



EVALUATING THE HAMAD MEDICAL CORPORATION AMBULANCE
SERVICES MAJOR INCIDENT RESPONSE TRAINING PROGRAM TO ASCERTAIN
KNOWLEDGE ACQUISITION AND RETENTION AMONGST FIRST RESPONDERS IN
QATAR

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By Naven Pullian

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This Thesis by Naven Pullian has been approved by the committee members below, who recommend it be accepted by the faculty of Unicaf University in Zambia in partial fulfilment of requirements for the degree of

Doctorate in Business Administration

Thesis Committee:

Dr Sankar Ganesh, Supervisor

Dr Isaak Papadopoulos, Chair

Dr Oluseyi Ajayi, External examiner

Dr James Mark Ngari, Internal examiner

Abstract

EVALUATING THE HAMAD MEDICAL CORPORATION AMBULANCE SERVICES MAJOR INCIDENT RESPONSE TRAINING PROGRAM TO ASCERTAIN KNOWLEDGE ACQUISITION AND RETENTION AMONGST FIRST RESPONDERS IN QATAR

Naven Pullian

Unicaf University in Zambia

Background: Hamad Medical Corporation Ambulance Services (HMCAS) employ staff from countries around the world including, Australia, Canada, India, Jordan, Morocco, New Zealand, Philippines, South Africa, Tunisia, United Kingdom as well as the United States of America. A mechanism to standardize the management of mass casualty incidents (MCI) by HMCAS paramedics was proposed through MIR training and a user-friendly MIR guide. Having an understanding and background knowledge of special circumstances such as Hazmat, mass gatherings and other special settings requires an understanding.

Aim: The aim of this study to determine if, and to what extent, HMCAS paramedics possessed MIR knowledge, skills and experience prior to completing the MIR training programme, determine the HMCAS paramedics' knowledge on mass incident response following the MIR training programme, and to evaluate the MIR training programme course content to prepare HMCAS paramedics to deal with major incident responses.

Methods: This was a quantitative cross-sectional study. A fit for purpose survey was created and then subsequently distributed to frontline operational paramedics and managers within HMCAS. Cronbach alpha was calculated to assess the survey's reliability whilst the Mann-Whitney U test was undertaken to make a comparison between the two independent groups. IBM-SPSS® (Statistical Package for Social Sciences) Version 26 was utilized for data analysis.

Results: 307 staff with varying backgrounds of major incident understanding and training completed the survey. With the Cronbach alpha being equal to 0.653, demonstrating a satisfactory level of reliability. The results highlighted assessment responses that revealed certain deficiencies in staff knowledge (acquisition and retention) of MIR concepts. The Shewhart control chart was used to understand the level of satisfaction amongst the themes identified and results showed that satisfaction was acceptable within the control limits.

Conclusion: Training themes were subsequently identified for both in-hospital and prehospital exposure to major incidents, were skills, training format, and the understanding of the current MIR guidebook all yielded a significant association with gaps identified in the current practice. The study had also identified areas for future research in governance, standard operating procedures, technology as well as training and exercises within HMCAS.

Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

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Dedication

This work is dedicated to the staff of Hamad Medical Corporation Ambulance Services, without them this thesis would have not been possible.

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This dissertation would have not been possible without the continued support of both family and friends. It is to them that I owe a deserved recognition.

To my wife Pravani Pullian and my daughters Mikayla and Gabriella Pullian, thank you for affording me the time in completing this degree, it has come at a cost of missing time spent together, but I do hope and pray that it shows you that anything is possible.

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List of Abbreviations and Acronyms

ALS	Advanced Life Support
AP	Ambulance Paramedic
BLS	Basic Life Support
CBRNE	Chemical, Biological, Radiological, Nuclear, Explosives
CCP	Critical Care Paramedic
DRR	Disaster Risk Reduction
ECV	Emergency Control Vehicle
EOC	Emergency Operations Centre
EMC	Emergency Medical Care
EMS	Emergency Medical Services
ESV	Emergency Support Vehicle
ETA	Estimated Time of Arrival
HAZMAT	Hazardous Materials
HFA	Hyogo Framework for Action
HLO	Hospital Liaison Officer
HMC	Hamad Medical Corporation
HMCAS	Hamad Medical Corporation Ambulance Service
IAP	Incident Action Plan
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System

JCAHO	Joint Commission on Accreditation
JESCC	Joint Emergency Services Control Centre
MERIT	Mobile Emergency Response Incident Team
MIO	Medical Incident Officer
MIR	Major Incident Response
MLP	Media Liaison Point

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CHAPTER 1: INTRODUCTION

Hamad Medical Corporation Ambulance Services (HMCAS) is the preferred service provider for any type of medical care prehospitally when one is faced with an emergency in the State of Qatar. HMCAS is tasked to deliver a high-quality prehospital care in the State to almost 3 million people with importance being placed on “access to effective care” (Morris, 2023).

The HMC ambulance service major incident response (MIR) guide has been written in 2015, updated in 2017 and in 2020 respectively. This was done post exposure to an incident which affected many in the country. In writing the MIR guide there was importance placed on command, control, triage, treatment, and transportation to hospital amongst other aspects such as, scene management which can encompass a host of scenarios in the management and response to mass casualty incidents.

Mass casualty incidents (MCI's) happen in the framework of “special events” and highlight unique tasks that needs to be carried out by emergency services (Turris, Lund, & Bowles, 2014). Whilst triage, treatment and transportation variables are significantly accepted and used, other aspects such as command and control, inter-operability and communications needs to be further understood and trained in order to develop an understanding of risks associated with mass gathering events should a mass casualty incident occur (Kuwari, 2020; Milsten, Maguire, Bissel, & Seaman, 2002).

The “Mass Gathering in Healthcare” conference held in Qatar in early 2020 placed emphasis on training across the health system to ensure that there is focus placed on health risks in mass gathering type events due to the potential of straining the health system (Kuwari, 2020). Considering the country's location, as well as the political stance (blockade imposed on by) its neighbours, the need to expand on attaining and retaining of the major incident response is

significant due to the upcoming mass gathering events planned for Qatar which included but not limited to the 2022 Fédération Internationale de Football Association (FIFA) World Cup. Qatar over the years has positioned itself as a leader in hosting mega events with the ability to showcase and organize large scale international gatherings that attract fans and spectators from around the globe. Qatar has gained notable attention with the successful hosting of the FIFA 2022 World Cup as well as the Formula 1 event that has highlighted the countries state of the art venues and infrastructure. With Qatar becoming the first Arab nation to host such a prestigious football event, others have been added to the calendar. After hosting the World Cup in 2022, Qatar has positioned itself to host many mega events. In 2024 alone the country is expected to host 80 major events ranging from the 18th AFC Asian Cup, the World Aquatic Championship, Formula 1 Grand Prix and the Web Summit (the world's biggest technology conference). Future mega events being planned for and confirmed is the World Basket Ball Championships, FIFA under 17 World Cup and the Asian Games to name a few.

Qatar being a small country (11,500 square kilometres), is made up of nationals counting for only three hundred thousand people, with the expatriate population being the workforce and accounting for around two million, six hundred thousand as of February 2021 (Planning & Statistics Authority Qatar, 2021). Although small, it is the richest country per capita.

Figure 1*Map of Qatar*

Source. Nations Online Project

Staff working in HMCAS are from various countries around the world including, Australia, Canada, India, Jordan, Morocco, New Zealand, Philippines, South Africa, Tunisia, United Kingdom as well as the United States of America. This poses a unique challenge to the ambulance services; as qualifications, experience and training varies from country to country.

With medical coverage needed at 64 games across 8 stadiums for the duration of the World Cup it became apparent and compulsory that medical services prepare for any potential mass casualty incidents on a large scale should one occur. However, the challenge that existed

was preparing for the medical coverage of 4 games per day in addition to the various side events, and fan zones hosting live coverage of the games as well as other fun activities to attract large crowds. These mass casualty preparations included 20 different fan zones and activities ranging from cultural shows to music concerts across 20 different locations across Qatar.

It became apparent that the major incident response training would need to be standardized. But, in order for this “standardization” to take place; an understanding of the current major incident response guide and training is required. Based on the outcome of the study, a curriculum would need to be written, evaluated and tested to ensure that mass gathering events and major incidents are adequately prepared for.

This study will attempt to ascertain the current knowledge of managers and frontline staff by assessing their acquisition and retention of the HMC ambulance service major incident response guide and managing/working at mass casualty incidents especially in the area of mass gatherings due to the international sporting federations requirements.

Statement of the Problem

The capabilities of the country far exceeds the planning and response capabilities to major incidents, together with state-of-the-art equipment and response trucks which are manned 24/7 for any type of mass casualty incident response. The problem being that there is no standard curriculum or training program that exists within HMCAS. Specific outcomes would need to be addressed and aimed at ensuring that there is an understanding, retention and acquisition of the HMCAS major incident response guide used by the ambulance service as observed by other emergency services around the world when it comes to responding to and working at mass casualty events. This problem is partly attributed to the ambulance service having their own

major incident response guide which has been specifically created for HMCAS and the environment that frontline staff work in within the borders of Qatar.

In addition, with the majority of staff within the ambulance service not having been exposed to mass casualty incident response prehospitally or working in the field as ambulance paramedics prior to joining HMCAS (majority are nursing trained) or having worked at mass casualty incidents in the field exposes them to shortfalls. An example of this shortfall would be the use of emotions when working at these type of mass casualty incidents instead of keeping to structured policies, action cards and guides. A 2020 study by Badawi and Alinier highlighted that in the pre-hospital management of major incidents in Qatar there are indeed challenges and there needs to be a solution to these challenges. Challenges highlighted were, the coordination of resources as well as assets to an incident, acquisition and application of HMCAS major incident training, disruption in the communication process, interoperability, lack of a commitment to the major incident response plan, and response too on scene treatment (triage) processes.

In a further study conducted within HMCAS, it was observed that whilst there is proper logistics and plans in place to manage incidents, there is a need for reinforcement by pre-hospital staff on the topic of major incidents associated with hazardous materials to ensure an effective response, as well as staff requesting more exposure and training in related MIR topics (Farhat et al, 2021).

HMCAS has appropriate industry standard logistics and plans to manage potential HAZMAT - CBRN incidents, however the knowledge survey done as part of the study demonstrated that the pre-hospital medical staff information about this topic needs reinforcement (Hassan et al, 2021).

In identifying gaps within the area of mass casualty incidents within an EMS response, Usono et al (2023) using a scoping review identified specific areas or themes that would need to be understood in order to ensure an effective response too and management of a mass casualty incident.

The themes/gaps identified were communications which includes situational awareness, the sharing of information and channels of communication; safety which includes understanding the scene itself e.g. hazardous materials (HAZMAT) situations; human resources although broad, the context in MIR specifically identified gaps in preparedness and willing to respond, training requirements and core competencies being understood; policy, procedures and planning can identify additional areas such as the MIR plan itself, activation of the MIR plan, standard operating procedures being clearly defined and understood; command and control and the understanding of incident command systems, understanding of scene incident command and roles and responsibilities and finally treatment and transportation by knowing the triage processes and procedures being understood, the correct distribution of patients and understanding decontamination treatment if faced with a HAZMAT incident.

Other studies, such as the one done by Davidson (2024) included gaps such as the need to improve working performance, interoperability, the need for training and to keep abreast of future developments in training.

The lack of evidence in ensuring a robust major incident response training curriculum can be a disservice to those managers that are expected to manage the incident as well as for frontline paramedics that are expected to work at the incident.

Goniewicz, Goniewicz, Szubzda, Burkle, Hertelendy, Wathinani, Molloy, and Manesh, (2021) best explained the resilience of having a robust mass casualty incident plan which ultimately depends on infrastructure, redundancy, plans and strategies and finally competencies of health care personnel. Overall management and response to major incidents should be done regularly within a planned framework, thus ensuring competencies and resilience which improves the process with interest placed or emphasized on staff (Goniewiza

et al., 2021). In addressing the problem of no standardised major incident response training which benefits frontline staff major incident response knowledge acquisition and retention, limited staff exposure to mass casualty incidents, current changes and training requirements internationally as well as best practice will lead to the study addressing these problems in detail in line with current literature.

Purpose of the Study, Research Aims, and Objectives

Purpose of the Study

The purpose of this study was to evaluate the current major incident training program in order to ascertain the acquisition and retention of the HMCAS frontline staff knowledge when responding too and working at mass casualty incidents. In evaluating the training program, trends and gaps was investigated based on current findings and data from the research allowing for a common understanding for all frontline staff working in HMCAS.

The consequence of this study led to the following research aims & objectives.

Research Objectives

The study main objectives are therefore summarized as follows:

1. To identify barriers that influence acquisition and retention of information in response to major incidents at mass gatherings.
2. To develop a custom-made major incident response training curriculum that can assist staff (frontline paramedics and managers) in the acquisition and retention of information when faced with mass casualty response at mass gatherings by assessing specific common topics that were identified or misunderstood.

3. Understand expectations of major incident response around mass gatherings by frontline paramedics and managers in the use of response aids or action cards to boost confidence when working at mass casualty incidents.

This study was aimed at evaluating the current attitude in responding to major incidents as well as mass gathering type events or scenarios amongst frontline paramedics in the ambulance service. The intention of the study was also, to evaluate the major incident response training guide that is currently recognized and accepted as the benchmark for current and future staff employed in the service, as a build up to the upcoming mass gathering/events that would be hosted in Qatar.

The evaluation would enable a common understanding amongst the various nationalities working in the ambulance service and serve as a core major incident response curriculum when employed in HMCAS. The study highlighted significant roles and responsibilities that is expected to be acquired and retained by frontline staff as well as managers and executives that are called to work at and manage incidents related to mass casualties. Remington, Witkowski and Contreras (2023) highlighted that staff need to understand what is expected of them as emergency workers, as previous studies have indicated that there are indeed limits to what first responders will endure when faced with complex and emergencies that are uncertain.

Waller et al. (2011) further highlights that in major incidents staff tend to become emotionally led leading to them forgetting the basics of what they are expected to do. The communications aspect in mass casualty incidents needs training by those in the field, the lack of understanding in current technology such as electronic tracking of patients and procedures ultimately can lead to the breakdown in essential communications.

Research Questions

Q1. What are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance service?

Q2. What are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?

Q3. What current major incident response aids need to be revised in order to better assist ambulance and critical care paramedics to work confidently at a major incident?

Sub Questions

Q1.1. What are the most important factors that influence decision making by ambulance and critical care paramedics when working at a major incident?

Q2.1. Do the number of major incidents that an ambulance paramedic and a critical care paramedic respond to have an influence on their knowledge retention of major incident response?

Q3.1. How often would an ambulance paramedic and critical care paramedic require training and updates on working at and managing major incident response?

Q4.1. What aspects of the current major incident response training improved skills and knowledge of ambulance paramedics and critical care paramedics?

Research Hypothesis

The following were the presuppositions which were stated in the form of hypotheses. The hypotheses stated in the null (Ho) and omitting the alternative (Ha) hypotheses:

H1o. Frontline paramedics and managers within HMCAS are not subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

H1a. Frontline paramedics and managers within HMCAS are subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

H2o. Pertinent, core essential topics do not need to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

H2a. Pertinent, core essential topics needs to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

H3o. Frontline paramedics and managers within HMCAS do not need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

H3a. Frontline paramedics and managers within HMCAS do need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

Significance of the Study

The significance of this research was to identify the understanding or not of the HMCAS major incident response (MIR) guide by staff within the organization in order to develop suitable procedures of teaching a core curriculum to enhance staff confidence in response procedures such as command and control, triage and communications. This will include those unusual HAZMAT circumstances to be better understood and retained for any mass casualty incident, thus enabling HMCAS frontline operational staff to be content when working at any mass casualty or major incident if it should occur at a mass gathering event or any other mass casualty incident.

With the inception of using the major incident response guide within the ambulance services, there has been various international changes in responding too and managing mass

casualty incidents especially an incident that can become complex in nature. Human factors must be considered when first responders are expected to respond too and work at mass casualty incidents, an example being that first responders are unable to remember what is needed by them because of getting fixated and or caught in the feelings of what they are currently faced are highlighted by Usoro et al (2023) who further indicated that core competencies would need to be known and taught to first responders so that they can overcome uncertainties.

Mass casualty incidents that are caused by either man-made or natural disasters over the years has made it necessary for reviewing the manner in which emergency services the world over responds too and, manage these types of incidents. The rise in mass casualty type incidents according to Yanez, Tilsed, Weinstein, Herman, Montan, and Faccincani (2023) are estimated to rise, this required that best practices, experience, multi-institutional, multi-disciplinary and the advancement in the use of technology must be further developed to better prepare an optimal response to incidents. Mass casualty education and training as well as triage are three of the most important factors that prompted international change in responding to and managing major incidents (Yanez et al., 2023).

International changes and development efforts in trying to reduce disasters has seen a global response and action such as mitigation in climate change and the development of various committees addressing frameworks on practices needed to ensure development in reducing disaster risks (Usoro, Mehmood, Rapaport, Ezeigwe, Adeyeye, Akinlade, & Razzak, 2023).

The evolution of disaster response can be traced back to the 1980's where the United Nations decided on passing a resolution whereby governments worldwide were called to participate on reducing the loss of life, property and the impact caused by disasters resulting in mass casualty incidents and loss of life. With the establishment of the United Nations

International Strategy for Disaster Risk Reduction (UNISDR) the promoting of disaster risk plans and strategies started to not only strengthen efforts in response and preparedness by ensuring that capacity building, early warning, community or local development in capacity, appropriate disaster response capacity, mitigation and recovery are in place (Usono et al., 2023).

Over the years several disaster management conferences held ensured changes and developments. The first world conference on natural disaster risk reduction held in 1994 advocated for the development of the Yokohama strategy which ensured that policy development and mechanisms were initiated by local governments. The second world conference held in 2005, developed the Hyogo framework which capitalised on the importance of reducing the loss of life and, enhancing the role of knowledge at local level, implementing and integrating the use of disaster risk reduction strategies in resilience, and planning (Usono et al., 2023).

With the adoption of the Sendai framework in 2015 at the third world conference on disaster reduction, seven goals were developed which ultimately catapulted changes and ensuring international change. These priorities highlighted, were reconstruction and rehabilitation, being able to enhance the preparedness in disaster response as well as recovery, disaster managers and emergency personnel being able to understand disaster risk reduction and the ability to strengthen governance associated with disasters (Usono et al., 2023).

To summarise international changes in the field of disaster management which incorporates mass casualty incidents, the three distinct areas developed over the past 30 years are, the stages of disaster management in the 1990's, disaster risk management in the 2000's, resilience development and management in 2010, these ensured that a change from response to preparedness being adopted internationally (Usono et al., 2023).

