UNIVERSITY OF EDUCATION, WINENBA

OPERATIONAL HAZARDS OF THE NATIONAL AMBULANCE SERVICE IN THE BONO, BONO EAST AND AHAFO REGIONS OF GHANA

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(MASTER OF PHILOSOPHY)

2022

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A THESIS SUBMITTED TO THE DEPARTMENT OF PUBLIC HEALTH EDUCATION, UNIVERSITY OF EDUCATION WINNEBA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY IN ENVIRONMENTAL AND OCCUPATIONAL HEALTH EDUCATION

AUGUST, 2022

DECLARATION

I hereby declare that except references to other people's works which have been duly acknowledged, this thesis is my own original work towards the award of a Master of Philosophy in Environmental and Occupational Health Education, and that this thesis or part has not been accepted for the award of a degree in this university, or elsewhere.

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ACKNOWLEDGEMENTS

I am most thankful to the ALMIGHTY GOD for granting me the grace to complete this work successfully. May all the glory and honour be unto His holy name.

I would like to extend my appreciation to the following people who have helped with this demanding journey. Foremost, I would like to express my sincere gratitude to my Supervisor Dr. Richard Kuffour and Dr. Denis Dekugmen Yar of the Department of Public Health Education, UEW for their support, patience, commitment, advice, and enthusiasm which has been a constant source of support throughout this long process, relentless efforts in giving the necessary assistance and guidance. God richly bless you.

The next gratitude goes to all those who helped in diverse ways and contributed immensely to the success of this research work, especially Mr. Frederick Boateng who helped in the statistical analysis, my family, and colleagues at my workplace without whose help, this work would not have been successful.

I wish to thank the Management and Staff of the National Ambulance Service most especially the C.E.O Professor Nuhu Ahmed Zakariah and all the staff of NAS in the Bono, Bono East and Ahafo regions not forgetting the various administrators and station managers of these regions.

Finally, I would like to thank my wife, Juliana, who has patiently watched, supported, and encouraged me through a lifelong journey of learning, change and continuing challenge.

DEDICATION

I dedicate this work to the Creator and sustainer of the universe.

I dedicate this work to my beloved wife and Children (Manasseh, Ian, and Julius)

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LIST OF ACRONYMS

AED…… Automated External Defibrillator

ED…… Emergency Department

EMS……. Emergency Medical Service

EMT……. Emergency Medical Technician

GSS……Ghana Statistical Services

HBV…… Hepatitis B Virus

HCV…… Hepatitis C Virus

HCW……. Health Care Workers

HIV…….. Human Immunodeficiency Virus

KATH……. Komfo Anokye Teaching Hospital

NAS…… National Ambulance Service

OSHA……. Occupational Safety and Health Administration

PPE……. Personal Protective Equipment

PPME…….. Policy, Planning, Monitoring and Evaluation

SPSS……Statistical Package for Social Sciences

ABSTRACT

Pre-hospital emergency care has had rapid progress in Ghana in terms of technology, treatments, staff strength, and fleet management. In Ghana, there is at least one Ambulance with trained Emergency Medical Technicians (EMTs) to man a station in every constituency. The risk of occupational death is disproportionately high for Emergency Medical Services (EMS) personnel, largely because of the high incidence of transportation-related fatalities. A systematic review of the literature showed evidence that EMTs are susceptible to higher rates of injuries, musculoskeletal disorders, poor sleep, and a high rate of fatigue because of general and Ambulance-specific stressors. The aim of the research was to evaluate the operational hazards and risks associated with the National Ambulance Service. A total of 29 Ambulance Service Stations and 250 Emergency Medical Technicians (EMTs) were sampled. The primary data for the study were collected from the respondents through questionnaire administration and interviews. The mean age in the study was 27.8±8.21 years. Out of the 250 respondents, 92.4% were aware of the operational hazards associated with their work, 84.7% had experienced biological hazards with 73.7% cuts and wounds constituting the main biological hazards. Sixty-two percent of responders had been injured during operations with back pain being the most identified injury to EMTs. Regular inspection, preventive maintenance of equipment and the ambulance was proposed by EMTs as one of the measures to control hazards. The study showed that the majority of EMTs had knowledge and have experienced exposure to operational hazards. EMTs with diploma educational level were 102.70 times more likely not to experience biological hazards as compared to those with BECE or no formal education (AOR=102.7 (CI: 1.97 - 5335.1), P=0.022). The study concludes that EMTs experience several hazards at their workplace with blood being the most biological substance they are exposed to.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Approximately 1.35 million people die from road traffic crashes in the world (Mahama *et al.,* 2018). Road traffic crashes cost most countries 3% of their gross domestic product, and more than half of all road traffic deaths are among vulnerable road users: pedestrians, cyclists, and motorcyclists (Mahama *et al.,* 2018). Nearly 93 % of the world's fatalities on the roads occur in low and middle-income countries, even though these countries have approximately 60% of the world's vehicles Road traffic injuries and this is the leading cause of death for children and young adults aged 5-29 years (Mahama *et al.,* 2018). Africa is responsible for the majority of road traffic-related deaths and have the world's most undeveloped Emergency Medical Services (EMS) (Mahama *et al.,* 2018). The menace of road traffic accidents in Ghana is a cause for concern. Road traffic management in Ghana has been entrusted to many institutions.

The Motor Traffic and Transport Unit (MTTU), the National Road Safety Commission (NRSC), and the Drivers and Vehicle Licensing Authority (DVLA) are among the institutions. Road traffic accidents have had catastrophic consequences for human lives and property, (Kalu Awa, 2018). In Ghana, road crash statistics for 2016 showed an increase of 15.6 percent in fatalities and 6.77 percent in serious injuries, respectively, but a decrease of 11.7 percent in crashes compared to (National Road Safety Commission, 2018). In 2017, the National Road Safety Commission reported that 2,076 people died in road accidents. Many of these deaths were attributed to trauma and could have been prevented if there was adequate pre-hospital medical care in the country (National Road

Safety Commission, 2018). A quick reaction time, enough logistics, and effective Emergency Medical Technicians (EMTs) are critical to the survival of trauma patients in car accidents. The Emergency Medical Services (EMS) providers' reaction to a distress call with an ambulance at the incident scene is a visual sign of EMS providers' efficiency and efficacy. Exposure to dangerous activities and settings, which may result in occupational injuries, is a part of these emergency reactions. Between 2003 and 2007, an estimated 99,400 EMS personnel sought treatment for non-fatal occupational injuries in Emergency Departments (EDs). (Reichard *et al.,* 2017). EMS workers suffered 21,690 non-fatal occupational injuries and illnesses during the same period, resulting in a lost workday rate of 3.49 per 100 full-time employees, approximately three times the rate of all private-industry workers (Maguire & Smith, 2013). It is necessary to better understand the non-fatal injuries and illnesses occurring to these workers to develop and implement effective prevention efforts needed to preserve this workforce.

Body motion and overexertion has been identified as the most common event leading to non-fatal injuries among EMS workers (Reichard *et al.,* 2017), Compared to all private industry workers, EMS workers were at higher risk for lost work time, occupational injuries from overexertion, transportation-related incidents, assaults, and falls (Reichard *et al.*, 2017). Harmful exposures and contact with objects and equipment were other common contributors to injuries among EMS workers treated in Emergency Departments. EMS employees play a vital role in public health and safety. While the need for EMS personnel is expected to grow by 24% in the next ten years (Maguire & Smith 2013), there are barriers to worker retention, such as injuries, diseases, and disabilities, which lead to workers quitting the field (Maguire *et al.,* 2002).

1.2 Problem Statement

Ambulance collisions, attacks, contagious diseases, hearing loss, lower back injury, hazardous materials exposure, stress, long work hours, and exposure to severe temperatures are just a few of the hazards that EMS professionals face on the job (Maguire & Smith, 2013). These paramedics and Emergency Medical Technicians (EMTs) respond to a variety of situations, including shootings, medical emergencies, hazardous material events, and large-scale disasters (Maguire & Smith, 2013). Ambulance services within EMS units labour under difficult conditions for seven days. Employees in this unit are in danger of musculoskeletal ailments, cardiovascular difficulties, allergies, aggression, and stress, to name a few (Kahya & Sakarya, 2020).

EMS professionals face a variety of challenges in the workplace, including movements that have a detrimental impact on the body, repetitive motion injuries, hard physical tasks, and disproportionate or improper use of body parts (Kahya & Sakarya, 2020). Many of the occupational dangers and risks faced by EMTs are dependent on the ambulance service's operational protocols. Since the founding of the National Ambulance Service (NAS), however, there has been no documented evidence of operational and occupational injuries, trauma, or other harm sustained by EMTs. A study is urgently needed to analyze and evaluate the operational dangers related to ambulance services, as well as occupational injuries among EMTs.

1.3 Justification of the Study

In Ghana, the prevalence of road crashes/accidents deaths is a major public health concern. Pre-hospital care for accident victims and critically ill individuals is the key intervention to save the lives of victims if not avert their deaths. Since the inception of

the National Ambulance Service (NAS), there has not been a comprehensive evaluation of the operational hazards associated with the service. The cliché, "the unexamined life is not worth living" is an undisputed fact of life and therefore relevant to the NAS and EMS vis-à-vis the prevalence of injuries suffered by EMTs. Furthermore, there is a paucity of data on the operational hazards suffered by the staff of NAS. Moreover, there is little empirical data on operational hazards among EMTs in the Bono, Bono East, and Ahafo regions of Ghana. The findings and recommendations of the study will be useful for ensuring that operational hazards are minimized among EMTs. Recommendations emerging from this study will be useful for minimizing operational hazards among the pre-hospital fraternity. The EMTs will be the ultimate beneficiary of interventions that will be based on findings from the study.

1.4 Objectives for the study

1.4.1 General objectives

This study sought to evaluate operational hazards associated with the National Ambulance Service in the Bono, Bono East, and Ahafo Regions of Ghana.

1.5 Specific Objectives

The specific objectives of the study were to:

1. Identify operational hazards associated with EMTs in the Bono, Bono East, and Ahafo Regions.
2. Determine the causes of operational injuries suffered among EMTs in the Bono, Bono East, and Ahafo Regions.
3. Examine the impact of the operational hazards on the performance of EMTs of the NAS in the Bono, Bono East, and Ahafo Regions.

1.6 Research Questions

The following research questions were raised to meet the goals. These are;

1. What are the operational hazards associated with NAS?
2. What are the causes of operational hazards suffered among EMTs?
3. What are the impacts of operational hazard exposures on the performance among EMTs of NAS in Ghana?

1.6 Scope of the Study

The study was limited to EMTs in the Bono, Bono East, and Ahafo regions who had worked in the National Ambulance Service for more than one year. This study excludes EMTs of the National Ambulance Service who had worked for less than one year in the service. Also, EMTs who were having their annual leave and who were critically ill during the data collection period were excluded from the study. In addition, due to the nature of the study, administrative and dispatch staff of the NAS in the study population were excluded. The scope was limited to the specific objectives of the study. The result of it cannot, therefore, be applied beyond the said objectives.

1.7 Study Significance

The results of this study will be valuable to National Ambulance Service which provides Emergency Medical Services, the health facilities, and the populace at large. The outcome of this study would provide up-to-date data on the operational hazards among these EMTs and opportunities which could influence policy change and consequently improve the services and save lives. This would also serve as empirical literature and engender future research in the field of medical emergencies. Largely, the recommendations from this study serve as a precursor for decision-makers, planning

work processes, to have the knowledge to prioritize, develop, and evaluate interventions that can be implemented to reduce these occupational risks. The results would further provide empirical feedback data on the rate of injuries among EMS workers, and this will also stimulate future research.

1.8 Organization of the report

The study covered six chapters. The first chapter deals with the introduction to the study, statement of the problem, objectives, research questions, study significance, scope, and finally organization of the study. The second chapter discusses the literature review of the topic. It deals with both theoretical and empirical studies of the research.

The third chapter delves into research methodology. It describes the research design, study population, sample size, the instrument used, data collection procedures, and its analysis. The fourth chapter deals with the presentation of the results from the data collected. Finally, the fifth and sixth chapters tackled the discussion of the results, summary of the findings, conclusion, and recommendations respectfully.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Emergency Medicine

Emergency Medical Service (EMS) systems, defined as "Formalized pre-hospital care, provided by emergency care professionals who respond to medical emergencies within a well-defined jurisdiction (Mould-Millman *et al*., 2017), play a critical role in emergency care systems by providing timely, safe, on-scene evaluation, stabilization, and transport of patients to an appropriate facility (Mould-Millman *et al*., 2017). The use of the term Emergency Medical Services may refer solely to the pre-hospital element of the care, or be part of an integrated system of care, including the main care provider, such as a hospital. Emergency access to care is particularly vital for developing countries and their rural communities to access available preventive and curative services, and also supports indirect determinants of health including livelihoods and education (Aikins, 2014). Emergency Medical Services may also be locally known as first aid squad or ambulance service. Emergency Medicine (EM) is considered to be a new specialty in comparison to internal medicine and surgery, and the creation of residency training programs in developing nations is a recent occurrence (Martel *et al.*, 2015).

Emergency medicine in the highly advanced world is traditionally performed in two different ways (Fleischmann *et al.*, 2007). The first is the well-known Anglo-American system with skilled EDs, and pre-hospital Emergency Medical Service utilizing paramedics. The second is the so-called Franco-German system, with a highly developed pre-hospital emergency physician service, but only a basic organization of hospital-based

emergency medicine. This gap is now closing fast because of the rapid advancement of hospital-based emergency medicine in Europe and Africa (Fleischmann *et al.,* 2007). Urbanization of populations across the developing world has led to a demographic shift from infectious disease to traumatic injury and cardiopulmonary disease and has prompted increased interest in the development of emergency medicine and pre-hospital care (Martel *et al.*, 2015). Emergency Medical Services (EMS) systems provide professional pre-hospital emergency medical care and transportation to help improve the plight of patients from emergency conditions. Across Africa, in-hospital and pre-hospital emergency care systems are advanced to serve diverse, multicultural, and multilingual populations of varying socioeconomic strata. For example, innovative programs in which motorbikes equipped with stretchers are developed in Malawi to transport emergency obstetric patients. In Ghana, the National Ambulance Service (NAS) provides professional crews (EMTs) and timely care of pre-hospital service for the sick and injured and transport to definitive care. (Mould-Millman *et al*., 2017).

2.1.1 Emergency workers

Emergency workers encompass large professional groups ranging from professional and volunteer firefighters, police officers, emergency medical staff (paramedics, emergency medical technicians, doctors, and nurses) to psychologists. In major disasters, rescue workers, technicians from large relief organizations, additional medical staff, military personnel, anti-terrorist forces, body handlers, clean-up workers, construction workers, and numerous volunteers are involved. Depending on the emergency/disaster site, emergency workers need knowledge for instance in water rescue, mountain rescue, or rescue from heights (EU-OSHA,2011).

Emergency workers' priorities are to protect human life, property, and the environment, and their most common fields of action include:

1. Everyday emergencies (road accidents, crime scenes, gas explosions, fires)
2. Natural disasters (floods, storms, fires, earthquakes, volcanic eruptions)
3. Industrial accidents (involving hazardous materials, such as in the nuclear and mining sectors)
4. Transport accidents (major car crashes, plane crashes, rail accidents)
5. Terrorist and criminal attacks (bomb attacks, gas attacks, shootings)
6. Massive public events (negative events during concerts, sports events, demonstrations)

2.1.2 Pre-hospital care in Ghana

Ghana's National Ambulance Service (NAS) is the premier and only true pre-hospital emergency medical response system in the country (Mould-Millman *et al.*, 2017).The NAS began piloting in 2004 and became fully operational in 2006 (Mould-Millman *et al.,* 2014), as the first known organized, national, public response system to medical emergencies in Ghana. Ghana adopted the Anglo-American model of Emergency care in which Physician-led emergency care is hospital-based and pre-hospital physician care is rare. This model contrasts with the Franco-German model in which the ambulance team is physician-led and the emergency department is effectively the ambulance (Osei-Ampofo *et al.*, 2013). The mandate of NAS was to provide efficient and timely pre-hospital emergency medical care to the sick and the injured and transport them safely to health facilities. NAS has since expanded to cover all regional capitals and districts as well.

