of one. 574.This means that there are more observations to the left of the mean than to the right. This means that most of the distances from scene to hospital were less than 10.94 minutes. A kurtosis greater than 3 confirms that there are some extreme values talking about larger times than usual taken from the scene. A range of 45 – 1 = 44 shows that the times taken to pick patients from their initial scene by the EMS personnel to the hospital are spread across a wide spectrum from 1 minute to 45 minutes. This means that there are variations in the times which are confirmed by a standard deviation of 6.724.

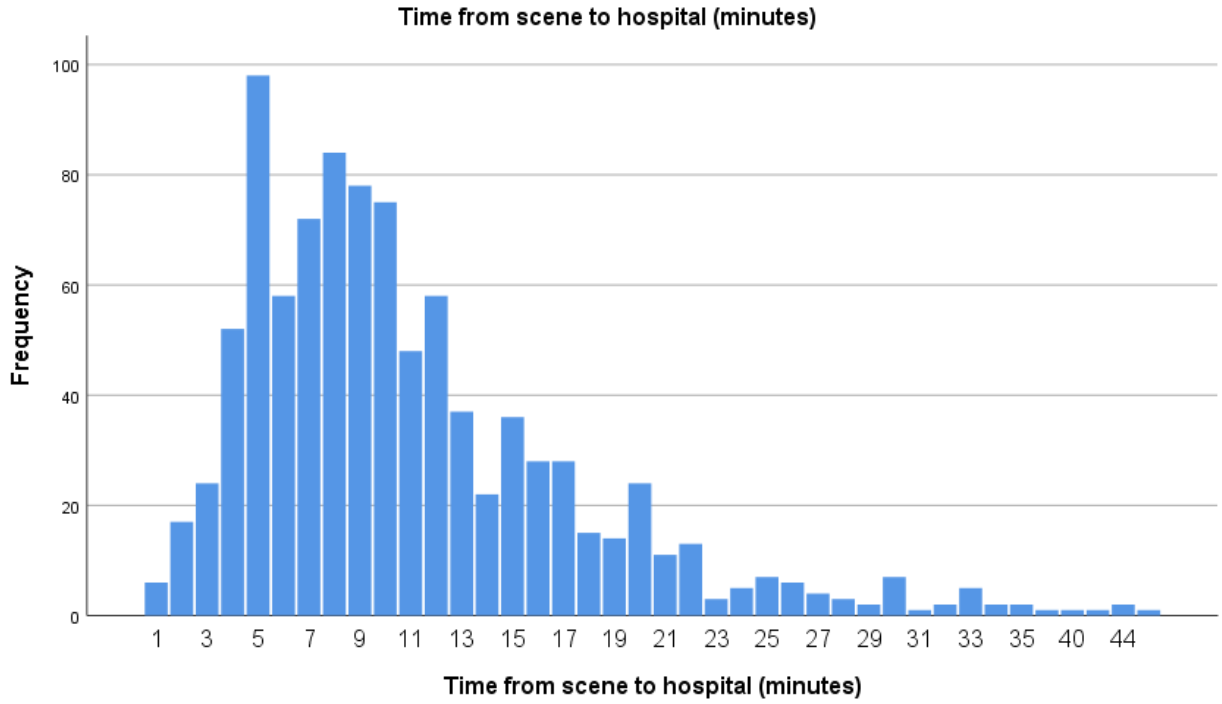

Figure 4.12 Times the patients were taken from the scene to the hospital for admission

The bar chart in Figure 4.12 shows that the data are positively skewed as shown by a long tail to the right. The bar chart reveals that for most areas within Gaborone, it took the EMS personnel 1 minute to less than 20 minutes to arrive at the hospital where the patients were being admitted. However, there were a few extreme cases where the journey was longer. It is important to note that the time taken to arrive at the scene by the EMS personnel was longer than the time that was taken to arrive at the hospital for the patient to be admitted.

4.2.3.4 Relationship between the geographical location of the patient and the hospital they were taken to

The relationship between the geographical location of the patient and transportation to hospital times was also analyzed. Patients were transported to the nearest medical facility for treatment.

The researcher also checked through the gathered records of the distance from the scene was related to the hospital the patient was taken to. The records revealed that the patients were transported to Princess Marina Hospital being the most popular and the biggest hospital in Gaborone where more than 50% of the patients were taken to followed by Extension 2 Clinic, Bokamoso private hospital, Gaborone private hospital, Nkoyaphiri Clinic, Block 9 clinic and several other clinics around Gaborone and its peripheries. The patient records reveal that all the hospitals and clinics in Gaborone and its peripheries were used as places to admit the trauma patients. From the records it was clear that the nearest possible hospital or clinic was targeted as the health facility to take the patient to.

In addition, a Chi-square test was conducted to confirm the relationship. The hypotheses that were tested were:

H_0: There is no significant relationship between the patient's geographical location and the hospital or clinic they were taken to.

H_1: There is a significant relationship between the patient's geographical location and the hospital or clinic they were taken to.

The test was conducted at 5% level and the H_0 was rejected when the p-value was less than 0.05.

Table 4.7 Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	31911.668[a]	25728	.000
Likelihood Ratio	2840.268	25728	1.000
N of Valid Cases	954		
a. 26164 cells (99.9%) have expected count less than 5. The minimum expected count is .00.			

Table 4.6 shows a Pearson Chi-Square value of 0.000 which is very small showing that there is significant evidence to reject the null hypothesis and conclude that there is a significant relationship between the patient's geographical location and the hospital or clinic they were taken.

4.2.3.5 Relationships between analgesia administration and distance to the health facility from the geographical location of the patient

However, Goddard et al. (2023) talked about the lack of correlation between response times and analgesia administration in the EMS due to several reasons including distance to the health facilities, this was of interest to the researcher to establish if the issue of distance travelled to the health facility from the scene was related to prehospital management of pain in trauma patients presenting to the EMS in Gaborone, Botswana. In this regard, Lourens, Hodkinson & Parker (2020) indicated that EMS practitioners in Western Cape South Africa were influenced to administer analgesia by their knowledge and attitudes regarding pain including the time they spent with the patient reflecting distance to the health facility. Thus, the relationships between increased analgesia administration and distance to the health facility from the geographical location of the patient were assessed by considering the following hypotheses:

H_0: There is no significant relationship between increased analgesia administration and distance to the health facility from the geographical location of the patient.

H_1: There is a significant relationship between increased analgesia administration and distance to the health facility from the geographical location of the patient.

The correlation and Chi-square tests were conducted at 5% level and the H_0 was rejected when the p-value was less than 0.05.

Table 4.8 Correlations

		Time from call to scene (minutes)	Time from scene to hospital (minutes)	Distance in kms
Time from call to scene (minutes)	Pearson Correlation	1	.331**	.329**
	Sig. (2-tailed)		<.001	<.001
	N	954	954	954
Time from scene to hospital (minutes)	Pearson Correlation	.331**	1	.992**
	Sig. (2-tailed)	<.001		.000
	N	954	954	954
Distance in kms	Pearson Correlation	.329**	.992**	1
	Sig. (2-tailed)	<.001	.000	
	N	954	954	954
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 4.8 shows that there are significant strong correlations between time from call to scene (minutes) and time from scene to hospital (minutes) as shown by a p-value < 0.001. A positive correlation r = 0.331 indicates that the longer it took to get to the patient's geographic location

from call was proportional to the time it took from the scene to the hospital. Similarly, there was a significant strong correlation ($p < 0.001$, $r = 0.329$) between time from call to scene (minutes) and distance in kms to the place of admission of the patient. Also, there was a significant strong correlation ($p < 0.000$, $r = 0.992$) between distance in kms to the place of admission and time from scene to hospital (minutes). In brief, the response times of the EMS were directly proportional to distance to the geographical location of patient and distance to the hospital or clinic the patient was admitted. However, this study established that analgesia administration had nothing to do with the response times or distances to the hospital or clinic of admission.

Table 4.9 Analgesia administered (mg) and Distance in kms to the place of admission

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	433.942[a]	468	0.869
Likelihood Ratio	222.503	468	1.000
N of Valid Cases	954		
a. 476 cells (91.9%) have expected count less than 5. The minimum expected count is .00.			

Table 4.9 shows that testing for a relationship between analgesia administration and the distance travelled to have the patient admitted were not significantly related given a Pearson Chi-Square p – value of 0.869 which is greater than 0.05. This finding indicates that analgesia administration by the EMS in Gaborone had nothing to do with the distance between the patient's geographical location and point of admission. This finding was also consistent with analgesia administration and the time from call to scene (minutes) with a p – value of 1.000 and analgesia administration and the time from scene to hospital (minutes) with a p – value of 0.948. However, there may have been several confounders here, but since the data were secondary, nothing much was done to solve the situation.

4.2.3.6 Relationships between traumatic injuries sustained and the pain management practices of EMS

Relationships between traumatic injuries sustained and the pain management practices of EMS were assessed by considering the following hypotheses:

H_0: There is no significant relationship between traumatic injuries sustained and the pain management practices of EMS.

H_1: There is a significant relationship between traumatic injuries sustained and the pain management practices of EMS.

The Chi-square tests were conducted at 5% level and the H_0 was rejected when the p-value was less than 0.05.

The relationship between traumatic injuries sustained and the pain management practices of EMS in Gaborone were tested by looking at the relationships of Injuries sustained, and Analgesia administered, injuries sustained and pain scores, injuries sustained and GCS records and injures sustained and times taken to and from the scene.

It is important to note that though a lot of information was missing, especially about analgesia administered and pain scores, the tests were conducted for the few recorded. Since this was a secondary study, the researcher used available information. Looking at the above stated subcomponent relationships the following results were obtained to prove the existing relationships.

1. Injuries sustained and initial pain scores

Table 4.11 Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14496.179[a]	14200	.040
Likelihood Ratio	2344.134	14200	1.000
N of Valid Cases	954		
a. 14921 cells (99.9%) have expected count less than 5. The minimum expected count is .00.			

Table 4.9 shows a p-value of 0.040 which is less than 0.05 showing that there is significant evidence to reject the null hypothesis and conclude that there is a significant relationship between injuries sustained and initial pain scores recorded. A p-value of 0.040 is supporting evidence at 5% level to reject the null hypothesis and conclude that there is a relationship between injuries sustained and initial pain scores. These findings confirm that there is a relationship between traumatic injuries sustained and the pain management practices of EMS. In addition, injuries sustained, and GCS records had a p-value of 0.000 and injures sustained, and times taken from the scene were significantly related with a p-value of 0.000. However,

injuries sustained, and second pain scores and injures sustained, and times taken to the scene were not related. This may be due to a lot of missing records. However, due to the significant relationships, it was concluded that there are significant relationships or associations between traumatic injuries sustained and the pain management practices of EMS practitioners in Gaborone.