The Sendai framework and the Hyogo framework were instrumental in ensuring change, development and enhancement in disaster management and response. The Sendai framework expected outcome was to reduce the risks associated disasters by focusing on goals such as developing and ensuring that a multi hazard early warning system exists, there is information readily available to communities, ensure that there is international cooperation by developing an adequate support system, improve the amount of countries with reduction risk strategies, decrease economic loss, decrease the number of people that are affected by disasters worldwide and ultimately ensure that there is a decrease in mortality (Usono et al., 2023).

The Sendai framework highlighted that priorities for action must encompass the understanding of risk associated with disasters, the investment in the area of resilience, strengthening of governance and enhancing preparedness to ensure an appropriate response and recovery (Usono et al., 2023).

With the Hyogo framework the outcome expected was to be able to substantially decrease losses associated with disasters be it in countries, communities, environments, social and economic aspects. With the setting of their goals the framework ensured that there was a systematic incorporating of implementation and design of preparedness in emergencies, response too and recovery from disasters, building of a resilient hazard approach to disasters, ensuring that institutions are not only developed but strengthened, policies and procedures that are sustainable and achievable and the programming and planning for disasters at all levels (Usono et al., 2023).

The Hyogo framework also highlighted certain priorities, these were the reducing of risk factors, strengthening in the area of preparedness, reducing disaster risks being a priority, make use of education and training to improve on knowledge in order to build resilience and capitalise in early warning systems (Usono et al., 2023).

In being realistic, this study will look at “incremental extensions” of filling in knowledge gaps in the current literature that exists as described by Henriques, Crane, & Husted (2016). Therefore, this study intends to contribute theoretically by ensuring frontline staff and managers understand major incident response, are able to acquire and retain core fundamental principles on understanding the dynamics of specific such as command & control, role identification, terminology and finally triage, treatment and transport arrangements.

The study aimed at making a contribution to the field of major incident response planning for any type of mass casualty incident by ensuring that the acquisition and retention of the HMCAS MIR guide is achieved through the development of a training curriculum. In doing so, new opportunities and training ideas in major incident training will aimed to be established, an evaluation of the current training methods will be reviewed, decision making processes will be validated and new guidelines and aids will be developed as part of an improvement project should the organization wish to develop as outlined by the results of this study.

The intention would be that this study will benefit not only staff employed in HMCAS currently, but it would benefit future prospective employees and ultimately the community at large which includes other emergency services in the State of Qatar. Considering the demand for keeping up with trends in major incidents and responding to such incidents highlights the need for a more effective and life changing approach to teaching. Therefor HMCAS will apply the recommended approach which will be derived from this study to better train both managers and frontline paramedics in managing and working at major incidents.

In evaluating the major incident response guide with the intention of developing and improving on core training curriculum on major incident response in mass gathering for the frontline staff, one will be able to better understand and practically carry out knowledge learnt by

filling in the gaps with training aids. Of importance would be managers who respond to major incidents as they often have a different role to perform i.e. command and control therefore the intention for them would be for this study to enhance their skills, both practically as well as theoretically if they are called upon to work at an incident.

Gregory (2010) and later Usoro et al (2023) highlighted the importance of frontline emergency services staff having an embedded knowledge, in what they are expected to do in mass casualty situations. Practically the outcome of this study should highlight the importance of a core training curriculum for HMCAS frontline staff to understand procedures, terminology, and fundamentals in major incident response as highlighted by Citonne et al. (2023). Having an understanding and background knowledge of “special situations” such as Hazmat and mass gatherings events requires an “understanding of the changes, but the concept of major incident response should be the same” (Smith, 2012).

By definition, a feasibility study is meant to be a structured way that one can evaluate whether a project is both desirable and practical prior to an organization investing both time and money into a project (Kenton, 2020). In line with the writing off and the use of the major incident response guide in managing and responding to major incidents within HMCAS, it becomes imperative for senior management to decide on the best way forward in ensuring both managers and staff understand, acquire and retain pertinent information that they would need if and when they called to work at such incidents. HMCAS being a professional organization and heavily researched centred to ensure best and current practice, mandates that any research conducted be based on the aims of the organization, which one of them being “ To provide a well-planned, resourced and managed emergency response to major incidents and disasters”, (HMCAS, 2021).

The study will intend to assist with the development of a core curriculum for major incident response training with the use of helpful tools to assist staff as part of a quality improvement project.

Nature of the Study

The study would be descriptive as it would describe a topic by accurately collecting data and then being summarized. Although basic, it would prove to be valuable by assessing the needs of the chosen population specific to the acquisition and retention of MIR in mass gathering type events as this would expand both educational and practical aids with the intent to improve current major incident resource training.

According to Kesmodel (2018) a cross sectional study can be characterised by the collection of data or information that is taken at a “point in time”, this understanding therefore entails that there is no time aspect that is of concern, hence data collected is spoken of and refereed to the time in which data is collected.

Cross sectional studies are often descriptive and is found in the form of a survey, a hypothesis is not usually required however the aim is said to describe a population (Levin, 2018).

In undertaking a cross sectional study, one must understand that it may be descriptive or analytical, where a descriptive study aims to provides estimates such as knowledge and attitude in a chosen population, an analytical study can assess if there are any links between distinctive factors.

In making use of a cross sectional study, one needs to understand that it can be based on data that is required of an entire population that is being studied or a subset of the population (Kesmodel, 2018). Most cross-sectional descriptive studies being based on data of the entire

population, or a subset of the population being studied would be able to provide estimates of commonness, however bias would need to be considered and addressed (Kesmodel, 2018).

With cross sectional studies indicating an association that may or may not exist, it can be valuable in the producing of hypothesis which can be used for future research (Levin, 2018).

The chosen methodology to commence the research was a descriptive cross sectional study. The researcher had chosen this due to the participants being of a similar group (all paramedics). The method will be via a questionnaire which would be developed and circulated amongst the group chosen. The questionnaire would entail closed ended questions enabling a quicker response in answering. Using Statistical Product and Service Solutions (SPSS) the researcher would be able to input data, graphically show the results, and then write up the results. Results will enable the researcher to ascertain areas that need improvement on the acquisition and retention of MIR to develop the training curriculum.

The study will meet the set objectives by evaluating the effectiveness of the current major incident response training and then employing a new training curriculum with the use of teaching/training aids to determine the acquisition and retention of the curriculum in order to work at major incidents at mass gathering type events. The short-term steps or objectives that would be taken in attaining the desired results would be to get all the chosen population to complete the questionnaire so that the study aims, and objectives are achieved.

Dissertation Structure

The structure of the dissertation entails a literature review which will become the foundation of a theoretical framework whereby resources will be selected and critically evaluated and analysed to show trends or themes that arise to highlight the importance of a core training curriculum by addressing gaps, proposing a solution and build on knowledge that currently exists.

In writing the methodology chapter the researcher aimed to describe how the research was conducted by highlighting the approach taken, type of research, data collection method, a description of the research area, tools used and then discuss any obstacles faced with an evaluation of methods chosen.

The researcher at the end of this chapter will conclude with the intent that the reader will be able to assess the validity of the research by showing that the method chosen was indeed the best way in answering the objectives and research questions. The results of the survey was reported by structuring the results around themes, sub questions and the hypothesis. Figures and tables was used to allow for a detailed explanation. In the discussion the researcher ascertained the implications of the results with regards to the research questions, results were construed by addressing expectations, interpretations, implications and finally limitations. In concluding the research, the main research questions will be answered which would aim at leave readers of this study with an understanding of contributions that the research has made with the possibilities of future research being highlighted. The terms that are used in this study echo theories as well as outcomes that are expected in the professional environment. Both learning and understanding according to Andreucci, Riedemann, Cortés, Mellado, del Río, & Vega-Muñoz (2023) responds to a stimulus, the stimulus in this study being the understanding and retention of core major incident principles when responding to and working at mass casualty incidents by first responders within EMS.

The ability to think critically is directly related to skills and dispositions, and making use of a cognitive route can ensure training and teaching can be achieved in the professional environment (Andreucci et al, 2023). Both formal and informal learning can occur within organizations where there is structure required in order to ensure acquisition and retention.

Whilst the study employs 31 variables, the key variables and critical terms used in the study are the following which addresses the objectives of the study. Critical terms identified and addresses the study are; HMCAS paramedics prior MIR knowledge, skills and experience, HMCAS paramedics MIR knowledge post MIR training programme, MIR training programme content, HMCAS paramedics confidence in dealing with MIR and the perception of MIR training programme gap.

The list of variables, categories, testing methods of the variable and reason as well as the reference to the variables can be found within the appendix section. This will allow for the reader to have an overview of the critical terms used in the study. However, the following terminology used throughout the study will craft the reader with concise definitions to provide clarity and relevance in order of significance.

Knowledge

Knowledge can be defined as skills that are acquired either through education or experience and is typically represented in four phases i.e. information management, acquisition, integration and exchange (Perry, Jaffe and Bitan, 2021).

Knowledge Acquisition

According to Perry, Jaffe & Bitan (2021) can be defined as the rate at which information is compiled by individuals over time and specifically to mass casualty incidents it is the gathering of information by an individual, as well as how quick that team member can acquire said information.

Knowledge Retention

Is the process of engaging with and maintaining or remembering of information by ensuring that constant training is undertaken, having roles and responsibilities evaluated and

assessed, ensuring that knowledge transfer is associated with training, having documented steps which assists in knowledge retention, communication and lessons learned (Downey, 2019).

Confidence

According to Rosander & Johnson (2017) is one's belief in successfully having a task assigned to them completed. In the professional setting confidence can be related to professional identity and self-efficacy.

Training program

Kapur (2019) said that a training program is there to provide knowledge to someone in order to have a task or duty completed effectively. Training programs can either be long or short term and should ensure that organizations employ modern as well as innovative processes to ensure a significant approach is achieved in education and training in ones chosen field of work.

Major Incident Response

According to the Joint Emergency Services Interoperability Programme (JESIP) a major incident is defined as “an event or setting with a range of severe effects which necessitates special preparations to be applied by one or more emergency responder group” (JESIP, 2024).

Mass Casualty Incident

Is “an event which overwhelms a local health care system where the casualties exceeds the resources as well as capabilities available locally”, these mass casualty incidents can be categorised into planned (such as at a sporting event), conventional, catastrophic health events such as a major explosion or a pandemic, chemical, biological, radiological or nuclear (CBRN) incident (DeNolf & Kahwaji, 2022).

CHAPTER 2: LITERATURE

Introduction

In chapter two of the study a review of the literature was conducted with the intention of providing a theoretical framework for the study. The intention of the literature review was to provide a comprehensive wealth of knowledge whilst simultaneously reducing bias by discussing current literature and their relation to the study field chosen. The review will discuss aspects that have been highlighted and written about previously as well as areas that have been overlooked and not written about or not considered in general. These aspects range from terminology, mass casualty management, crowd management in the sphere of events mass casualty management, the disaster management continuum, triage, control tasks by both frontline responders and managers and finally to bridge the gap between current and proposed training within Hamad Medical Corporation Ambulance Services (HMCAS).

The research questions and hypothesis discussed in chapter one of the research was used to guide the literature review in this chapter (two). In addition, the leading questions listed below was used to further guide the subtopics.

Hypothesis used to guide the review

The researcher's intention was to investigate the core knowledge that is retained by frontline responders and managers in their response too and, in the management of mass casualty incidents, to ascertain core knowledge that they would need to retain to effectively carry out core functions in the response to mass casualty incidents related to mass gathering type events. In order to better understand roles and responsibilities the researcher would first need to identify the problem areas that frontline staff and managers face or encounter in their current training for mass casualty type incidents, identify core content specific to roles and responsibilities, be able to

identify factors that have a significant influence when it comes to a paramedics/frontline staff or managers ability to learn and retain knowledge related to mass casualty incidents and finally investigate the approach that the organization should take in conveying theory into practical application.

Search terms used and sources of literature

The literature review conducted detailed the search strategy which established, revised and was used to refine the search. Databases included: PubMed, ResearchGate, Science Direct from the period 2014-2024. The third stage ensured that there where both inclusion and exclusion measures, the search included peer reviewed articles in English only, due to the lack of academic related articles around the topic of this research study area on mass casualty incidents and mass gatherings at events, a much wider strategy was used to search using a more generalized terminology such as “mass gathering”, “events”, “multi casualty”, “mass casualty” and “triage” to be able to both identify and choose studies that can be included in this review and the fourth stage was an assurance that there was representation of the searches conducted and the articles collected by choosing the years from 2015 - 2024, duplicated articles or studies was eliminated based on relevance.

The researcher was also able to identify and use guides written by various emergency service originations on mass casualty or major incident response as well as academic books, a detailed reference is in place showing all works referenced and used.

Conceptual framework

To appreciate the use of a conceptual framework in a descriptive study, one would need to understand the background and the thought processes. According to Imenda (2014) a conceptual framework is said to be the “soul” of a research whereby the investigator is given the

opportunity to describe how they investigate the problem they want to explore and what significance they place on data collected as part of their investigation.

HMCAS, has recently taken delivery of major incident response equipment and stepped up in its training towards major incidents especially due to the mass gathering type events being hosted by the state. To address objectives of any study, one has to understand terms that are associated with a conceptual framework, i.e. theory, concept as well as in the case of this study a conceptual framework.

In understanding these terminologies, it is best to recognize and appreciate the various terminologies in the framework of research. Liehr & Smith (1999) identified a correlation between practice and theory, with practice being the enabler of testing theories in order to formulate questions associated with research, which is able to strengthen through practice what is learnt for one to be able to bring about knowledge creation and expression in a systematic method in a chosen discipline.

Theory according to Liehr & Smith (1999) should also be able to correctly describe opinions and thoughts based on a model with elements that is able to make predictions on future observations, these should include variables or concepts, term definition and, claims that are specific to predications made.

Liehr & Smith (1999) defined a concept as “a representative of an idea that is abstract”, creating views that exist in literature around a situation allows for empirical findings, this is then called a conceptual framework or model as it joins in with the problem described or that one with like to address in one’s research as it would be put together in application to a specific study.

In making use of a conceptual framework various variables would need to be described, these according to Imenda (2014) are the creation in which the conceptual framework is formed

by the investigator from a mixture of conceptual perspectives. Purpose would assist with clearly identifying variables as well as concepts in a study, having an approach whereby the methodology, design, the chosen population, research sample and the collection of the data and analysis thereof, interpretation that is correct as well as the researcher being able to rationalise data collected and purpose would also allow for a guided future research where the conceptual framework allows for integration of the literature review and data. Conceptual meaning allows for the seamless amalgamation of concepts whilst, reviewing of the literature and its core methods is fundamental in the use of a conceptual framework where a research problem is unable to be rationalised by only one theoretical viewpoint. The methodological approach although available for use in both a qualitative and quantitative research methods, it is often advocated in a mixed method study, data collection is achieved through a descriptive instrument and or empirical survey instrument and there is a convincing deliberation of context. Finally, the scope of application is limited to a precise problem identified in the research.

Although HMCAS is not “struggling” with the problem, there has been considerable noticeable inconsistency between managers and frontline paramedics responding to and working at mass casualty incidents across teams and the service as a whole often deviating from the major incident response guide which can be attributed to a lack in understanding or retention of the various components that they are required to both know and understand.

Staff training, perception, knowledge, and their understanding are areas of importance that must be investigated to ensure a robust understanding of major incident or mass casualty response. Qatar as a country has spent both time and money in the development of infrastructure to assist emergency workers in response to major incidents should the need arise. The various programs are therefore made to align to best international standards and this in turn is interpreted

in both the “Qatar National Vision, 2030” and the previous National Health Strategy 2011-2016 which mandated the movement towards mitigation and preparedness of mass casualty incidents be it either natural or manmade (such as in the case of mass gatherings).

The conceptual framework adopted for this study will assist in the facilitation and the understanding of the research problem with emphasis placed on previous knowledge and understanding, skills dispositions and lifelong learning related to the field of major incident response/mass casualty incidents.

Education and training are key fundamental factors to assist in the improvement of learning and to ensure that there is “performance via knowledge retention” (Kim, Ritter, & Koubek, 2011). Over time people often start to forget skills that can lead to a decrease in overall performance. Skill retention plays a significant role in professions that need to perform a specific skill when its rarely practised (Kim, Ritter, & Koubek, 2011). “Proceduralising” can ensure the retention of skills be it declarative knowledge (factual), procedural knowledge (task orientated) or a mixture of both (Kim, Ritter, & Koubek, 2011).

To understand issues that are present in acquisition and retention in learning, cognitive states need to be predicted, and this can be achieved by understanding cognitive theory. Skill acquisition and retention based on cognitive theory further developed by Fitts and Anderson’s into stages that can be described as declarative, transitional, and procedural (Kim, Ritter, & Koubek, 2011).

Work highlighted by Fitts (1964), Anderson (1982), Rasussen (1986) and Van Lehn (1996) as discussed by Kim, Ritter, & Koubek (2011) showed that there must be the acquisition of procedural knowledge, consolidation of this knowledge and then turning the acquired knowledge into retention.

The definition of cognitive theory according to Hayes and Davis (2023) is the “explanation of human behaviour by learning the mental procedures when one is involved in the learning and understanding that is related with knowledge procedure capabilities”.

Cognitive theory has over the years been highlighted as a front liner in education due to its success across all spheres and professions including medical education both in and out the class, this is evident in medicine due to medical staff being heavily reliant on crisis resource management skills so that medical teams can be appropriately led in areas and times where medical staff are under stress, uncertainty and expected to carry out tasks or procedures with often incomplete information (Szulewski, Howes, Van Merriënboer, & Sweller, 2021).

Cognitive theory is a theory that has its roots or grounded in education where human cognitive skills or architecture is highlighted from an evolutionary view. Cognitive theory application lies on secondary instead of primary knowledge which allows for the transfer of information to be acquired from others as well as resources associated with learning such that information is stored long term for it to be used when required (Szulewski, Howes, Van Merriënboer, & Sweller, 2021).

Cognitive load is further divided according to Szulewski, Howes, Van Merriënboer, and Sweller (2021) into 3 elements which are classified into intrinsic cognitive load referring to a complex information being specific to a task and a person, extraneous cognitive load addresses conditions that are suboptimal for the presentation of information and germane cognitive load refers to working memory resources that are dedicated the processing of intrinsic cognitive load associated with mental information.

The above can be further explained as the main belief of cognitive theory is for instructors to abate extraneous cognitive load which in turn increases germane cognitive load within limits

whereby if the computation of extraneous and intrinsic cognitive load exceeds the ability of a normal memory capacity then there will be cognitive overload which can result in poor outcome in learning.

Whilst cognitive theory has over the years become the go to model in psychology education, it has started to gain ground in the field of medical education and practice, this has been evident in the complex environments that clinicians work under (Szulewski, Howes, Merrienboer & Sweller, 2021). Whilst this model has been used to retrieve information from memory and enable the transfer of said information to working memory that is able to generate action that is applicable to the environment that one is in, studies have shown that cognitive theory allows for one to focus on information that is relevant to the task required to be completed (Szulewski, Howes, Merrienboer & Sweller, 2021).