The ambulance service in Ghana saw a significant improvement in January 2020 with the acquisition of new ambulances and staff. With an estimated population of 30,984,320 people (United Nations, 2020), 275 constituencies, and 8,847 healthcare facilities (Ghana Health Service, 2019), the country currently has 362 functioning ambulances and 180 ambulance service stations. Recruitment, training, and resourcing of additional Emergency Medical Technicians (EMTs), as well as allied administrative and maintenance staff, have also taken place to augment the operations of the NAS (Osei-Ampofo *et al.,* 2013). This constitutes nearly a seven-fold increase in the fleet of functioning national ambulances. Worthy of mention is the Government's introduction of drone services to boost emergency medical care, thus contributing to timely, reliable, and secure delivery of some essential healthcare products to health facilities, medical emergency scenes, and hard-to-reach areas, and consequently reducing waste, improving the supply chain of critical medical supplies, and generally improving/saving lives (ISSER, 2019). A current drawback, however, is the lack of adequate support facilities for the smooth operation of the greatly boosted Emergency Medical Services in Ghana.

2.1.3 History and Establishment of National Ambulance Service in Ghana

On the 9th of May 2001, the Stadium Disaster in which one hundred and twenty-seven (127) sports enthusiasts died provided the leverage for the establishment of the National Ambulance Service (NAS). The New Patriotic Party (NPP) Government led by His Excellency, then President, John Agyekum Kufuor saw the need for the establishment of a Nation-wide Comprehensive Pre-Hospital Emergency Care System in Ghana. Accordingly, in his Annual Sessional address to Parliament in the year 2002, the President charged the Ministry of Health and its collaborators to establish a Nation-Wide Ambulance Service to provide effective pre-hospital care to trauma casualties and

convey such victims to hospitals (NAS, 2011). The necessary preparations, stakeholder engagements, and policies were put in place which culminated in the establishment of the nucleus of the National Ambulance Service (NAS). The Service started as a unit under the Policy, Planning, Monitoring and Evaluation (PPME) unit of the Ministry of Health in 2004, later progressed to a directorate, and has now attained an Agency status with its headquarters in Accra (NAS, 2011). Ghana is proud to be one of sub-Saharan Africa's progressing EMS systems. Injuries are the most common reason for public utilization of NAS services (Mould-Millman *et al.,* 2014). Despite sustained growth of NAS over the past decade, annual reports have indicated low public utilization, which may be a contributor to continued poor outcomes of acute care. The reasons behind low utilization have not been studied sufficiently (Mould-Millman *et al.,* 2014). The staff strength of EMTs as of December 2020, was two thousand, one hundred and forty-seven (2,147) working in two hundred and seventy-eight ambulance stations in Ghana, (NAS, 2011). It is also estimated that the ratio of EMT to the population of the country is one (1) EMT to serve Four-teen Thousand, Nine Hundred, and Nine people (i.e.,1 EMT:14,909 people), (NAS, 2011)

2.2 Operational Hazards associated with EMTs

Hazards are inherent properties of a substance, agent, source of energy, or circumstance that have the potential to cause unfavorable outcomes, whereas risk is the likelihood that a hazard will cause harm to 'life, health, and or the environment (Aluko *et al.,* 2016). Hazard perception is defined as the ability to perceive risky factors in the roadway environment in the literature on traffic safety (Johnston & Scialfa, 2016). Hazard perception is a skill that allows people to recognize a hazard based on situational clues and respond properly, and it has been linked to safe driving. Studies on hazard

perception have found a link between reaction time and the frequency of missed dangers during hazard perception tests, as well as ratings by driving instructors, who found that better hazard perception was linked to safer driving (Johnston & Scialfa, 2016). Workplace safety refers to the practice of protecting employees' health and safety while on the job. Occupational safety is the control of risks in the workplace to attain an acceptable level of risk, irrespective of vocation (Aluko *et al.,* 2016). Occupational injuries and diseases among Health Care Workers (HCWs) are among the highest in any industry, according to previous studies, although they can be reduced or eliminated. Blood-borne infections, the Human Immunodeficiency Virus (HIV), Hepatitis B virus (HBV), and Hepatitis C virus (HCV), back and neck pain, burn-out stress, allergic reactions to latex materials, chemical spills, radiation exposure, and patient assault were among the major hazards identified in the study among HCWs (Aluko *et al.,* 2016).

Significant morbidity and mortality among these professionals would ultimately result in the loss of skilled personnel, putting a burden on healthcare services in many poor and medium-income countries (Ndejjo *et al*., 2015). Also, according to Aluko *et al.(*2016), some of the major contributors to occupational illnesses and injuries in Health Care Facilities (HCF) include healthcare workers' negligence and carelessness, a lack of adequate protective aids and equipment, insufficient number of staff, an excessive workload, a failure to follow basic safety and hygiene guidelines, and a lack of operational knowledge of modern healthcare equipment. Occupational illnesses have been linked to physical injuries, economic losses, and psychological harm to HCWs and their dependents (Aluko *et al.*, 2016). The likelihood of hazards in health institutions varies greatly based on the type of facility. 80 % of women in the healthcare workforce are among the worst affected, with implications for their reproductive health. The HCP

has the greatest rate of non-fatal injuries and illnesses in any industry. Agriculture and construction have also become safer than health care facilities. At health facilities, infection control, injury prevention, and violence prevention must all be in place (Chhabra, 2016) . According to the linked research, 50.0 % of respondents in a study by Ndejjo *et al.,* (2015) reported encountering an occupational health hazard. Thirty-nine percent (39.5%) of them were exposed to biological dangers, whereas 31.5 % were exposed to non-biological hazards. Sharp injuries (such as needle sticks) accounted for 21.5 % of biological hazards, while cuts and wounds accounted for 17 % direct contact with contaminated specimens/bio-hazardous materials accounted for 10.5%, airborne diseases accounted for 19.0 %, infectious diseases and/or infections accounted for 7.5 %, and others (blood borne pathogens, vector-borne diseases, and bioterrorism) accounted for 7.5 %. Health care providers with stress were 21.5 %, and in non-biological hazards, dangers; physical, psychological, sexual, and/or verbal abuse was 10.5%.

Ambulance workers had the highest incidence of musculoskeletal system injuries among medical staff (Kahya & Sakarya, 2020). This is because EMTs perform a lot of lifting and movement as part of their job. In the event of an Acute Myocardial Infarction (heart attack), the EMT must get the patient into the ambulance if the patient develops a dangerous cardiac rhythm that requires shock, known as Ventricular Fibrillation. In such cases, personnel cannot remain in their seats with their seat belts fastened while performing interventions on the patient. If the ambulance brakes suddenly or maneuvers unexpectedly during such operations, EMTs are exposed to a great deal of danger (Kahya & Sakarya, 2020).In providing such interventions to patients in the ambulance, personnel risk injuring themselves by hitting their heads on sharp corners of drawers and cabinets, as well as infecting themselves with diseases, due to the position and size

imperfections of the seats in the patient compartment of the ambulance, because the items used during treatment cannot be conveniently disposed of because the ambulance's garbage bins are not in a convenient location for EMTs to access while seated (Kahya & Sakarya 2020). Another cross-sectional study conducted in Uganda among healthcare workers in a tertiary hospital reported needle stick injuries prevalence of 67.8% and cuts from sharp related objects of 31.7%. EMTs who drive the Ambulance during emergency calls are at higher risk of road accidents. These are serious problems that lead to injury and death to emergency responders (Hsiao *et al*., 2018).

2.2.1 Types of Occupational Hazards

EMTs as part of healthcare workers operate in an environment that is considered to be one of the most hazardous occupational settings (Ndejjo *et al.,* 2015). Also, EMTs encounter varied occupational hazards due to their work-related activities. Exposure to these occupational hazards lead to morbidity and mortality among health workers which leads to the loss of trained personnel (Ndejjo *et al.,* 2015). While trying to ensure the health of patients and the public, healthcare care personnel face a wide range of hazards to their health due to injuries (needle prick, musculoskeletal, allergens), infections (viruses, bacteria, parasites), violence, and so on (Chhabra, 2016). Common hazards experienced by health care workers include biological, ergonomics, physical, and psychosocial hazards (Hamid *et al.,* 2018).

2.2.2 Biological hazards

Biological hazards refer to organisms or organic matter produced by these organisms that are harmful to human health. These include parasites, viruses, bacteria, fungi, and protein. In general, there are three major routes of entry for these micro-organisms into

our body, i.e., through the respiratory system, transmission through contact with body fluids of the infected, or contact with contaminated objects. The harmful effects posed to human health by these biological hazards are mainly of three types - infections, allergies, and poisoning (2003 Occupational Safety & Health Council, n.d.). Biological hazards comprise needle stick injuries, exposure, and susceptibility to infections such as tuberculosis, hepatitis, and HIV/ AIDS occurring through direct and indirect body contact (Hamid *et al.,* 2018). Exposure to blood can occur from a sharp's injury, such as a needlestick after use on a patient or a cut from a contaminated sharp object. Exposure can also occur from a splash to the eyes, nose, or mouth; contact on non-intact (broken or cracked) skin; or a human bite (NIOSH, 2010). California paramedics had one-quarter the national rate of needlesticks and half the national rate of all exposures to blood. The national sharps injury rate for paramedics was also high compared with most hospital workers.

The primary routes of getting affected are direct contact, droplets, and airborne. Droplets containing infectious agents are generated through cough, sneezing, talking, or certain medical procedures, such as suction or endotracheal intubation (Chhabra, 2016). Elimination of the source of contamination is fundamental to the prevention and control of biological hazards. Engineering controls such as improvement of ventilation, partial isolation of the contamination source, installation of negative pressure and separate ventilation and air conditioning system (e.g., in medical wards for infectious diseases), and the use of ultraviolet lamps can help contain the spread of contaminants. If contact with biological hazards cannot be prevented, the employees must use personal protective equipment and adhere strictly to the practice of personal hygiene. The personal

protective equipment includes masks, gloves, protective clothing, eye shields, face shields, and shoe covers (2003 Occupational Safety & Health Council, n.d.).

2.2.3 Ergonomic hazards

Work-related musculoskeletal disorders (WMSDs) are most often experienced by medical professionals i.e., EMTs. Ergonomic hazards included muscle aches/ muscle sprains, carpel tunnel syndrome, chronic back pain, elbow/wrist/ hamstring/neck pain, the problem with body posture, excessive stretching of muscles, bending/ twisting as well as lifting heavy loads multiple times at work (Hamid *et al.*, 2018). Ergonomic hazards in workplaces results from improperly adjusted workstations, frequent lifting, awkward posture, repetitive actions, frequent excessive force exertion and vibrations. Sources of chemical hazards in workplaces also include; paints, acids, solvents-especially if chemicals containers are not labeled or not labeled appropriately, vapours, fumes from welding or solvents, gases like acetylene, propane, carbon monoxide, flammable materials like gasoline, solvents and explosive chemicals and pesticides (Of *et al.*, 2018). The HCWs face high ergonomic risks and therefore have greater potential for musculoskeletal issues along with other work-associated injuries. According to an estimate, more than 5000 injuries among HCWs have been reported annually. These are mainly attributed to the manual handling of patients and excessive workloads (Hamid *et al.,* 2018).

2.2.4 Psychosocial hazards

Psychosocial hazards are defined by the International Labour Organization (ILO, 1986) in terms of the interactions among job content, work organization and management, and other environmental and organizational conditions, on the one hand, and the employees'

competencies and needs on the other (Jain, 2019). Psychosocial hazards included physical abuse, stress, and assaults from co-workers (Hamid *et al.*, 2018). Psychosocial hazards at work are aspects of work and situations that may cause a stress response which in turn can lead to psychological or physical harm (Worksafe victoria, 2021). Psychosocial hazards include work-related factors such as repetitive work, high workloads, and aggressive or abusive behaviours, including bullying and violence at the workplace (Worksafe victoria, 2021). EMTs are essential first responders in the community. The nature of ambulance work, the uncontrolled and often unpredictable environments, the everyday experience of trauma, and the cumulative nature of that trauma all play a key role in the development and impact of mental distress and psychological injury (Lawn *et al.,* 2020).

A study on the effects of emergency medical service work on the psychological, physical, and social well-being of ambulance personnel maintained that the rate of anxiety among paramedics was as high as 22%, with depression and suicidal ideation both at 10%. The study further revealed that apart from psychological impacts, a range of physical impacts resulting from the nature of ambulance work and exposure to occupational stress have also been reported. These include headaches, sleep disruption, muscular skeletal injuries, fatigue, dietary problems, weight gain, and, in some cases, exposure to dangerous pathogens (Lawn *et al.*, 2020).

2.2.5 Physical hazards

Physical hazards included trips/falls, exposure to x-rays, high noise levels and chemical spills, and the experience of skin burns (Hamid *et al.*, 2018). Potentially, physical exposures in the pre-hospital setting that the EMTs face consist of excessive noise

(Christian *et al*., 2017), patient handling, slip, falls due to wet floors of stairways, needle stick injuries (Chhabra, 2016), Ionizing radiation from x-ray, cold, electric and magnetic field from MRI. Physical hazards are generally perceptible. Physical hazards, unlike many microbiological, biological, and chemical hazards do not require laboratory analysis for their recognition or description (Bartram *et al.,* 2000). Noise is one of the most common physical hazards present in the occupational setting and a major occupational hazard in the field of EMTs. EMTs are said to be at risk of occupational hearing loss due to excessive noise exposure. (Hansen *et al.*, 2017) cited in their study that the use of a siren which produces a high pitch of sound affects the hearing of EMTs operating in ground ambulances.

It was also indicated in the study by (Christian *et al.,* 2017) that when the sirens were on, all noise values measured inside the cabin of the Ambulance exceeded the national occupational health regulation of 85 dB(A) as a mean of 96 dB(A) was measured. Christian *et al.,(*2017) also recounted that the overall pre-hospital noise exposure during emergency responses with ambulances exceeds the threshold defined in the E.U. Regulative for Noise (>80 dB(A). It was concluded in a study in Brazil that the sound pressure levels to which workers are exposed during working hours in ambulances are high and beyond compared to what is established by the Brazilian standard of 85 dB (A) (Oliveira & Santos, 2015). Control of physical hazards may involve their removal or reduction, if possible, or measures to prevent or reduce human exposure or to minimize the adverse effects of exposure (Bartram *et al.*, 2000).

2.2.6 Chemical hazards

EMTs are exposed to a variety of chemical hazards including cleaning agents used for housekeeping (excluding sterilization and disinfection of surgical or medical instruments), on floors, windows, washrooms, carpets, and other surfaces throughout the hospital and waiting areas. Some of these chemical hazards that may be a threat to EMTs when exposed include disinfectants, cleaning components, latex, etc. (Chhabra, 2016). The primary routes of exposure to cleaning agents are inhalation of aerosolized droplets or vapors and skin exposure with the risk of skin, and eye irritation (Chhabra, 2016). Cleaning and disinfecting products used by EMTs contain some chemical hazards that can cause or exacerbate asthma because of their sensitivity or irritant properties (Casey *et al.*, 2017). These chemicals include quaternary ammonium compounds, ethanolamine's, chlorhexidine, glutaraldehyde, ortho-phthalaldehyde, hexachlorophene, and chloramine-T (Casey *et al*., 2017).