2. Injuries sustained, and analgesia administered (mg)

Table 4.10 Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	169511.515[a]	166850	0.000
Likelihood Ratio	5626.692	166850	1.000
N of Valid Cases	954		
a. 167791 cells (100.0%) have expected count less than 5. The minimum expected count is .00.			

Table 4.8 shows a Pearson Chi-Square p-value of 0.000 which is less than 0.05 and very small showing that there is significant evidence to reject the null hypothesis and conclude that there is a significant relationship between injuries sustained and analgesia administered (mg). A p-value of 0.000 is very small supporting strong evidence to reject the null hypothesis and conclude that there is a strong relationship between traumatic injuries sustained and the pain management practices of EMS.

4.2.3.7 Qualifications of the senior staff members

The senior staff personnel working in the Botswana EMS had the following qualifications which included the Emergency Medical Technician - Basic (Certificate Qualified) (1st Level of Training), Emergency Medical Technician - Advanced (Diploma Qualified) (2nd Level of Training), Emergency Care Practitioner - Highest level of training for Paramedics (Degree qualified) (3rd Level of Training) and the Advanced Nurse who is the Professional Nurse (Another group working on the ambulances besides a Paramedic with the Provincial Service).

Table 4.12 Qualifications of the EMS personnel

Senior Staff member Qualification			
		Frequency	Percent
Valid	EMT - B	591	62

	EMT – A	210	22
	ECP	35	4
	Advanced Nurse	118	12
	Total	954	100

Table 4.10 shows that most of the EMS personnel (62%) have an EMT-B qualification followed by 22% with an EMT-A qualification, 12% with an advanced nursing qualification and very few (4%) have an ECP qualification.

4.2.3.8 Relationship between the qualifications of the senior staff members and analgesia administration

The relationship between the qualifications of the senior staff members and analgesia administration were assessed by considering the following hypotheses:

H_0: There is no significant relationship between the qualifications of the senior staff members and analgesia administration.

H_1: There is a significant relationship between the qualifications of the senior staff members and analgesia administration.

The Chi-square tests were conducted at 5% level and the H_0 was rejected when the p-value was less than 0.05. The following results were obtained:

Table 4.13 Qualifications of the senior staff members and analgesia administration Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	828.143[a]	364	.000
Likelihood Ratio	323.134	364	.939
N of Valid Cases	954		
a. 389 cells (95.8%) have expected count less than 5. The minimum expected count is .00.			

Table 4.11 shows a Pearson Chi-Square p-value of 0.000 which is less than 0.05 showing that there is significant evidence to reject the null hypothesis and conclude that there is a significant relationship between the qualifications of the senior staff members and analgesia administration. A p-value of 0.000 is supporting evidence at 5% level to reject the null

hypothesis and conclude that there is a relationship between the qualifications of the senior staff members and analgesia administration. These findings reflect the qualification of the EMS personnel influences the type of analgesia they administer to their trauma patients. In fact, the Chi-Square test shows that most of the basic EMT qualified personnel did not administer anything at all or they did not document what they gave to the patients whilst some efforts were noted on the advanced EMT and advanced ECP. However, it is important to note that in the few cases where analgesia was administered, it was at the point of admission at the health facility.

4.2.3.9 Relationship between analgesia administration and the personal characteristics of the patients

To establish the variables that led to increased administration of analgesia, the relationships between analgesia administration and the personal characteristics of the patients were assessed.

Table 4.14 Analgesia administered (mg) and Age (Years) Crosstabulation

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1402.871[a]	1078	<.001
Likelihood Ratio	334.380	1078	1.000
N of Valid Cases	931		
a. 1115 cells (95.3%) have expected count less than 5. The minimum expected count is .00.			

Table 4.14 shows that there was increased analgesia administration based on age as confirmed by a p - value of < 0.001. The crosstabulation showed that there was increased analgesia administration with increase in the age of the patients. In other words, the mature and older patients received analgesia more than the babies, children and the young. Also, this study established that there was a relationship between analgesia administration and the weight of the patients.

Table 4.15 Analgesia administered (mg) and Weight (kg) Crosstabulation

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1056.963[a]	266	<.001
Likelihood Ratio	86.447	266	1.000
N of Valid Cases	954		
a. 294 cells (98.0%) have expected count less than 5. The minimum expected count is .00.			

Table 4.15 shows that there was increased analgesia administration based on the weight of the patients as confirmed by a p - value of < 0.001. The crosstabulation showed that there was increased analgesia administration with increase in the weight of the patients. This confirmed the earlier findings of increased analgesia administration with the increase in ages of the patients.

4.4 Chapter summary

This chapter presented a consolidated analysis and interpretation of the research findings. The chapter looked at personal information of the participants and how pain management was handled by the Botswana EMS personnel. It is important to note that very little or nothing at all is being done to trauma patients from the injury scene to the medical facility. All the patients under study were treated for pain at the point of admission at a medical facility, suggesting pain management was indicated. Some of the important information needed to effectively assess and manage pain has not been recorded.

Chapter 5: Discussion, Conclusions and Recommendations

5.1 Introduction

This chapter presents a detailed discussion of the research findings in relation to the available literature. The discussion was guided by the research objectives and the research questions. Research conclusions are presented based on how the research objectives and the research questions have been addressed by the primary research. In addition, the research contribution, implications, and limitations of the study are also presented in this chapter. Finally, the recommendations are made based on the research findings and the chapter is concluded.

5.2 Research Objectives

As outlined in chapter 1, the research was guided by the following objectives:

- To determine the different types of traumatic conditions presented to the Emergency Medical Services in Gaborone, Botswana.
- To establish how pain in trauma patients presenting to the Emergency Medical Services in Gaborone, Botswana is managed.
- To analyse the factors that influence how pain is managed in traumatic patients presenting to the EMS in Gaborone, Botswana.

5.3 Discussion

The discussion presents a critical analysis of the research findings with respect to available literature and previous studies in the EMS field. In this section, the research findings are discussed based on the objectives of the research and how these findings fit in the available literature.

5.3.1 Common problems of prehospital pain management presented to the EMS practitioners

Table 4.1 shows that the number of trauma patients were spread over a range of 45 to 135. This is a wide range. Also, a standard deviation was found to be 29.3 confirming the wide spread of the trauma cases. In addition, an average of 86.7 cases was also calculated meaning that there were more months when the cases were below average as compared to those which were above average. This means that the data is negatively skewed. The differences in months can have several explanations including the challenge of unreliable documentation as testified to

throughout this report. In addition, several authors including Mphela (2020) alluded to the point of view that most of the injuries suffered by the patients occurred in the roads and in bars/nightclubs during the night especially during weekends and summer evenings and introduces seasonality. The authors indicated that there are more accidents, especially from August going to the end of the year as many people tend to visit the bars more frequently in this season and drive at night whilst they are drunk.

This research established that there were several different causes of the injuries that were suffered by the trauma patients. The mechanisms of injuries that were presented to the EMS practitioners in Botswana included different kinds of assaults, bites (e.g., dog and snake), burns (e.g., from boiling water, cooking, etc.), accidents (e.g., with cars, in the industry, in homes, gas cylinder explosions, etc.) In addition, drugs overdose, falling objects on patients like gates and goalpost, gunshot, electrocution, ingestion of tablets and other types of harmful or dangerous substances, stabbing and various MVC cases involving the drivers, passengers, pedestrians and cyclists were some of the mechanisms of injury recorded. These findings support what Lourens, Parker & Hodkinson (2020) established about trauma patients due to assault, transport-related incidents and accidental injuries being the three most common types though different populations have been analyzed. In addition, the authors revealed that though the injuries were painful no pain record was made.

Similarly, as much as the mechanisms of injury were recorded in this research, it was established that the EMS personnel failed to record any form of pain assessment for the patients. This was because for most of the cases no pain scores were recorded at the scene or after being picked to be transported to the nearest health facility. These findings were consistent with several previous studies including Zimmerman et al., (2023) Thai & Huh (2022) who supported the notion that most EMS personnel do not take or record pain scores because they transfer patients to nearest health facilities. In this regard, the Botswana EMS may be justified for not recording pain scores for the patients they attended to. Most of the cases (71%) had no records for initial pain scores and 98.9% had no record at all about their second pain assessment after being handled by the EMS personnel.

These findings were consistent with Abdolrazaghnejad et al. (2018); Lenssen et al. (2017) and Matthews (2017) who also established that failure to document pain in patients is one of the

major problems of pain management in emergency care. Pain acknowledgement is only possible when a proper assessment of pain is done which include the use of appropriate tools to measure pain, documentation of the patients' pain and implementation of pain management guidelines and protocols to meet the patient's expectations or needs (Simon, 2012). In this regard, Germossa, Hellesø & Sjetne (2019) concurred with Simon (2012) that pain needs to be appropriately acknowledged using correct tools and well trained or knowledgeable medical practitioners. This implies that pain management is not just a casual practice but needs to be properly done for successful management of the patient's condition (Kizza et al. (2016). Thus, Lourens, Parker & Hodkinson (2020) advocated for EMS to operate following straight forward guidelines to enable necessary handling of pain for all pain levels. These findings confirm poor documentation; however, the lack of pain assessment can only be inferred. Assessments may have been completed by the paramedics, but not documented.

In the same argument, Mura et al. (2017) and Wilson & Pendleton (1989) concurred that there is a problem of oligoanalgesia in the EMS department. This can be ascribed to poor pain assessment or failure to implement pain management guidelines and protocols. Lack of pain documentation is a big challenge as the receiving health facility cannot make a follow up on the progression of the patient from the time, they received therapy from the EMS if any therapy is given. In fact, the authors revealed that the patient's pain should be assessed or evaluated as soon as the EMS personnel arrive at the scene of incident, and it should be reevaluated after some therapy has been given. This is important as Mura et al. (2017) indicated that pain assessment is used as a quality measure. This means that this research confirms what Lourens, Parker & Hodkinson (2020) aired, that there is poor quality of assessment and management of pain in the EMS environment worldwide and it is an issue of concern. Poor pain evaluation may result in the deterioration of the patient's condition resulting in a chronic condition or death. This means that the Botswana EMS is faced with critical problems of failure to document pain in trauma patients as they are failing to record initial pain and pain scores at the time of admission. They are failing to document the pain of the patients, meaning they cannot meet the patient's expectations as they oversee the patients before handing them over to health facilities. These findings reflect that there is a clinical quality issue due to poor documentation. Though there is a field on the Botswana PRF that requires pain assessment the EMS practitioners are not responding to that whilst handling trauma patients.

Furthermore, Schwerin & Mohney (2021) argued that failure to conduct pain assessment limits the options for treating the pain the patients will be suffering from. In addition, the authors proposed that:

"every EMS protocol should have the following components: mandatory assessment of both the presence and severity of pain, use of reliable tools for the assessment of pain, indications and contraindications for prehospital pain management, non-pharmacologic interventions for pain management, pharmacologic interventions for pain management, mandatory patient monitoring and documentation before and after analgesic administration, transferal of relevant patient care information to receiving medical personnel and quality improvement and close medical oversight to ensure the appropriate use of prehospital pain management".