With the development of the new cognitive theory model various limitations have been highlighted, these are age being a factor on memory acquisition and retention and the collective memory of a team that would need to collaborate on tasks at hand therefore the decision to stick to the original model as team work has a direct influence on the management of mass casualty incidents.

The additional 2 framework theories discussed and represented in the figure below will assist in understanding the research problem by focusing on knowledge, skills dispositions, and lifelong learning, in addition to the following traits that will further enhance and assist in improving the acquisition and retention of core skills and knowledge of HMCAS managers and frontline paramedics in managing, responding, and working at mass casualty incidents.

These factors are teamwork, communication, critical thinking and problem solving, the use of information, professional competence and personal values in addition to the need to further

develop training and education in the context of major incident response within the emergency sector that need to show support in the standardization of roles and responsibilities between all levels that are involved in the response and management of such incidents and therefore value has been found in standards being developed to facilitate cooperation and professionalism in the field (Fitzgerald et al., 2017).

The need to identify that disaster management training and development was best researched and developed by the generic emergency and disaster management standards (GEDMS) by making use of international literature on course development, university programs on disaster management, detailed focus groups, consultations with experts in the field to be able to test standards with the aim being to pay attention to those type of events where communities and organizations are challenged to cope and build resilience in the response to and management of major incidents (Fitzgerald et al., 2017).

In addition to role specific and specialty specific knowledge needed by individuals in the response to and management of mass casualty Fitzgerald (2017) highlighted that tasks must be related to a function, roles and responsibilities must be “role specific”, and disaster elements such as described in the disaster management continuum must be known and identifiable by those tasked in specific areas.

Fitzgerald (2017) described the framework for teaching and understanding disaster management as being organized with specific skills and knowledge one must have in order to practice, with the main themes within the domain of knowledge being policy and governance frameworks that must exist in order to be effective, there must be both a conceptual and theoretical basis in order to practice in the field, the areas identified with skills enhancement has

been identified as collaboration, leadership and communication with skills in the application being critical thinking and professional practice.

These are highlighted in the figure below:

Figure 2

Fitzgerald's Framework for Teaching and Understanding Disaster Management in the Context on Mass Casualty Response



Note: Adapted with permission

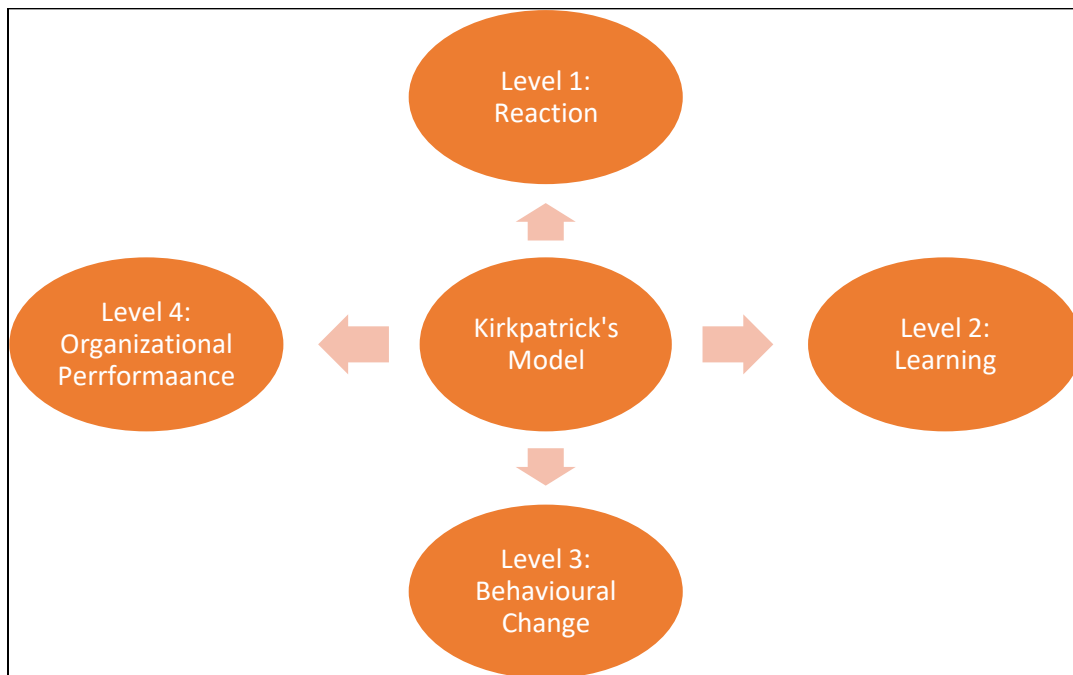
Additionally, the work done by Kirkpatrick evaluation model (Figure 3) is a useful framework that can be used in evaluating training to ensure that managers and frontline staff are able to not only apply what has been learnt but to make a meaningful impact on the organization that they work for (Falleta, 1998).

This model allows for potential effects to be measured by looking at the following:

- (a) The reaction of the training (level 1) by the participants: by evaluating the reaction to questions which establishes thought processes, an example of evaluation would be the individual's "reaction" to the current training by making use of questionnaires post

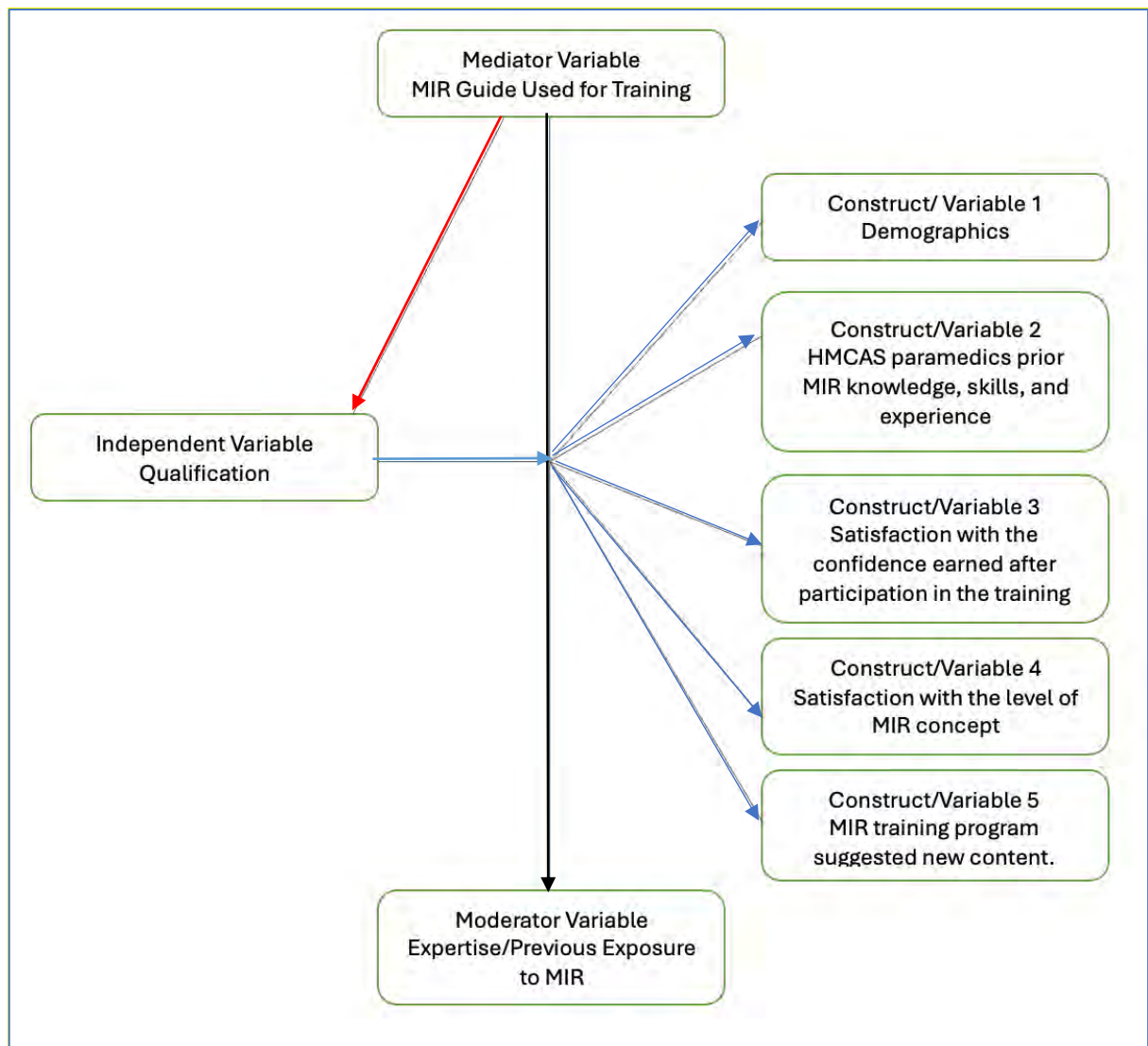
training or presentation, this measures the satisfaction with the training provided by an organization.

- (b) The learning (level 2) as an outcome by the participants in relation what has been learnt i.e. knowledge, skills, competence and confidence and attitude to what has been learnt by gauging the techniques or mindset by taking a pre-test and following with a post-test in the attempt to gauge ones understanding (acquisition) as well as the retention of outcomes/material. This would have to be done in a consistent manner.
- (c) Behaviour (level 3) of the participants due to the training received: this stage of the program would evaluate the differences in behaviour post course completion i.e., teaching of the new curriculum. With the assessment of changes proposed, it would ensure that skills, and knowledge thoughts are receptive and beneficial in the workplace by evaluating the effectiveness of the curriculum, systems would need to be in place to ensure that learning and performance can be evaluated by making use of transfer of skills, attitude and knowledge. An example would be the use of the “360-degree feedback” method and this can be developed according to observations and the results itself rather than taking opinions into consideration, this further supports level 3 (behaviour) of the Kirkpatrick model by ensuring application of learning to the job at hand.
- (d)** The organization performance (level 4) impact that education and training has had on the organization, this stage would evaluate the success of the program or curriculum developed by undertaking an assessment in line with the outcomes of the curriculum by adapting specialised delivery training by maintaining expectations on deliberate proactive training programs.

Figure 3*Kirkpatrick's Model on Evaluation*

Note: Adapted with permission

In the study conducted by Sabrina et al.(2020) it was highlighted that staff who undertook training and exercises in emergency preparedness responded better than those who did not undertake any such training, these included staff (managers and responders) being able to identify their limitations and then addressing them to be better prepared should a real major incident occur.

Figure 4*Conceptual Framework for this study*

As seen in Figure 4 the study will place focus on evaluating the major incident response guide by looking at the independent variable (qualification) used in this study and its influence or impact on the 5 construct variables themed from the 33 identified variables of this study. It will attempt to highlight if there is any correlation between the independent and dependant variables and how it will be useful in creating strategies to improve on frontline staff's acquisition

and retention of major incident response principles. The MIR training guide will be evaluated (mediator variable) to ascertain influence on the dependant variables which were themed. The moderator variable will investigate if expertise and previous training or exposure strengthens the relationships that will be identified. This framework will outline the reasons and factors that are necessary for frontline response staff to possess in retaining and learning of MIR information and core components. In evaluating the MIR guide relevance, clarity, topics covered within the guide. With the review, real world applications would be assessed on relevance such as use of resources, stakeholder engagement and mechanisms to provide feedback on areas that are identified for improvement. The study method will entail a questionnaire focusing on the five themes identified from the dependant variables identified and these results will be analysed by the data. The theoretical framework used will be cognitive theory which places emphasis on human behaviour and the learning process that individuals learn engage and understand across various topics. In addition, the Kirkpatrick four level training evaluation model which places emphasis on reaction to training, the level in which participants acquire and retain intended skills and knowledge as well as confidence, participant behaviour and finally the results which supports training and accountability.

The final part of the framework will evaluate the findings to refine the MIR guide content to ensure that it is current with international current best practice for frontline staff to be abreast of best practice in order to retain and acquire MIR concepts as well as identify the gaps which will form the basis to improve the current MIR teaching guide that is used by HMCAS.

The remaining part of chapter two will consist of a comprehensive literature review that will discuss aspects of major incident response in relation to mass gathering type events. The literature review would include overviews which would include specific emergency services and

mass casualty terminologies, definitions and background to the research and the research question itself. The review will then take on an in-depth discussion and examination of topics that support the mass casualty/major incident response and highlight areas that requires an emergency response manager and frontline paramedic to know to be able to carry out their respective duties. Finally, the review will touch on the importance of training in the field, the various methods used to train and how relevant the training is, to provide an impact and relevance in the field, both to patients as well as to HMCAS as an organization with the creation of a standard training curriculum.

HMCAS/EMS understanding of major incident response: Creative teaching methods

Teaching methods

Various styles of teaching methods exist and those that are involved in education have various methods in executing their roles and responsibilities. Such “theoretical frameworks” used often overlaps and are referred to as instructional epistemologies and pedagogies (Vavrus & Bartlett, 2012). This would depend on what outcomes would need to be achieved in order that a specific teaching method or strategy is best suited to the framework chosen. There are numerous theoretical frameworks that exist and is associated with teaching; however, the following best describes the theories used in emergency medical services teaching of major incident response:

Andragogy/Adult learning Theory

Christian & Gaikwad (2015) looked at the theory developed by Knowles (1980) which is thought to have believed that adults are problem-oriented. They tend to mix both self-direction and experience into areas that are relevant to what they are doing or need to accomplish. Making

use of andragogic education incorporates styles such as connectivism, constructivism & collaboration, whilst making the most of tasks that are orientated which results in proper application.

Behaviourism

Is often focused on behaviour that is observable by believing that learning was best reinforced using drills & practice (Goddard, 2017).

Pedagogy

Is the fundamentals as well as the backbone of education. Pedagogy seeks to understand both methods and practices of instruction that assist those in education to draw out the best from learners, pedagogy finds ways to best understand how to teach and educate learners in all age groups (Melrose, Park, & Perry, 2015).

Constructivism

According to Melrose, Park, & Perry (2015) constructivism is suggestive of knowledge being constructed by the ones that are learning themselves, and the teacher or in the case of this research the organization (HMCAS), is to build on the knowledge of major incident response by providing staff with activities that are meaningful. Therefor the interaction between staff and those assigned to teach in major incident response needs to plan for i.e., practiced at regular intervals.

Staff that are assisted in the process of learning tend to enjoy the experience and can achieve the outcomes independently (Melrose, Park, & Perry, 2015). Activities should be tailor made yet innovative that can incorporate diagrams and maps to better facilitate understanding. The use of a strategies that are creative (such as the use of mnemonics) is a perfect example of making use of memory aids to assist in stressful and time critical situations (Melrose, Park, & Perry, 2015).

The use of creative strategies such as case studies e.g., the London bombings in 2005 highlighted areas that stand out and assist staff to strengthen both their understanding and response by basing their learnings on actual cases including “system and organisational learning based on actual incidents and exercises to improve preparedness” (Skryabina, Betts, Reedy, Riley, & Amlot, 2020).

Conducting training and exercising in environments that are low pressured i.e., not in real time allows for aspects such as plans, procedures and multiple agencies to work together in order to identify gaps and understand their roles and responsibilities in response to an actual incident (Skryabina et al., 2020). Making use of practical teaching and exercising enables practical thinking which enables “a multiple cognitive learning” benefit allowing staff to facilitate their management and response with the added benefit of improved knowledge in systems and roles and an improved confidence in working at major incidents (Skryabina et al., 2020).

History of ambulance services

Until recently many suffered when it came to war and battles over the past many years, illnesses such as scurvy, smallpox and scurvy (too name a few) combined with the acts of war ensured that many succumbed to their wounds in numbers. Those “lucky” enough where often

carried to the back lines by those comrades that served next to ill and injured in the battle (Haller, 2011).

First aid was often administered by servants, bandsmen, or the locals that war was often fought in, but history has shown that caring for the ill and injured dates to 1200 B.C., where the Egyptian leaders encouraged the saving of lives. The early records of transportation of the sick and injured showed that Anglo Saxons and the Normans provided an ambulance bearer as early as 1000 B.C., however this became organized by the 15th century where a dedicated unit was allocated in a military organization to specifically take care of by providing emergency care and transporting the injured (Haller, 2011).

Various systems existed and have shown the existence of ambulances as a mobile unit that provides medical care however the French system in the latter part of the 18th century showed a modernized concept where a young surgeon Dominique-Jean Larrey (1766-1842), played a pivotal role in evacuation of the sick and injured (Haller, 2011).

With the use of wagons, the concept of an ambulance was born which allowed for medical personnel to render care where patients were found (now known a triage) and then rapidly transport them to a nearby hospital (Haller, 2011).

This system was then perfected by the Italians in 1796 where one ambulance unit was allocated for every 10 000 men who worked under the supervision of a surgeon, in 1808 the creation of a trained team in carrying stretchers was developed under the leadership of Pierre François Percy (1754-1825), to provide discipline as well as organized transport to those that were injured (Haller, 2011).

In later wars such as the Crimean war and the American Civil war previous developments in the ambulance and transportation of the sick and injured in war times were refined and the

system allowed for development where surgeons Hammond and Letterman introduced ideas in ambulance development and transportation with the result being the birth of an ‘ambulance system’, which allowed for an ambulance director to determine the number of ambulances needed, where they will be stationed as well as the consumables needed and with this came the post of a chief ambulance officer that ensured stretcher bearers operated as instructed (Haller, 2011).

The Birth of the Modern Ambulance Service

In the 70’s the Americans were losing more people to road accidents than those lost in the Korean war. The president at the time received a report that highlighted survival of the injured had a better outcome if they were injured in war. The report received at the time showed various recommendations to make emergency training standardized for ambulance attendants which then led to the EMS – emergency medical technician – ambulance (EMT – A) course which was the start of what we know as the modern emergency medical services (EMS)

(Edgerly, 2013).

Despite the approval and creation of this course, many argued that there was more that could be done to save those out of hospital. Ideas such as airway management, the administration of medication and intravenous or vascular access could be better developed and understood in the pre-hospital setting. Regulations such as minimum hours in class, hours spent in the field (internship) gained favour as the field had started to become regulated (Edgerly, 2013).

The development of initial accredited (see table) programs in the 1980’s has vastly assisted in the improvement of standards by being affiliated to professional health care bodies that regulate licensing, protocols and continued professional development in the modern era.

Table 1

History of accredited ambulance services, the early years

1980	UCLA Center for Health Services – Los Angeles, Calif.
1980	Eastern Kentucky University – Richmond, Ky.
1981	Pennsylvania College of Technology – Williamsport, Pa.
1982	HealthONE EMS/Arapahoe Community College – Englewood, Colo.
1983	University of Texas Health Science Center – San Antonio, Texas
1983	Centura Health-St. Anthony Hospitals – Denver, Colo.
1984	University of Alabama – Huntsville, Ala.
1984	Harrisburg Area Community College – Harrisburg, Pa.
1984	Southwest Tennessee Community College – Memphis, Tenn.
1984	Texas Tech University Health Sciences Center – Lubbock, Texas

Note. Adapted with permission

Over the years there has been vast improvements and developments within EMS structures and organizations around the world, globally there has been prioritization on response as well as treatment of patient's pre-hospital with importance placed on emergencies that are life threatening. With the advancement placed on education, protocols and skills development and retainment, EMS has become a force to reckon with in recent years. With the advancement of EMS, it has become evident that the standardization of protocols is necessary to safeguard paramedics in delivering care that is deemed excellent in today's EMS (Bossert, 2024).