2.3 Causes of Operational Injuries Suffered among EMTs

Responding to calls involving individual patients as well as large disasters and mass casualty occurrences, Emergency Medical Services (EMS) workers examine and manage the medical care of patients outside the hospital environment. Exposure to dangerous activities and situations, which may result in occupational accidents, is inherent in these emergency reactions (Reichard *et al.*, 2017). In a 2015 research of health workers in Kampala, Uganda, it was discovered that those who worked for longer periods were more likely to be exposed to biological and non-biological hazards. Long working days result in prolonged exposure to hazards and limited recuperation time, resulting in physiologic depletion that lasts till the next day (Ndejjo *et al*., 2015). Respondents who were under work-related stress were more likely to report occupational dangers,

according to the same study. Workplace pressures have been found to have detrimental consequences, such as compromising patient care and lowering the quality of life for both healthcare personnel and patients (Ndejjo *et al.,* 2015). There was inadequate information concerning ambulances and/or crew in the related literature, both national and international, that addressed the exposures and reflected some concerns identified due to the lack of ergonomic design of equipment. According to (Yusuff *et al.*, 2013), 60% of personnel had difficulty giving interventions to patients in the ambulance due to the narrow workspace in the patient compartment, 43 % had difficulty having workable access to treat the patient, and 57 % had difficulty reaching the ambulance's equipment. The findings of (Gilad *et al.,* 2007) study on "the ergonomic evaluation of the ambulance interior to reduce Paramedic discomfort and posture stress" revealed that (74%) of paramedics thought the location of the paramedic's seat was inefficient, (94%) thought the bench was uncomfortable, (77%) thought the bench and stretcher in the patient cabin were too far apart, and (86%) thought they needed something (Harari *et al.*, 2020).

Responders in a study done by Gilad (2007) indicated that the location of the paramedic's seat was unsuitable for performing most regular clinical interventions. Moreover, eye contact between the patient and the paramedic seated in the patient compartment was found to be problematic. As a result, for better accessibility to the patient, the paramedics (and the doctors) prefer to sit on the bench alongside the patient's stretcher (Gil ad *et al.*, 2007). According to the findings of the study on "work-related injuries and exposures among emergency medical service personnel due to interior design of ambulance" the most common work-related injuries and exposures among staff were hitting arms, legs, and other body parts on sharp corners (87 %), slamming of the rear door during the transfer of the patient into the ambulance with the stretcher (83 %),

and difficulty in treatment because the stretcher is positioned on the left side (69 %). The interior design structure accounted for 83 % of the exposures, followed by the narrowness of internal space (82 %), system insufficiency (82 %), and the improper layout of the ambulance cabin (81 %) (Kahya & Sakarya, 2020).

2.4 Impact of operational hazards on the performance of EMTs

Emergency Medical Services (EMS) employees in the United States have an extremely high risk of occupational fatality. EMS workers are expected to have a two-and-a-half times higher risk of occupational fatality than other American workers (P.Care, D.Slattery, 2015). Transportation events are responsible for most EMS fatalities (about 74%) (Harthi & Rachman, 2019). As a result, the transportation fatality rate for EMS employees is roughly five times greater than for other U.S. workers. Over 350 people were killed and almost 23,000 were injured in ground ambulance incidents between 1988 and 1997, according to reports (Slattery *et al*., 2015). Most respondents reported being diagnosed with either a sprain/strain or an exposure to a harmful substance in a study done by (Reichard *et al*., 2017) on the topic; Occupational Injuries and Exposures among Emergency Medical Services Workers. Respondents in the same survey stated that their trunk and neck were the most affected body areas (31%), followed by upper extremities (excluding hand) (16%), and hand (16%). (16 %).

Almost two-thirds of the workers (66%) were injured after working eight hours or less of their shift (95 %). As a result, half of the study participants (95%) did not complete their work shifts after suffering an injury at work. The majority of respondents (83%) said they were on a call when they were injured (Reichard *et al*., 2017). Furthermore, the most prevalent procedures respondents had at the time of their Emergency Department

(ED) visits were radiological treatments (i.e., x-rays, MRIs, or CT scans). Almost half of injured EMS workers (45%) said they were supposed to follow up with a healthcare provider after their ED visit (95 percent), and more than 80 percent of those said they did. More than half of those surveyed (55%) returned to work the day after their injury or on their next scheduled workday. (95%) said they missed one or more days of work due to their injury, 40% said they missed three or fewer days, and 16% said they missed 30 or more days (Reichard *et al.*, 2017). In the 30 days following their accident, injured workers reported some limits at home and work, the most prevalent of which was restricted lifting (Reichard *et al.*, 2017). Other restrictions included activities involving bodily motion (e.g., bending or twisting), limited use of the injured body part, and limitations in self-care and domestic chores including driving, shopping, and childcare. A few people said they were put on light duty at work. The majority of injured or exposed workers (85 percent), even those who experienced limitations, expected a full recovery.

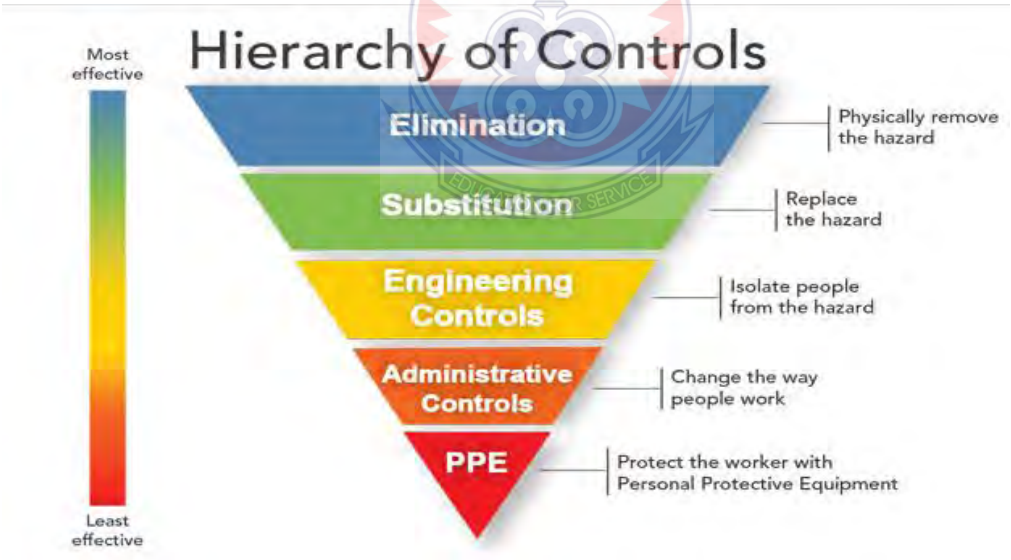
The nature of the work, including routine 'everyday' callouts and those that generated associated secondary or vicarious trauma, had a cumulative effect on ambulance personnel, according to another study conducted by (Lawn *et al.*, 2020) on the effects of Emergency Medical Service work on the psychological, physical, and social well-being of ambulance personnel. During and after the occurrence, they experienced frustration, helplessness, fear, and feelings of being overwhelmed because of this. The consequences of job stress on the psychological well-being of ambulance personnel deeply their psychosocial life (Lawn *et al.*, 2020). The growing build-up of emotions and continued encounters with stress led to compassion fatigue and self-blame (Lawn *et al.*, 2020). The above-mentioned signs and symptoms combined to create an environment that affected

personal relationships exacerbated feelings of isolation and withdrawal, and resulted in what they described as a tragic loss of compassion (Lawn e*t al*., 2020). The findings of this study also revealed that the professional environment and nature of ambulance personnel's work were well recognized as key contributors to stress, with a variety of repercussions on both mental and physical health. Excessive occupational demands, along with a lack of crisis support from employers, resulted in poor physical and mental health, higher sick leave, and decreased productivity (Lawn *et al.*, 2020), as well as increased total morbidity and physical and mental disorders (Lawn *et al.,* 2020).

The increased risk of probable aggressiveness and violence, particularly verbal abuse, which paramedics encountered added to their sense of work-related insecurity and vulnerability. This was exacerbated if concerns were ignored or under-reported because possible aggressiveness and violence were considered a "normal part of the profession" in many cultures (Lawn *et al.*, 2020). According to (Obono *et al*., 2019), Occupational injury or illness of a health care worker does not only affect the healthcare worker and his immediate family, but it also comes at a cost to the healthcare facility, the patient, and society. When a healthcare worker is injured, the hospital pays the worker's compensation for lost wages and treatment costs. Health care worker's occupational injury affects patient safety and satisfaction. Manual lifting of patients can injure the health care worker and also put the patient at risk of falls, fractures, bruises, and skin tears. Overtime is associated with worker fatigue, injury, and stress which can result in higher medication errors and patient infection (Obono *et al.*, 2019).

2.5 Measures proposed by EMTs to reduce the impact of operational hazards

To ensure a healthy and safe work environment there is the need to carry out most operational hazard control measures to help reduce exposure and injuries. It also involves an effective and efficient Hazard Identification Risk Assessment (HIRA) of the operational hazards at the workplace (Rout & Sikdar, 2017). This will help to determine what hazard to control at a particular point in time (Society, 2015). Measures for the prevention of occupational infections should aim to align with the hierarchy of controls commonly used for preventing exposures to hazards. The hierarchy of controls gives priority to highly effective measures, such as protection of all workers through engineering and administrative control, instead of relying only on measures dependent on individual behaviour, such as adherence to personal protection (*COVID-19 : Occupational Health and Safety for Health Workers*, 2021)



Source: NIOSH, 2015

Figure 2.1 Hierarchy of Controls

With the Hierarchy of Control, the most effective control appears at top of the pyramid whiles the least effective is the one at the bottom (NIOSH), 2015).

2.5.1 Hazard elimination

Eliminating serve as the most effective and efficient in the Hierarchy of Control. It is associated with controlling operational hazards being the most difficult to control in a prevailing process exposure. The best way to control a hazard is to eliminate it and remove the danger. This can be done by changing a work process in a way that will get rid of the hazard; substituting a non-toxic chemical for a toxic substance; having workers perform tasks at ground level rather than working at heights; and other methods that remove the hazard all together (Lorena & Mayorga Huerfano, 2011) . At the design stage, the elimination of hazards may be cheap and simple to implement ((NIOSH), 2015). To prevent body motion injuries, workers must be educated about injury prevention, eliminating physical risk factors when feasible, and implementing targeted strength and flexibility programs (Reichard *et al.*, 2017).

2.5.2 Substitution

The second best way on the hierarchy of control on the pyramid to control a hazard is to substitute something different in place of elimination that would be non-hazardous or less hazardous to workers (CCOHS, 2021). It is used when operational hazards are not able to be eliminated (Rout & Sikdar, 2017). Substitution is used to replace one substance with another to be able to achieve a lower level of risk (Lissner & Romano, 2011). This type of hazard control focuses on replacing the occupational hazard with something that serves the same purpose, thereby reducing the risk (Analysis, 2016). In protecting workers where necessary hazardous substances or processes are replaced using substitution, as far as is practical.

2.5.3 Engineering/environmental controls

If the hazard cannot be eliminated from the workplace, measures are taken to avoid or reduce the spread of the pathogen and its concentration in the work environment. For example, through adapted structural design conducive to patient flow and spatial separation for isolating patients, and design and repurposing of wards). Adequate ventilation, sanitation practices, infrastructure, 'touch-free' technology, sneeze guards and barriers; safer needle devices, and safe healthcare waste management are other critical elements. In a study conducted by (Kahya & Sakarya, 2020) on work-related injuries and exposure among Emergency Medical Service personnel, it was determined that although there are seat belts in the cabin of the ambulance, there are cases where the belt must be unfastened, and staff had to stand up to intervene the patient. In such cases, doctors, paramedics, or EMTs working in the patient compartment may encounter traumatic events like falling or hitting on somewhere. In such a case, the presence of sharp corners carries a risk to the staff in charge. It will therefore be appropriate to use soft covering over the sharps to help minimize injuries (Kahya & Sakarya, 2020).

2.5.4 Administrative controls

Gloves, mask or respirators and goggle or face shield are personal protection equipment often used in conjunction with engineering and administrative controls to provide protection for workers (Of *et al.*, 2018). Measures may need to be taken to change the way people work such as: restricting workplace access to essential workers with specific training and skills for protection; ensuring appropriate working hours; rostering and, where possible, avoiding workers being shifted from high to low transmission settings. Other helpful controls include the addition of surge personnel to meet work demands; rest breaks; time off between shifts; appropriate task delegation; supportive supervision;

'just-in-time' and refresher training on IPC practices; procedures for monitoring performance and giving feedback; paid sick and holiday leave; and policies for workers to stay home if unwell, or in self-quarantine and self-isolation, without loss of income.

As part of administrative control, The following best practices to reduce the impact of fatigue on driver performance were proposed in a recent study titled "A Research Study on Ambulance Operations and Best Practice Considerations for Emergency Medical Services Personnel" (Security & Group, 2015).

I. Management of Ambulance Driver Fatigue

Each year, around 6,500 ambulance crashes occur, injuring 10 people every day and killing nearly two people every month. Unnecessary speeding, insufficient driver training, driver exhaustion from long work hours, and inadequate dispatch processes can all be blamed for some of these collisions. Many EMS operations allow employees to work in two or three extended shifts (Security & Group, 2015). Fatigue is a term used to describe a general state of impaired mental and physical capability caused by a lack of restorative sleep or a disruption of the circadian rhythm, the body's natural biological clock that drives the body's cycle of sleeping at night and waking at daylight. On-the-job stress and poor personal habits can exacerbate this. Working night shifts, double hours, and "sleeping with one eye open" while waiting for the next emergency call are all common occurrences for EMS workers (Security & Group, 2015).

II. Provision of Education

Every programme developed to combat job-related fatigue considers education to be the first step. Employees who understand and appreciate the impact of fatigue on their work and personal lives are more willing to welcome change, especially change that affects

off-duty behaviour. Most of the education programmes are mandatory for all employees, including management, and include expert lectures, brochures, and other reference materials such as websites, instructive videos, and a hotline for employees (Security & Group, 2015). Education and training are key elements of workplace safety programmes, and this training will ensure that all staff is aware of potential hazards and how to prevent injuries. It will help raise safety and health knowledge across the workforce; provide employees with tools needed to identify hazards and help address potential problems before they arise (Obono *et al.,* 2019).

III. Design Rotating Shifts to Reduce Fatigue

To avoid a permanent night shift workforce, rotating shifts should be considered, as should providing adequate recovery time for personnel between shift changes. Although many workers desire a set shift schedule because of family obligations, research shows that most permanent night shift workers rarely become acclimated to their schedules (Security & Group, 2015). Regular night shift workers never catch up on deep sleep since daytime sleep has been determined to be less restorative than midnight sleep. Furthermore, most companies report that on their days off, night shift workers revert to a day schedule, disrupting their sleep patterns. If the shifts are rotated forward, from a day to an evening to a night shift, rotational shifts can help overcome the challenges presented by permanent shifts. When comparing shifts of 6, 8, and 12 hours, researchers discovered that 12-hour shifts offer the optimal balance of productive work and relaxation time for employees (Security & Group, 2015).

IV. Avoid Quick Shift Changes

Quick-shift changes, extended work periods, and overtime should be avoided whenever possible to maximize the amount of soothing sleep that employees can get. Night shifts should be limited to two to four nights in a shift, and staff should have at least 24 hours of rest before reporting to the next shift (Security & Group, 2015).

V. Provide Appropriate Length Off-Duty Shifts

Employees will be able to get the full 6-10 hours of sleep they require if off-duty shifts are longer than eight hours. Personnel will have more time to commute back to their homes, eat, and relax before sleeping (Security & Group, 2015).