Pain assessment including measuring and recording pain at the scene is a basic process towards maximizing prehospital handling of pain to allow for easy movement of the patient from scene to a health facility (Friesgaard et al., 2018). However, Amjad et al. (2022) and Manfredini (2022) indicated that failure to measure and record pain can have negative consequences including worsening the situation resulting in further health complications to the patients. The authors elaborated that failure to measure and document pain may hinder further management of a patient's healing process.

5.3.2 The use of analgesic agents by Botswanan EMS

This research established that 62% of the EMS personnel have a basic EMT qualification followed by 22% with an EMT-A qualification, 12% with an advanced nursing qualification and 4% have an ECP qualification. This shows that most of the EMS personnel in Botswana have the basic qualifications for EMS. In other words, most of the EMS practitioners have basic qualifications being the lowest in the hierarchy. Van Woerden et al. (2016) indicated that in an emergency department there are patients whose pain is not measured as they are taken to be not serious. However, the authors indicated that implementation of guidelines in EMS improves analgesia administration. Agreeing with this, Scarborough & Smith (2018) concurred with Motov & Khan (2008) that insufficient knowledge and formal training in acute pain management are some of the reasons why EMS personnel fail to offer appropriate pain management to their patients.

This research further confirmed the types of analgesia that were administered to patients as they are taken by the emergency medical services in Botswana. In this regard, 0.1% of the cases

were given Diazepam 5mg at the point of admission in a health facility, 0.1% were given Midazalom (these are not even analgesic) and only 0.1% were given Paracetamol. Also, 9.4% were given some analgesia which was not specified, whilst 32.5% had no records made and 57.8% had no analgesia administered at all. These findings reflect that the trauma patients handled by the EMS in Gaborone are rarely given analgesia. In most of the cases no pain relief is given to help the trauma patients being handled by the EMS in Gaborone. These findings support what was established by Brunson et al. (2023). However, the authors further revealed that Opioid or Ketamine were given to a certain ethic group whilst patients from minoritized racial and ethnic groups were less likely to have a pain score recorded. Among patients with a high pain score, Black patients were significantly less likely to receive analgesia when compared with White patients. In the case of the Botswana EMS, does not show evidence of discrimination based on ethnicity or race was recorded. However, in the Botswana EMS, those who were given something they were getting Diazepam 5mg, Midazalom and Panado stat which was for a child who was transported from a clinic to hospital. However, this study confirmed Vallogini et al. 2022) who indicated that Diazepam and Midazalom are sedatives. It was also established during data gathering that all the patients whose information included analgesia were taken from clinics or hospitals not from home or the scene of injury. This can be explained by the fact that patients transferred from clinics or inter-hospital transfers were stable and there was no need for any further medications. Patients picked up from a scene were supposed to receive pain management.

These findings are in line with previous literature as Glomb et al. (2018) posed doubts on the capacities and qualifications of the EMS personnel in Botswana. The authors reported that since the conception of EMS in Botswana in 2012, most of the practitioners were informally trained or others were not trained at all to efficiently work as EMS service providers. In a way, this means that most of the EMS personnel were not trained or were not qualified, hence offering suboptimal assistance to their customers. To help the situation, authors indicated that the government of Botswana embarked on simulation trainings through partnerships with qualified EMS specialists from other countries to help the situation in the EMS. Hence, most of the EMS personnel acquired basic life support or basic international trauma life support qualifications through the collaborations.

Furthermore, Kosoko et al. (2019) alluded that the EMS systems in Botswana suffers from a lack of resources for the practitioners to use, inadequate training, and other system shortcomings. Bearing this in mind, it can be assumed that the use of analgesia by the EMS

personnel in Botswana may be so limited due to lack or shortages of analgesia in the ambulances or insufficient knowledge on the part of the practitioners. This can be handled by offering more on-the-job training and provision of the required analgesia to the ambulances by the Ministry of health working in partnership with the government and the EMS providers.

More so, Cox, Masunge, & Geduld (2020) revealed that the first EMS specialists in Botswana graduated in 2018 supporting the shortage of qualified and experienced EMS personnel and a need for intensive and extensive training of the EMS providers in the nation. All this evidence points at the explanation of lack of skills and limitations of the EMS personnel in Botswana including their lack of appropriate and sufficient analgesia to administer to their clients. These findings reflect that the EMS providers in Botswana use analgesia to a very limited extent. In other words, most patients attended to by the EMS personnel do not get analgesia at all. To a greater extent the findings in this research about analgesia use confirm to a greater extent what Glomb et al. (2018) indicated that most of the Botswana MOHW EMS staff have limited to no formal training in prehospital care. They are trained more as first responders offering first aid and basic lifesaving skills.

This available information can be taken to provide the major reason why to a less extent analgesia is used for trauma patients in the hands of the EMS personnel and why in most cases no analgesia is used. This was explained by the finding that there was a strong relationship between qualifications of the senior staff members and the analgesia that was administered, or no analgesia given at all. This may be because they lack knowledge in prehospital care. Thus, simulation-based training was taken as an option to equip the EMS providers with clinical knowledge, procedural skills, and communication skills according to Kosoko et al. (2019). This should continue as a support base and the initial training needed for EMS personnel who can then advance in tertiary institutions accredited by the Botswana Qualifications Authority and recognised internationally.

Furthermore, these findings may be pointing at barriers that prevent EMS practitioners to administer analgesia to trauma patients as this research established that inadequate knowledge and limited formal training of ED practitioners in acute pain management are the major barriers to administer analgesia to trauma patients. This was because most of the EMS personnel have a basic EMT qualification and they lack ongoing training on the job. This may imply that lack of skills in emergency services may result in poor use of available analgesia in the emergency department as the practitioners are limited in their knowledge and understanding of the

different analgesia and how they work. These findings agreed with several previous studies like Bertrand et al. (2021), Friesgaard et al. (2018) and Hennes, Kim & Pirrallo (2005). These authors revealed that basic qualifications in EMS limit the practices of the practitioners as they lack critical knowledge and skills needed to help patients in acute pain.

In this regard, Bertrand et al. (2021) elaborated that less experienced or less knowledgeable EMS practitioners tend to be afraid of the side effects and introducing drug addiction to the patients resulting in oligoanalgesia. Unfortunately, the findings of this study do not tell us anything about the EMS being afraid of side effects besides the issue of insufficient resources. However, oligoanalgesia is not good for the patients as they end up leaving the EMS without being helped adequately or may even deteriorate due to excessive pain which is not properly managed. In addition, Dahllöf & Lichterman (2022) and Hennes, Kim & Pirrallo (2005) revealed that different levels of education of EMS practitioners cause significant variations to exist between different levels as practitioners differ in perceptions and practices towards pain management, frequency of giving analgesia and the general ways of doing things. In this case, failure to evaluate pain can be a hindrance to analgesia provision.

In addition, Friesgaard et al. (2018) further explained that EMS practitioners can be classified into EMTs who are more of ground transporters and physicians (or anesthesiologists) who can be available in life threatening situations. As such, this implies that in the Botswana set up, since more than 60% are basic EMTs, they may be having just basic knowledge to handle the cases that are presented to them. This may be taken to imply that there is a shortage of highly experienced and qualified EMS practitioners resulting in the prevention of EMS practitioners to administer analgesia to trauma patients. This means that most ambulances do not carry any analgesics, or these findings may be taken to reflect that the EMS practitioners are acting according to their capabilities. This study reflected that the trauma patients being handled by the EMS in Gaborone are rarely given analgesia which can be explained by the qualification levels of the EMS personnel and available resources for them. However, it is important to note that this research did not collect specific information to indicate whether the EMS personnel hold qualifications that prevent them from using certain medications or cannot give medications.

5.3.3 Pain management practices of EMS practitioners during the management of trauma patients

This research established that the EMS practitioners use the Glasgow coma scale to assess and calculate a patients' level of consciousness and most of the patients observed in this study had mild GCS score or they were fully awake. However, there was poor pain assessment due to poor measurement or lack of pain records at the time of meeting the patient when the EMS practitioners appeared on the scene and after analgesia administration.

In addition, this research established that the EMS practitioners rarely if ever administer analgesia to trauma patients. As highlighted earlier this may be due to lack of resources or lack of knowledge on the part of the practitioners. Only Diazepam 5mg, Midazalom and Panado stat were clearly stated as administered to very few patients (0.3%) with a few others (9.7%) being said to have been given unspecified analgesia including different concentrations of Morphine. However, about 859 (90%) had no record made or no analgesia was administered at all. This means that the EMS in Botswana were using sedatives more but to a very less extent and to a very less extent analgesia as the majority of the patients were given nothing as shown by absence of record or no analgesia given record. This can be attributed to the limited capacity of the practitioners and availability of resources as indicated in chapter 1, Section 1.1. These findings were consistent with previous literature including Marinangeli et al. (2009) who alluded that it is common practice that patients handled by non-physician emergency staff are at a risk of insufficient pain treatment. In this regard, Hemmila et al. (2018) explained that EMS practitioners should have access and be able to use both pharmacologic and non-pharmacologic analgesia. Hence, either way they should be able to administer analgesia to the trauma patients in their care at any given moment.

In addition, Friesgaard et al. (2018) elaborated that despite non-pharmacological interventions, such as splinting fractures, prehospital patients with painful conditions can be treated with intravenous fentanyl by EMTs, who are also certified to administer nitroglycerine and acetylsalicylic acid to patients with cardiac chest pain. Prehospital emergency personnel have a wider range of analgesic options including alfentanil and ketamine, but these are primarily used for intubation or in cases of hemodynamically instable patients, who only account for a fraction of the total prehospital population. Repeated assessment of pain intensity on the NRS scale is only required with patients treated with intravenous fentanyl by EMTs.

More so, the patients suffered from various injuries including bruises, burns, deep lacerations, fractures and several other painful injuries. Also, some of the patients had no visible injuries, others had no injuries at all, and some had no complaints. These findings were consistent with Gries et al. (2022) who indicated that some patients in EMS suffer pain from visible injuries or conditions whilst it is difficult to ascertain the position of some of the patients due to unseen conditions. Though there were patients who were not in pain, the number of those in pain was more significant such that the records were still found lacking full information as shown by the analgesia administered at the point of admission. In addition, those who suffered injuries were treated upon admission using oxygen, dressing, IV MRL 1000mls, ETI & Midazolam 10mg, 5mg, 10mg & 5mg and Morphine 2.5mg, 3mg, 4.5mg, 5mg, 6mg, 7.5mg, and 10mg which is analgesic (Fenikowski & Tomaszek, 2022). However, this study concurred with Marchesi (2022) that different concentrations of Morphine are used together with other pain-relieving drugs or pain management mechanisms. These included IV MRL 1000mls, Ketamine 80mg, splints, 02, and NS 1000mls among other things. However, it is important to note that very few, less than 10% of the advanced nurses recorded the administration of any other analgesia. These medications clearly show that the patients were in pain and really needed pain management.