With the advancement in EMS the facilitation of other emergency services working together has brought about a response that is coordinated to ensure collaboration thus improving on teamwork and communication, the use of technology has seen an advancement whereby GPS

has shown to improve on response times and allocation of resources which renders effective care at the right time and place (Bossert, 2024).

Bossert (2024) highlighted that technology in medicine and techniques have improved in order to deliver a higher level of care prehospitally. This ultimately has shifted the focus from transport to providing patient stabilization to improve on a patient's survivability, the previous records of EMS has been able to provide lessons that are valuable to better shape the future of EMS in various aspects of emergencies being covered (Bossert, 2024).

Mass Casualty Incidents and Ambulance Services

The ambulance services generally relates a mass casualty incident to the number of victims that are injured as defined by most agencies in the field i.e. “an event that overwhelms the local healthcare system where the number of casualties exceeds the resources available to manage the incident” (Lomaglio, Ansaloni, Catena, Sartelli, & Coccolini, 2020).

Klein & Irizarry (2021) highlighted that to have an in-depth discussion on disaster planning and response by EMS one should understand and dissect meaningfully disaster management, disaster management continuum and the various definitions that currently exist in the field that often have concepts that overlap. Ambulance and emergency medical services (AEMS) are the first line response to provide medical care to those that are injured in a mass casualty incident. AEMS are considered an important component in any health care system to achieve access to effective care. Disasters due to either being man-made or natural will occur and affect communities which can often cause human, material, environmental and economic impacts and loss (Beyramijam, Khankeh, Farrokhi, Ebadi Masoumi, & Aminizadeh, 2020).

The past years have shown that emergency medical services (EMS) around the world have developed and still are constantly developing their systems in ensuring that prehospital emergency care is strengthened to train and respond methodically to both emergencies and disasters no matter which provider they work for around the world (Beyramijam et al., 2020).

EMS personnel being the frontline response team to any type of incident (man-made or natural) are themselves exposed to danger making their role an important one in the various phases of disaster or mass casualty incident response. As an organization preparedness is key in managing mass casualty incidents as many lives could be saved if there is accessibility to an appropriate response system which places an importance on infrastructure, human and organizational capacity (Ben- Ishay, Mitaritunno, Catena, Sartelli, Ansaloni, & Kluger, 2016).

There are well documented gaps that exist in health care systems where preparedness has shown to be key but are often not addressed systematically especially in countries that do not have a well-documented and developed mass casualty incident (MCI) management plan (Lomaglio et al., 2020).

As described by Alazamy, Samarkandi, and Williams (2020) a disaster or MCI can be associated as an event that is labelled catastrophic which is due to its unforeseen nature often causing disruption to daily activities in a community. The need for a rapid and effective system to respond to and manage such incidents often is dealt by the local emergency service system that are in place making them the major role players in the management of all phases of MCI's including prevention, preparedness response and the recovery of such an incident.

Hand in hand with various MCI's, there need to be consistent training in areas such as communications, triage, command, control as well as roles and responsibilities to ensure that standards are adhered to ensuring as many lives as possible are saved (Lomaglio et al., 2020).

Components needed to be trained in by EMS staff as highlighted by Lomaglio et al. (2020) are concurred by Beyramijam et al. (2020) in their paper on disaster preparedness among emergency medical services providers when they argued that triage, treatment, incident management and the correct distribution of medical equipment in mass casualty incidents are the core duties of EMS in any mass casualty incident.

Lomaglio et al. (2020) highlighted the survey taken by the World Society of Emergency in 2015 where roles and strategic planning was examined which was directly related to both preparedness and experience. The 31 countries that participated in the survey experienced more than 5 MCI's a year which 73.9% of them highlighted that they had robust written MCI protocols in place with emphasis placed on training as an important aspect whereby drills were seen as an important tool in planning for and management of an MCI (Lomaglio et al., 2020).

Barriers to effective management

The management of mass casualty incidents is at best challenging be it natural or man-made. In a management review paper by Hugelius, Becker, & Adolfsson (2020) challenges were identified when managing mass casualty incidents, those identified were identification of the situation faced and being able to deal with mass casualty incident uncertainty, being able to balance reality with contingency plans that organizations have in place, being able to establish and function in a crisis , adaptation of the response by the organization in relation to the situation or mass casualty type event faced and making certain that the response and management of the incident is resilient.

A postgraduate study by Adesina and Ingirige (2019) identified several barriers hindering effective disaster management which was highlighted, these barriers have a significant impact on planning, responding to and recovery when faced with major incidents.

Six of the barriers identified that can improve on a holistic approach in major incidents are private sector involvement, standards improvement, identifying the demand when dealing and planning for major incidents or disasters, building on resilience, the transfer of knowledge and ensuring that experiences in the management of disasters/major incidents are capitalised on (Adesina & Ingirige, 2019).

As discussed earlier in this chapter the Hyogo framework placed emphasis on planning, response and the identification of gaps, these can only be achieved by adequate research with identifying the various challenges that organizations at all levels are exposed to, the framework went on to highlight that the management of knowledge and governance are key factors in ensuring preparedness (UNISDR, 2023).

The framework went on further to highlight that organisations involved in mass casualty or disaster responses can overcome barriers by ensuring that there is built in elements that support the acquisition and understanding of responding to and working at disasters, by including core topics into an organisation's teaching or training sessions (UNISDR, 2023).

Adesina and Ingirige (2019) further indicated that skill development is a core component in building capacity to enable the effective response in efforts needed to manage, respond to and work in mass casualty incidents.

Additional areas for overcoming barriers are the development and use of technology, the bridging of gaps between material and human assets, understanding and making use of previous data on how the response to and management of a mass casualty incident was handled,

overcoming challenges to change and ensuring process management is developed and prioritised (Adesina & Ingirige, 2019).

A key method in identifying barriers is the pressure and release (PAR) model developed by Ben Wisner, in the 1990's, it is a model that enables the appropriate reduction in risks and management of disasters or major incidents, the model indicates that there are two main factors that must be addressed in reducing disasters i.e. vulnerabilities and pressure.

Vulnerabilities are said to be the conditions that are specific to a population that makes them vulnerable to disasters (e.g. inadequate preparedness) whereas pressure is the identification of the root causes that make a population or community prone to disasters (Blaikie, Cannon, Davies, & Wisner, 1994).

Interestingly, the ability to overcome barriers can be found in the PAR model, where capacities are discussed enabling resilience improvement by connecting the strategies that management identifies in reducing risk. The PAR model has four main parts that are connected, these are:

- (a) Root causes: factors such as social, economic, failure in governance.
- (b) Dynamic pressures: identification of the immediate triggers of a mass casualty incident or disaster.
- (c) Unsafe conditions: is the identification of vulnerabilities e.g. inadequate preparedness.
- (d) Disaster: this is the last step in overcoming barriers whereby the actual impact of an incident or disaster is addressed, this stage would also speak to response and recovery activities.

Making use of a specific tool or model in overcoming barriers identified enables an approach to a mass casualty incident holistically, systematically, adaptable and sustainable (Blaikie, Cannon,

Davies, & Wisner, 1994).

Management of mass casualty incidents in Qatar

Qatar having hosted the FIFA World Cup 2022 ®, various plans were put into place ensuring that the country is prepared for any eventuality to adequately prepare for any unforeseen eventuality. Two such planning documents used is the Qatar National Vision 2030 which sets out to explain various pillars used in ensuring that the future of Qatar is built on by ensuring that provision is made for a high standard of living for all that live and work in the country (General Secretariat for Development Planning, 2008).

For the health services to achieve the vision set out by Qatar, the second document titled Qatar's National Health Strategy 2011 – 2016 highlighted various projects that needed to be started and attained to successfully accomplish the goals set out by government. One such aspect was the development of a successful Major incident response plan, improve road safety and emergency preparedness (Ministry of Public Health Qatar, 2016).

Themes for the development of the major incident response guide and training to respond to and manage such mass casualty incidents for the national ambulance service are supported by different agencies or committees in the country such as ministry of interior (MOI), ministry of public health (MOPH) and Hamad medical Corporation (HMC) in which the ambulance services sit in.

The recommendations/themes set out by the various committees are adopting and developing a framework for disaster response, ensuring that disaster response planning strategies include scenarios, there must be a multi-agency plan and response to major incidents, early

warning systems to inform the public of any potential hazard or risk must exist, shelters in the event of major incidents/disasters must be identified, ensure that there are stockpiles of medication, food, and water, plans must be developed and tested as well as it must be made available and communicated to the various agencies.

Hamad Medical Corporation Ambulance Services (HMCAS) being the national ambulance in the state of Qatar are therefore responsible for all prehospital emergency care and transportation of the sick and injured, this includes both preparedness and response to major incidents and mass gathering type events in the country. The HMCAS major incident response guide was developed to ensure that there is an understanding in roles and responsibilities when it comes to the management of a major incident from an ambulance services perspective. Aspects such as command systems, command and control, triage, treatment, and transportation arrangements are covered as well as the communications aspect of reporting scene management and patient dispositions. The guide outlays the steps that would need to be taken during major incidents following a national mandate. In line with the Hyogo framework for action (HFA) the following areas were used in the writing of the guide to ensure that written plans translated into action by ensuring that disaster risk reduction (DDR) is both a national as well as a local priority which places an emphasis on the institution being able to implement such plans, being able to identify, assess and monitor disaster risks, make use of knowledge, education, and new innovative ideas to build on existing theories and strengthen current preparedness towards MCIs to respond appropriately.

Following on from the Hyogo Framework, the Sendai Framework for DDR 2015 – 2030 places an importance on health and mandates 2 approaches for DDR i.e. (top down and bottom up approach) that places importance on the technical knowledge by moving away from policies

that previously existed such as being response focused to adopting a more all hazard type approach that incorporates a multidisciplinary as well as a multi sector approach (Selmi, Murray, McCloskey, Azhar, Petersen, Zumla, & Dar, 2016).

One aspect according to the Sendai Framework is the development and strengthening of training to empower the cooperation between stakeholders and to find solutions within organizations that enables and enhances safety as well as promoting capacity in DDR in health by ensuring resilience by promoting an effective lifesaving and essential service to mass casualty incidents/disasters (Selmi et al., 2016).

The ability to achieve these outcomes as highlighted by both the Hyogo (2005 – 2015) and the Sendai Framework (2015 -2030) supports the use of technology in decision making, updating the relevant technology that is associated with disasters/MCI's and makes use of post disaster reviews.

EMS & the disaster management continuum

Throughout the world the initial contact are emergency services when it comes to mass casualty incidents. The World Health Organization (WHO) views EMS as one of the most important components in responding to disasters or mass casualty incidents due to their ability to bring about structure in chaos when responding, managing, and treating those that are involved in incidents (Rifino & Mahon, 2016).

Van Niekerk & Wentink (2017) argued that disaster risk management (DRM) has over the years worldwide has taken the spotlight and deemed important around the world due to various types of disasters that has occurred i.e., manmade or natural such as earthquakes, flooding, and epidemics that has an impact on lives.

DRM for it to be effective need to start at an institutional level as well as involve communities (Van Niekerk & Wentink, 2017).

The link created by national policies must be converted into principles that can be driven by local organizations to ensure vulnerabilities are minimized by ensuring that decision making is expanded upon by ensuring people are empowered and not left to their own understanding which is known to increase overall vulnerability (Van Niekerk & Wentink, 2017).

Challenges highlighted in the paper by Van Niekerk & Wentink (2017) looked at South Africa and their DRM policies however the challenges highlighted are said to be current worldwide and still exist, these challenges identified were, no funding being available for training, uncertainty in structures and various departments having different roles and responsibilities in the same organization, lack of training and poor communications systems.

For effective management of disasters and the risks that are associated with it, capacity development would need to take place , this implies there is a need to strengthen capacity to be able to assist people within organizations to achieve and maintain objectives.

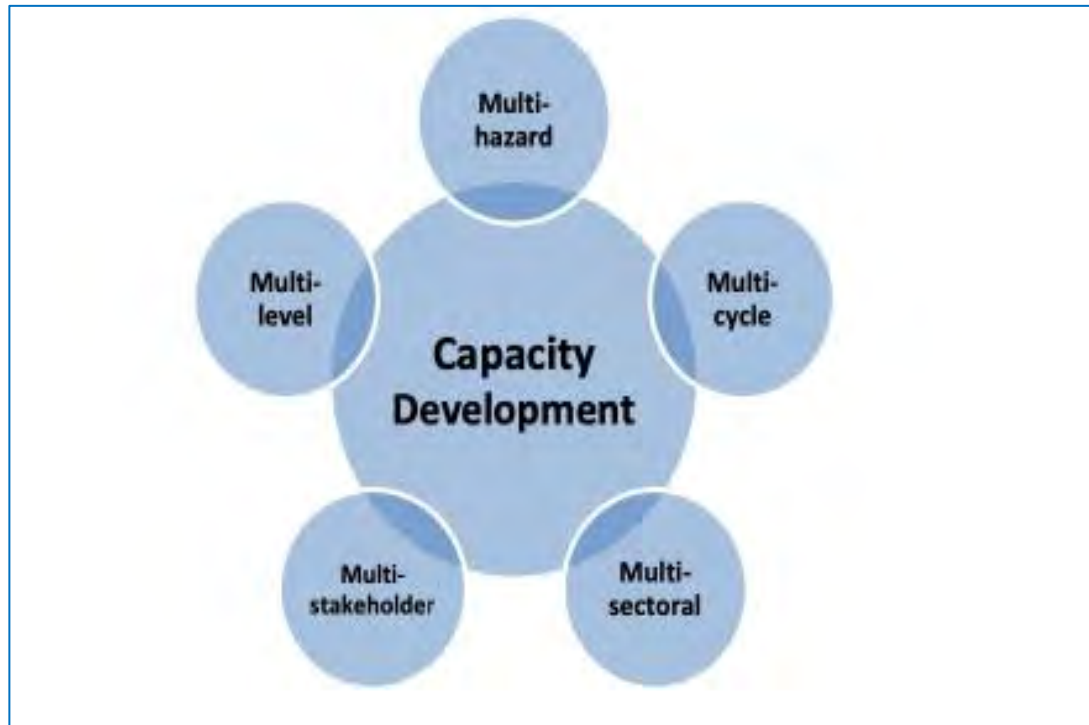
The understanding of local capacities is crucial to understand relationships within the organization as well outside organizations which was highlighted by Hagelsteen & Burke (2016) who identified elements in capacity development such as terminology, understanding of context (local), roles and responsibilities and the evaluation and monitoring of learning activities.

Van Niekerk & Wentink (2017) highlighted that the scope and complexity of disasters require varied resources and skills, in addition the National Education, Training and Research Needs and Resource Analysis for Disaster Risk Management in South Africa (NETaRNRA) concurred that there needs to be a platform for representation from personnel and role players that participate in order to pursuit goals and strategies (NETaRNRA, 2013).

The UNISDR Terminology on Disaster Risk reduction 2009 further describes capacity development as being multi-dimensional which incorporates five factors as seen in figure 4 below:

Figure 5

Five Dimensions of Capacity Development on Disaster Risk Reduction



Note. Adapted with permission

When developing capacity in major incident response it must have an all-hazard approach which must address all aspects/phases of disaster management cycle namely prevention and mitigation, preparedness, response, and recovery (Zottarelli, Sharif, Xu, & Sunil, 2021).

The disaster management continuum has four phases i.e., preparation, response, recovery, and mitigation which shows the path that EMS managers and responders should undertake when planning for and responding to major incidents/disasters (Klein & Irizarry, 2021).

The disaster management phases, or cycle is a framework that was developed in 1975 to be able to assist various agencies to address the impacts in actively managing events and disasters, the pre disaster action involves the prevention, mitigation and preparedness activities whereas the during disaster phase addresses the response activities and post disaster addresses the development and recovery phases (FEMA, 2023).

The phases together are there to assist in the management of a disaster with the intention being to prevent loss of life and destruction of property (Tay et al., 2022).

Federal Emergency Management Agency (FEMA) describes emergency management as the procedure that is put in place so that any emergency can be dealt with. These types of emergencies can be natural or man-made however there is a focus on the emergency cycle.

According to FEMA (2023) emergency management can be traced back to the 1800” s, where in 1803 the first disaster management legislation was passed in order to provide assistance to a fire. In 1979, with the establishment of FEMA a program was developed to assist managers to deal with a single type of hazard where the idea of a “comprehensive emergency management” was developed, this idea had progressed from a single hazard approach to an all-hazard type approach as it is today (FEMA, 2023). Making use of a comprehensive emergency management approach the aim was to focus on protecting population and property affected by disasters with concentrating on the phases of emergency/disaster management.

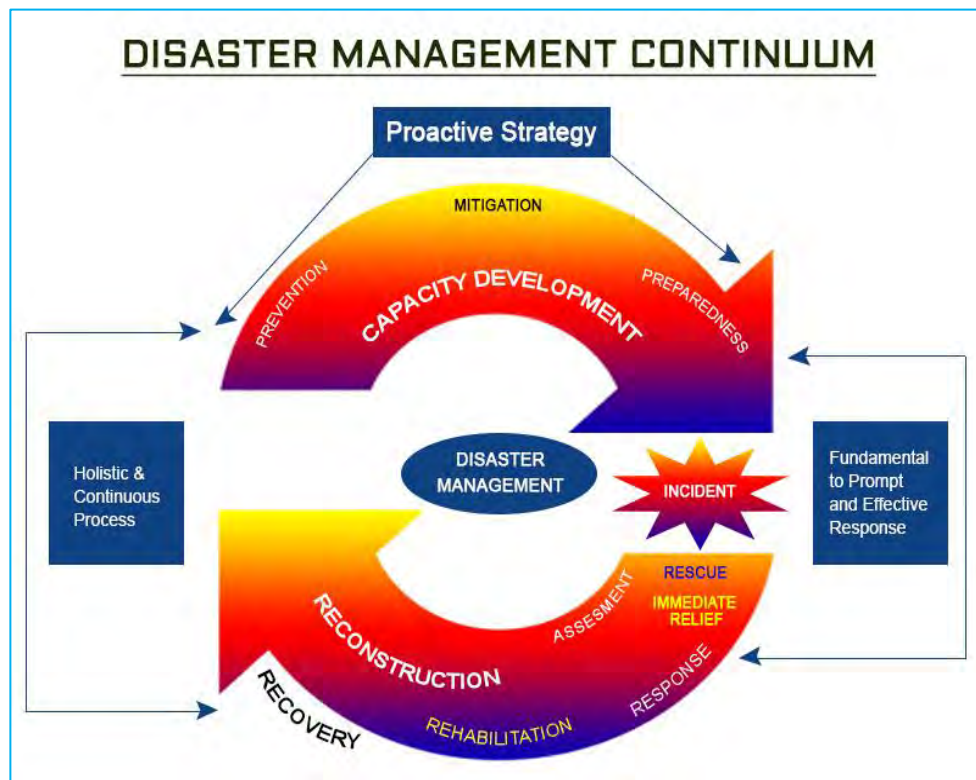
One concept identified in the emergency management of disasters by FEMA (2023) is that planning must be the foundation to achieve objectives in the response and recovery efforts when faced with a disaster, with the planning for emergencies under non-emergency situations as this enables the effective response to and recovery from disasters.