VI. Provide Appropriate Workplace

Companies take steps to reduce employee fatigue and make the workplace more comfortable by maintaining a reasonable temperature, reducing excessive noise, and providing well-lit duty areas and dark, quiet sleeping facilities. To provide a brief reprieve to employees, some companies provide recreational spaces with comfortable furniture, televisions, and other leisure pursuits. Exercise equipment encourages employees to take a break from work and engage in physical activity on the job, which has been shown to temporarily improve alertness and efficiency (Security & Group, 2015). Sleep is the only thing that can make you feel better. To avoid starting a shift tired, EMS operators should sleep as much as possible before or between duty days. It has been discovered that developing a consistent sleep routine, such as going to bed and waking up at the same time each day, makes it simpler to fall asleep. Regularly relaxing before going to sleep will increase the quality of your sleep (Security & Group, 2015).

2.5.5 Optimal use of PPE

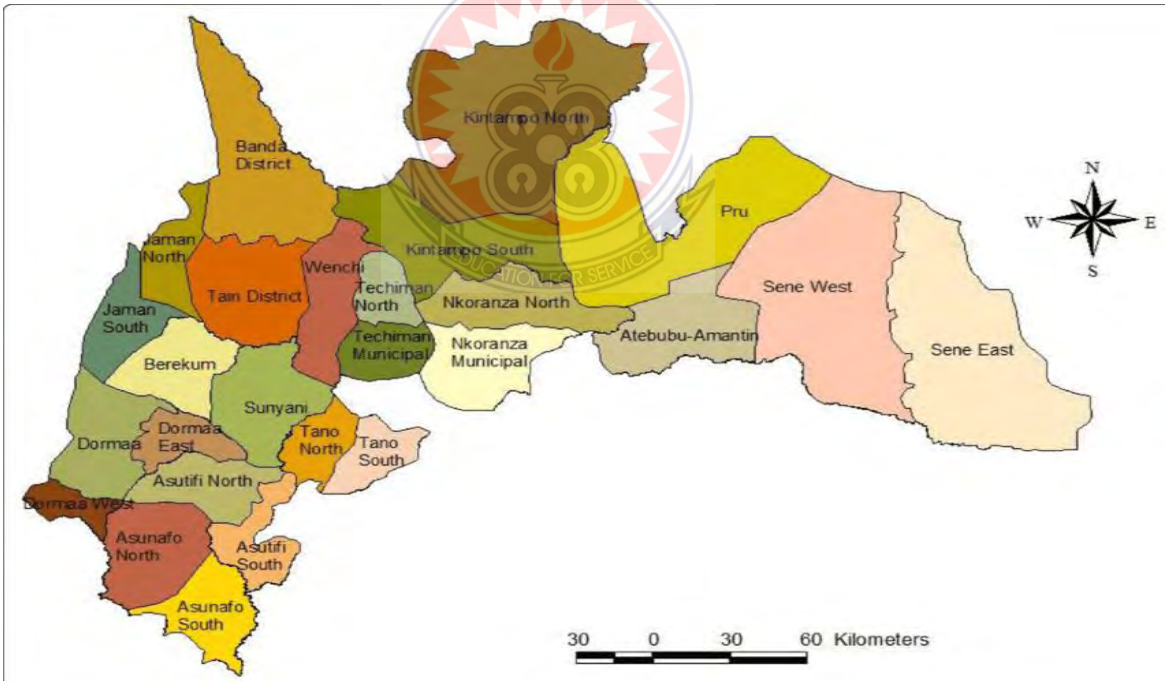
Measures should be in place to protect individual health workers from exposure, including the provision of adequate and appropriately fitted PPE based on risk assessment, the type of procedure to be performed, and the risk of infection during a procedure. Appropriate training and monitoring on the proper use and disposal of PPE are also important. The PPE used for protection against occupational infections should comply with standard technical specifications. PPEs when worn correctly, provide a barrier to protect healthcare workers from exposure to contaminated body fluids that may contain infectious agents. At the basic level, PPE protects the hands, eyes, nose, and mouth (Mossburg *et al*., 2019). Evidently from a study on occupational health hazards among healthcare workers in Kampala, Uganda, on hand washing practices, most health workers washed their hands before and after every procedure (79.5%) and after handling soiled materials (68.5%). Forty-six percent of health workers washed their hands when they were dirty while slightly over half (53.5%) did so after using the toilet (Ndejjo *et al.,* 2015).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

The then Brong-Ahafo Region was in the southern belt of Ghana. It was bordered to the north by the Black Volta River and the east by the Lake Volta and to the south by the Ashanti, Eastern, and Western regions. The capital of then Brong-Ahafo was Sunyani. The then Brong-Ahafo was created on 14th April 1959 from the then Western Ashanti predominantly inhabited by Akans. In 2019, a referendum led to the creation of three new regions out of the then Brong-Ahafo namely Bono, Bono East, and Ahafo regions. The study was conducted in these three new regions created out of the then Brong-Ahafo Region (GSS, 2019).



Source: Ghana Statistical Services (2019).

Figure 3.1 Regional map showing Bono, Bono East, and Ahafo regions of Ghana

STUDY SITES

3.1 Bono East Region

The Bono East Region of Ghana is a newly carved region out of the then Brong Ahafo Region of Ghana. The capital of the new region is Techiman.

3.1.1 Location and size

The Bono East Region is bordered on the north by the Northern region, on the west by the Bono Region, on the south by the Ashanti region, and on the east by the Volta Lake.

3.1.2 Climatic conditions of the study area

The Bono East Region is part of the vegetative belt of Ghana and enjoys a climate that is not harsh. The vegetation consists predominantly of forests and fertile soils. Between December and April is the dry season. The wet season is between July and November with an average annual rainfall of 750 to 1050 mm (30 to 40 inches). The highest temperatures are reached at the end of the dry season, with the lowest in December and January. However, the hot Harmattan wind from the Sahara blows frequently between December and the beginning of February. The temperatures can vary between 14 °C (59 °F) at night and 40 °C (104 °F) during the day (GSS, 2019).

3.1.3 Demography of Study area

The Bono East Region has a low population density, and, along with the official language of English, most inhabitants speak the Bono (Abron dialect) language. Christianity and the Akan religion form the dominant religions of the region.

3.1.4 Districts

The Bono East Region of Ghana contains 11 districts. They are: Atebubu-Amanten Municipal Kintampo Municipal, Kintampo South District, Nkoranza Municipal, Nkoranza North District, Pru-East District, Pru West District, Sene East District, Sene West District, Techiman North District and Techiman Municipal. Bono East, an ethnically diverse enclave, represents about two-thirds of the entire landmass of the then Brong-Ahafo Region.

Table 3.1 Districts and their capitals in the Bono East region

Name	Status	Population Census 2010-09-26	Projected Population 2020-09-26
Bono East (← Brong Ahafo)	**Region**	**904,156**	**1,133,768**
Atebubu-Amantin Municipal	Municipal District	105,938	132,818
Kintampo North Municipal	Municipal District	95,480	119,762
Kintampo South	District	81,000	101,494
Nkoranza North	District	65,895	82,622
Nkoranza South Municipal	Municipal District	100,929	126,593
Pru East	District	72,799	91,278
Pru West	District	56,449	70,746
Sene East	District	61,076	76,506
Sene West	District	57,734	72,383
Techiman Municipal	Municipal District	147,788	185,450
Techiman North	District	59,068	74,116
Ghana	**Republic**	**24,658,823**	**30,955,204**

Source: Ghana Statistical Service Geographical Information System (2019).

3.1.5 About Regional capital, Techiman

Techiman is a leading market town and one of two major cities and settlements of the region. Techiman is located on a historical crossroads of trade routes and the Tano River and serves as the capital of the Techiman Municipal District. Techiman celebrates the annual Apoo in April/May a kind of Mardi Grass. In August, an annual yam ceremony takes place, and it marks the end of the yam production in the former Brong-Ahafo Region towns of Techiman and Wenchi. Techiman is connected by road to Sunyani and its domestic airport, the Sunyani Airport. Techiman is not yet serviced by a railway station on the Ghana Railway Corporation, and it has been proposed that a line be extended to Techiman. The Tano River is navigable. The city borders four Districts/Municipalities namely, the Techiman North District to the north, Wenchi Municipality to the north-west, Nkoranza South Municipality to the southeast in the Brong Ahafo Region, and Offinso North District to the south in the Ashanti Region. The population of the Municipality according to the 2010 Population and Housing Census stands at 147,788 with 71, 732 males and 76,056 females with a population density of 227.7 persons per square kilometer (GSS, 2019).

The city of Techiman is blessed with large trading activities, strategically located to serve the people of Ghana and across the West African sub-region. The Techiman market, which has become a daily affair, is believed to be the largest of its kind in the West African Sub-region. The city has earned itself the food basket of Ghana, thus attracting people from varied destinations and generating huge sums of revenue for the government. Techiman is the commercial nerve center of the Brong Ahafo Region with a very active financial market. The city has a total of fifteen commercial banks and over thirty microfinance institutions as well as various insurance companies. Agricultural and

livestock practices are widespread in the Municipality. Dominants among them are cattle rearing, poultry, and marine or aquatic farming. The Bono Kingdom has various festivals which are celebrated among the people of Techiman. These festivals are "Apoo," "Fofie," and Yam festivals. The festivals uphold social interaction and settle family disputes among the people of the area. They also attract both domestic and international tourists during the weeklong celebration. Techiman and its environs are gifted with unique tourism potentials from natural and man-made perspectives.

3.2 Bono Region

3.2.1 Vegetation and Climate

The topography of this region is mainly characterized by a low elevation not exceeding 152 meters above sea level. It has a moist semi-deciduous forest, and the soil is very fertile. The region produces cash crops like cashew, timber, etc., and food crops like maize, cassava, plantain, cocoyam, tomatoes, and many others.

3.2.2 Location and Size

Bono Region shares a border at the north with the Savannah region, bordered on the west by Ghana-Cote d'Ivoire international border, on the east by Bono East, and on the south by the Ahafo region. It has a population of about 1,082,520 according to Ghana's statistical service in the 2019 census.

3.2.3 Tourism and parks

Bui national park covers 1,821-kilometer squares and covers part of the Black Volta River; Bui National Park is endowed with several species of antelopes and a variety of birds. It is also known for its hippopotamus population. The tourist can take a cruise on

the Black Volta River through the National Park. Bui dam is located at the base of the Banda Mountains; the Bui Dam was built to improve Ghana's energy requirements.

3.2.4 Education and Religion

The region can pride itself on having public institutions such as the University of Energy and Natural Resources, Sunyani Technical University plus many other Private Educational institutions. Akan religion and Christianity are the dominant religion within this domain.

3.2.5 Cultural and Social life

There are several cultural practices and festivals within this region; Kwafie is celebrated by the Dormaa, Berekum, and Nsoatre people in November, December, or January. It is celebrated to cleanse and feed the stools and gods respectively. It is climaxed with a large bonfire in the palace courtyard. It is believed that the people of Dormaa (Aduana) brought fire to Ghana and hence this legend is symbolically re-enacted. Akwantukese is celebrated by the people of Suma in March. (GSS, 2019).

Table 3.2 Districts and their population in the Bono region

Name	Status	Population Census 2000-03-26	Population Census 2010-09-26	Projected Population 2019-09-26
Bono (Brong Ahafo)	**Region**	**737,667**	**922,617**	**1,142,506**
Banda	District	...	20,282	25,701
Berekum Municipal (Berekum East Municipal / Berekum West)	Municipal District	93,235	129,628	159,950
Dormaa Central Municipal	Municipal District	...	112,111	139,955
Dormaa East	District	...	50,871	62,851
Dormaa West	District	...	47,678	59,986
Jaman North	District	...	83,059	102,829
Jaman South Municipal	Municipal District	...	92,649	114,257
Sunyani Municipal	Municipal District	...	123,224	151,378
Sunyani West	District	...	85,272	105,680
Tain	District	...	88,104	108,532
Wenchi Municipal	Municipal District	...	89,739	111,387
Ghana	**Republic**	**18,912,079**	**24,658,823**	**30,280,811**

Source: Ghana Statistical Service Geographical Information System (2019).

3.3 Ahafo Region

3.3.1 Demography

The Ahafo Region is newly created Region in Ghana with Goaso as its capital. The region had administrative and governmental legislature like all the ten already existing regions in Ghana. The region was carved out of the southeastern part of the Brong Ahafo Region and was in fulfillment of a campaign promise made by the New Patriotic Party. There are six administrative districts within the Ahafo region.

Table 3.3 Districts and their capitals in the Ahafo region

Name	Status	Population in 2010	Projected Population in 2020
Ahafo (Brong Ahafo)	Region	484,210	613,049
Asunafo North Municipal	Municipal District	124,685	157,870
Asunafo South	District	95,580	120,976
Asutifi North	District	52,259	66,141
Asutifi South	District	53,584	67,763
Tano North Municipal	Municipal District	79,973	101,305
Tano South Municipal	Municipal District	78,129	98,994
Ghana	Republic	24,658,823	30,955,204

Source: Ghana Statistical Service Geographical Information System (2019).

3.3.2 Location and size

The Ahafo Region is bordered on the north by the Bono region, the east by Ashanti Region, the west by the Bono region, and the south by the Western North Region and is made up of 6 districts. The Ahafo Region is part of the forest belt of Ghana and has vegetation that consists predominantly of fertile soil, grassland, and especially savanna with clusters of drought-resistant trees such as baobabs or acacias.

3.3.3 Climate and vegetation

The Ahafo Region is part of the forest belt of Ghana and has vegetation that consists predominantly of fertile soil, grassland, especially savanna with clusters of drought-resistant trees such as baobabs or acacias. Between December and April is the dry season. The wet season is between July and November with an average annual rainfall of 750 to 1050 mm (30 to 40 inches). The highest temperatures are reached at the end of the dry season, and the lowest in December and January. However, the hot Harmattan wind

from the Sahara blows frequently between December and the beginning of February. The temperatures can vary between 14 °C (59 °F) at night and 40 °C (104 °F) during the day (GSS, 2019).

3.4 Study Design

This research implored a quantitative type of research. A descriptive cross-sectional study was used to evaluate the operational hazards of the National Ambulance Service. The study focused on the operational hazards and risks, causes of operational injuries, the impact of the operational injuries, and the mitigating measures to reduce the impact of the operational hazards on EMTs.

3.5 Study population and sample size estimation

The study population for this study included EMTs in the operation unit of the various National Ambulance Service stations in the three (3) selected regions of interest namely Bono, Bono East, and Ahafo regions of Ghana. The population of EMTs in the three regions is estimated at 270. From all EMTs staff at the 29 NAS facilities, 250 study participants were selected for this study.

3.6 Sampling Technique

Purposive sampling was employed in selecting participants and sites for the study. The study regions Bono, Bono East, and Ahafo were selected purposively for this research. The selection of the respondents in the three regions was also purposive sampling. Respondents in the operation unit from the various service stations of the three regions were selected by census sampling technique.

3.7 Data Collection Tools

A structured questionnaire was developed by modifying the occupational health hazards risks tool from different studies in the literature to evaluate the operational hazards and risks associated with EMTs of the National Ambulance Service. The questionnaire was developed and divided into sections: socio-demographic characteristics of the respondents including age, marital status, education level, and their work experience; operational hazards; causes of these hazards, and injuries; consequences of injuries on the performance of the EMTs in their profession. The questionnaire developed was subsequently transformed into an electronic tool using Google form and deployed to participants' group WhatsApp platforms for them to download and complete, and return same via electronic means.

3.8 Data Collection Procedures

3.8.1 Pilot study

Pre-testing of the data gathering tool was done using in-hospital EMS staff of the Goaso Municipal hospital to ensure its validity and sequence. Before the main trial, the questionnaire linked to the electronic Google form was uploaded onto a WhatsApp platform and pre-tested with Android phones among in-hospital EMS to finalize changes and other input.