Also, the EMS practitioners travelled very short distances and long distances within the boundaries of Gaborone and its peripheries. However, due to preparation, the time taken to arrive at the scene by the EMS personnel was longer than the time that was taken to arrive at the hospital for the patient to be admitted. Oyataniet al. (2023) argued that the EMS personnel always look for the nearest available ambulance and nearest hospital. It is possible that the EMS practitioners in Botswana targeted the nearest possible hospital or clinic for the patients' admission though in some cases the patient would suggest where they wanted to go. Some of the distances were very short and maybe the EMS practitioners saw no need to administer analgesia as they were close to the qualified physicians to diagnose and administer the needed medications. Even though, Hemmila et al. (2018) argued that analgesia is always required even for the shortest distances to be travelled meaning the EMS practitioners had no excuse for not administering analgesia to their patients. Unfortunately, in this study, there was no proper documentation to explain the pain the patients were going through. More so, for the long distances, it was even more necessary for the EMS personnel to administer analgesia for pain relief and stabilizing the patients.

This research established that the EMS personnel were poor at recording and monitoring pain but they were able to record GCS, injuries sustained, geographical location of patient at the

time of injury or scene incident, health facilities they took the patients to, times from call to scene and scene to hospital and they were able to make reasonable decisions as to where to take the patients for admission.

The findings of this research are consistent with other previous studies as indicated earlier in section 5.3.2. As Schwerin & Mohney (2021) put it across, EMS practitioners should be able to assess patients for pain with correct validated equipment for them to perform as expected. In this research, it was not clear whether the Gaborone EMS practitioners have appropriate equipment like the numerical rating scales (NRS), verbal rating scales (VRS), visual analog scales (VAS), and the faces pain scale-revised (FPS-R) to conduct an effective pain assessment and this may need to be checked in future studies. This may imply that their failure to record pain at different stages may be due to lack of skills including lack of understanding of the PRF document since it has a field which requires pain score. Otherwise, according to Erbay (2016), it is unethical for the prehospital providers to fail to offer the needed and compassionate care necessary for pain relief to trauma patients they attend to.

The findings of this research were also consistent with Lourens, Parker & Hodkinson (2020) who conducted a study on "prehospital acute traumatic pain assessment and management practices amongst emergency care providers in the Western Cape Province, South Africa." The authors established that trauma pain analysis and supervision practices in the EMS in the Western Cape Province were not adequately established. The authors cited that the emergency education, EMS culture in the sector, availability of analgesic resources needed further research, and this presented a situation similar to the Gaborone EMS.

For best characteristics of pain management practices of EMS practitioners during the management of trauma patients, Schwerin & Mohney (2021) proposed that it will be good to have teams which are composed of different "professionals including EMS practitioners, physicians, pharmacists, and nurses", who can work together for effective pain assessment and management in the EMS setting. Best characteristics of pain management practices of EMS practitioners during the management of trauma patients may prevent a lot of things which may progress negatively including reducing length of stay of trauma patients in hospitals (Friesgaard et al., 2018). Similarly, Ahmadi et al. (2016) highlighted that the major goal of handling pain in trauma patients is "reducing the mortality, morbidity, shortening hospital stay, contributing to early mobilization, and reducing hospital cost, and enhance patient's satisfaction and quality of life". Thus, further research may need to assess if the EMS personnel

in Gaborone understand their mandate and see why they demonstrate such practices which compromise the patients' life or future.

5.3.4 The variables associated with increased administration of analgesia

This research established that there are significant relationships or associations between traumatic injuries sustained and the pain management practices of EMS practitioners in Gaborone. These relationships were confirmed by the following sub relationships which included a significant relationship between injuries sustained and analgesia administered, injuries sustained and GCS records and injures sustained and times taken from the scene to the hospital of admission. These relationships were also confirmed physically from the records as the administered medications were based on the pain the patient was experiencing, the seriousness of the injuries was confirmed by the GCS records and time taken from the scene of incidence to the health facility proved to be much shorter as compared to the initial times going to the scene. However, it is very important that very few patients were administered with analgesia. These findings supported Blondell, Azadfard & Wisniewski (2013) who established that pain management practices by EMS personnel needs a proper assessment of the traumatic injuries sustained as the pain can be categorized and analgesia need to be administered according to quantities that relieve the patients according to the severity of their pain.

The findings of this research also concurred with Landman et al (2013) who revealed that the EMS practitioners work together with medical facilities, and they tend to provide timely care like in this research where the EMS were seen to take much shorter times from scene to hospital. In addition, Schwerin & Mohney (2021) revealed that best practices by EMS personnel help them to conduct a proper assessment of the patient's pain and to administer appropriate pharmacological or non-pharmacological interventions to correctly address the traumatic injuries sustained by the patients. This means that poor pain assessment and management practices may fail to benefit the patient resulting in adverse effects from the sustained injuries. Ahmadi et al. (2016) highlighted that giving of sufficient analgesia is a critical aspect of trauma handling that will need sufficient analysis of "pharmacologic pain management; establishment of sufficient analgesic to relieve moderate to severe pain; cognizance of serious adverse effects of pain medications and weighing that against their benefits, and regularly reassessing the patients and reevaluating their pain management regimen." This means that there is a strong relationship between traumatic injuries sustained and the pain management practices of EMS. In other words, good practices relieve the patients

of pain, and poor practices may result in partial success or poor handling of sustained injuries resulting in further pain or complications.

Thus, these findings agreed with Marinangeli et al. (2009) who alluded that it is common practice that patients handled by non-physician emergency personnel suffer from insufficient pain treatment. In addition, the findings of this research were consistent with Lourens, Parker & Hodkinson (2020) who established that patients whose pain scores were recorded were more likely to get analgesia administered to them. Thus, in this case, seeing that pain scores were not recorded for most of the patients, analgesia was also not administered for most of the patients. In addition, this study established that analgesia administration had nothing to do with the response times or distances to the hospital or clinic of admission. Thus, most of the patients attended to by the Botswana EMS personnel did not receive analgesia despite of the distance traveled to the hospital of admission. However, Hemmila et al. (2018) argued that analgesia is always required even for the shortest distances travelled. This means that failure to administer analgesia may impact negatively on the patients' ongoing pain or condition. At the same time, Friesgaard et al. (2018) alluded that the initial stage in optimizing EMS pain management is to have basic knowledge of acute pain. This was supported by The American Society of Anesthesiologists (ASA) Administrative Council (2020) who indicated that efficient handling of pain by EMS personnel depend on the level of expertise and scope of practice of the EMS people. In addition, the council revealed that the EMS practitioners are guided by protocols which are recognized by the state's EMS regulations. This means that the pain management practices towards sustained traumatic injuries must meet the expected standards and be supported by the competence of the personnel.

Furthermore, this study established that analgesia administration was to some extent closely related to the age or weight of the patients. Of the few that received analgesia, they were mostly adults or mature who had more weight. The young ones or children with less weight were the least to receive analgesia. In this regard, the findings of this study contradicted the findings of Lourens, Parker & Hodkinson (2020) who established that there was no relationship between the administration of analgesia and the age of the patients. This can be due to differences in settings as Lourens, Parker & Hodkinson (2020)'s study was done in Western Cape province in South Africa. In fact, the findings of this study reflected that analgesia administration increased with increase in age of the patients. It is important to note that the Ministry of Health in Botswana through the BHPC has developed set standards to be followed as pain management

protocol by the Gaborone EMS personnel. The Ministry of Health (2013) presented guidelines and standards by EMS in Botswana. These standards include the protocols that must be observed by both private and government EMS practitioners and institutions. The BHPC has included in their scope of practice the use of Entonox, Morphine Sulphate (Opioid Analgesic) for the purposes of providing pain relief to patients that require it. (HPCSA, 2018). In addition, the EMS practitioners should assess and document all their practices including assessing and measuring pain, recording the analgesia administered, recording pain evaluation or assessment after administration of analgesia, and several other information that helps the health workers in hospitals and clinics to assist the patients. The BHPC pain management protocol talks about complete compliance where the EMS personnel observes all the major practice standards and partial compliance where the practitioners miss or fail to observe some of the compliance standards and guidelines.

Thus, in this research, the Gaborone EMS seems to be failing in some of the major practices like identifying and recording pain and analgesia administered. This means that the EMS personnel are partially compliant, and their compliance is of low levels as they are lacking on some of the major aspects of pain assessment and management. These findings are consistent with a number of previous studies including Bertrand et al. (2021), Lourens, Parker & Hodkinson (2020) and several others who revealed that documentation and pain assessment are some of the barriers to effective pain assessment and management in EMS departments in different countries and the world at large. However, poor compliance was attributed to lack of experience, knowledge, and research as most of the EMS practitioners are under qualified or have low level emergency practice qualifications (Lourens, Parker & Hodkinson, 2020). In addition, Erbay (2016) and Blondell, Azadfard & Wisniewski (2013) concurred that the EMS sector is being haunted by poor compliance due to various reasons including differing perspectives of the practitioners in the same teams, unavailability of the required or necessary analgesia, lack of on-the-job training or personal advancement of the practitioners and failure to observe and implement set standards. The authors recommended that EMS practitioners need to have the protocols imprinted or pasted in their work environment so that they are reminded, or they observe and do the needful.

5.6 Contribution of the study

Drawing on the findings of prehospital management of pain in trauma patients presented to the Emergency Medical Services in Gaborone, Botswana, this research contributes to the EMS discourse in Botswana. This research is one of the few studies that focused on the recording

and assessment of pain (and pain management) practices of the EMS practitioners as they manage pain in trauma patients presented to them. This research will be of paramount importance to the Ministry of Health, the EMS in Botswana and other health bodies in the nation. New information about the actual practices of the EMS practitioners and their levels of compliance to set guidelines and standards have been discussed to a great extent and the loopholes in the practices have been documented. It is important for the government and the health facilities to understand how the EMS are operating and introduce necessary interventions to help the situation. The findings of this research are also important as they are adding new knowledge to the body of knowledge of EMS and the health sector at large.

5.7 Implications of the study

The research findings have implications for clinical practice, policy, theory and research. Pain among trauma patients is inadequately assessed and managed. Pain management training, clinical guidelines and further research may be needed.

For policy development, the government of Botswana, the EMS personnel and the Ministry of Health may need to come together and establish working policies that promote effective EMS pain management provision. This is important for EMS to fully comply and deliver the best for the benefit of the public. The government through its arms of human resource development like the Human Resource Development Council (HRDC) and Botswana Qualifications Authority (BQA), the medical private sector and the tertiary institutions may need to form a coalition and establish working policies, measures, and processes to promote compliance, progression of practitioners and best practices in the EMS field. The findings of this research imply that the EMS personnel need to be empowered for effective provision of prehospital emergency services.