There are specific skills that one would need to develop and expand on in the field of emergency management, these critical skills that need developing can be categorised into the phases of the disaster management cycle (FEMA, 2023).

The emergency management continuum for it to be successful must include a scan of the environment, engagement at leadership level, an all-hazard risk assessment, training, exercises, an assessment of capability and performance (Zottarelli, Sharif, Xu, & Sunil, 2021).

Figure 6

The Disaster Management Continuum



Note: Adapted with permission

Planning and prevention/mitigation

The planning and prevention phase in the disaster management assists by identifying the various hazards that may exist in communities to prevent loss (Nojavan, Salehi, & Omidvar, 2018).

This is seen as the most efficient means of reducing the effect of hazards as it allows for the identification of risks and then developing plans appropriately that includes mitigation strategies as well as operational continuity (Upstate Medical University, 2021).

In the prevention phase of the disaster management cycle, emergency medical staff and managers would need to be skilfully analytical, be able to solve problems as and when they arrive and be able to identify hazards, risks and threats (FEMA, 2011). The mitigation phase of the disaster management cycle entails managers having a skill that would enable them to develop and adapt strategies to mitigate threats, this is important in making communities and staff under their span of control to be made aware of plans being developed and implemented to address contingencies (FEMA, 2011).

Of the various phases in the disaster management cycle the mitigation phase is seen as the most important as it directly addresses potential incidents and if done correctly it can reduce any impacts of the crisis or disaster faced (FEMA, 2011).

Tay, Banomyong, Varadejsatitwong, & Julagasigorn (2022) in their study on risk mitigation highlighted that there are specific procedures that must be taken pre- and post-disaster so that the effect of the incident can be lessened, these procedures must involve policies and strategies being reviewed, mechanisms being put into place timeously (such as training and education). The fundamental difference according to Tay et al. (2022) between preparation and

mitigation is that mitigation addresses the practicality of applying the measures developed and put into place to address the disaster whereas preparation is there to address the actual response both in a constructive and operative manner.

Preparedness

Preparedness is seen as a component within continuum. The inclusion of training and education should be an important component in ensuring that EMS are prepared to deal with any incident (Nojavan, Salehi, & Omidvar, 2018). This is seen as a cycle of planning and organizing activities that allows for an effective and structured coordinated response to disasters as well as mitigate against events that have been revealed (Upstate Medical University, 2021).

The preparedness phase of the disaster management cycle is said to be equally as important due to the specific requirements that must be addressed, these requirements according to Tay et al. (2022) is the development of skills that are required in order to respond to and work at disasters. It is also important to learn from previous disasters, activities that must be addressed in this phase are training and education, effective communication strategies, coordination between response agencies and communities and the development of core critical information.

Response

Disasters usually require a multi-agency response, responding agencies such as EMS must ensure that they have the necessary skills and tools to manage such an incident. Importance must be placed on the understanding of command systems, structures, and coordinated response mechanisms (Nojavan, Salehi, & Omidvar, 2018).

Rifino and Mahon (2016) highlighted the importance of response by EMS to disasters to include critical tasks such as span of control, triage, treatment, transport and meeting set objectives.

The critical skills that require development in this phase according to Tay et al. (2022) is the ability to make decisions that are crucial in a sensitive manner, additional activities that must be developed within this phase is the ability to delegate as well as the ability to have an understanding in organizational policies and procedures when responding to and working at major incidents or disasters.

Recovery

EMS does not have an active role in the recovery phase of disasters or major incidents. A component of the recovery phase is the analysis of the incident, and this analysis can assist EMS by improving systems that are critical in responding to and working at major incidents (Rifino & Mahon, 2016).

To ensure success in training and development, major incident response cannot be limited to one sector, it must have involvement from all sectors which implies that training and the development of capacity are seen as fundamental programs (Capacity Development Strategy for Disaster Management Training Centre, 2017).

Training is seen as just one aspect when it comes to the development of capacity in disaster management, other aspects that organizations should be considering are education, awareness and research with each component making a valid contribution (CDSDMTCM, 2017).

The introduction of fundamentals in disaster management is an effective tool that provides an understanding in managing and responding to major incidents, this combined with the knowledge of differentiating between man-made and natural disasters can also be seen as a way

of preparedness due to the inculcation of understanding in the preparedness phase of the disaster management continuum. Various training programs exist however the main types of training according to CDSDMTCM (2017) are sensitization programs which is essential in the provision of core knowledge that enables one to make and discharge decisions in major incidents.

The development of function capacities is meant for frontline staff in disaster management who handle an aspect of disaster response such as preparedness or the response phase of the disaster management continuum. Whilst, the development of technical capacities ensures that technical skills are imparted such as incident command systems, triage, response or the modelling of training scenarios and drills.

Included were awareness programs on disaster management which can be highlighted in training programs via various methods such as print, electronic or any other mechanism that is able to disseminate accurate and well researched information. Skills required in the recovery phase according to FEMA (2011) is the ability to have both empathy and a relationship to understand what the community has gone through, often overlooked this stage entails the problem solving activities from a long term standpoint.

The management of major incidents in the areas of preparedness, disaster reduction, mitigation and response must be viewed holistically with the correct application of knowledge in the various elements and of equal importance is the technical aspects.

Critical Information & Core Essential Topics

Equally important is the accommodation of critical information drawn from technical aspects that one must know when preparing for and responding to mass casualty incidents, these aspects can be tailor made to suit individuals with varying roles and responsibilities and should include the following critical skills according to Albanese and Paturas (2018) which are the decision making ability, critical thinking ability, the ability to network and build relationships and negotiation with being able to address conflict resolution by having the appropriate training in conflict resolution skills

The knowledge and skills that need to be known by frontline paramedics and managers when preparing, responding, and managing mass casualty incidents should ideally be similar however managers should possess additional skills. Albanese and Paturas (2018) and the CDSDMTCM (2017) highlighted some of these skills that one should have, a scope of knowledge and understanding in major incident response, well balanced knowledge of emergency planning literature including terminology, familiar with organizational methods and procedures and the correct processing and management of information.

A core knowledge of important areas in their field related to disaster risk reduction and mass casualty incidents should be understood, this understanding should include but not limited to key terminology, rules (roles, responsibilities), principles and practices (command and control) (Albanese & Paturas, 2018).

Terminology

Ernst, Mladenow, and Strauss (2017) collectively agreed that terminology in disaster management is used interchangeably especially if used in a situation that describes actions that are meant to be immediate. Snaprud, Haldorsen, & Munkvold (2020) on the other hand highlighted that a conventional understanding of both concepts and languages is an important component in communication especially for first responders who are required to save lives. Those in disaster management planning often use the United Nations Office for Disaster Risk Reduction (UNISDR) terminology guide to ensure that there is consistency in terminology, a new guide on disaster terminology was introduced with new terms, removal of terms and redefined terms (Delgado, 2019).

A comparative need to be done against the 2009 and 2017 changes and this will determine if the terminology updates are indeed positive, this decision can be made by the organization or individuals itself that are undertaking research in the field of disaster management/mass casualty incidents (Delgado, 2019).

Researchers in the field of disaster management themselves should be welcoming to the new terminology as they offer more precision and allow for discrimination although some researchers might prefer older terminology as it offers for the researchers needs to be met, this change in terminology has evolved and matured to streamline the direction in which disasters are addressed and planned for without ambiguity (Delgado, 2019).

The modifications in the terminology guide are broken down into categories with the highlights being twelve new entries with definitions that the previous terminology guide omitted to define, seventeen terms have been removed and eighteen terms have been updated and merged with six terms that remain unchanged, these can be viewed in the tables below (Delgado, 2019)

New UNISDR Terminology

Table 2

New UNISDR Terminology Introduced in the Field of Disaster Management

New Entry	Comment
Affected	New terminology introduced
Build back better	New terminology introduced
Critical infrastructure	Replaced ' <i>critical facilities</i> '; with a definition changed
Disaster loss database	New terminology introduced
Disaster management	Replaced ' <i>emergency management</i> '; with a change in definition
Disaster risk assessment	Replaced ' <i>risk assessment</i> '; with a change in definition
Disaster risk governance	New terminology introduced
Disaster risk information	New terminology introduced
Economic loss	New terminology introduced
Evacuation	New terminology introduced
Extensive disaster risk	Replaced ' <i>extensive risk</i> '; with a change in definition
Hazardous event	New terminology introduced
Intensive disaster risk	Replaced ' <i>intensive risk</i> '; with a change in definition
Reconstruction	New terminology introduced

Rehabilitation	New terminology introduced
Underlying disaster risk drivers	New terminology introduced

Note. Adapted with permission

Removed Terminology

Table 3

Terminology that was Removed in the Field of Disaster Management

Removed Entries	Description
Acceptable risk	Appears underneath ‘ <i>disaster risk</i> ’; which is not defined
Adaptation	Removed from 2017 terminology
Biological hazard (and other hazards)	Included for entries ‘ <i>geological hazards</i> ’, ‘ <i>hydrometeorological hazards</i> ’, ‘ <i>natural hazards</i> ’, and ‘ <i>technological hazard</i> ’, which are not defined but described
Critical facilities	Replaced with ‘ <i>critical infrastructure</i> ’; with a change in definition
Disaster risk reduction plan	Removed from 2017 terminology
Emergency management	Appears under ‘ <i>disaster management</i> ’; it no longer has a definition, the term is described synonymously
Emergency services	Appears as part of the entry on ‘ <i>response</i> ’
Public awareness	Removed from 2017 terminology
Risk	Removed from 2017 terminology
Risk management	Removed from 2017 terminology

Note. Adapted with permission

Terminology with Broadened Definitions

Table 4

Terminology with Broadened Definition in the Field of Disaster Management

Redefined terms	Degree of definitional change
Building code	updated definition is the same
Capacity	definition retains parts of its original formulation
Contingency planning	definition does not resemble the old definition
Critical infrastructure	definition does not resemble the old definition
Disaster	definition retains parts of its original formulation
Disaster risk	definition retains parts of its original formulation
Disaster risk management	definition does not resemble the old definition
Disaster risk reduction	definition does not resemble the old definition
Early warning system	definition does not resemble the old definition
Exposure	definition does not resemble the old definition
Extensive disaster risk	definition does not resemble the old definition
Hazard	definition retains parts of its original formulation
Intensive disaster risk	definition does not resemble the old definition
Mitigation	definition retains parts of its original formulation
Preparedness	definition retains parts of its original formulation
Prevention	definition retains parts of its original formulation
Recovery	definition does not resemble the old definition
Resilience	updated definition is the same
Response	definition retains parts of its original formulation
Vulnerability	definition does not resemble the old definition

Note. Adapted with permission

There is an assortment of terms and definitions that either has been made broad or has been clarified in the new terminology on disaster management with the most prominent being the term “risk” removed and changed to “disaster risk”, with all these changes highlighted by UNISDR in their 2017 terminology guide, it is apparent that some terms have been made clear to understand whilst others remain ambiguous (Delgado, 2019).

EMS Major Incident Terminology

The following are important ambulance specific terminology that must be understood and known by first responders as well as by those that manage mass casualty or major incidents, terminology mentioned are not limited to the following but merely highlight important ones.

Acceptable risk: A risk that has considerably smaller and has fewer detrimental significances than the impending hazards of other paths of action (UNISDR, 2009).

Ambulance Control Point: is the point at which a specially equipped vehicle (Command & Control) is situated usually close enough but not too close to the scene of a major incident. This is done to operate as an ambulance as well as a medical control point. This provides a reporting, communications, and a centre for coordinating of ambulance, medical, nursing, doctors as well as for voluntary personnel (HMCAS, 2019).

Ambulance Silver Commander: the appointed frontline responder responsible for ambulance operations at the site of the incident (HMCAS, 2019).

Ambulance Tactical Advisor: Various tactical advisors can exist, BRONZE/SILVER, they are disaster management qualified personnel who are appointed to advise commanders on major incidents protocols and procedures (HMCAS, 2019).

Casualty Clearing Point/station is an area that is specifically evaluated and set up by the medical commander to assess, triage, treat and transport patients from scene, access and egress needs to be considered when setting up this area (HMCAS, 2019).

Capacity is the blend of all assets, characteristics, and resources that is available within an organization, society or community that can be used to accomplish goals that are agreed (UNISDR, 2009).

Capacity development is the manner whereby people and organizations methodically motivate and develop their capabilities to achieve both economic and social goals (UNISDR, 2009).

Command is the directing, controlling, and ordering those under one's control (HMCAS, 2019).

Contingency planning is the administration procedure that examines specific events or emerging conditions that might threaten the environment or society and institutes preparations to enable responses that are appropriate to such situations and events (UNISDR, 2009).

Corrective disaster risk management is defined as a set of activities set out by management that seek and address to correct current disaster risks (UNISDR, 2009).

Command Staff is an officer from the ambulance service that consists of an incident commander as well as other positions such as safety officer, public information officer who in essence are required to report directly to the commander of the incident (HMCAS, 2019).

A disaster is regarded as a disruption that is serious enough that involves widespread environmental, human, material and economic impact and losses which exceeds a community's ability to cope using resources that are available (UNISDR, 2017).

Disaster Risk Management is described as a process that is systematic that makes use of directives, administrative, operational skills, and capacity with implementation of strategies and policies that are reduces impacts caused by disasters or hazards (UNISDR, 2017).

Emergency management is the management and organization of resources as well as tasks for addressing all phases of emergencies, i.e. preparedness, response, mitigation, and recovery (UNISDR, 2009).

Emergency services are specialized agencies that possess a specific skill set and responsibility to meet objectives in protecting and serving the community that they operate in (UNISDR, 2009).

Forward Control Point is the point that is allocated by the silver commander usually close to the scene where operations can be directed.

Hazard is a dangerous occurrence, substance, condition, or human activity that has the potential to cause serious human injury, harm and possibly death (UNSIDR, 2017).

Hot Zone an important area that must be identified early, it is the area that surrounds a HAZMAT incident, the hot zone must be a 360-degree radius around the incident, this is also known as a restricted or exclusion zone (HMCAS, 2019).

Incident Action Plan is a written plan that contains objectives that reflects the strategy for managing the incident, resource identification as well as operational resources must be included in this plan (HMCAS, 2019).

Incident Command Post is an area in the field where the incident command functions are carried out by the tactical and scene commander (HMCAS, 2019).

Incident Command System is the “on scene” management structure that is standardized which represents the complexity of either a simple or complex incident which is not

obstructed by boundaries, the incident command system must be a combination of equipment, procedures, facilities, personnel as well as communications that must be in an organizational structure that is deemed common, this is generally used to organize incident management operationally in the field (HMCAS, 2019).

Incident Commander is the responsible individual that has responsibility over all activities at the incident, this person should be able to strategize and use tactics to manage resources at the incident, he/she has authority as well as responsibility for all operations at the site (HMCAS, 2019).

Major Incident are classified as incidents that present with a serious threat to the community and cause a disruption to an organization or service by becoming stretched in management due to size and complexity of an incident (HMCAS, 2019).

Mass Casualty Incident is an incident that results from either a natural or man-made cause which often results in injuries that can overwhelm the ambulance service in a specified jurisdiction (HMCAS, 2019).

Mitigation is described as the reducing of impacts that are adverse which are related to disasters (UNISDR, 2017).

Multiple Casualty Incident is an incident that involves multiple casualties or victims that can generally be managed with an increased response by a single ambulance organization, these types of incidents do not generally overwhelm the capabilities in a jurisdiction (HMCAS, 2019).

Preparedness is described as the core knowledge and capacity development by organizations that ensures a response, management and recovery from the impact caused by a hazard (UNISDR, 2017).

Public awareness is the extent of knowledge that is common regarding disaster risks and the factors that lead up to disasters as well as the steps that can be acquired collectively and individually to lessen the vulnerability and exposure to hazards (UNISDR, 2017).

Response is the making available of public assistance and emergency services both during or after a disaster to ensure that lives are saved and to reduce health impacts, ensure public safety and to meet the necessary needs of people that are affected (UNISDR, 2017).

Recovery is the rebuilding and development where applicable, of services, infrastructure and living conditions of communities affected by disasters (UNISDR, 2017).

Risk is defined as the amalgamation of the likelihood of an event and its negative effects (UNISDR, 2017).

Span of Control is the number of people that a supervisor is responsible for, the general span of control is between one supervisor for three people to one supervisor for seven people, depending on the organization structure and manpower available to manage an incident (HMCAS, 2019).

Aspects of Disaster Management in EMS

Although there has been massive progress in the field of disaster management especially in the mitigation and preparedness phases, the magnitude of disasters worldwide has vastly increased yet disaster management principles remain the same and crucial as ever when responding to ensure that there is no further lives and property being lost (Klein & Irizarry, 2021).

The response to disasters by EMS is seen as one of the most crucial aspects as EMS personnel are seen as stakeholders that can work in unison when faced with working in and managing disasters if they are well trained in incident command (Klein & Irizarry, 2021).

EMS can classify a response to disasters under various definitions, the incident being responded to can either be classified as an accident, significant incident or even a disaster, the difference being the number of casualties that would needed to be managed by the organization.

Aspects that EMS would need to concentrate on in the first phase of being made aware of a disaster or incident is knowing the type of disaster, the location, risks, number injured, fatalities and nature of the injuries (incident dependant).

There were four aspects that EMS would need to be familiar in, in order to improve on the overall quality of EMS management in mass casualty incidents, these according to Saadatmand, Marzaleh, Abbasi, Peyravi, and Shokrpour (2023) these are the ability to make improvisations which must be based on the responding organizations competence and established command structure, investing in networks that are multi-dimensional and multi professional, continuously assess the planning, training and education needs in the field of mass casualty incidents and be research orientated and be kept abreast of knowledge through data collection and latest international developments.

Apart from the phases used in disaster management and the points mentioned in the above paragraph, which covers planning and responding to disasters used by emergency management teams, specifics that would need to be immediately understood according to Farahani, Lotfi, Baghaian, Ruiz, and Rezapour (2020) are appropriate dispatching of resources were the resources being dispatched to the scene must match the information received, i.e. if it's a building collapse, search and rescue personnel with appropriate equipment would need to be equipped and sent to

search for people. Primary Triage must be done where the patients are found, categorised according to their injuries, basic lifesaving interventions be carried out and then sent through to for a secondary triage for further treatment, management and transportation. Provide for medical assistance onsite by being able to adequately treat and stabilise patients on site to ensure survival of those injured prior to being transported to hospitals and transport which must ensure that adequate number of ambulances are available to transport the injured, this can be by air or land depending on resources available by the responding organisation.