3.8.2 Data Collection Techniques

For the various operating stations, the questionnaires linked to the electronic Google form were uploaded to the respondents' WhatsApp platforms. Participants with Android phones downloaded the tool, followed the instructions, and completed the questionnaires before returning them electronically for cloud storage. Where participants could not be

reached via WhatsApp, the questionnaire was circulated to them for them to complete and return to the researcher.

3.9 Data Analysis

The data that was collected was edited to get rid of errors; the data was coded and then entered Statistical Package for Social Sciences (SPSS version 21) to allow for the analysis. Descriptive statistics such as frequencies, percentages were used to summarize the baseline characteristics appropriately. The results were presented in tables and charts. The chi-squared test or Fishers exact test was used for two-group comparisons of categorical variables to establish associations. Multiple regression analysis was used to determine the association between EMTs' sociodemographic variables and EMTs training on operational hazards.

3.10 Ethical Consideration/Issues

Ethical clearance for the study was obtained from the Kwame Nkrumah University of Science and Technology (KNUST)/Komfo Anokye Teaching Hospital (KATH) Committee on Human Research, Publications, and Ethical approval number of CHRPE/AP/350/20. In addition, clearance and permission were obtained from the National Ambulance Service Headquarters, in Accra. Permission from the regional administrators and respective officers in charge of the various stations of the NAS facilities was also sought. Written informed consent was obtained from participants. Based on the Data Protection Act, 2012 (Act 843) which emphasizes the fundamental rule that all who process personal data must take into consideration the right of that individual to the privacy of his or her communications, data generated in this project will only be used for the purpose stated. Participants were assured of their privacy and

confidentiality. Privacy and confidentiality of field data were insured by keeping all records in a pass-worded computer at the College of Agriculture Education, Asante-Mampong (CAGRIC) and were accessible to the principal investigator and the supervisors. All other hardcopy records obtained from participants were coded and kept under lock and key at the institution.

CHAPTER FOUR

4.0 RESULTS OF THE STUDY

4.1 Socio-demographic characteristics of EMTs

Table 4.1 Socio-demographic characteristics of EMTs

Variables	Frequency [N=250]	Percentage (%)
Age range		
20 – 29	141	56.4
30 – 39	86	34.4
40 – 49	23	9.2
50-60	0	0
Sex		
Female	58	23.2
Male	192	76.8
Educational level		
None	3	1.2
Secondary/SSCE/WASSCE level	170	68.0
Diploma	49	19.6
Degree	28	11.2
Level of Practice		
EMT Basic	224	89.6
EMT Advance	26	10.4
Experience (Years)		
1 – 5 years	10	72.0
6 – 8 years	49	19.6
Above 8 years	21	8.4
Marital status		
Divorced	1	0.4
Widowed	4	1.6
Married	118	47.2
Single	127	50.8
Religion		
Christian	139	55.6
Muslim	91	36.4
Traditional	20	8.0
Location of EMTs		
Rural ground	103	41.2
Urban ground	147	58.8

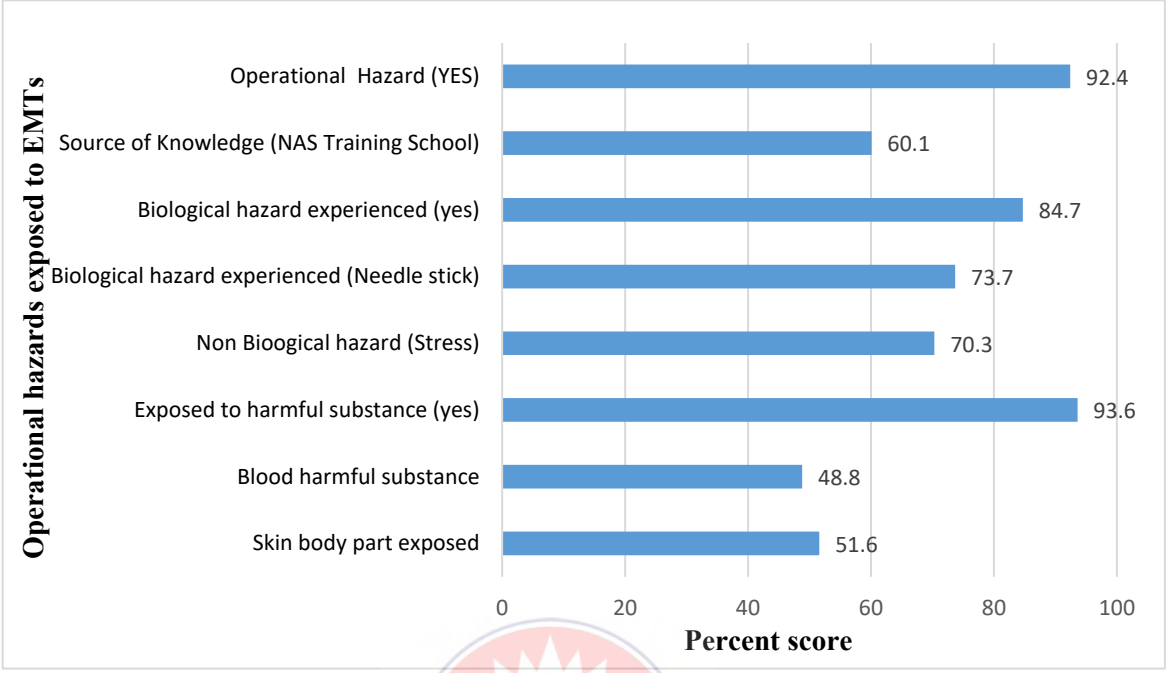
Source: Field Survey, (2020).

The study showed the socio-demographic characteristics of two hundred and fifty (250) respondents who were recruited for the study. The age of the respondents ranged from 20-60 years with a mean age of 27.8±8.21years. A majority (56.9%) of respondents were aged between 20-29 years with the age between 50-60 years being zero. A majority (76.8%) were males, 68.0% had attained secondary level education whilst 1.2% had no formal training. A majority (89.6%) of respondents practice at EMT Basic level with only 10.4% having practiced at the advanced level. 72.0% had worked between 1 and 5 years, whilst 8.4% had worked for more than 8 years. A majority (50.8%) of respondents were single, 55.6% were Christians and 58.8% of them lived in urban areas.

4.2 Operational hazards exposed to EMTS

The present study showed that (92.4%) of the respondents indicated operational hazards were associated with their work and (60.1%) indicated their source of knowledge on operational health hazards was from training at NAS. Also, (21.4%), (8.2%), (6.2%), and (4.1%) stated their source of knowledge on operational hazards as colleagues, friends, television, radio, and books respectfully. Most (84.7%) EMTs had experienced biological hazards of which the most reported exposures among respondents were indicated as cuts and wounds (73.7%), needle sticks (11.5%), airborne disease (8.2%), and blood-borne pathogens (6.6%). Most (93.6%) EMTs stated they had been exposed to harmful substances of which (48.8%) were exposed to blood, being spat on (12.2%), patient cough (14.7%), and needle pricks. Regarding the body part which received the most exposure, (51.6%) attested their skin, (31.9%), (16.5%) stated their face and eyes respectively. Generally, in this study as shown in figure 4.1, the experience of non-biological hazards by respondents was very high in stress (70.3%), whiles physical

/verbal abuse (13%), slips and falls (11.4%), noise, burns, radiation (4.5%) and fracture (0.8%) contributed to the rest.



Source: Field Survey, (2020)

Figure 4.1 Operational hazards exposed to EMTs

4.2.1 Operational hazards and PPEs usage

A majority, (81.2%) of EMTs believed that putting on PPEs would minimize exposure to harmful substances. The significance of putting on PPEs was better in this study as (96.0%) of the respondents stated that PPEs are important in reducing exposure to harmful substances. A majority (62.4%) of EMTs stated hand gloves were the most frequently used PPEs with the others being face mask (17.4%), protective goggles (10.3%), apron (6.2%), and overall coat (3.7%). All of the (100%) the respondents for this study agreed that operational hazards should be given urgent attention at workplaces.

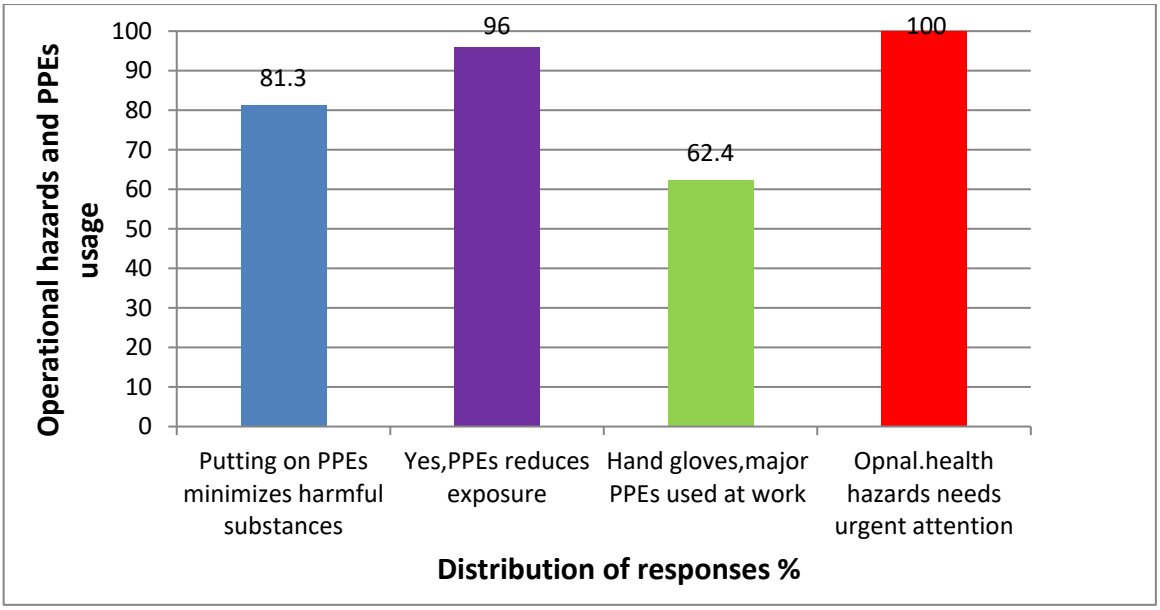


Figure 4.2 Operational hazards and PPE usage

4.3 Causes of operational hazards among Emergency Medical Technicians

In table 4.2 the study showed that (43.6%) of respondents always had an adequate supply of PPEs in the ambulance, (32.0%) stated sometimes, (22.0%) stated often, whilst the least (2.4%) stated not at all. A majority (67.6%) of EMTs indicated they worked between 8 – 12 hours a day whilst the least (1.6%) stated less than 8 hours a day. Meanwhile, (95.6%) of EMTs recounted they overworked whilst the least (3.4%) stated 'no' when asked if they perceived to be overworking, ninety-two percent (92.0%) and eight (8%), attributed their overworking to a lack of adequate staff and overwhelming accidents respectfully. The present study further showed that the majority of EMTs (94.8) responded that fatigue was one of the reasons that led to their injuries at work whiles (59.6%) indicated inadequate sleep as the cause of injuries. Although 62.7% of EMTs had training on operational hazards, 91% indicated that these trainings were occasional. A little above seventy-four percent (74.8%) of respondents were of the strong view that the location of the paramedic seat in the ambulance was not efficient, (77.6%) and (68.8%) had difficulty in reaching the patient and paramedics bag in the ambulance.

On the issue of working space in the ambulance, 60.8% of respondents claimed the space in the ambulance was inadequate and a greater chunk of respondents (80.8%) attested to the inefficiency of the position of the paramedic seat in the ambulance which does not support their work. Also, 68.4% of respondents claimed to have hit their head on sharp corners of the cabinet, and drawer edges, forty-five percent (45.2%) attributed this to lack of ergonomic interior design while 39.2% stated narrowness of the area as the cause. Thirty-four percent (34%) of respondents attested that they often encountered hitting their head on sharp corners of cabinets and drawers, 72.4% responded that other road users did not give way to the ambulance upon hearing the blurring of the siren. Thirty-four percent (34%) recounted the usage of good road networks whiles 17.7% responded that the road they use was very bad.

Table 4.2a Causes of Operational Hazards among Emergency Medical Technicians

Variables	Frequency	Percentage
Availability of PPEs during emergency		
Adequate	109	43.6
Inadequate	141	56.4
Daily work duration		
Less than 8 hours	4	1.6
8 – 12 hours	168	67.6
12 – 24 hours	77	30.8
Perceived overwork		
Yes	239	95.6
No	11	4.4
Factors contributing to overworking		
inadequate staff	230	92.0
Overwhelming emergencies	20	8.0
Is the location of the paramedic seat in the ambulance efficient?		
No	187	74.8
Yes	63	25.2
Difficulty in reaching patients in the Ambulance		
No	56	22.4
Yes	194	77.6
The closeness of paramedic bags to EMTs		
No	172	68.8
Yes	78	31.2
Assessment of working space in the ambulance		
Adequate	26	10.4
Not Adequate	152	60.8
Don't know	72	28.8
Position of the paramedic seat in the ambulance, support work efficiency		
No	202	80.8
Yes	48	19.2
Experience with hitting head on sharp corners of the cabinet, drawer edges, etc in the ambulance		
No	52	20.8
Yes	171	68.4
If yes, the cause in the above		
Lack of ergonomic interior design	113	45.2
System deficiency	15	6.0
The narrowness of the area	98	39.2
Frequency of hitting on sharp corners		
Never	2	0.8
Rarely	18	7.2
Sometimes	60	24
Often	85	34
Always	53	21.2

Table 4.2b Causes of Operational Hazards among Emergency Medical Technicians

Variables	Frequency	Percentage
Compliance of other road users when they hear the siren blurring		
No	181	72.4
Yes	69	27.6
Rate of the road network		
Excellent	0	0
Very good	49	19.6
Good	86	34.4
Bad	71	28.4
Very bad	44	17.6
Fatigue leads to injuries at work		
Strongly Agree	237	94.8
Agree	9	3.6
Uncertain.	4	1.6
Hours of sleep		
Less than 8hrs	142	59.6
More than 8hrs a day	39	16.4
Don't know	57	23.5
Pressure at work		
Yes	197	89.5
No	23	10.5
Training on operational hazards		
Yes	153	62.7
No	91	37.3
Frequency of training		
Once a while	221	91
Once every month	14	5.7
Once every week	9	3.7

4.4 Impact of operational hazards among Emergency Medical Technicians

Table 4.3 Impacts of operational hazards among EMTs

Variable	Frequency	Percentage
Injured during operation		
Yes	154	62.4
No	94	37.6
Mechanism of injury		
Collision with another object	91	59.1
The ambulance collision with another vehicle	26	16.9
The ambulance crashed by another vehicle	6	3.9
Sudden brake	31	20.1
Body part involved		
Back	79	51.3
Head	18	11.7
Multiple body part	57	37.0
Treatment for the ailment		
General medical care	125	81.2
Diagnostic test	20	13
Rehabilitation	1	0.7
Don't know	8	5.2
The impact of an injury on a person's ability to work.		
Greatly	92	59.7
Somehow	39	25.3
Very greatly	14	9.1
Don't know	9	5.8
Source of injury		
Caring for patient	106	68.8
Climbing the ambulance	11	7.1
Offloading patient	12	7.8
Worker motion position	25	16.2
Cause of injury		
Slips, trips	81	52.6
Fall to a lower level	36	23.4
Overexertion in lifting	22	14.3
Exposed to harmful substances	11	7.1
Assault, Violent	4	2.6
Do you usually get these kinds of injuries?		
Yes	151	98.7
No	2	1.3
The frequency with which this injury occurs		
Once a while	112	95.7
Every day on duty	2	1.7
Once every month	1	0.9
Once every week	2	1.7
How long do you usually take off after an injury?		
Missed 3 or a few days of work	76	50.3
On the same day of injury	45	29.8
More than a week	30	19.9
Rate of operational injuries at work		
Very high	17	11.2
High	113	74.3
Medium	14	9.2
Low	8	5.3
Health rate after injury		
It sometimes affects my ability to come to work	106	69.3
Everything is normal	38	24.8
It often affects my ability to work	9	5.9

Source: Field Survey, (2020)

The study showed that (62.4%) of EMTs had been injured during their operation, and (59.1%) attested that collision with other objects was the mechanism of their injury. Fifty percent (51.3%) of EMTs stated that their back was the body part that was mostly involved in the injury. Table 4.3 showed that 81.2% sought general medical care after their injury 5.2% did nothing about their injury. More than sixty percent (66.7%) claimed that caring for the patient was what resulted in their injury with a little more than half stating that slips and trips caused their injury. Almost all the respondents (98.7) affirmed that they normally experience these injuries occasionally. Meanwhile, 50.3% missed 3 or few days of work, 74.3% stated that the rate of operational injuries at work was high. Almost seventy percent of respondents (69.3%), claimed that their injury sometimes affects their ability to come to work.