In addition, for theory and research, the findings of this research may imply that there is limited information and theory development in terms of research that is being done as there is limited information available about the EMS practitioners and their practices in Gaborone and the nation at large. There is a need to conduct more research and to develop more theory about the compliance and practices of EMS personnel in Gaborone, Botswana.

Furthermore, future research needs to be conducted involving the EMS personnel, the health facilities, and the patients. It will be important to understand the situation from different stakeholder perspectives to have a bigger picture of the situation.

5.8 Limitations of the Study

This study had several limitations with the major one being a lot of missing information which may have compromised some of the findings. Missing data is a major limitation that significantly affects the statistical power and thus the validity of the study. However, since the study was based on secondary data, the researcher had no control over the data and could not do anything to correct the missing data. Missing data may result in limitations of the analysis, and this has a potential impact on the study's conclusions. Missing data may result in selection bias as the missing data might not be random and could lead to a biased sample, affecting the representativeness of the study population. Overrepresentation or underrepresentation of certain groups or characteristics in missing data could skew the results, leading to inaccurate estimates or generalizations. In addition, missing data may lead to information bias due to incomplete information on variables, affecting the accuracy and reliability of analyses involving those variables. However, this has the potential of introducing measurement errors, misclassification, or distortion in associations between variables. Also, working with secondary documents limited the research in that, in some cases the researcher had questions or assumptions which could not be cleared or clarified. The research was limited in that only a quantitative approach was used as data were coded numerically and some aspects of the research needed in-depth information which needed interviews to probe for more information to consolidate the research. It is important to note that this research did not collect specific information to indicate whether the EMS personnel hold qualifications that prevent them from using certain medications or cannot give medications.

5.9 Conclusions

Responding to the problems that are presented to the EMS practitioners regarding prehospital pain management, it was concluded that the EMS personnel failed to document pain assessment for the patients. For most of the participants, there were no pain scores that were recorded at the scene or after being picked to be transported to the nearest health facility. This also means that the EMS personnel failed to acknowledge pain in patients. The EMS practitioners failed to conduct proper assessment of pain leaving one wondering if they have appropriate tools to measure pain or if they are failing to implement pain management guidelines and protocols to meet the patient’s expectations or needs.

Looking at the use of analgesic agents by Botswana EMS, it was concluded that analgesia administration was omitted. However, in cases where analgesic agents were used, this study was not able to tell if they were associated or related with the injuries sustained. In addition, there were barriers that were established as preventing EMS practitioners from administering

analgesia to trauma patients. This research established that inadequate knowledge and limited formal training of ED practitioners in acute pain management are the major barriers to administering analgesia to trauma patients. This was because most of the EMS personnel have a basic EMT qualification and they lack ongoing training on the job. Low levels of education in emergency services may result in poor use of available analgesia in the emergency department as the practitioners are limited in their knowledge and understanding of the analgesic agents. The practitioners lacked experience and most of them have a basic qualification such that they are just as good as transporters with no analgesia being administered to the patients. Most of the patients who received analgesia were from clinics or other medical facilities and were being transferred to other health facilities.

In addition, considering pain management practices of EMS practitioners during the management of trauma patients, this research concluded that the EMS personnel rarely record and monitor pain. However, they record GCS, injuries sustained, geographical location of patient at the time of injury or scene of incident, health facilities they took the patients to, times from call to scene and scene to hospital and they make timely decisions on where to take the patients for admission. The Gaborone EMS practitioners have been practicing suboptimal prehospital analgesia administration to some significant extent.

It was concluded that there are significant relationships or associations between traumatic injuries sustained and the pain management practices of EMS practitioners in Gaborone. This was because significant relationships existed between injuries sustained and analgesia administered (in terms of dosage), injuries sustained, and GCS records and injuries sustained, and times taken from the scene to the hospital of admission.

Assessing the Gaborone EMS personnel compliance with the BHPC pain management protocol, the EMS personnel are partially compliant to as they did not comply with some of the major aspects of pain assessment and management like measuring pain, documenting pain and administering analgesia to trauma patients.

5.10 Recommendations

There is a failure of the EMS practitioners to conduct pain assessment and management for the patients, evidenced by no pain scores recorded at the scene or after being picked to be transported, the EMS practitioners need to be thoroughly trained and conscientized on the process of pain assessment and management. The fact that most of the patients with pain records were from medical facilities and not from other scenes away from the clinics or

hospitals shows that the EMS practitioners lack fundamental pain assessment skills and compliance. This means that further training, empowerment workshops, conferences and seminars are needed for the EMS personnel to be equipped and be revived to do their job appropriately and successfully. It is also recommended that the EMS personnel should advance themselves so that they continue to be relevant and useful in the field.

To make sure that there is acknowledgement of pain in patients, it is recommended that the EMS practitioners be given appropriate tools to measure pain and that the guidelines and protocols to meet compliance be all over their transport and other environments. In addition, there is a need to run a good pain management system which helps the EMS personnel to implement correct practices appropriately.

To address the issue of inadequate knowledge and limited formal training of acute pain management, the practitioners are encouraged to advance themselves personally and as organizations to boost their knowledge levels. This can also be addressed through further training, empowerment workshops, conferences, seminars, collaborations, and exchange programs for the EMS personnel to be equipped to do their job appropriately and successfully.

In addition, considering pain management practices of EMS practitioners during the management of trauma patients, this research concluded that the EMS personnel rarely record and monitor pain. However, they record GCS, injuries sustained, geographical location of patient at the time of injury or scene of incident, health facilities they took the patients to, times from call to scene and scene to hospital and they make timely decisions on where to take the patients for admission. The Gaborone EMS practitioners may have been practicing suboptimal prehospital analgesia administration. A pain management registry may serve as an EMS quality indicator for determining and meeting need in relation to pain.

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Appendices

Appendix 1 Extraction tool

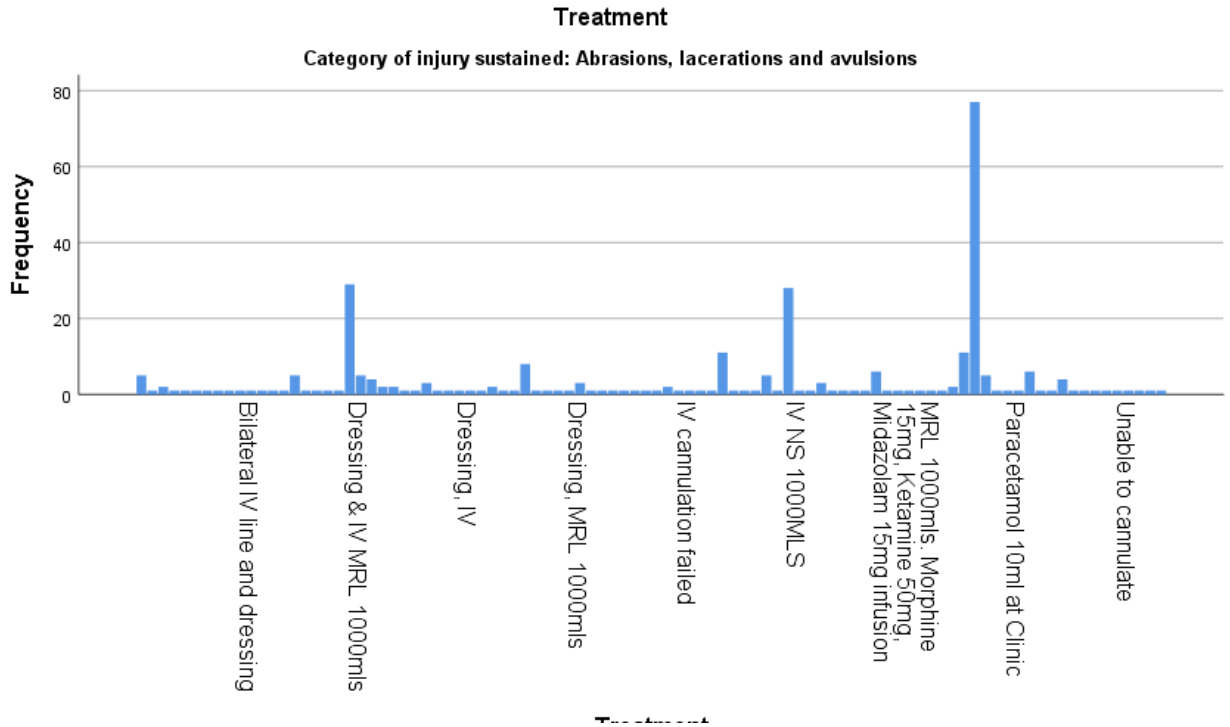
Variables	Date	Month	Age (Years)	Gender	Weight (kg)	MOI	CATEGORY OF MOI	Place of injury	GCS	Pain score	Analgesia administered (mg)	Pain Score 2	Injuries sustained	Category of injury sustained	Body region	Diagnosis	Treatment	Geographical location	Time from call to scene (minutes)	Time from scene to hospital (minutes)	Distance in kms	Hospital	Senior Staff member Qualification

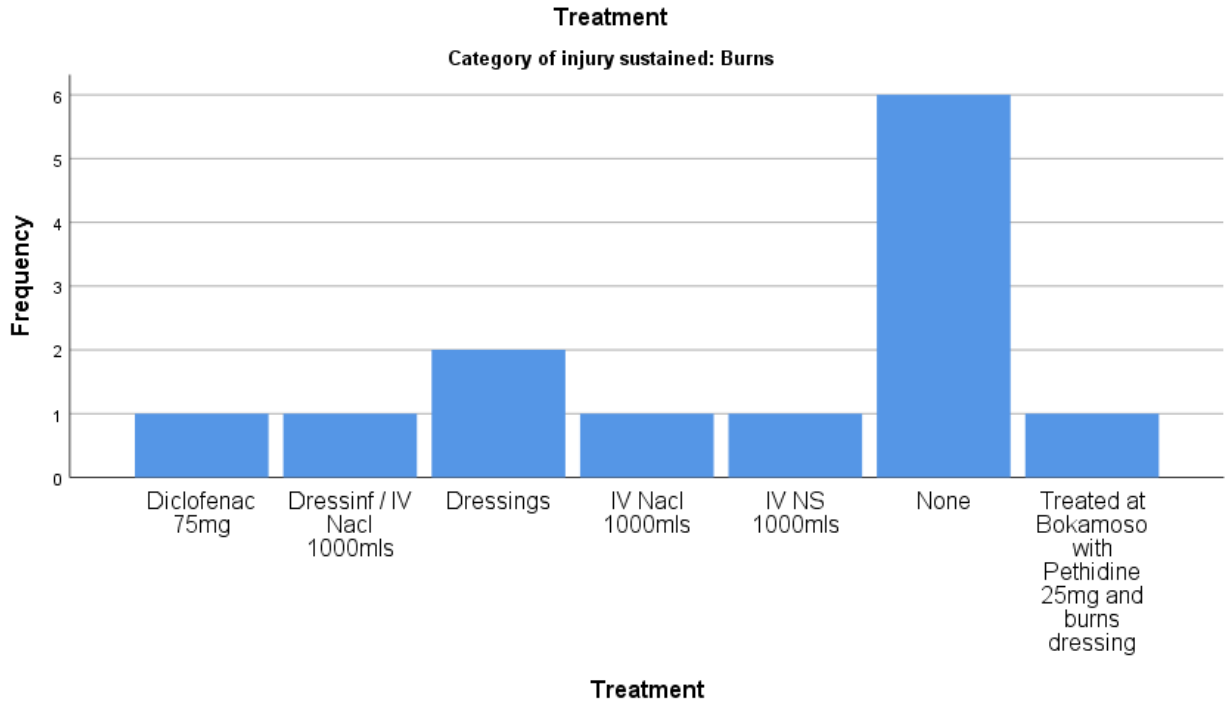
Appendix 2 Ages of patients presented to the EMS in Botswana