In addition to the above Farahani et al. (2020) highlighted the following aspects under the headings used in emergency planning/disaster management i.e.

Response which is the management of casualties, preparation for relief, be able to set up appropriate shelters, and ensure safety.

Preparedness is the ability to ensure preplanning is done for all hazards i.e. “all hazard approach”, appropriate prepositioning of resources to ensure a swift and timeous response.

Mitigation makes use of technology and strengthen infrastructure within the organization. Recovery is the restocking, preparing for any possible future eventuality and learning from mistakes encountered.

A position paper on the role of EMS in disaster response by Liu, Catlett, Jenkins, Lowe, and Millin (2021) agreed on within a community, the local (EMS) in charge of that area must have a role when it comes to the medical components of planning and responding to major incidents/disasters, and they must ensure collaboration with agencies to enable a unified command and control system.

EMS management and responders must be part of all the phases of the disaster management continuum as first responders are said to be in a unique position that enables them

to respond to and be able to work at a major incident due to them being able to work in an incident command system which places them at all levels of an integrated response be it local, regional, or nationally within a country especially if surge capacity is required. There should be a culture of encouragement for EMS personnel to work together, train together especially if a community has other response teams in major incident/disaster response.

EMS management has a vast knowledge of both technical and clinical skills combined with policies, procedures and operational capacity that ensures that they are the most ideal to fill in command and control roles at major incidents and disasters, these roles can be defined as operations, parking, loading, logistics and safety. EMS generally plans on addressing issues such as disaster response, protecting the responder (PPE), stress management and most importantly being specific in areas such as training and education especially in disaster management/mass casualty incidents and response and collaboration should exist between various organizations and sectors to ensure that there is standardization when planning, responding, and working at any type of major incident.

Rishipathak, Bhandri and Hinduja (2021) further highlighted that EMS personnel play an important role if there are major incidents or disasters; however, the area of improvement is training and skill management in the management of major incidents and they do require an understanding in baseline preparedness. The regular training of EMS personnel in disaster management/major incident response is currently the need with the design of an effective training program as EMS are often the first line response (Rishipathak, Bhandri, & Hinduja, 2021).

In a systemic review on disaster preparedness among EMS providers published by Beyramijan, Khankeh, Farrokhi, Ebadi, Masoumi, and Aminizadeh (2020) the health system is

seen as the most important function in disaster response with emphasis placed on EMS due to their systems being able to provide emergency medical care for victims of disasters.

This review echoes the point raised by Liu et al. (2021) as well as by Rishipathak, Bhandri and Hinduja (2021) on EMS needing to be further strengthened in the areas of training and education in disaster management which includes mass casualty incidents/major incident response. EMS personnel being first line response in any type of disasters can become potential victim themselves by being targeted by terrorist attacks such as in Hazardous materials or roving shooter situations (Beyramijan et al., 2020).

This highlights the importance of training and education as highlighted by agencies such as the United States Department of Homeland Security to include aspects such as incident management, command and control, triage, treatment, transportation and management of medical equipment and sundries in major incidents (Beyramijan et al., 2020).

Equally the lack of training and education leads as highlighted by Beyramijan et al. (2020) can result in outcomes that are undesirable such as loss of life. In the discussion of the literature review by Beyramijan et al. (2020) preparedness is one of the most critical aspects in disaster management making preparedness of healthcare care workers especially those in the EMS system as being critical. The lack of training and education in disaster management is evident in studies as often EMS are “not prepared adequately to respond to disasters” (Beyramijan et al., 2020).

The inadequacy according to Beyramijan et al. (2020) is due too scope and size of the incident, surge capacity which includes aspects of staffing and infrastructure, planning, communication, policies, support in finances, early warning systems, safety and security, experience in the response to disasters and training and education.

Mass Gathering and Emergency Medical Services

Mass gathering type events are often connected challenges in the public health sectors. The World Health Organization (WHO) defines a mass gathering as an “event that is spontaneous or planned that has a large attendee base” which often places strain in the response and planning in the community that the event is held in (WHO, 2017).

Although the definition of mass gathering by the WHO is unrelated to the scale of a mass gathering event or participants, these factors do however affect the disaster risk management process.

The objectives of making provision by healthcare in a mass gathering is to ensure services are provided to all to prevent and reduce the possibility of injuries and at the same time ensuring an appropriate response (Khan, Sabbagh, Ranse, Molloy, & Ciottone, 2021).

Memish, Steffen, White, Dar, Azhar, Sharma and Zumla (2019) described mass gathering medicine as a newly evolved discipline which was touched on in Geneva during the World Health Assembly of Ministers of Health in 2014, the reviews covered spoke on public health threats, risks and healthcare providers experience in the management and covering of large-scale events. Various challenges are generally associated with mass gathering events and these have since continued to pose a challenge in the planning of such events such as music festivals, football events, religious festivals, and political gatherings (Memish et al., 2019).

The WHO (2017) highlighted disaster risks in a mass gathering events such as points of access and egress being restricted, extremities in weather, medical care on site that is inadequate and poor preparation. The potential for an MCI at a mass gathering event is always present and therefor necessitates a well-planned and trained on site medical personnel who are often responsible for the medical coverage at such events (Maleczek et al., 2021).

Various strategies and consideration's where highlighted by Memish et al. (2019) and Margolis et al. (2021) these being that there must be an appropriate disaster risk assessment, adequate emergency medical planning and response, make use of modelling (predictive) to plan, make use of historical data, provision and review on public health measures such as food and water provision/syndromic surveillance, appropriate disaster medicine coverage to include triage and associated levels of care and be able to provide on-site medical care, treatment and medication to participants, workforce, and spectators.

An important but overlooked threat at a mass gathering is the is threat of a stampede causing crush injuries that can occur due to panic from a variety of reasons an example being a structural collapse or fire which is often unpredictable.

Regular training and exercises for first responders and other health care workers are paramount in the management and response to mass casualty incidents arising from mass gatherings to improve one's knowledge and improve areas that are identified as lacking (Memish et al., 2019).

Sporting events are one of the biggest and most regular type of mass gathering with football representing various factors that can contribute to a mass casualty such as weather and the use of alcohol however the reason behind providing medical assistance at these types of events is to ensure that patients that require help are assessed and treated appropriately with the resources that are provisioned for without affecting the local EMS system (Imbriaco, Flauto, Bussolari, Cordenons, & Gordini, 2020).

A higher risk is associated with football events and planning for such an event should consider factors such as planned capacity, single groups versus family groups, location of the

event (indoor versus outdoors), water availability or alcohol availability and planned consumption and crowd behaviour (Imbriaco, Flauto, Bussolari, Cordenons, & Gordini, 2020).

Football is generally associated with aggressive and energetic spectators, which has the potential to increase risks such as violence, injuries, and cardiac related emergencies. The hosting of big football games as in the Qatar FIFA World Cup 2022 is seen as an honour and a privilege for the host country which attracts massive fans which are dedicated and devoted to their countries teams and these crowds are often concentrated in stadiums (Khan, Sabbagh, Ranse, Molloy, & Ciottone, 2021).

Football related mass gatherings are associated with and prone to mass casualty incidents, the density of the population is also a threat that can cause various injuries and death due to stampedes that can hinder EMS access. The lack of competent personnel, resources and poor safety are identifiable features that increases health risks as well as overall workload on the local EMS system, the normal communication in mass gatherings should be “business as usual” instead of relying on “crisis communication plans”, in addition the planning in mass gatherings should consider aspects such as safety, briefings, command incident systems, command & control, triage, treatment and transportation as well as have an “all hazard approach”, (Khan., et al 2021).

The training of personnel in mass casualty incident management including the chosen triage methodology as well as treatment and being aware of the limitations that personnel can face on the site of the incident at mass gathering events are vital, training should include evacuation procedures and routes to be used (Khan., et al 2021).

Table 5 below highlight all of the football games played over the years that are associated with mass casualty incidents.

Table 5*List of Football Disasters*

April 5, 1902	1902 Ibrox disaster	25 people were killed and more than 500 were injured when heavy rainfall the previous night caused part of the West Tribune Stand to collapse, causing 200 to 300 people to fall onto the concrete below at the Ibrox Stadium, Glasgow, Scotland.
March 9, 1946	Burnden Park disaster	33 died when the collapse of two crash barriers in an overcrowded stand led to the crowd falling forward upon each other.
May 24, 1964	Estadio Nacional disaster	328 died and 500 injured during match between Argentina and Peru when referee disallowed a goal scored at last minute which ignited crowd protest. Police fired tear gas into the crowd, causing a panic and a rush for the exits at National Stadium, Lima, Peru.
June 23, 1968	Puerta 12 tragedy	71 dead related event in Argentine history. Cause of crush undetermined in the deadliest sports
January 2, 1971	1971 Ibrox disaster	66 people were killed when the collapse of stairway barriers occurred after someone fell as fans were leaving the stadium, leading to a crush.
February 8, 1981	Karaiskakis Stadium disaster	A total number of 21 people, 20 supporters of Olympiacos and 1 supporter of AEK, lost their lives while rushing out of the stadium to celebrate the victory of Olympiacos against AEK Athens (6–0). The accident occurred in the historic Gate 7
October 20, 1982	Luzhniki disaster	Between 3 and 340 people died due to a stampede followed by the collision between exiting and returning viewers when a goal was scored at Lenin Stadium, Moscow, Russia. ^{[4][5]}
May 29, 1985	Heysel Stadium disaster	39 people were killed and 600 injured when escaping fans were pressed against a collapsing wall in the Heysel Stadium in Brussels, Belgium.
March 10, 1987	20 people were killed when panicked soccer fans fled from knife	wielding ruffians and triggered the collapse of a sports stadium in Tripoli, Libya.
March 12, 1988	Kathmandu stadium disaster	93 people were killed and 100 more injured when fans attempted to flee from a hailstorm inside the national Dasarath Rangasala Stadium watching a football match between Bangladesh and Nepal at Kathmandu, Nepal. The crowd first fled to the main stand, where they were beaten back by police with clubs. The crowd then made for the tunnel leading to the exit gate, which was locked, yet people kept entering the tunnel, not knowing about the deadly crush ahead of them. ^[6]
April 15, 1989	Hillsborough disaster	97 dead after police negligence led to overcrowding in standing pens.
October 16, 1996	Estadio Doroteo Guamuch Flores.	83 dead and several hundreds wounded before an international match between Guatemala and Costa Rica
April 11, 2001	Ellis Park Stadium disaster	43 stampeded to death after non ticketed spectators gained access into stadium by force. Johannesburg, South Africa.
February 1, 2012	Port Said Stadium riot	local Al Masry fans attacked fans of Al Ahly which led the deaths of 72 Al Ahly fans, 1 Al Masry fan and a Police Officer, and a couple more thousands wounded

Note. Adapted with permission

Margolis, Leung, Friedman, McMullen, Guyette and Woltman (2021) highlighted that there is an increase in literature around the preparation, planning and staffing for mass gathering events which incorporates prehospital emergency care as they are entrusted to provide the best medical care in normal an emergency and a mass casualty situation.

Various organizations tend to use different terms to describe events with many people in attendance, however it should be remembered that emphasis should not only be placed on the

total number of people that are expected to attend but on the communities EMS systems ability to be able to respond to and manage a disaster or mass casualty incident (Margolis et al., 2021).

Components in training for and planning for the management of mass gatherings should include appropriate staffing or level of care such as basic life support and advanced life support first responders, the most suitable transport options for patients and in the event of mass transportation should there be a mass casualty incident, hospital capabilities, EMS staging areas, landing zones for air evacuation, ingress and egress and a medical threat assessment that is based on historical data (Margolis et al., 2021).

Importantly, according to Margolis et al. (2021) the planning for mass casualty incidents should incorporate the incident command system (ICS) to ensure command and control of an incident, be able to expand or contract the response by EMS and others to an incident, appropriate use and knowledge of triage algorithms and the regular testing and exercising by staff to possible incidents.

Al-Wathinani, Hertelendy, Mobrad, Alhazmi, Althunayyan, Molloy and Goniewicz (2021) clearly states that mass gathering events that are planned for should be considered and planned as if it's a real disaster in order to ensure that the local EMS is able to provide for and respond to real mass casualty events should they occur. This was further highlighted by Wathinani (2021) who quoted Ciottone (2016) saying that having drills often enough is best in ensuring preparedness to disasters by disaster teams. Mass gathering events that have a pre-planned date can be appropriately planned for and should be prepared for as if it's a disaster as it provides opportunities for responding to and testing systems should a real disaster occur (Morimura et al., 2021).

The initial step in preparing for disasters is to identify the health care responders who should have a knowledge in different aspects in disaster management such as ICS and triage and such training in these aspects must incorporate a complete package in the field of disaster response and must be appropriate for the country that the responder is working in (Wathinani, 2021).

There are various risks and benefits that are associated with mass gathering type events for the local health care system in a country as mass gatherings will have a profound increase in EMS demand because of people being concentrated in certain areas such as stadiums, fan festivals and other areas that attracts people during a sporting event (Morimura et al., 2021).

Aspects such as crowd size, weather conditions, venue access, venue air conditioning systems, alcohol availability are factors that increase the risk of disasters in a mass gathering, these coupled with an interest from international fans to a major sporting event are often associated with an MCI. Some of the MCIs at sporting events is the 2014 Boston Marathon bombings where 264 people were injured and three died, the act of terrorism at the 1972 Olympic games where eleven athletes died and most recently was the 2015 Paris attacks where 129 died and 356 needed to be triaged and transported to 18 different hospitals for further care (Morimura et al., 2021).

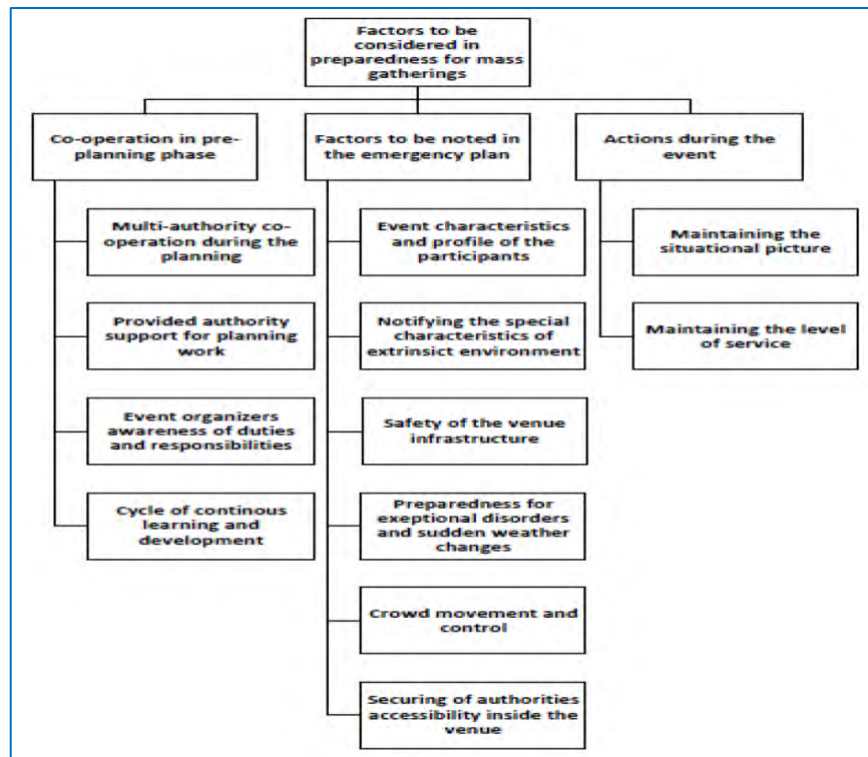
Various international conferences have highlighted the importance of emergency medical care and mitigating disaster risks at mass gathering events, some of the conferences where the 2019 Rugby World Cup conference, the 2019, Osaka G20, and the 2019 Enthronement ceremony (Morimura et al., 2021).

The concentration of people in a specific venue or area as in the case of a mass gathering event has an impact on the emergency system by there being an increase in requests for medical

or emergencies, an increase in the use of ambulances and an overall increase in patients being seen at hospitals, in addition should there be a major incident then there would be the added impact on EMS to be able to respond to and manage victims at the disaster itself (Morimura et al., 2021). Various factors need to be considered when planning for a mass gathering event, these factors are but not limited to the following: (Koski, Kouvonen, & Sumanen, 2020).

Figure 7

Main Factors to Consider when Planning for a Mass Gathering Event



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The planning for mass gathering type events requires a multi-authority all hazard type approach so that safety is ensured to participants and there are minimal delays should there be a response required to an emergency, these gatherings often attract crowds in numbers, and this can

cause a higher density of injuries should there be a major incident although the population attending the event is generally a healthy one (Koski, Kouvonen, & Sumanen, 2020).

In planning appropriately for mass gathering events many disaster risks can be mitigated, especially as these types of events place a large amount of pressure on EMS systems however having a well-trained and prepared team is key in responding to disasters at mass gathering events knowing full well that a mass casualty incident can occur at any time (Brown, Smith, & Tataris, 2021).

Mass gathering events although places a huge burden on health care systems also makes provision for benefits such as building a robust health care system as plans have been put into place to deal with injuries (Morimura et al., 2021).

Health systems must be structured to manage routine priorities and must have the ability to expand incident command systems (ICS) although the most sophisticated system can properly plan for mass gathering events, disasters can be encountered therefore effective communication, cooperation and coordination, crowd psychology and behaviour is important in mitigating risks at mass gatherings as well as the provision of well-trained responders and personnel (Khan, Sabbagh, Ranse, Molloy, & Ciottone, 2021).

Understanding crowds in mass gatherings

A crowd is defined as a gathering of people in groups in a limited place randomly or organized where movement is limited (Abbot & Geddie, 2000). The types of crowds are generally characterized by determining the purpose of the people gathering, the goals of the gathering, situation that the crowd adopts and the relation of the crowd to the gathering.

The gathering of spectators can be described as random (no prior warning or arrangements), crowds having the same interest, crowds that are expressive which is usually

associated with a sporting event where joy is experienced, and the traditional crowd gathering such as a holy festival.

Having a knowledge of the people that are gathering helps to determine the psychological aspects of the crowd in being able to control and facilitate dialogue to prevent a mass gathering type incident or to plan for one. In relation to mass gatherings emergency planners would need to understand crowd management which a pre-emptive method to manage big groups of people and employ an efficient and logical measures to ensure that people that are gathered are safe as well as comfortable at the gathering. Crowd control is seen as an annex of crowd management as it is a reaction to an event that is unplanned for as agencies would try to normalize a situation as they occur. (Templeton, Drury, & Philippides, 2018).