4.4.1 Emergency Medical Technicians' current health problems

Regarding EMT's current health status, 51.4% had back pain, 28.4% had abdominal pain, 28.4% had restrictions in their arms, 26.8% had hearing difficulties, 25.9% had visual limitations,22.2% had chest pain, and 13.2% difficulty in breathing. (Figure 4.3) Other health challenges reported by EMTs were speech problems (0.08%), psychological problems (4.1%), headache or migraine (30.9%) reported, and skin problems (2.1%).

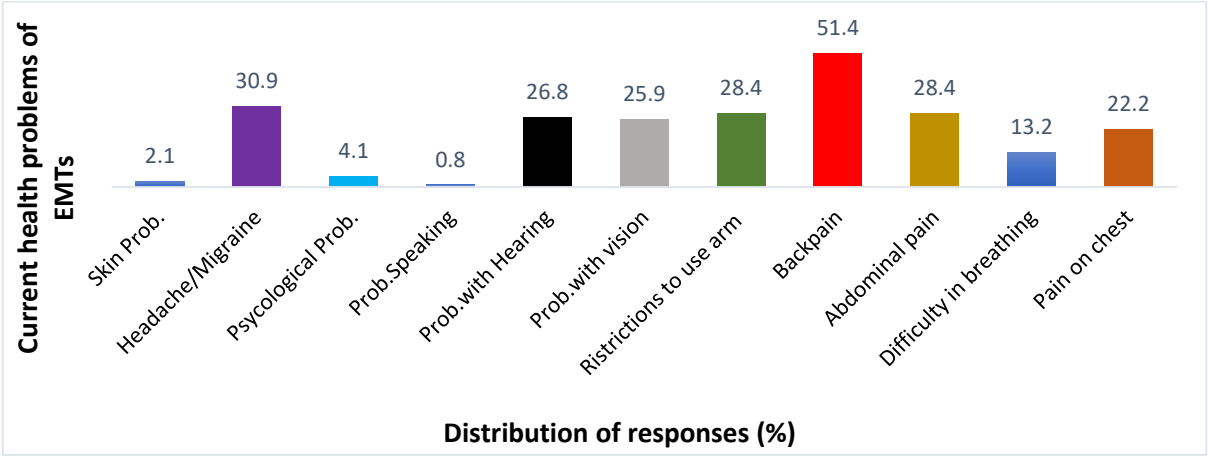


Figure 4.3 Respondent's current health problems

4.4.2 Measures to control hazards among EMTs

On EMTs' measures to control hazards, the majority, (76.4%) stated regular inspection of the Ambulance as a measure, and (80.0%) responded that they practiced hand washing after every intervention. A very good number of respondents (73.2%) stated that the conduction of regular inspection of equipment in the ambulance was a measure to control hazards. Other EMTs, (61.6%) testified that they were trained on how to operate the various equipment in the ambulance as a measure to control hazards. As presented in (Figure 4.4), slightly more than half of the respondents (62.6%) stated that routine or preventive maintenance of equipment and ambulance was one measure used to control hazards while only (34.0%) stated services with an operational hazards control plan as a measure to control operational hazards.

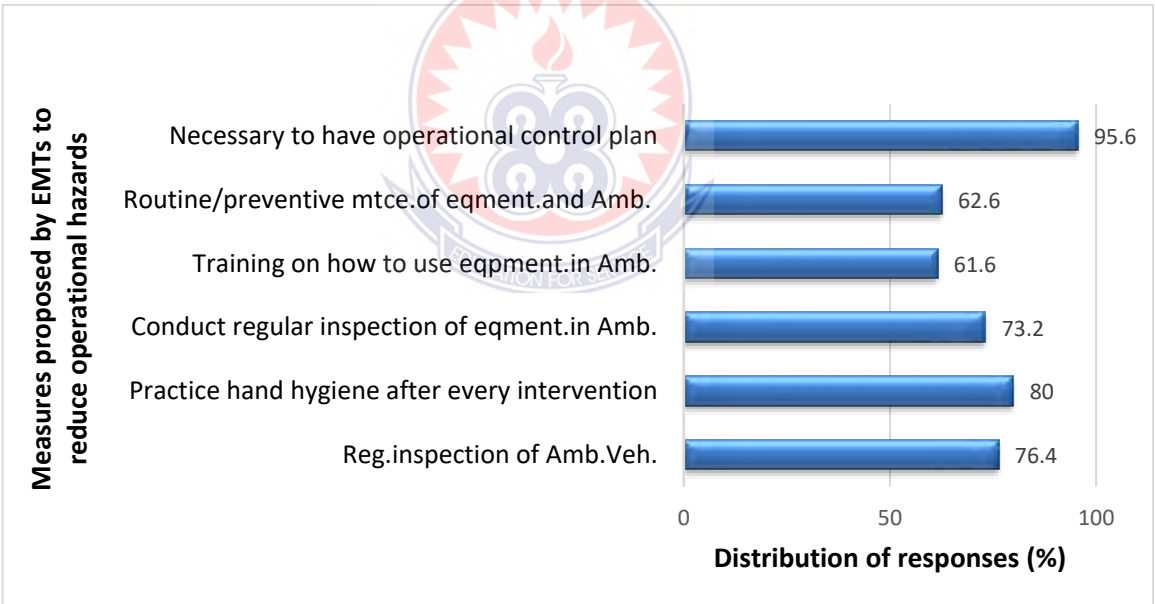


Figure 4.4 Measures to control operational hazards

4.5 Association between socio-demographic characteristics of EMTs and respondents exposure to operational health hazards

Table 4.4 Shows a significant association between religion and EMTs exposure to operational health hazards (x^2=9.74p<0.008). EMTs who were Muslims were 0.24 times

less likely to be exposed to operational health hazards relative to Christians and other religions [AOR=0.24(0.05-1.06), p=0.040]

Table 4.4 Association between socio-demographic characteristics of EMTs and exposure to operational hazards

Variables	Perceived operational hazards		(χ^2) (p-value)	COR (95%CI) p-value	AOR (95%CI) p-value
	No[N=19]	Yes [N=228]			
Sex					
Female	11(8.4)	120(91.6)		1(base)	
Male	8(7.2)	103(92.8)	0.11(0.732)	10.90(5.88,20.22)0.732	1.07(0.29,4.01)0.910
Age					
20-29	9(6.4)	132(93.6)		1(base)	
30-39	6(7.2)	77(92.8)		0.87(0.29,2.55)0.807	0.53(0.13,2.08)0.366
40-49	4(17.4)	19(82.6)	3.41(0.182)		0.05(0.00,0.81)0.035
Marital Status					
Single	12(9.5)	115(90.6)		1(base)	
Married	7(6.0)	110(94.0)		1.63(0.62,4.31)0.317	5.23(1.04,26.2)0.044
Divorced	0(0.0)	1(100.0)			
Widowed	0(0.0)	4(100.0)	1.45(0.692)		
Religion					
Christian	6(4.3)	133(95.7)		1(base)	
Muslim	13(14.4)	77(85.6)		0.26(0.09,0.73)0.010	0.24(0.05,1.06)0.040
Others	0(0.0)	20(100.0)	**9.74(0.008)**		
Level of Practice Religion					
EMT Basic	18(8.0)	206(92.0)		1(base)	
EMT Advance	1(4.0)	25(96.0)	0.51(0.471)	2.09(0.26,16.41)0.481	1.89(0.03,92.4)0.748
Educational level					
None	0(0.0)	3(100.)		1(base)	
BECE/WASSCE	12(7.1)	158(92.9)		0.50(0.06,4.06)0.522	1.47(0.02,77.0)0.847
Diploma	6(12.2)	43(87.8)		0.27(0.03,2.41)0.245	1.56(0.03,77.9)0.822
Degree	1(3.7)	26(96.3)	2.39(0.494)		
Years of practice					
1 – 5 years	12(6.7)	168(93.3)		1(base)	
6 – 8 years	6(12.5)	42(87.5)		0.5(0.17,1.40)0.190	1.05(0.22,4.86)0.946
Above 8 years	1(4.8)	20(95.4)	2.097(0.350)	1.42(0.17,11.57)0.738	27.17(0.86,850.6)0.060
Location					
Rural Ground	5(4.8)	98(95.2)		1(base)	
Urban Ground	14(9.6)	132(90.4)	1.92(0.166)	0.48(0.16,1.38)0.174	**0.51(0.11,2.33)0.391**

Source: Field Survey, (2020).

4.6 Association between socio-demographic characteristics of EMTs and exposure to biological hazards

Table 4.5 showed a significant association between age and number of years EMTs have practiced and EMTs exposure to biological hazards (χ^2=22.87, p<0.001) and (χ^2=18.70, p<0.001). Respondents within the age category of 40 – 49 years were 0.14 times more likely to be exposed to biological hazards compared to 30-39 years and others [AOR=0.14 (CI: 0.02 – 0.77), p=0.025]. EMTs with diploma educational levels were 102.70 times more likely not to be exposed to biological hazards as compared to those with BECE or no formal education [AOR=102.7 (CI: 1.97 - 5335.1), P=0.022].

Table 4.5 Association between socio-demographic characteristics of EMTs and exposure to biological hazards

Variables	Experienced any biological hazards		(χ^2) (p-value)	COR (95%CI) p-value	AOR (95%CI) p-value
	No[N=38]	Yes [N=203]			
Sex					
Female	15(11.6)	114(88.4)			
Male	23(20.5)	89(79.5)	3.58(0.058)	0.50(0.25,1.03)0.061	1.20(0.44,3.27)0.710
Age					
20-29	13(9.4)	126(90.7)		1(base)	
30-39	13(15.5)	71(84.5)		0.56(0.24,1.28)0.171	0.55(0.18,3.27)0.288
40-49	11(47.8)	12(52.2)	**22.87(<0.001)**	**0.11(0.04,0.30)0.000**	**0.14(0.02,0.77)0.025**
Marital Status					
Single	17(13.6)	108(86.4)		1(base)	
Married	20(17.0)	98(83.0)		0.77(0.38,1.55)0.468	1.21(0.42,3.51)0.717
Divorced	1(100.0)	0(0)		1(empty)	
Widowed	0(0)	4(100.0)	6.77(0.079)	1(empty)	
Religion					
Christian	23(16.8)	114(83.2)		1(base)	
Muslim	15(16.5)	76(83.5)		1.02(0.50,2.08)0.952	1.97((0.72,5.35)0.182
Others	0(0)	20(100.0)	3.94(0.139)	1(empty)	
Level of Practice Religion					
EMT Basic	33(14.9)	189(85.1)		1(base)	
EMT Advance	5(19.2)	21(80.8)	0.34(0.559)	0.73(0.25,2.08)0.560	3.07(0.26,35.73)0.369
Educational level					
None	0(0)	3(100.0)		1(empty)	1(empty)
BECE/WASSCE	22(13.1)	146(86.9)		2.21(0.84,5.81)0.107	4.27(0.47,38.04)0.193
Diploma	9(18.4)	40(81.6)		1.48(0.48,4.54)0.492	4.74(0.46,48.88)0.190
Degree	7(25.0)	21(75.0)	3.55(0.314)	1	1(omitted)
Years of practice					
1 – 5 years	17(9.4)	163(90.6)		1(base)	
6 – 8 years	13(27.7)	34(72.3)		0.27(0.12,0.61)0/002	0.39(0.13,1.16)0.091
Above 8 years	8(38.1)	13(61.9)	**18.70(<0.001)**	0.16(0.06,0.46)0.001	0.72(0.13,3.86)0.706
Location					
Rural Ground	12(11.9)	89(88.1)		1(base)	
Urban Ground	26(17.7)	121(82.3)	1.55(0.212)	0.62(0.30,1.31)0.215	**0.51(0.18,1.47)0.218**

Source: Field Survey, (2020).

4.7 Association between socio-demographic characteristics of EMTs and exposure to non-biological hazards

Table 4.6 shows no statistically significant association between the socio-demographic characteristics of EMTs and exposure to non-biological hazards.

Table 4.6 Association between socio-demographic characteristics of EMTs and exposure to non-biological hazards

Variables	Experienced any non-biological hazards		(χ^2) (p-value)	COR (95%CI) p-value	AOR (95%CI) p-value
	No[N=14]	Yes [N=227]			
Sex					
Female	9(6.9)	120(93.0)		Ref.	
Male	5(4.5)	107(95.5)	0.69(0.406)	1.60(0.52,4.93)0.409	4.50(0.69,28.93)0.113
Age					
20-29	6(4.3)	133(95.7)		Ref.	
30-39	4(4.8)	80(95.2)		0.90(0.24,3.29)0.876	1.03(0.14,7.29)0.975
40-49	3(13.0)	20(87.0)	3.07(0.215)	0.30(0.06,1.29)0.108	0.01(0.00,0.59)0.024
Marital Status					
Single	8(6.4)	117(93.6)		Ref.	Ref.
Married	6(5.1)	112(94.9)		1.27(0.42,3.79)0.661	1.03(0.14,7.29)0.340
Divorced	0(0)	1(100.0)			1(empty)
Widowed	0(0)	4(100.0)	0.50(0.918)		1(empty)
Religion					
Christian	6(4.3)	133(95.7)		Ref.	Ref.
Muslim	8(9.0)	81(91.0)		4.96(2.87,8.57)0.000	0.37(0.06,2.20)0.280
Others	0(0)	20(100.0)	3.52(0.172)	1(empty)	1(empty)
Level of Practice Religion					
EMT Basic	12(5.4)	210(94.6)		1(base)	Ref.
EMT Advance	2(5.7)	24(94.3)	0.22(0.633)	3.16(1.32,7.59)0.010	4.45(0.12,153.22)
Educational level					
None	0(0)	3(100.0)		1(empty)	1(empty)
BECE/WASSCE	8(4.8)	160(95.9)		0.37(0.16,0.84)0.018	46.10(1.88,1126.6)0.019
Diploma	3(6.1)	46(93.9)		1.21(0.46,3.18)0.687	102.70(1.97,5335.1)0.022
Degree	3(10.7)	25(89.3)	1.79(0.616)	1(omitted)	1(omitted)
Years of practice					
1 – 5 years	8(4.5)	170(95.5)		Ref.	Ref.
6 – 8 years	6(12.2)	43(87.8)		0.55(0.28,1.07)0.082	1.04(0.14,7.47)0.969
Above 8 years	0(0)	21(100.0)	5.70(0.058)	1.25(0.50,3.10)0.620	
Location					
Rural Ground	4(3.8)	99(96.2)		Ref.	
Urban Ground	10(6.9)	135(93.1)	1.02(0.311)	27.79(12.44,62.06)0.000	0.26(0.04,1.63)0.152

Source Field Survey, (2020).