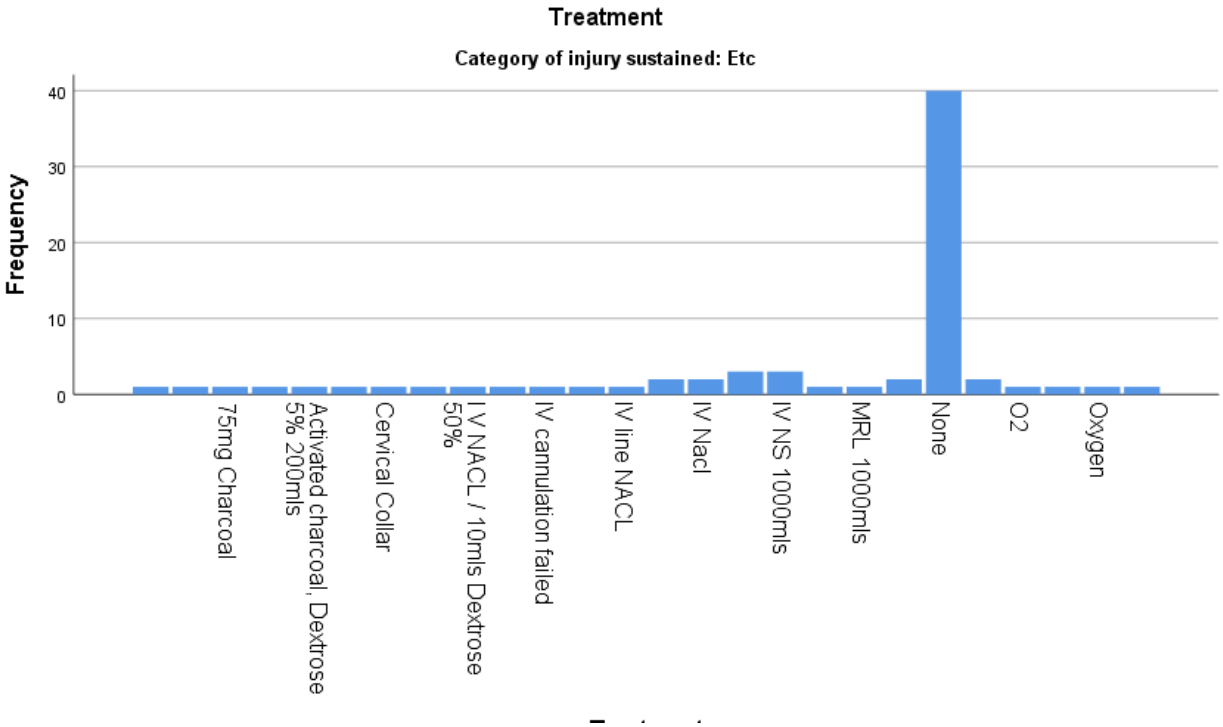
	Age (Years)	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0.5	1	0.1	0.1	0.1
	0.6	1	0.1	0.1	0.2
	0.67	2	0.2	0.2	0.4
	1	2	0.2	0.2	0.6
	1.1	1	0.1	0.1	0.8
	1.25	1	0.1	0.1	0.9
	1.6	1	0.1	0.1	1
	2	5	0.5	0.5	1.5
	3	3	0.3	0.3	1.8
	4	7	0.7	0.8	2.6
	5	3	0.3	0.3	2.9
	6	5	0.5	0.5	3.4
	7	2	0.2	0.2	3.7
	8	5	0.5	0.5	4.2
	9	2	0.2	0.2	4.4
	10	4	0.4	0.4	4.8
	11	4	0.4	0.4	5.3
	12	8	0.8	0.9	6.1
	13	5	0.5	0.5	6.7
	14	10	1	1.1	7.7
	15	5	0.5	0.5	8.3
	16	11	1.2	1.2	9.5
	17	11	1.2	1.2	10.6
	18	15	1.6	1.6	12.2
	19	20	2.1	2.1	14.4
	20	26	2.7	2.8	17.2
	21	24	2.5	2.6	19.8
	22	34	3.6	3.7	23.4
	23	33	3.5	3.5	27
	24	35	3.7	3.8	30.7
	25	35	3.7	3.8	34.5
	26	36	3.8	3.9	38.3
	27	36	3.8	3.9	42.2
	28	37	3.9	4	46.2
	29	35	3.7	3.8	49.9
	30	36	3.8	3.9	53.8
	31	30	3.1	3.2	57
	32	28	2.9	3	60
	33	34	3.6	3.7	63.7

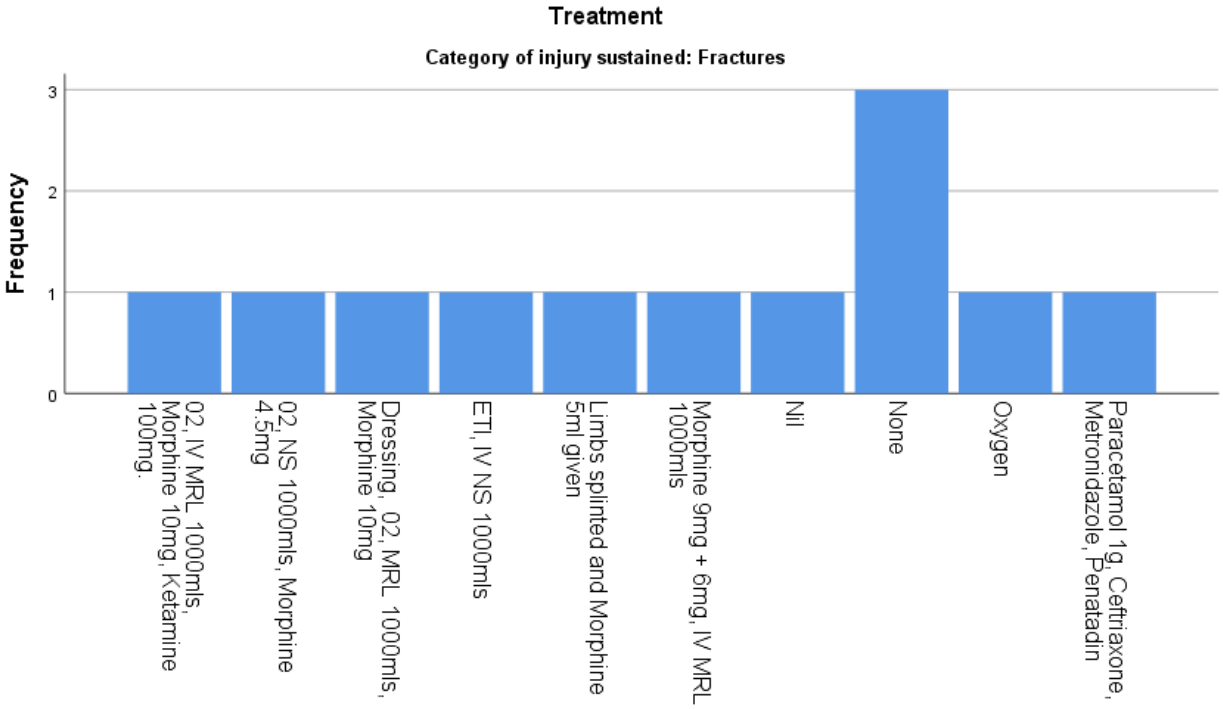
	34	24	2.5	2.6	66.3
	35	25	2.6	2.7	69
	36	25	2.6	2.7	71.6
	37	24	2.5	2.6	74.2
	38	27	2.8	2.9	77.1
	39	20	2.1	2.1	79.3
	40	24	2.5	2.6	81.8
	41	18	1.9	1.9	83.8
	42	12	1.3	1.3	85.1
	43	9	0.9	1	86
	44	11	1.2	1.2	87.2
	45	11	1.2	1.2	88.4
	46	12	1.3	1.3	89.7
	47	7	0.7	0.8	90.4
	48	10	1	1.1	91.5
	49	8	0.8	0.9	92.4
	50	7	0.7	0.8	93.1
	51	4	0.4	0.4	93.6
	52	5	0.5	0.5	94.1
	53	4	0.4	0.4	94.5
	54	5	0.5	0.5	95.1
	56	8	0.8	0.9	95.9
	57	7	0.7	0.8	96.7
	58	5	0.5	0.5	97.2
	59	4	0.4	0.4	97.6
	61	2	0.2	0.2	97.9
	62	2	0.2	0.2	98.1
	63	2	0.2	0.2	98.3
	65	4	0.4	0.4	98.7
	66	1	0.1	0.1	98.8
	67	1	0.1	0.1	98.9
	68	2	0.2	0.2	99.1
	69	2	0.2	0.2	99.4
	71	1	0.1	0.1	99.5
	72	1	0.1	0.1	99.6
	76	1	0.1	0.1	99.7
	79	1	0.1	0.1	99.8
	80	1	0.1	0.1	99.9
	81	1	0.1	0.1	100
	Total	931	97.6	100	
Missing	System	23	2.4		
Total		954	100		