The objectives described by Templeton, Drury, & Philippides (2018) in the management of crowd control is to prevent disorder, protect people and to ensure that there is a response to either control or prevent an incident from occurring. To understand mass gathering type events, one must understand the physical criteria that are used in determining crowd management such as in sporting events, these are knowing aspects in crowd speed, acceptable density and crowd dynamics.

Crowd Speed which is measured in meters per second, which is understood by slow, normal and fast walking of spectators, crowd density is a criterion that is used crowd density is a criteria that is used to describe people in a square meter and it is measured in one area which is equal to density per square meter, crowd density it should be equal to density per square meter. Acceptable density is between one to four people per square meter overcrowding, or critical density is between five to six people per square meter and dangerous crowd density is when there are more than seven people per square meter. Crowd dynamics is understood to be the change

and transference of movement of the crowd weather expected, perceptible or otherwise, aspects that determine crowd dynamics are temperature weather conditions and infrastructure (Still, 2017).

Psychology of crowds in mass gatherings

Several theories exist which crowd management planners and emergency planners would need to know, emergency services such as EMS would need to have an understanding of these theories in order for them to better prepare, respond to and manage incidents within mass gatherings, Sigmund Freud defined the behaviour of crowds as people within a crowd act as an individual and different from others with the risk of that individual following another such as a leader and not considering what impact their individual behaviour could have, Floyd Allport highlighted that a crowd has the ability to create an elevate emotions which leads to excitement or overstimulation and thereby forgetting them being an individual which leads to a united survival disposition, Gustav Le Bon also highlighted that people lose identity in crowds and therefore are subject to emotions and a collective unconscious behaviour (Mondal, “n.d”).

Sporting events that attract large crowds are generally peaceful by nature, but it does have the tendency to attract violence as well as hooliganism which is often a rapid onset that can be difficult to control leading to people being hurt or cause of a stampede due to panic. (Templeton, Drury, & Philippides, 2018).

Crowd tactics and patterns

The crowd type is known to reflect collective activities and actions as described below (Munoz & Anduiza, 2019);

Crowd movement

Fixed crowds which are assembled in one area, crowds that are moving towards an event and in crowd activities which describes an energetic crowd which is expressive and often organized in the way they move i.e., alone, in groups be it small or large.

Crowd categories

Crowd categories can be described as anarchism, regular, change in activities such as direction loss due to panic or spontaneous.

Crowd tactics: Groups

Crowd group tactics can be divided into nonviolent, violent and unplanned behaviour.

Nonviolent

Nonviolent crowd movement are generally ones that have preapproval from relevant authorities, they have the tendency to gather in the same location as permission that was granted for, they march in manner that is consistent and is peaceful (Munoz & Anduiza, 2019).

Violent

Crowd behaviour associated with violence is generally a result of fans being hostile to a rival football group with a known history of inciting hostility, verbal abuse, they riot against authority, public order is disturbed, there is the potential use of petrol bombs, starting of fires, vandalism, destruction of property, throwing of debris and assault with the intent to do grievous bodily harm (Munoz & Anduiza, 2019).

Unplanned

The unplanned behaviour of crowds is mainly due as a reaction, people being in crowd with a high density often scramble to get out of the situation they are in, this leads to being crushed (stampedes/fire/collapse of infrastructure) and severely injured as a result of panic (Munoz & Anduiza, 2019).

Bosta (2021) highlighted that people panic as a result of their lives being in danger, exacerbated by aggressive crowd behaviour in high density crowds which results in a reaction of fighting and pushing. The presence of high-density crowds is not necessarily the primary reason of panics and anxiety in crowds, restriction of movement, narrowed walkways and pathways, tunnels and heights are known to cause anxiety which manifests as chest pain, fainting, diaphoresis, breathing difficulties and tachycardia, panic and anxiety can also be a reaction to being suddenly startled such as no warning when fireworks are let off (Bosta, 2021).

A stampede in a mass gathering event is generally due to more than 7 persons being in a square meter (high density), which is usually due to them trying to escape from a sudden unexplained situation that they find themselves in, this generates panic and then they often find themselves in a situation of not being able to be rescued which then generates a physical pressure, vibrations and turbulence in all directions which causes horizontal effects making it impossible for movement or to breathe as a result of being pushed against a fixed objective or trying to self-rescue which causes them to fall and be trampled on (Bosta, 2021).

General concepts & considerations

Incident command

Incident command system (ICS) is a tool that is used to assist an organization to manage and incident when it arises in order to assist managers and staff to be effective in the management and running of said incident (Giordano & Loesch, 2016).

ICS was first developed by FEMA to ensure a standard framework for first responders in the effective management of disasters (Nagarajan, 2018).

The ICS was developed due to various organizations having to work together at incidents which often led to unclear lines of command, unclear objectives, and poor use of resources (Williams, Freeman & Goldstein, 2017).

Ndabezitha (2019) in a South African study on “incident command systems”, recommended that responding agencies respond to an incident apply, ICS in both planned and unplanned responses to as it ensures a standardized approach to organizational structure, communication, coordination and resource management.

The ICS as described by the Federal Emergency Management Agency (FEMA) (2021) is an efficient and effective method that can assist in the proper communication methods in order to manage complex, simple or large incidents with the goal being accountability, management of span of control be it for staff and equipment management.

The development of the ICS was due to incidents that required cooperation from various agencies needing to work together, this ICS was brought further developed and used due to real world incidents and disasters which provided a foundation for multiple responding agencies (FEMA, 2022).

Based on business management ideologies, ICS development included the following aspects, planning, coordination, communications and delegation which is constructed around a sectional format that is expanded or reduced based on the need of the incident itself.

The two command categories that is used within the ICS are either single command (one commander that is identified) in managing the incident or unified command (where multiple individuals from various agencies) manage the incident. FEMA (2022) highlighted that there are eight components that the ICS is structured around i.e., terminology, integrated organization responses (Interoperability), communications, a command structure that is cohesive, an action

plan that is understood and trained in by all responding agencies, span of control, designated incident services and an all-inclusive resource management.

In understanding ICS's, EMS would need to focus on the incidents itself by ensuring that the "greatest good is done for as many as possible", at mass casualty incidents. Apart from the importance placed on the treatment of patients the focus on ICS is the combination of a clinical as well as the management approach whereby first responders understand the evolution of the incident and base their management of the incident according to the needs identified (FEMA, 2022).

Organizations would need to understand that preplanning and training are important factors when using ICS's, as this would enable responders to be effective in carrying out the operation required of them at the scene of an incident, roles as well as responsibilities must be defined as well as use of the ICS, training and exercising the ICS in live exercises should be part of the process (FEMA, 2022).

The initial response to an incident and the subsequent use or activation of a pre-determined attendance to an incident mentally enables and prepares first responders to activate and or set up their organizations ICS, this however should not deter them from what is being faced with or their organizations policies and protocols (FEMA, 2022).

The operations set up happens when the first responding unit from the organization arrives on scene, the operations stage the confirmation of the incident occurs, a staging area for arriving units is set up, a suitable incident command post is identified, it is at this stage that the incident commander activates the ICS (FEMA, 2022).

Within the maintenance stage of the incident the incident commander would continue to manage the major incident via the ICS, it is at this stage that reporting is done to update hospitals

that will be receiving patients, the operation at the incident is adjusted, resources are evaluated, and progress is reported to relevant department heads (FEMA, 2022).

The demobilisation and termination phase of both the incident and the use of the ICS would be dependent on the incident commander (FEMA, 2022).

ICS has a specific set of tools that are extremely beneficial that can be used by frontline responders in an effective manner to necessitate the appropriate response needed in an emergency, when an ICS is used and embraced it ensures a well-coordinated and organized response. These findings are in support of work done by FEMA (2022) where the approach to the management of an organization is carried out using the ICS.

Buck, Trainor and Aguirre (2006) argued that an “ICS is effective when duties are understood, direct and stable”, this ensures that people are informed about what needs to be done as part of the collective aims and objectives of an organization. Although beneficial, ICS must be used by responders who are well trained in it, have the practical conviction of using it.

ICS, according to Buck, Trainor and Aguirre (2006) is not beneficial if it is used as a universal method of management, it must be adapted to specific disasters or major incidents to effectively coordinate activities of first responders.

In an ICS the incident commander is the person that has overall responsibility for the management and response, the commander would have to ensure that objective as well as goals are formulated, a unified command in an ICS has a representative from every agency although roles and responsibilities can be shared by Fire, EMS and police (Williams, Freeman, & Goldstein, 2017).

The incident commander (IC) is overall responsible for the operations during a disaster, the IC can expand or reduce the roles and responsibilities at an incident depending on the overall

requirements of the incident by having an understanding on situational needs to ensure that lives are saved, the incident is stabilized, and property is conserved (Nagarjan, 2018).

Medical personnel have various roles to play when involved in ICS's, the type of event faced dictates roles and functions that they would undertake which can vary from the incident commander to various others, healthcare workers might not always be involved in an incident however they should know the organizational ICS used, staff working under the incident commander for the various components in response to an incident, these roles can vary from safety, liaison and sector commanders (Williams, Freeman, & Goldstein, 2017).

ICS according to Reynolds, Michael and Spiess (2017) is the gold standard in the management of major incidents in the health sector as it ensures flexible yet effective hierarchical organizational structure by ensuring those personnel, resources, communications and procedures is well integrated in the conventional ICS operations.

The management of disasters and major incidents often differ and require various training methods in order to manage incidents effectively, these areas are terminology which needs to be common to have clarity in communicating as well roles understanding, the use of universal terminology eliminates misunderstanding and miscommunication (Williams, Freeman, & Goldstein, 2017). A unified command ensures that all responding agencies function in unison whilst maintaining organizational territory by ensuring aims and objectives are met by commanders with "span of control" protocols followed (FEMA, 2021).

Chain of Command must be part of the ICS, in order to achieve objectives as well as work force preservation whilst modular organizations often the complexity as well as the size of any incident determines the ICS required to manage said incident (FEMA, 2021).

Having a modular ICS ensures adaptability to any incident, meaning that all positions are not necessarily filled in a small incident whilst positions are added as the incident grows (Williams, Freeman, & Goldstein, 2017).

FEMA (2021) highlighted that predetermined roles and responsibilities should be predetermined in response to and the management of disasters, various communication methods need to exist and understood by all first response agencies however, the use of communication technology should be robust to ensure effectiveness at incidents.

The recommendation for “span of control” should be limited between 3 -7 people in an ICS, this ensures that the responding agency is effective, it is also described as a hierarchical system, with an established chain of command, the commander of an incident is effective within the ICS by limiting responsibility and maximizing effectiveness (FEMA, 2021; Williams, Freeman, & Goldstein, 2017; Nagarajan, 2018). Making use of “transfer of command” ensures that in the event commanders need to change i.e., handover of command due to a senior officer/manager arriving or due to a protracted incident, there must be a briefing (handover & takeover process) with both outgoing and incoming staff and deployment of “ON CALL”, personnel for an agency/organization should not self-dispatch to incidents as this creates both duplication and confusion in major incidents (FEMA, 2021).

The preceding four paragraphs highlighted, requires both training and planning to ensure managers and staff are responsible in learning their organizational ICS structure together with their roles and responsibilities tasked to them at major incidents. These points discussed were further highlighted by Ndabezitha (2019) who argued that, the need for the implementation of s ICS must contain a standard organizational approach, terminology that is common, standard operating procedures (SOP), clearly defined roles and responsibilities which must include that of

the incident commander and criteria for individual staff under the commander to be able to command and to give the power/authority to function in an ICS during an incident.

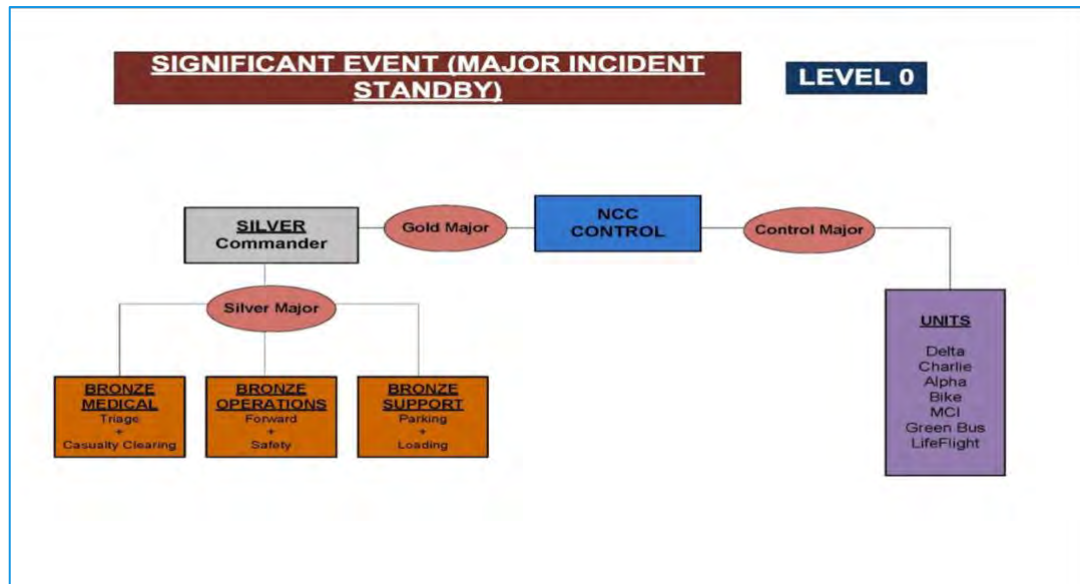
The unified ICS command theory highlighted by Farcas, Chan, Malik, Nono, and Chiampas (2021) allows for roles and responsibilities to be spread but interconnected with the aim of goals and objectives to be achieved with models and systems that are described by FEMA such as communications, span of control, resources, and effective coordination.

Various examples taken from previous disasters such as the Boston marathon bombings and Hurricane Katrina have shown that breakdown in communications as an example resulted in challenges with coordinated responses which resulted in command structure as well as roles and responsibility uncertainty making ICS's to be ineffective if there is a lack in training (Farcas, Chan, Malik, Nono, & Chiampas, 2021).

Previous endeavours with multi-agency incident command systems (ICS) have proven successful for mass gatherings, such as the Chicago Marathon, Ebola and Zika virus outbreaks comparably, ICS principles have been used to arrange responses to other major incidents and disease outbreaks such as the coronavirus disease 2019 (COVID 19) which required a coordinated response and a unified ICS (Farcas, Chan, Malik, Nono, & Chiampas, 2021).

Figure 8

Example of An Incident Command



Note. Adapted with permission.

Figure 9

Example of an Expanded Command System



Note. Adapted with permission.

Principles in ICS's ensures that correct applications are used and disorders are reduced, the principles associated with ICS's must be applied at every level of a crisis and must ensure that health related fields in disaster management adopt the latest methods that is internationally recognized when coping with disasters, the absence of an ICS leads to equipment loss and lack, inability to correctly classify patients, an increase in mortality related to conditions that are often critical and an overall lack of preparedness in the effective response based on components that are key such as command and control, triage and communications (Shooshtari, Tofighi, & Abbasi 2017).

The principles associated with ICS according to Kaye, Cornett, Kallurkar, Colantonio, Chandler, Mosieri and Fox (2020) are management by objectives which consists of evaluating a problem, developing a plan to solve it, implementing the plan (putting the plan into action), and allocating the necessary resources, addressing areas in planning and response to ensure that its scalable to an incident, adopt an approach that is modular which provides adaptability to various incidents i.e., an all-hazard approach and having a specified span of control with added principles to ensure an effective communication strategy that can be used.

Kaye, Cornett, Kallurkar, Colantonio, Chandler, Mosieri and Fox (2020) went on to further highlight that it is paramount to have a team that is strong in order to achieve goals in ICS's, consideration must be taken in their emotional intelligence, ability to control emotions, be empathetic, and personality's that are desirable and welcomed by peers.

In essence an integral part ensuring the success of the ICS is tied in with the effectiveness that must be achieved by ensuring that training and education in ICS must incorporate aspects such as communication, standard formats, identification of key concerns in identified areas and the ability to expand and contract the incident in order to ensure that goals and objectives in

managing the incident is achieved no matter how big or small the incident is (Ogle, Chowdhury, Huynh, Davis, & Xie, 2017).

Triage

Triage is derived from a French word “tier”, which is understood to mean separate, classify or categorize and is often referred to patients who are injured and required medical care that is categorized according to their acuity with the process allowing for respondents to treat the most that they can (Bazyar, Farrokhi, & Khankeh, 2019).

Triage is one of the most important aspects in the management of an MCI, with the aim and objective being to standardize protocols to provide a valid, reliable, reproducible tool that can assist EMS (Dittmar, Wolf, Bigalke, Graf, & Birkholz, 2018).

Decision making in a clinical setting should be a process that is standardised in approach, the thinking process used, as well as the focus on the task at hand to ensure that the methodology is focused on information that is needed to be interpreted (Lorenzi et al., 2023). Having an understanding of what is needed requires a “cognitive flow” which is able to assist in the simplification of the decision making process in a time critical moment in time, making use of aids in these time critical moment ensures an approach that is standard and assists with a clear decision making process (Lorenzi et al., 2023).

Sedlar and Kassaiova (2022) added that the interpretation of information, anticipating a course of events, being able to identify options and being able to maintain standards are important cognitive skills that are required in emergency medical services, therefore according to Lorenzi et al. (2023) having a systematic approach and adhering to guidelines must be applied by all staff when faced with a stressful situation in delivering care.

Triage is often used to allocate a limited resource during a mass casualty incident or disaster although the application of triage is the resource that is often made reference to patient care, it is the key principle to effectively manage victims in a major incident (Bazyar, Farrokhi, & Khankeh, 2019).

In triaging patients prehospitally, speed is generally the priority to EMS in order to assess and treat as many as possible with the resources available, this needs to be done objectively with the use of parameters and not discriminate, as well as be able to integrate with hospital triage categories ensuring that the correct patient receives the correct care timeously (Manesh, Nordling, Carlstrom, Goniewicz, Faccincani, & Burkle, 2021).

The development and use of triage in mass casualty incidents offers emergency workers to be able to do the “most for the most” or do the “greatest good for the most amount of people” in an environment that is often strained by equipment and personnel (Clarkson & Williams, 2017).

Triage often requires the system to have some sort of logical and sequenced method such as assessing patients where they are found also known as primary triage using a tag which is often coloured and then designating the patient an appropriate colour which is often a fluid process as triage is dynamic due to patients’ medical condition being able to change depending on patient acuity (Clarkson & Williams, 2017).

Various triage systems exist that are often implemented and used by various organizations around the world, examples of these are the “Simple Triage” and, “Rapid Treatment” (START), “Sacco Triage Method” (STM), “Care Flight Triage”, “Sort”, “Assess”, “Life Saving Interventions”, “Treatment/Triage” (SALT), “Secondary assessment of Victim Endpoint” (SAVE), “Triage Sieve” and “Triage Sort”, the important aspect being to choose one and ensure

that the algorithm chosen is adhered to which ensures a coordinated approach (Clarkson & Williams, 2017).