4.8 Association between socio-demographic characteristics of EMTs and overwork

Table 4.7 shows a significant association between religion and the location of EMTs on work overload of EMTs (χ^2=6.75, p<0.034) and (χ^2=4.89, p<0.027) respectively. Respondents who were in urban areas were 0.04 times less likely to overwork than those in the rural [AOR=0.04 (CI: 0.00 – 0.57), p=0.018].

Table 4.7 Association between socio-demographic characteristics of EMTs and overwork

Variables	EMTs overwork		(χ^2) (p-value)	COR (95%CI) p-value	AOR (95%CI) p-value
	No[N=11]	Yes [N=232]			
Sex	7(5.3)	124(94.7)		1(base)	Ref.
Female	4(3.6)	108(96.4)	0.43(0.508)	1.52(0.43,5.34)0.510	2.68(0.39,18.03)0.310
Male					
Age					
20-29	5(3.6)	136(96.4)		1(base)	Ref.
30-39	3(3.6)	81(96.4)		0.99(0.23,4.26)0.992	0.53(0.05,4.84)0.581
40-49	3(13.0)	20(87.0)	4.43(0.109)	0.24(0.05,1.10)0.067	1.75(0,0)0.994
Marital Status					
Single	6(4.7)	121(95.3)		1(base)	Ref.
Married	5(4.2)	113(95.8)		1.12(0.33,3.77)0.854	5.56(0.52,59.02)0.154
Divorced	0(0)	1(100.0)		1	1
Widowed	0(0)	4(100.0)	0.26(0.966)	1	1
Religion					
Christian	3(2.2)	136(97.8)		1(base)	Ref.
Muslim	8(8.8)	83(91.2)		0.22(0.05,0.88)0.033	0.60(0.08,4.10)0.606
Others	0(0)	20(100)	**6.75(0.034)**	1	
Level of Practice					
Religion					
EMT Basic	10(4.5)	214(95.5)		1(base)	Ref.
EMT Advance	1(3.9)	25(96.1)	0.02(0.884)	1.16(0.14,9.51)0.884	0.38(0.00,848.4)0.806
Educational level					
None	0(0)	3(100.0)			
BECE/WASSCE	8(4.7)	162(95.3)		0.75(0.09,6.23)0.790	0.35(0.00,940.6)0.797
Diploma	2(4.1)	47(95.9)		0.87(0.07,10.05)0.911	5.16(0.00,12666.8)0.680
Degree	1(11.4)	27(96.4)	0.23(0.972)	1	1
Years of practice					
1 – 5 years	8(4.4)	172(95.6)		Ref.	Ref.
6 – 8 years	2(4.1)	47(95.9)		1.09(0.22,5.32)0.912	1.32(0.00,0.0000.995
Above 8 years	1(4.8)	20(95.2)	0.01(0.990)	0.93(0.11,7.82)0.947	1.4(0.00,0.00)0.994
Location					
Rural Ground	1(1.0)	102(99.0)		Ref.	Ref.
Urban Ground	10(4.4)	239(93.6)	**4.89(0.027)**	0.13(0.01,1.06)0.058	**0.04(0.00,0.57)0.018**

Source: Field Survey, (2020)

4.9 Association between socio-demographic characteristics of EMTs and training on operational hazards

Table 4.8 shows a significant association between years of practice and the location of EMTs, and training on operational hazards (χ^2=6.75, p<0.034) and (χ^2=4.89, p<0.027) respectively. Respondents with 6 – 8 years of working experience were 0.30 times more likely to be trained on operational hazards relative to those above 8 years and between 1 – 5 years [AOR=0.30 (CI: 0.13 – 0.72), p=0.007]. Also, EMTs who worked at the urban grounds were 0.30 times more likely to be trained relative to those in the rural grounds [AOR=0.30 (CI: 1.12 - 0.73), p=0.008].

Table 4.8 Association between socio-demographic characteristics of EMTs and training on operational hazards

Variables	Training on operational hazards		(χ^2) (p-value)	COR (95%CI) p-value	AOR (95%CI) p-value
	No[N=87]	Yes [N=155]			
Sex					
Female	38(29.0)	93(71.0)		Ref.	Ref.
Male	49(44.1)	62(55.9)	**5.97(0.014**)	0.51(0.30,0.87)0.015	0.61(0.27,1.37)0.235
Age					
20-29	44(31.2)	97(68.8)		Ref.	Ref.
30-39	31(37.4)	52(62.6)		0.76(0.43,1.34)0.347	1.21(0.57,2.57)0.603
40-49	16(69.6)	7(30.4)	**12.51(0.002)**	0.19(0.07,0.51)0.001	0.46(0.09,2.23)0.341
Marital Status					
Single	48(37.8)	79(62.2)		Ref.	Ref.
Married	45(38.5)	72(61.5)		0.97(0.57,1.63)0.915	2.31(1.00,5.31)0.049
Divorced	0(0)	1(100.0)		1	
Widowed	0(0)	4(100.0)	3.05(0.383)	1	
Religion					
Christian	50(36.0)	89(64.0)		Ref	Ref.
Muslim	37(41.1)	53(59.0)		0.80(0.46,1.38)0.434	1.26(0.57,2.77)0.558
Others	6(30.0)	14(70.0)	1.11(0.572)	1.31(0.47,3.62)0.602	1.41(0.34,5.80)0.633
Level of Practice Religion					
EMT Basic	80(35.7)	144(64.3)		Ref.	Ref.
EMT Advance	13(52.9)	12(48.0)	2.54(0.110)	0.51(0.22,1.17)0.115	1.65(0.15,6.97)0.974
Educational level					
None	0(0)	3(100.0)			1
BECE/WASSCE	54(31.8)	116(68.2)		2.31(1.01,5.25)0.045	1.65(0.24,11.16)0.605
Diploma	25(51.9)	24(49.1)		1.03(0.40,2.64)0.945	1.08(0.16,7.31)0.930
Degree	14(51.9)	13(49.1)	**10.39(0.015)**	1	
Years of practice					
1 – 5 years	48(26.8)	131(73.2)		Ref.	Ref.
6 – 8 years	30(61.2)	19(38.8)		0.23(0.11,0.45)0.000	**0.30(0.13,0.72)0.007**
Above 8 years	15(71.4)	6(28.6)	**30.84(<0.001)**	0.14(0.05,0.39)0.000	0.50(0.10,2.34)0.383
Location					
Rural Ground	25(24.5)	77(75.5)		Ref.	Ref.
Urban Ground	*68(46.3)*	*79(62.7)*	***12.17(<0.001)***	*0.37(0.21,0.65)0.001*	***0.30(0.12,0.73)0.008***

Source: Field Survey, (2020).

4.10 Association between socio-demographic characteristics of EMTs and those injured during operation

Table 4.9 shows a significant association between sex, age, marital status, religion, and location of EMTs and those injured during operation (χ^2=10.32, p<0.001), (χ^2=16.30, p<0.001), (χ^2=55.56, p<0.001), (χ^2=79.62, p<0.001), and (χ^2=54.10, p<0.001) respectively. Respondents who were married were 0.18 times more likely to suffer an injury during operation compared to the others [AOR=0.18 (CI: 0.06 – 0.50), p=0.001]. Also, respondents who were Christians were 0.07 times more likely to experience injury during operation relative to other religions [AOR=0.07 (CI: 0.02 – 0.20), p<0.001].

Table 4.9 Association between socio-demographic characteristics of EMTs and those injured during operation

Variables	Injured during operation		(χ^2) (p-value)	COR (95%CI) p-value	AOR (95%CI) p-value
	No[N=87]	Yes [N=155]			
Sex					
Female	38(29.0)	93(71.0)		Ref.	Ref.
Male	55(49.1)	57(50.9)	**10.32(0.001)**	0.42(0.24,0.71)0.001	1.33(0.47,3.70)0.582)
Age					
20-29	38(27.0)	103(73.0)		Ref.	Ref.
30-39	45(53.6)	39(46.4)		0.31(0.18,0.56)0.000	0.51(0.199,1.33)0.174
40-49	10(43.5)	13(56.5)	**16.30(0.000)**	0.47(0.19,1.18)0.111	0.19(0.03,1.15)0.071
Marital Status					
Single	21(16.5)	106(83.5)		Ref.	Ref.
Married	72(61.0)	46(39.0)		0.12(0.06,0.22)0.000	**0.18(0.06,0.50)0.001**
Divorced	1(100.0)	0(0)			
Widowed	0(0)	4(100.0)	**55.66(0.000)**		
Religion					
Christian	19(13.7)	120(86.3)		Ref.	Ref.
Muslim	65(71.4)	26(28.6)		0.06(0.03,0.12)0.000	**0.07(0.02,0.20)0.000**
Others	10(50.0)	10(50.0)	**79.62(0.000)**	0.15(0.05,0.43)0.000	0.13(0.02,0.67)0.015
Level of Practice Religion					
EMT Basic	84(37.5)	140(62.5)		Ref.	**Ref.**
EMT Advance	10(38.5)	16(61.5)	0.00(0.924)	1.66(1.27,2.18)0.924	33.43(2.22,503.3)0.011
Educational level					
None	0(0)	3(100.0)			
BECE/WASSCE	68(40.0)	102(60.0)		1.12(0.50,2.52)0.775	4.48(0.38,52.68)0.233
Diploma	14(28.6)	35(71.4)		1.87(0.70,4.95)0.205	28.70(2.05,399.98)0.013
Degree	12(42.9)	16(57.1)	4.25(0.235)		
Years of practice					
1 – 5 years	75(41.7)	105(58.3)		Ref.	Ref.
6 – 8 years	12(24.5)	37(75.5)		2.20(1.07,4.50)0.031	2.26(0.74,6.91)0.151
Above 8 years	7(33.3)	14(66.7)	5.02(0.081)	1.42(0.55,3.71)0.464	2.51(0.34,18.12)0.359
Location					
Rural Ground	11(10.7)	92(89.3)		Ref.	Ref.
Urban Ground	83(56.5)	64(43.5)	**54.10(0.000)**	0.09(0.04,0.18)0.000	0.46(0.16,1.32)0.152

Source: Field Survey, (2020)

CHAPTER FIVE

5.0 DISCUSSION

5.1 Operational hazards associated with EMTs

Healthcare workers experience exposure to numerous occupational hazards due to the unique nature of their work (Aluko *et al.,* 2016). In this study, most respondents (92.4%) were aware of the operational hazards associated with their work and majority of them (60.1%) indicated training at the National Ambulance school was the source of their knowledge. Two-thirds of the respondents reported having suffered from biological hazards and most of which were cuts and wounds. This present study reported that EMTs with diploma educational levels were 102.70 times more likely not to experience biological hazards as compared to those with BECE or no formal education [AOR=102.7 (CI: 1.97 - 5335.1), P=0.022]. These findings agree with a study that showed that the level of education and working experience influenced the staff's knowledge of risk levels at a statistically significant level (Tziaferi *et al.*, 2011). The present study also revealed that (70.3%) of respondents claim that stress was the most nonbiological hazard experienced by EMTs.

The findings from this study were similar to a study by Ndejjo *et al.* (2015) who reported that 50.0% of respondents experienced an occupational health hazard and 39.5% biological hazards by healthcare workers with sharp related injuries (21.5%) and cuts and wounds (17.0%), while 31.5% experienced non-biological hazards. A study conducted among emergency medical providers found that 18.2% had at least one needle-stick injury within the past 12 months (Ganczak *et al.,* 2021). The results of this study also support a study among healthcare workers in Nigeria which reported that most

respondents perceived risk exposure to occupational hazards in the hospital whereas two-thirds of them perceived high-risk exposure to occupational hazards (Aluko *et al.,* 2016). PPEs were thought to decrease exposure to dangerous compounds by most respondents.

5.2 Causes of operational injuries suffered among EMTs

According to the present study, 43.6% of respondents said they always had an adequate supply of PPEs in the ambulance, 94.8% said fatigue was one of the causes of a work-related injury, more than half said they worked between 8 and 12 hours, and almost all the respondents said they overworked, which 92% blamed on a lack of adequate staff. According to a report by Ndejjo *et al.* (2015), long working hours result in prolonged exposure to hazards and limited recuperating time. According to a study by (Akagbo *et al.*, 2017) (74%) of healthcare practitioners in Ghana indicated that PPEs were not always available.

A cross-sectional study titled "occupational exposure to blood and body fluids among health care workers in Gondar Town, Northwest Ethiopia" found that respondents agreed that lack of readily available/insufficient personal protective equipment was significantly associated with occupational exposure to blood and body fluids (Abere *et al*., 2020). Moreover, half of the respondents stated the paramedic seat in the ambulance was ineffective, (77.6%) said it was difficult to reach the patient, and (68.8%) said the ambulance bag was too far away to reach, according to the findings of the current survey. A little more than half of EMTs thought the working area in the ambulance's patient compartment was inadequate, and 80.8% stated the paramedic seat's location is inefficient. The causes of operational hazards and risks faced by EMTs are further reinforced by a study by Yusuff *et al.* 2013, which found that (60%) of personnel had

difficulty reaching the patient, (43%) had difficulty accessing the equipment, and (57%) had difficulty reaching the patient. The outcomes are remarkably similar. According to the findings of Gilad and Bryan (2007), (74%) of paramedics thought the location of the paramedic's seat was inefficient, (94%) thought the bench was uncomfortable, and (77%) thought the bench and stretcher in the ambulance's patient compartment were too far apart. The present study also revealed that (68.4%) of respondents have bumped their heads on sharp corners of cabinets, drawers, and other objects, with (45.2%) citing a lack of ergonomic interior design as the cause. Ergonomic-related injuries pose a considerable health risk to workers, according to Ndejjo *et al.* (2015), and yet they are the most common occupational injury in the healthcare industry.

In the present study, more than half of the participants stated that this incidence occurs frequently in the ambulance. Sakarya *et al*. (2020) published a study in which (87 %) of respondents stated that they suffer from hitting their heads on sharp corners in ambulances and attributed this to the narrowness of the space, (82%) due to system deficiencies, and (81%) to a lack of ergonomic interior design (Kahya & Sakarya, 2020). Almost sixty percent (59.6%) of respondents said they get fewer than 8 hours of sleep per day, while 16.4% said they slept less than 8 hours per day. Long hours at work can induce emotional and physical stress, causing the ambulance driver to get drowsy on the road. Driving over an extended period causes a person to become weary or exhausted, which can impair their performance and reaction time when driving. Fatigue reduces visual efficiency and impairs sound decision-making, such as overestimating the distance to traffic signs and seeing bigger fluctuations in lane position (Roslin *et al*., 2021).

5.3 Impact of operational hazards on the performance of EMTs

The present study reported that slightly more than half (57.6%) of respondents stated that they had been injured through a collision with another object, and 3.8% of respondents reported that the ambulance crash with another vehicle was the mechanism of their injury. Up to 51.6% of respondents said that slips and trips caused their injuries, and that their back and multiple body parts were the most afflicted (45.9% and 11.5%, respectively). This suggests the need for improvement in the work environment and periodic education.

Almost all the respondents (>90%) said they got this injury regularly. More than half of respondents who had previously been injured said their injury had hampered their ability to work, and almost half (47.2 %) said they had lost three days of work because of their injury. In addition, 25.6% of respondents missed work for more than a week because of their injuries, whereas 28% returned to work the same day. Eighty-seven percent (87%) of EMTs sought medical attention, 12.7% requested diagnostic tests, and surprisingly, 5.1% of respondents did nothing to address their ailment. In contrast, according to a study on the "Prevalence and prevention of needle stick injuries among healthcare workers in a German university hospital," 50.4% of respondents did not report a needle stick injury they sustained at work, and only (20.9%) reported it regularly (Wicker *et al*., 2007). This research supports Reichard *et al.* 2017. study on EMS employees found that nearly two-thirds (66%) of the workers were injured after working eight or fewer hours of their shift. After the injury, half of the respondents did not finish their work shifts. However, half of the respondents (55%) returned to work on the same day as their injury or the following planned workday. Forty percent of individuals who said they lost one or more days of work due to an injury said they missed three or fewer days, while 16% said

they missed 30 or more days. In the same study by Reichard *et al*., 2017, injured workers reported a variety of limitations at home and at work in the 30 days following their injury, with lifting being the most prevalent restriction. Other restrictions included limited bodily motion (e.g., bending or twisting), limited use of the injured body part, and limitations in self-care and domestic duties including driving, shopping, and childcare.