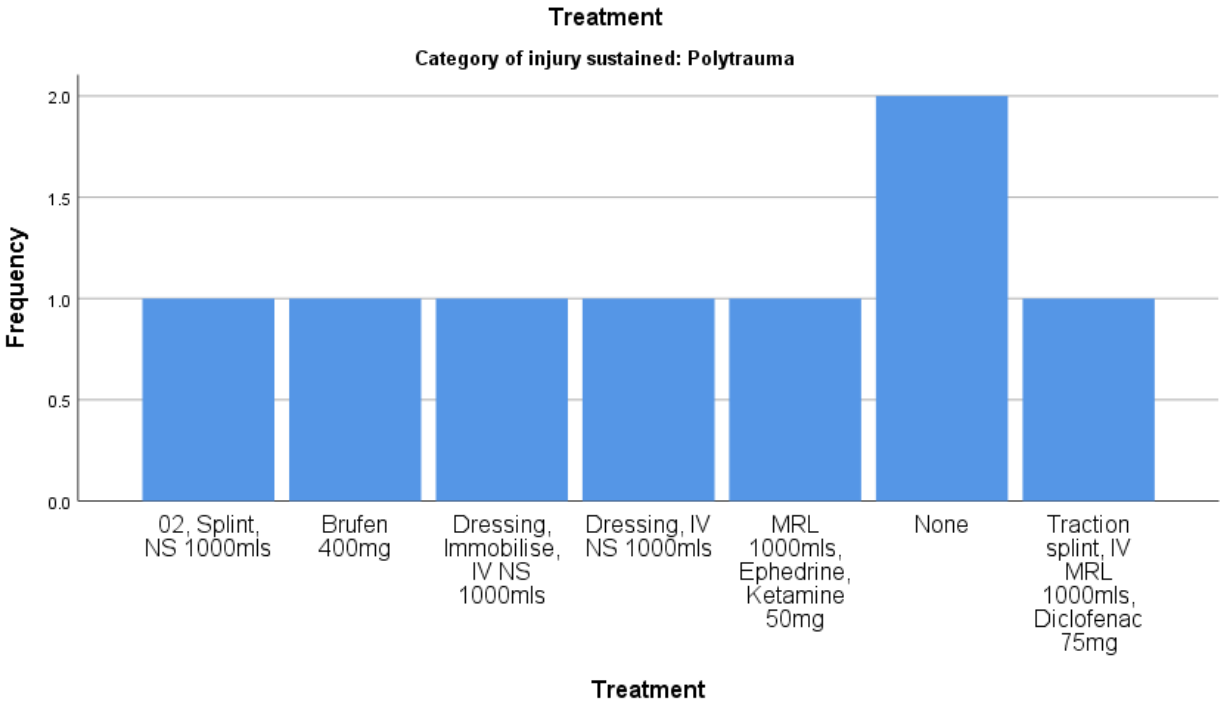
Appendix 3 Treatments given to the patients at the point of admission according to category of injury sustained

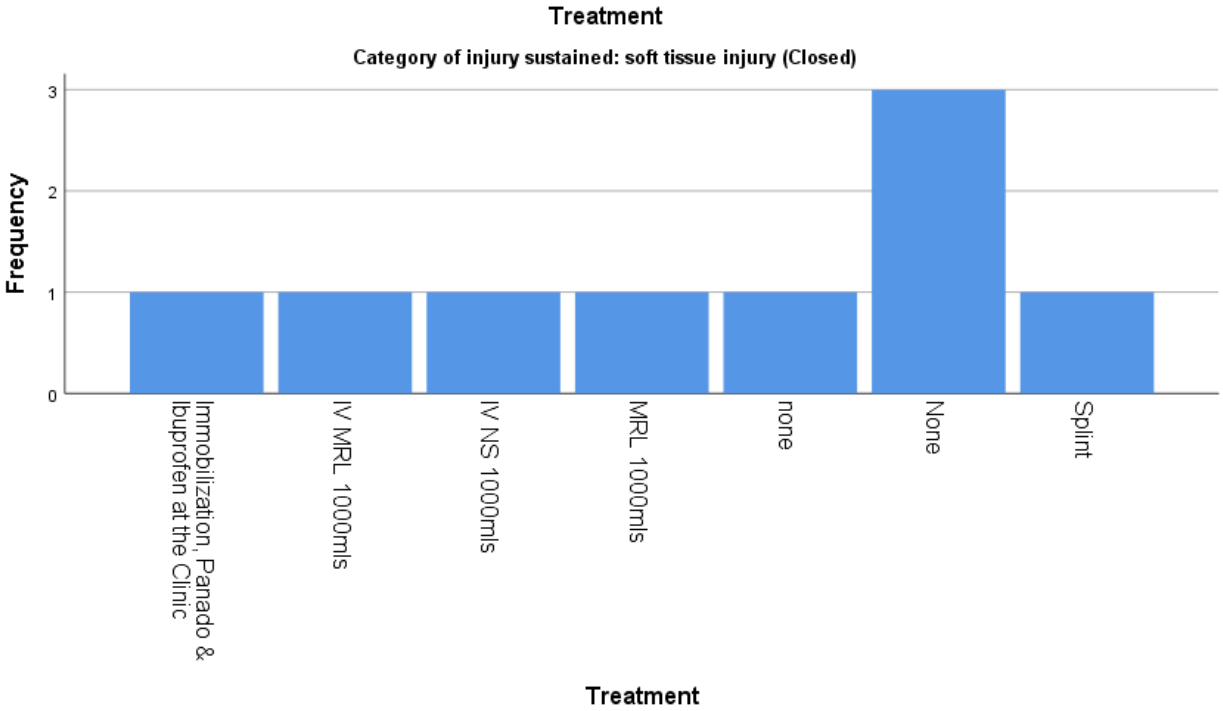


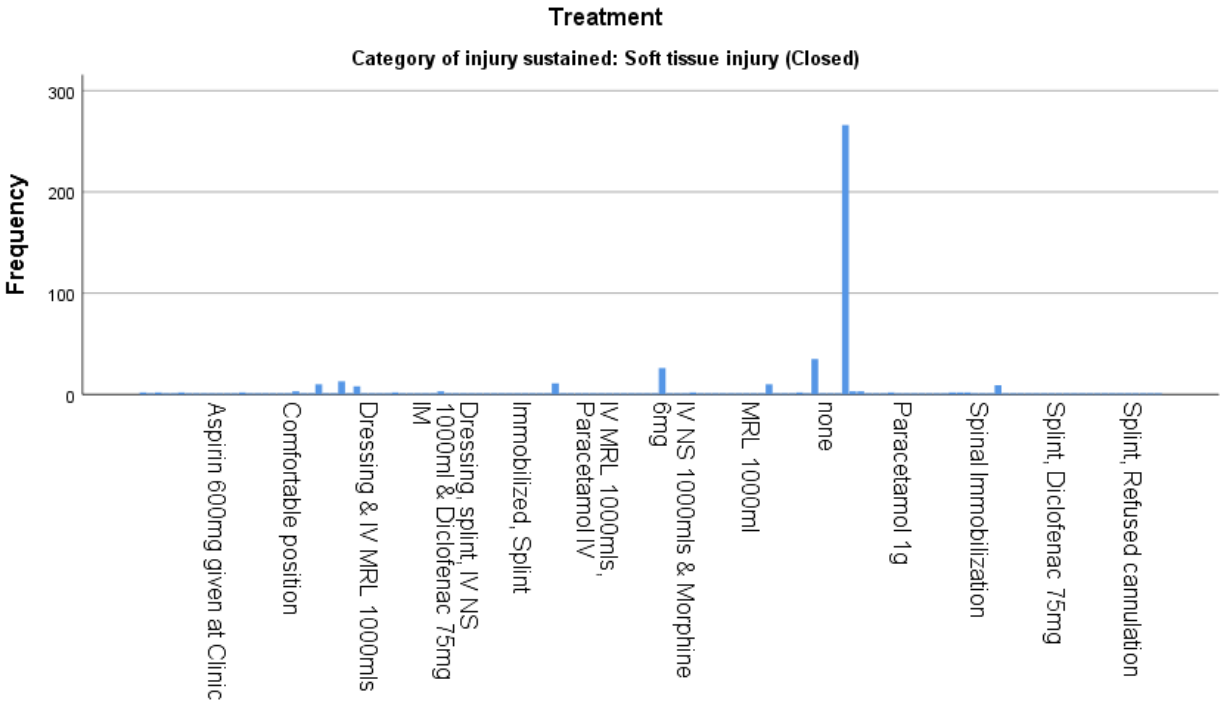


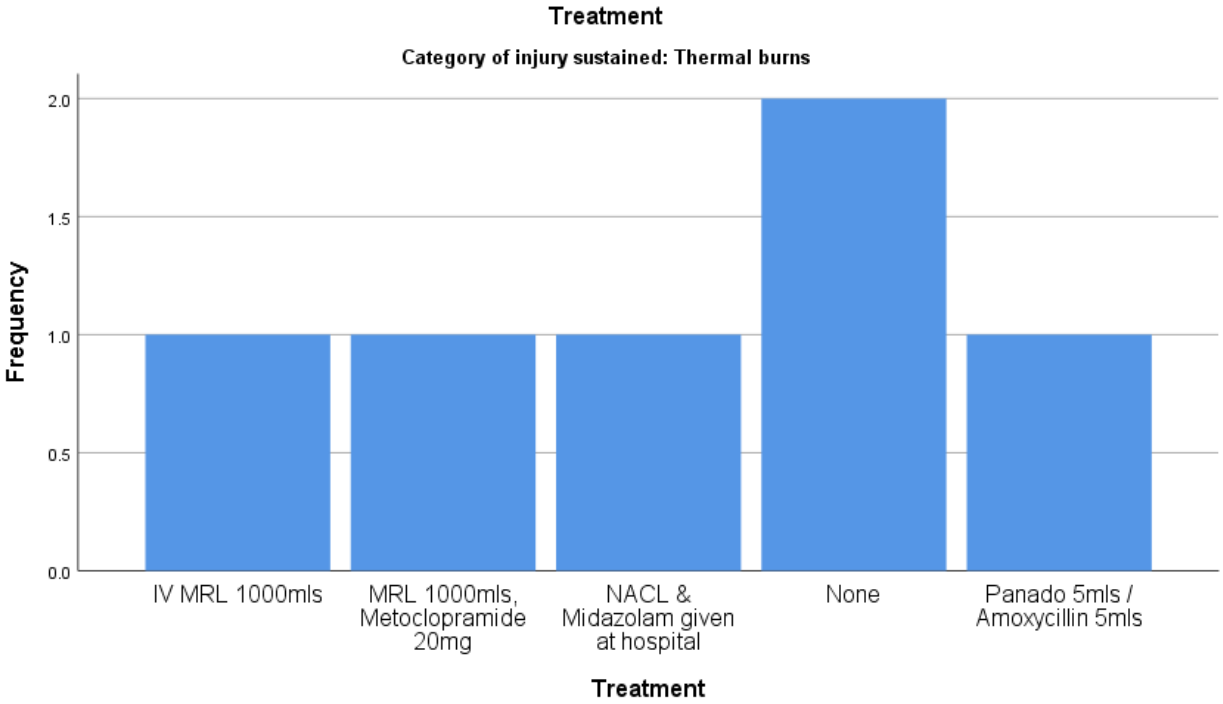

Treatment
Category of injury sustained: Etc
Frequency
40
30
20
10
0
75mg Charcoal
Activated charcoal, Dextrose 5% 200mls
Cervical Collar
I V NACL / 10mls Dextrose 50%
IV cannulation failed
IV line NACL
IV Nacl
IV NS 1000mls
MRL 1000mls
None
O2
Oxygen