5.4 Mitigating measures proposed by EMTs to reduce the impact of operational hazards

According to the findings of the present survey, 76.4 % and 73.2 % of respondents proposed that regular inspection of the ambulance and equipment, respectively, is a measure to mitigate the impact of operational hazards and risks. Another way to reduce hazards, a large percentage of respondents said that hand washing after each intervention reduces infection control to the bare minimum. This was supported by the findings of (Aluko *et al*., 2016) study's which found that all respondents were aware that hand washing was critical for preventing cross- infection after clinical procedures. More than half (61.7%) of healthcare workers washed their hands before and after every healthcare procedure or handling of blood and body fluid contaminated waste, according to a Cross-Sectional Study on Occupational Exposure to Blood and Body Fluids among Health Care Workers in Gondar Town, Northwest Ethiopia (Abere *et al.,* 2020). Respondents in this survey agreed with health workers in Kampala where 79.5 % of respondents said they washed their hands before and after every procedure and after handling soiled materials. In the same Kampala survey, 46% of health workers washed their hands when they were visibly dirty, whereas slightly more than half (53.5%) did so after using the restroom

(Ndejjo *et al*., 2015). More than half of the respondents in the present study also suggested routine equipment maintenance of the ambulance vehicle to reduce dangers. According to 34% of respondents, their service lacked an operational hazard control plan. Almost all the respondents (>95%) believed that having an operational hazard control plan was necessary, and a large majority of them said they had received operational hazard control plan training. Furthermore, the present study backs up a study conducted on Nigerian healthcare workers on the topic of "Knowledge, attitudes, and perceptions of occupational hazards and safety practices," in which 99.4% of respondents believed that occupational hazards should be prioritized and promptly considered as part of conducive work provisions in healthcare facilities, and 98.3% respondents believed that prevention and control of hazards in healthcare facilities should be prioritized (Aluko *et al.,* 2016). In a study by (Mossburg *et al.,* 2019), it was also shown that many countries lacked national occupational safety and health regulations that covered public health care facilities. It also urged all governments in Sub-Saharan Africa to develop regulations, standards, and management systems per the global WHO/International Labor Organization framework.

Other research emphasizes the importance of workplace safety culture, climate, and other factors in preventing EMS worker injuries. The impression of a robust safety climate among EMS personnel has been linked to twice the likelihood of adherence to safe work practices and fewer reported injuries (Reichard *et al.,* 2017). Longer work shifts, less familiarity with teammates, and worker fatigue, on the other hand, have all been linked to an increased risk of injury (Reichard *et al.,* 2017). Furthermore, a parallel study conducted among German health workers concluded that using safety measures was the best approach to protect employees against needle stick injuries. These devices are an

effective and vital tool for reducing needle stick injuries, and their implementation should improve the health and safety of medical personnel (Wicker *et al.,* 2007).

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Study Limitations

Several limitations hindered the generalizability and importance of the data from this study. All non-fatal case data was restricted to government-employed EMTs rather than private-sector EMTs in other parts of the country. The fact that the study was self-reported was one of its major shortcomings. To reduce the risk of bias, participants were given complete confidentiality of the data collected as well as anonymity. Participants were asked to be honest in their responses because there were no names on the questionnaire to determine who responded to what. Participants were also informed that the study was undertaken only for academic objectives to contribute to the expansion of NAS, namely by putting in place measures to provide a safe working environment and reduce EMT injuries and fatalities.

6.2 Conclusion

1. The study results indicated that a greater chunk of respondents perceived operational hazards in their work and a good number of these respondents have had training on operational hazards at the NAS training school.
2. The findings also revealed that EMTs are exposed to potentially harmful substances, with blood being the most common biological substance they encounter.
3. EMTs considered the Ambulances' work area as insufficient,EMTs always bump their heads on sharp corners of cabinets claiming a lack of ergonomic interior design as the cause.
4. Back pain injuries were the most common non-fatal injuries seen in this study, and blood-borne pathogens were the harmful substance they were exposed to. EMTs

were injured by trips and falls while caring for patients in the ambulance, with most of these injuries occurring because of caring for the patient in the ambulance.

5. Currently, it is difficult to calculate the number of exposures suffered by wounded EMTs. For example, there is no information on the number of infectious disease patients transported by EMTs.

6.4 Recommendations

Based on the findings of the study, the researcher recommends the following;

1. **The Government (MOH);**

- People who are knowledgeable in Ambulance design should be consulted when procuring the ambulance vehicle. Redesigning and rearrangement of compartment seating should be considered as part of a structured improvement.

2. **Management of National Ambulance Service**

- Should develop policies to foster a culture of awareness of occupational hazards and their impact on patient outcomes. These policies may include mandatory workshops and training on occupational hazards, as well as dedicated occupational health units in NAS to address the inadequacies in the safe provision of pre-hospital services, occupational hazards, and statistics on the healthcare environment to ensure that EMTs are adequately rehabilitated and protected.
- Should conduct regular education and training on safety practices at workplaces which will lead to an improved workforce and provide better healthcare delivery. NAS Management should also focus on educating EMTs on event-specific injury prevention, including the use of equipment to reduce body stress during lifts, carries, and transfers, as well as providing proper PPE and vehicle occupant restraints, as well as training on how to use them.

- Should do a risk assessment regularly to help uncover EMTs' exposure to risk factors so that systems and policies may be put in place to reduce some of the hazards to which EMTs are exposed. This will also assist track risk variables as they change over time.

3. EMTs

- EMTs must be educated and encouraged to put on the appropriate PPE when necessary. Appropriate sanctions should be applied to EMTs who refuse to adhere to these necessary safety protocols.

4. Future Research

- Should look at the percentage of back injury incidences among EMTs; the data revealed that up to a 51percent of EMTs experienced back pain as a major injury occurrence. More research is needed to figure out why EMTs have such high rates of back injuries. Following the preliminary reviews, the EMS system can begin developing, evaluating, and disseminating evidence-based best practices to mitigate the probe.

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APPENDICES

APPENDIX I: DATA COLLECTION INSTRUMENT (QUESTIONNAIRE)

Operational Hazards of the National Ambulance Service in the Bono, Bono East, and Ahafo Regions of Ghana

NO	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS I would like to start by asking you a few questions about yourself.			
Q1	Sex	Male.....1 Female 2	
Q2.	Age	≤ 19 ……...1 20-29……...2 30-39 ……...3 40-49 ……...4 50 ≥……...5	
Q3.	What is your current marital status?	Married (civil, traditional, religious) ……...1 Living together.....2 Divorced ……...3 Widowed……...4 Single……...5	
Q4.	What is your religion?	Christian .....1 Muslim.....2 Traditional/Spiritualist .....3 No religion .....4 Other (specify)……...5	
Q5.	What is your level of Practice?	EMT-Basic ……...1 EMT- Advance……2	
Q6.	Years of experience in EMS	3-5 years……...1 6-8 years……...2 9-11 years……...3 12-14 years……...4 15 years and above……...5	
Q7.	Educational Qualification	None……1 MSLC / BECE……...2 GCE 'O' LEVEL/ SSSCE / WASSCE……3 Diploma……4 Degree……...5 Others (GCE 'A', Postgraduate……6	
Q8.	Nature of employment	Full time……...1 Contract……...2	

Q9.	Geographical location of operation	Rural ground……1 Urban ground……2	

SECTION B: OPERATIONAL HAZARDS &RISKS ASSOCIATED WITH EMTs

Q10.	Are you aware of operational hazards and risks associated with EMTs?	Yes……..1 No……2	**Q12**
Q11.	Source of your knowledge	Training on Health and Safety at work……1 From colleagues at work……..2 Books……3 NAS Training School……...4 Television and Radio……5 From friends……6 Other (specify)…..7	
Q12.	Have you experience biological hazard before?	Yes ……...1 No……....2	**Q13**
Q13.	Which of the following biological hazards- have you experience before? **Multiple options-Please tick where appropriate**	Needle sticks……..1 Cuts and wounds……...2 Airborne diseases……3 Infectious diseases/infections……..4 Blood borne pathogens……5	
Q14.	Which of the following Nonbiological hazards have you experienced before? **Multiple options-Please tick where appropriate**	Stress……...1 Physical/verbal abuse……2 Musculoskeletal……..3 Slips,trips,falls……4 Fracture……5 Others (noise,burns,radiations etc)……6	
Q15.	Have you been exposed to harmful substance before?	Yes ……...1 No……....2	**Q19**
Q16.	What is the means of exposure? **Multiple options-Please tick where appropriate**	Blood/|Resp.Secretion..……...1 Being spit on by patient…..……2 Patient coughing……..3 Needle pricks……4	
Q17.	Which part of your body received most exposure?	Eyes……..……...1 Skin…….……2 Face……3	
Q18.	Do you recognize the importance of PPEs in reducing exposures?	Yes ……...1 No……....2	
Q19.	Operational health risk is an issue that should be taken seriously and given quick attention in your workplace	Strongly Agree..……..……..……1 Agree ……..……..2 Uncertain……..…3 Disagree ……..……4 Strongly disagree…….……..…..5	
Q20.	Prevention of operational hazards is a joint responsibility of the NAS management and EMTs	Strongly Agree..……..……..……1 Agree ……..…..2	

		Uncertain……..…3 Disagree …….……...……4 Strongly disagree…….……..5	
Q21.	Which of these PPE(s) do you normally use in your workplace?	Hand gloves……..…1 Protective goggles…….2 Face mask……..…...3 Apron…….……...4 Overall coat…….…..……5 Gum boot……..6 Others (Specify)……...……7	
Q22.	Do you put on seat belt when on emergency?	Yes ……...1 No…….....2	**Q23**
Q23.	Do you normally use emergency lights and sirens when on emergency?	Yes ……...1 No…….....2	
SECTION C. CAUSES OF OPERATIONAL HAZARDS AMONG EMTS			
Q24.	Are PPEs Adequate for use in the ambulance?	Always……1 Often……2 Sometimes……3 Not at all……..4	
Q25.	How long do you work in a day?	8hrs……..1 12hrs……2 24hrs……3 More than 24hrs……4	
Q26.	Do you think you overwork yourself?	Yes ……...1 No…….....2	**Q27**
Q27.	What do you attribute your overworking hours to?	Lack of staff……1 Lack of Ambulance veh……...2 Overwhelming emergencies……3 Don't know……..4	
Q28.	Fatigue is one of the reasons of injuries at the workplace.	Strongly Agree...……..……..……1 Agree ……...……..2 Uncertain……..…3 Disagree …….……4 Strongly disagree…….…….……..5	
Q29.	How many hours do you sleep a day?	Less than 8hrs……1 More than 8hrs a day……..2 Don't know……3	
Q30.	Do you get pressure at work?	Yes ……...1 No…….....2	
Q31.	Do you receive training on operational hazards?	Yes ……...1 No…….....2	**Q32**
Q32.	How often do you receive this training?	Once a while……..…1 Every day on duty……2	

		Once in every month……..….3 Once in every week…….,….4	
Q33.	Is the location of the paramedic seat in the ambulance efficient?	Yes ……...1 No…….....2	
Q34.	Do you have difficulty in reaching patients in the Ambulance?	Yes ……...1 No…….....2	
Q35.	Are the paramedics bags in the ambulance in close to you for use on the patient?	Yes ……...1 No…….....2	
Q36.	How do you assess the working space in the ambulance?	Adequate……..1 Not adequate……2 Don't know……3	
Q37.	Does the position of the paramedic seat in the ambulance support work efficiency?	Yes ……...1 No…….....2	
Q38.	Have you ever hit your head on sharp corners of the i.e cabinet, drawer edges etc in the ambulance?	Yes ……...1 No…….....2	**Q40**
Q39.	If yes, what do you think is the cause in Question 37?	Lack of ergonomic interior design……...1 System deficiency……2 Narrowness of the area……3	
Q40.	What is the frequency of hitting on sharp corners?	Never……1 Rarely……..2 Sometimes……3 Often……4 Always……5	
Q41.	Do other road users give way when they hear the siren blurring?	Yes ……...1 No…….....2	
Q42.	How would you rate your road network?	Excellent……1 Very good……2 Good……3 Bad……..4 Very Bad……5	
SECTION D. IMPACTS OF OPERATIONAL HARZARDS AMONG EMTs			
Q43.	Have you been injured during the operation of your work before?	Yes……1 No……2	**Q48**
Q44.	What was the mechanism of injury?	Ambulance collision with another vehicle…….1 Ambulance crashed by another vehicle…….2 Sudden brake……..3 Collision with another object……4	
Q45.	Which of your body parts was involved?	Trunk…… ..1 Back…….....2 Shoulder……..……..…..3 Head……..……..4	

		Ankle……..…..5 Knee…….……..….6 Multiple body parts…….7	
Q46.	What was the remedy to your injury?	General medical care……..……..……..1 Diagnostic test…….……..2 Rehabilitation…….3 Permanent impairment……...….4 Don't know…….……...……5	
Q47	Has the impact of your injury affected your performance?	Very greatly……1 Greatly……2 Somehow……3 Don't know…….4	
Q48.	What was your source of injury?	Worker motion position……1 Climbing the Ambulance…….2 Caring for patient…….3 Offloading patient……4	
Q49.	Which event led to your injury?	Fall to lower level…….1 Exposed to harmful substance……....2 Assault, Violent act..……...3 Over exertion in lifting……4 Slips, trips…….5	
Q50.	Do you normally experience these injuries?	Yes ……...1 No……....2	
Q51.	How long did you stay off duty after your injury?	Same day of injury……..1 Missed 1 or more days of work……..2 Missed 3 or fewer days of work……..3 30 or ,more days……4	
Q52.	Did your injury affect a variety of limitations at home?	Yes .....1 No 2	
Q53.	If yes, which of these did you go through	Restricted lifting.....1 Bending or twisting.....2 Household activities i.e., driving, childcare etc...3 Recreational activities……..4	
Q54.	Did you expect full recovery?	Yes .....1 No 2	
Q55.	How will you rate operational injuries at your workplace?	Very high……...1 High……...2 Medium……..3 Low……4 Very low……5	

SECTION E: MEASURES TO CONTROL HAZARDS AMONG EMTs			
Q56.	Does your service have operational hazard control plan?	Yes .....1 No 2	**Q54**
Q57.	Do you think it is necessary to have operational hazard control plan?	Yes .....1 No 2	
Q58.	Do you have routine or plan preventive maintenance of equipment and the Ambulance?	Yes .....1 No 2	
Q59.	Have you been trained on how to operate the various equipment in the Ambulance?	Yes .....1 No 2	
Q60.	Do you conduct regular inspection of equipment in the Ambulance?	Yes .....1 No 2	**Q58**
Q61.	Who is responsible for the inspection of the equipment in the Ambulance?	OIC……1 Crew head……..2 Quality control officer……3 All personnel……..4	
Q62.	Do you conduct regular inspection on the Ambulance vehicle?	Yes .....1 No 2	
Q63	Have you received safety education before?	Yes ……...1 No……....2	**Q61**
Q64	How often do you normally go for safety training?	Once a while……..…1 Every day on duty……2 Once in every month……...….3 Once in every week…….,….4	
Q65	Do you practice hand hygiene after every intervention?	Yes ……...1 No…….....	
	Hand hygiene reduces the rate of infection to the barest minimum?	Strongly Agree...……..……..……1 Agree ……...……..2 Uncertain……..….3 Disagree ……..……4 Strongly disagree…….……..5	**END**