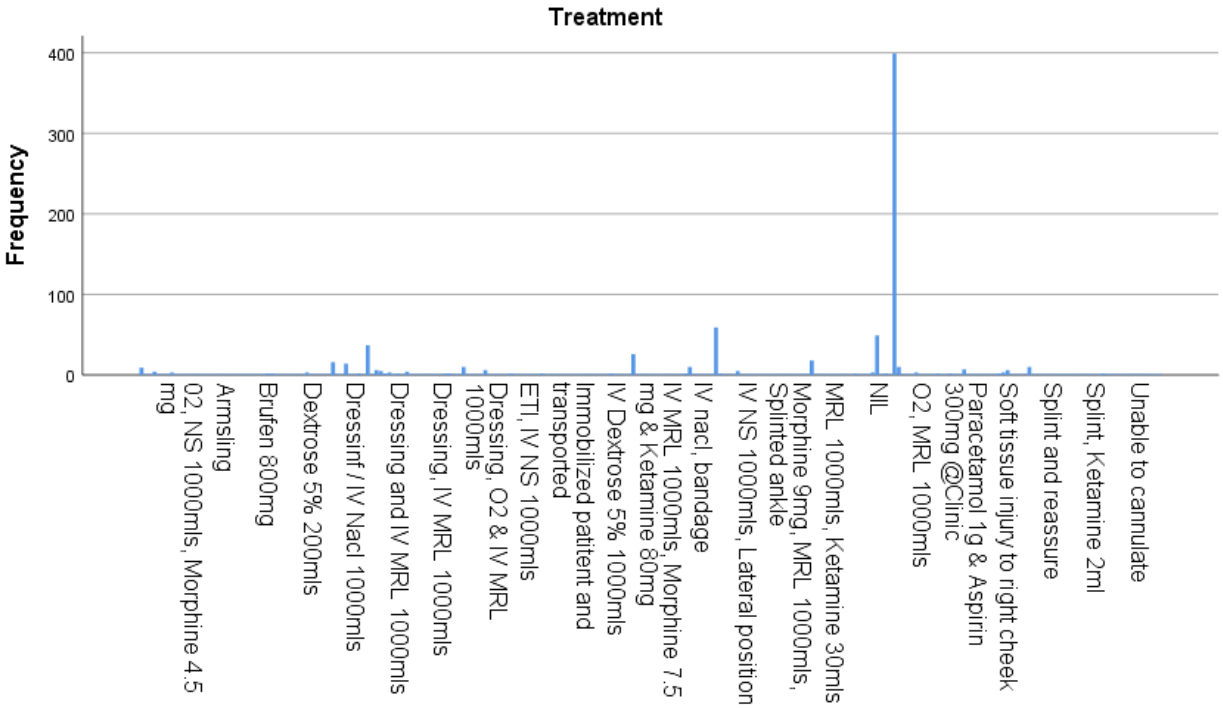

Treatment
Category of injury sustained: Fractures
Frequency
3
2
1
0
02, IV MRL 1000mls, Morphine 10mg, Ketamine 100mg.
02, NS 1000mls, Morphine 4.5mg
Dressing, 02, MRL 1000mls, Morphine 10mg
ETI, IV NS 1000mls
Limbs splinted and Morphine 5ml given
Morphine 9mg + 6mg, IV MRL 1000mls
Nil
None
Oxygen
Paracetamol 1g, Ceftriaxone, Metronidazole, Penatadin


Treatment
Category of injury sustained: Polytrauma
Frequency
2.0
1.5
1.0
0.5
0.0
02, Splint, NS 1000mls
Brufen 400mg
Dressing, Immobilise, IV NS 1000mls
Dressing, IV NS 1000mls
MRL 1000mls, Ephedrine, Ketamine 50mg
None
Traction splint, IV MRL 1000mls, Diclofenac 75mg
Treatment


Treatment
Category of injury sustained: soft tissue injury (Closed)
Frequency
3
2
1
0
Immobilization, Panado & Ibuprofen at the Clinic
IV MRL 1000mls
IV NS 1000mls
MRL 1000mls
none
None
Splint
Treatment


Treatment
Category of injury sustained: Soft tissue injury (Closed)
Frequency
300
200
100
0
Aspirin 600mg given at Clinic
Comfortable position
Dressing & IV MRL 1000mls
Dressing, splint, IV NS 1000ml & Diclofenac 75mg IM
Immobilized, Splint
IV MRL 1000mls, Paracetamol IV
IV NS 1000mls & Morphine 6mg
MRL 1000ml
none
Paracetamol 1g
Spinal Immobilization
Splint, Diclofenac 75mg
Splint, Refused cannulation


Treatment
Category of injury sustained: Thermal burns
Frequency
2.0
1.5
1.0
0.5
0.0
IV MRL 1000mls
MRL 1000mls, Metoclopramide 20mg
NACL & Midazolam given at hospital
None
Panado 5mls / Amoxycillin 5mls
Treatment


Treatment
Frequency
400
300
200
100
0
Unable to cannulate
Splint, Ketamine 2ml
Splint and reassure
Soft tissue injury to right cheek
Paracetamol 1g & Aspirin 300mg @Clinic
O2, MRL 1000mls
NIL
MRL 1000mls, Ketamine 30mls
Morphine 9mg, MRL 1000mls, Splinted ankle
IV NS 1000mls, Lateral position
IV nacl, bandage
IV MRL 1000mls, Morphine 7.5 mg & Ketamine 80mg
IV Dextrose 5% 1000mls
Immobilized patitent and transported
ETI, IV NS 1000mls
Dressing, O2 & IV MRL 1000mls
Dressing, IV MRL 1000mls
Dressing and IV MRL 1000mls
Dressinf / IV Nacl 1000mls
Dextrose 5% 200mls
Brufen 800mg
Armsling
02, NS 1000mls, Morphine 4.5 mg

Appendix 4 Ethics Clearance letter

Cape Peninsula University of Technology

HEALTH AND WELLNESS SCIENCES RESEARCH ETHICS COMMITTEE (HW-REC)
Registration Number NHREC: REC- 230408-014

P.O. Box 1906 • Bellville 7535 South Africa
Symphony Road Bellville 7535
Tel: +27 21 959 6917
Email: simonsy@cput.ac.za

10 February 2020
REC Approval Reference No:
CPUT/HW-REC 2020/H01

Faculty of Health and Wellness Sciences

Dear Mr Nithiananda Perumal,

Re: APPLICATION TO THE HW-REC FOR ETHICS CLEARANCE

Approval was granted by the Health and Wellness Sciences-REC to Mr Nithiananda Perumal for ethical clearance. This approval is for research activities related to research for Mr Perumal at Cape Peninsula University of Technology.

TITLE: **Prehospital Management of pain in trauma patients presenting to the emergency Medical Services In Gabarone, Botswana**

Supervisor: Dr N Naidoo

Comment:

Approval will not extend beyond 11 February 2021. An extension should be applied for 6 weeks before this expiry date should data collection and use/analysis of data, information and/or samples for this study continue beyond this date.

The investigator(s) should understand the ethical conditions under which they are authorized to carry out this study and they should be compliant to these conditions. It is required that the investigator(s) complete an **annual progress report** that should be submitted to the HWS-REC in December of that particular year, for the HWS-REC to be kept informed of the progress and of any problems you may have encountered.

Kind Regards

M. le Roes-Hill

Dr Marilize Le Roes-Hill
Deputy Chairperson – Research Ethics Committee
Faculty of Health and Wellness Sciences

Appendix 5 Botswana Ministry of Health and wellness Permit

PRIVATE BAG 003B
GABORONE
BOT3WANA
REFERENCE:

REPUBLIC OF **BOTSWANA**
MINISTRY OF HEALTH **AND WELLNESS**

TEL: t+267) 363.2500
FAX: (+267) 391.0647
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD

REFERENCE NO: HPDME 13/18/1 **6" August 2019**

Health Research and Development Division

Notification of IRB Review: New application

Nithinanda Peiumal
P.O. 1412 AAD
Gaborone

Dear Nlthinafida Perumal

Protocol Title: **PREHOSPITAL MANAGEMENT OF PAIN IN TRAUMA PATIENTS PMSENTING TO THE EMERGENCY MEDICAL SERVICES IN GABORONE, BOTSWANA**

HRU Appi oval Date:	06 August 2019
HRU Expiration Date:	05 August 2020
HRU Review **Type:**	Expedited Review
HRU Review Determination:	Approved
Risli Determination:	Minimal risk

Thank you for submitting new application for the above referenced protocol. The permission is granted to conduct the study.

This permit does not however give you authority to collect data from the selected sites without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for considei'ation and approval.

Furthermore, you are requested to submit at least one 1iat'dcopy and an electronic copy of the report to the Health Research, Ministry of Health and Wellness within 3 months of completion of the study. Approval is for academic fulfillment only. Copies should also be submitted to all other relevant authorities.

Continuing Review

In order to continue work on this study (including data analysis) beyond the expii'y date, submit a Continuing Review Form for Approval at least tluee (3) months prior to the

protocol's expiration date. The Continuing Review Form can be obtained from the Health Research Division Office (HRDD), Office No. 7A.7 or Ministry of 1-Iealth website: www.inoh.Nov.bw or can be requested via e-mail fi'om Mr. Kgomotso Motlhanka, e-mail address: kgminotlhanka@gov.bw As a courtesy, the HRDD will send you a reminder email about eight (8) weeks befoi'e the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Report form

Amendments
During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek HRDC approval before implementing it. Please summarize the proposed change and the rationale for it in the amendment foi'm available from the Health Research Division Office (HRDD), Office No. 7A 7 or Ministry of Health website: www.moh.gov.bw or can be requested via e- mail from Mr. Kgomotso Motlhanka, e-mai1 addi'ess: kginot11iankaJuov.bw . In addition submit three copies of an updated version of your original protocol application showing all proposed changes in bold or "track changes".

Reporting
Other events which must be reported promptly in writing to the HRDC include:
• Suspension or termination of the protocol by you or the grantor
• Unexpected problems involving rislc to subjects or others
• Adverse events, including unanticipated or anticipated but severe physical harm to subjects.

If you have any questions please do not hesitate to contact Mr. K. Motlhanka atk m ot ha a b , Tel +267-3632751. Thank you for your coopei'ation and your commitment to the protection of human subjects in i'eseaich.

Yours sincerely

Ms S weun' ane
for PERMANEov sECRETARY

MINISTRY OF HEALTH
RESEARCH DIVISION
2019 -08- 0 6
P/BAG 0038
GAE RONE
REPUBLIC OF BOTSWANA