In mass casualty incidents, first responders often move the injured to designated areas using categories such as the ones mentioned below which is based on patient injuries (Clarkson & Williams, 2017):

Table 6

Triage Identification Categories

Urgency	Priority	Colour	Description
Immediate	P1	Red	Life-threatening
Urgent	P2	Yellow	Serious
Delayed	P3	Green	Minor
Dead	P0	White	Not breathing
Expectant	P4	Blue	Potentially un-survivable injuries

Note. Adapted with permission

The colour that are highlighted in table 6 (above) are assigned by first responders giving triage tags to patients and then sorting them into categories following the process mentioned below where the waving, walking, and patients that are still or not moving. This can be accomplished by the first responder asking those at the incident who can walk to walk to a designated area and those that remain will then be assessed next.

Assessment of the patient who are unable to move will then be done and then a lifesaving intervention would be applied such as stopping bleeding or turning patients on their side, “lifesaving interventions”, will be applied by the first responder, these interventions

administered although simple can be lifesaving. Lifesaving interventions at this stage provided is not time intensive in order for them to move to the next victim and do the same, once assessed the patient would receive a colour coded tag. Finally, treatment and transport will follow once the disaster victim is tagged (primary triaged), patients will be moved to a secondary triage post where medical personnel reassess patients using various methods such as Triage Sort, once retagged and coded patients can either be sent to a designated point for transportation or for further treatment.

Triage levels

Being triaged “Red” is a patient who requires immediate treatment due to their life being in immediate danger e.g., a patient with an airway problem or with severe breathing problem patient is triaged “Yellow” if they are not in immediate danger but who requires urgent medical or surgical intervention within 2 to 4 hours, e.g., a patient with a bone fracture. A “Green” triaged patient with minor injuries that will require treatment (delayed urgency) e.g., a patient with minor lacerations. White/black is reserved for a patient that is not breathing and has no pulse and “Blue” is for a patient that has severe injuries and cannot be saved due limited resources, this is regarded as the most challenging due to ethical reasons.

The triage process is generally carried out in stages, the primary triage, which is started where the patient lies, secondary triage which is often used to not overwhelm receiving hospitals and the third is done to ensure that priority is allocated to those needing definitive care such as a theatre (Bazyar, Farrokhi, & Khankeh, 2019).

Thorough disaster planning, including the choice of an efficient triage tool, is fundamental to maximising survival (Malik, Chembumroong, Xu, Vassallo, Douglas, Bowley, Christopher, MLord, Belli, Keene, Foster, & Gkoutos, 2021).

HMCAS uses the following triage methods in dealing with mass casualty incidents due to it being reliable, fast, easy to use, reproducible and easy to teach, in addition Manesh et al. (2021) added that when one is triaging patients, they must remain objective and not be discriminatory in terms of the patients nationality, age and gender.

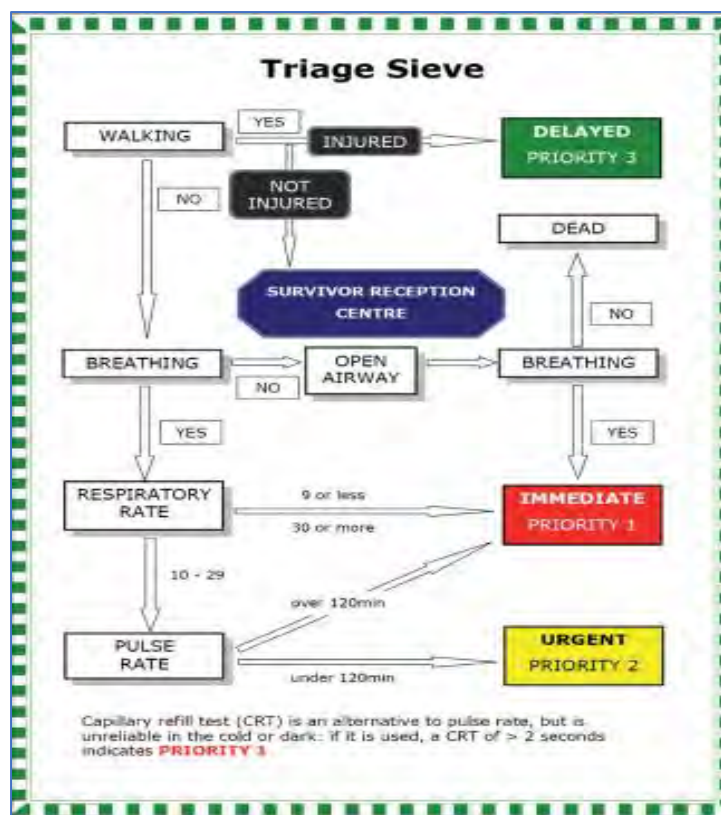
Triage sieve

This method is similar to triage start, it is used in various countries around the world with a strong EMS influence, it uses the walking category to be able to differentiate the “(Walking wounded) minor injuries” from the other categories mentioned in figure 10.

Triage sieve makes use of an algorithm as seen in the figure below, its simplistic approach makes it ideal for use in the field by EMS even if they have a limited experience (Bazyar, Farrokhi, & Khankeh, 2019).

Figure 10

Triage Process that Responders with Need to Follow (Triage Sieve/Primary Triage)



Note. Reprinted with permission

Triage sort

Triage Sort is also known as a type of a secondary triage which has four specific areas and a numerical system where a score is obtained, if a patient's score is 10 or less then the patient is automatically classified as Red (Figure 11) and if the score is 11 then this patient is classified as yellow and a score of 12 is classified as green (Smith, 2012).

Figure 11

Triage Process that Responders with Need to Follow (Triage Sort/Secondary Triage)

Triage Sort

STEP 1: Calculate the GLASGOW COMA SCORE (GCS)

A Eye opening:		B Verbal response:		C Motor response:	
spontaneous	4	orientated	5	obeys commands	6
to voice	3	confused	4	localises	5
to pain	2	inappropriate	3	pain withdraws	4
none	1	incomprehensible	2	pain flexes	3
		no response	1	pain extends	2
				no response	1

GCS = A + B + C

STEP 2: Calculate the TRIAGE SORT SCORE

X GCS	Y Respiratory rate	Z Systolic BP
13 - 15 4	10 - 29 4	≥ 90 4
9 - 12 3	≥ 30 3	76 - 89 3
6 - 8 2 +	6 - 9 2 +	50 - 75 2
4 - 5 1	1 - 5 1	1 - 49 1
3 0	0 0	0 0

TRIAGE SORT SCORE = X + Y + Z

STEP 3: Assign a triage PRIORITY

12 = PRIORITY 3
11 = PRIORITY 2
≤ 10 = PRIORITY 1

STEP 4: Upgrade PRIORITY at discretion of senior clinician, dependent on the anatomical injury/working diagnosis

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Heemskerk, Yamah, Hinojosa and Weinstein (2021) highlighted that an increase in time spent on scene by EMS with victims involved in a mass casualty incident is associated with an increase in mortality however EMS do provide a role in prehospital care as the first medical care providers on scene, these triage decisions made on scene are often done under stress as well as uncertainty.

The imbalances described by Heemskerk, Yamah, Hinojosa and Weinstein (2021) are often due to the medical demand of care for patients and the availability of essential resources to triage and treat patients accordingly, which are characterized by EMS needing to deliver care fast.

During an MCI, all patients cannot receive care that is of the highest quality due to resource limitations, essentially meaning that patients who have severe extensive injuries or are classified as dead cannot be saved and treatment should be concentrated on those patients who are salvageable, and this is seen as a challenge to EMS especially from an ethical and emotional view (Heemskerk., et al 2021).

The mindset of EMS providers would need to change from being able to treat a single patient to treating as many as possible, this can only be achieved if a robust triage tool is available and understood in order to make those critical decisions (Heemskerk., et al 2021).

Paucity of evidence is the reason behind disaster managers having a difficult time in choosing an appropriate tool in triage, various prospective studies have tried to compare triage tool performance in a MCI and was often difficult due to an MCI's infrequent or unpredictable nature (Malik et al., 2021).

Whilst the American College of Surgeons has instituted yardsticks for the implementation of pre-hospital triage tools for individuals there are no international standards that govern a tools execution when it comes to major incidents (Malik et al., 2021).

Constraints often do not allow for studies in triage models in real time, therefore there is a lack of evidence concerning the best triage method and tool to be used (Bazyar, Farrokhi, & Khankeh, 2019).

This unpredictability of MCI's to compare tools according to Malik et al. (2021) has led to evaluation of triage methods and tools post event. Training and education in triage are a fundamental aspect that needs to be investigated further however there is no evidence on training in triage algorithms available, there is also insufficient research on which triage method is superior to the other.

Dittmar, Wolf, Bigalke and Anderson (2017) highlighted that there is paucity of evidence in effective teaching methods on triage when it comes to first responders and MCI's, but highlighted aspects from other studies in his paper which mentioned that to triage patients accurately is important and often crucial as patients can be either over or under triaged, this leads to patients being classified at an higher acuity which can take time and resources being diverted from a patient that is need of such time and lifesaving procedures or equipment.

Clinically the under-triage of critical patients often leads to harm due to care that is delayed, or a patient is taken to an incorrect medical facility, reducing over-triage errors is just as important as it tends to overwhelm medical facilities with patients who are not critical (Malik et al., 2021).

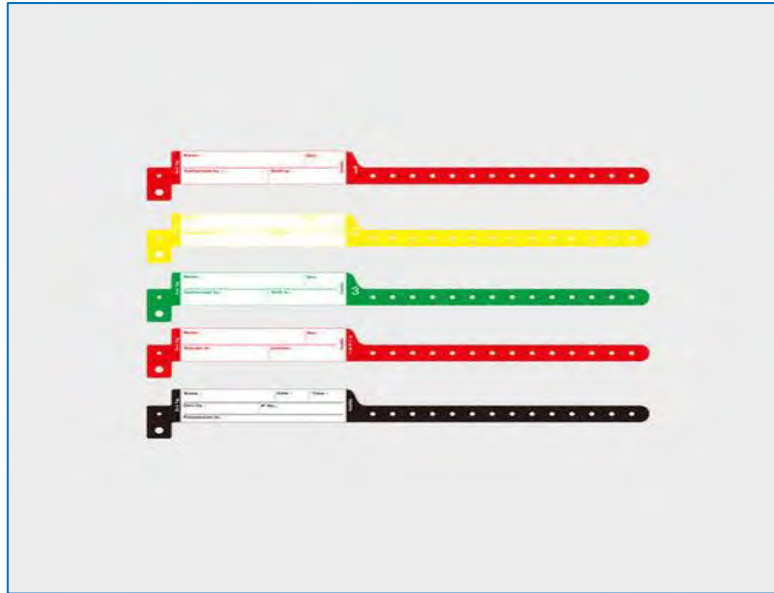
Training in triage when it comes to MCI's are crucial to first responders in order for them to effectively triage patients as a lack in training often leads to chaos, triage errors and loss of life (Anderson, 2017).

Bazyar, Farrokhi and Khankeh (2019) on the assessment of various triage tools have identified that there are a diverse range and availability of triage tools available worldwide, the onus rests with individual countries to consider their own circumstances and available resources in the event of a MCI and choose the most appropriate triage tool that is effective.

Additional work needs to be done in MCI triage training however according to Anderson (2017) suggestions include practical and didactic training as well as reality exercises which involves delivery of triage education is critical, the standardization in triage algorithms which allows for victims of disasters to get the best evidenced based care.

Figure 12

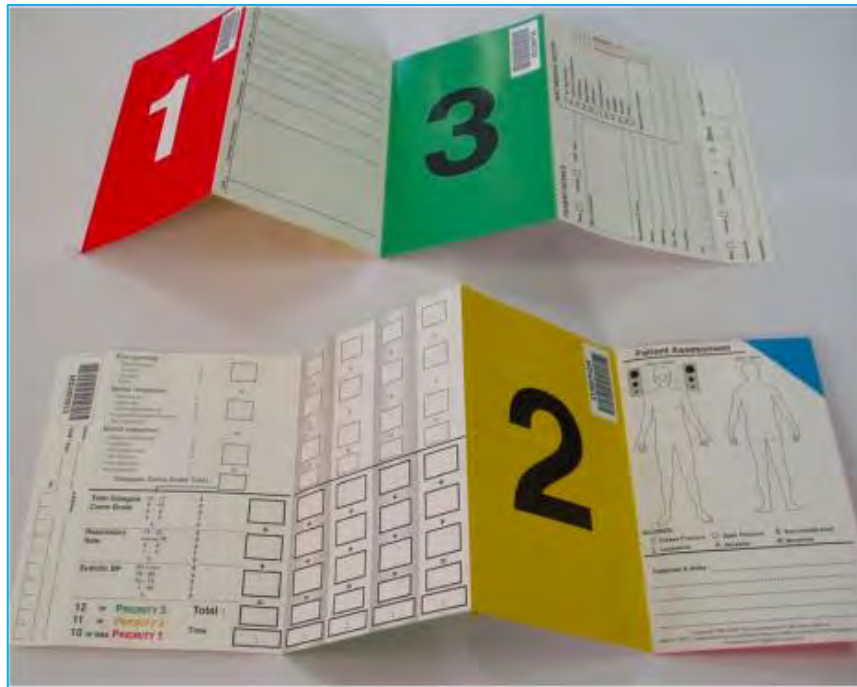
Example of Primary Triage Tags used by First Responders



Note. Reprinted with permission

Figure 13

Example of a Secondary Triage Tag used by Responders



Note. Reprinted with permission

Christian (2019) highlights that the benefit of using a protocol driven triage tool is due mainly to the first responder triage officer having a decision support and aids in performance improvement, if this tool is used effectively in its application, then appropriate care would be delivered timeously to those that need it and at the same time omitting errors in over and under triage.

The success of the various triage systems discussed is measured in the field by its effectiveness on the survival of patients at mass casualty incidents, these triage systems must show an accurate decision-making process to prioritize the clinical interventions needed by a practitioner to save patients that present with injuries that are life threatening (Aldossari & Bensaad, 2024).

The skill required to identify and select patients according to a pre-defined triage system have long been associated with an increased survival rate, making use of appropriate triage systems in the field have a direct impact on the ability to provide resources, type of resources required, allocation of these resources as well as augmenting the operational aspects during a major incident by an organization to better equip staff that are working frontline at major incidents (Aldossari & Bensaad, 2024).

Tawil, Bergeron and Khalil (2023) identified that most triage systems all share a weakness that is common in the very first step of the algorithm as it quite significantly limits the ability to assess a patient especially if that patient is a toddler or if a person has a disability, triage systems are all trauma related and medical induced onset of symptoms due to trauma can be severely missed (such as stress induced asthma), additional inconsistencies were poor inter-rater reliability, non-validation of critically ill patients and most triage systems or algorithms used different strategies without any being accurate.

The ability to ensure that there is consistency in triage and triage methods can only be achieved through collaboration, interoperability, best research practices and methods, the development of guidelines and training resources as well as the ability to implement quality improvement projects in the area of triage to improve on practice (Aldossari & Bensaad, 2024).

Standardization in protocols, methods, terminology, and use of the same triage method in a specified jurisdiction allows for collaboration between stakeholders both pre and in hospital, this collaboration increases the ability of organizations to and health care systems to be better prepared in their planning and response capability to mass casualty incidents (Alruqi, Aglago, Cole, & Brohi, 2023).

Whilst current triage tools as well as protocols that are used by prehospital personnel are crucial in responding to and working in major incidents, there is more that can be done globally to highlight the importance of accurate triage methods at such incidents in ensuring that challenges faced in the type of system used are highlighted and training and education challenges faced by staff using these systems are addressed (Alruqi, Aglago, Cole, & Brohi, 2023).

With the advancement in technology such as artificial intelligence (AI), the ability to collect data from wearable devices, predictive modelling, embedding algorithms into triage models and applications make it possible to automate triage systems, awareness in interoperability and organizations moving towards a practise that is evidence based, the ability to better integrate triage methods, enhance the accuracy of staff in using triage methods and types, integrate triage seamlessly between the field and hospitals do provide the opportunity for a better system to be used by medical personnel in the field (Alruqi., et al 2023).

Major incident levels

The concept used by HMCAS and that must be known by the organizations managers and first responders are defined by the identification of levels which is able to provide the commander of the incident with a suggested use of resources that must be made available to them, these are based on the number of patients that are categorized into their acuity and not on the total number of patients at the scene of the incident, in addition the responding managers as well as first responders would need to understand the concepts that are related to planning, responding and working at such incidents, these according to HMCAS (2019) are “major incident management” must be separated from day-to-day business, “command and control” implementation must be based on levels of response as an indication of pre-determined (PDA) resource.

To deal with multiple incidents/sectors, the escalation process must be understood and used and there must be participation from all departments within the organization in preparing, responding and recovering from an incident.

Table 7 shown below highlights the levels of response that is used in EMS to determine recommended resources, and that can be escalated to the next level which determines additional resource requirement at an incident, these additional resources can be viewed in the appendices.

Table 7

Example of Escalation Levels used by HMCAS in Response to Major Incidents

Escalation	Impact	Description	Significance
Level 0	Minor	Serious Incident	Routine/None
		Level 0	
Level 1	Major	Major Incident	Local Level
		Level 1	
Level 2	Major	Major Incident	National Level
		Level 2	
Level 3	Major	Major Incident	International Level
		Level 3	

Note. Adapted with permission

Level 0

HMCAS prioritizes the dispatching of ambulances and other resources according to the prescribed Medical Priority Dispatch System (MPDS), and with the use of a response matrix according to levels e.g. Zulu (emergency/priority 1), Yankee (non-urgent/priority 2) and X-Ray (non-urgent/priority 3) calls, level 0 response to major incidents implies that the organization

treats it as “business as usual”, without any escalations or requirements but is used as practice on a small scale to procedures right and trained in (HMCAS, 2019).

Level 1

This is the first level of activation when faced with a major incident that impacts the organization from a infrastructure and resource perspective, an incident of this magnitude usually requires ambulances that are covering different areas or geographical zones in the country, the decision on declaring level 1 incident is made by the incident commander with or without the establishment of a “Gold Command Centre” (HMCAS, 2019).

Level 2

This would be the second level of activation when faced with a major incident that impacts the organization on a national level. This type of activation has a direct effect on resource allocation as well as infrastructure which entails the establishment of a “Gold Command Centre” to strategically manage the incident as well the rest of the EMS activity in the country (HMCAS, 2019).

Level 3

Level 3 is the third as well as the last level that the national ambulance service in Qatar uses in response to a major incident, this is deemed to have an impact on the organization which is catastrophic in nature. Declaring a level 3 response entails the assistance of all prehospital medical resources with the coordination being done from the national strategic command centre due to response that would be expected from international teams (HMCAS, 2019).

Incident complexities

The complexity of an incident is often used to describe factors such as size of the incident, technicalities (such as Chemical, Biological, Radiological, Nuclear, Explosive) type of incident, this can also include any issues related to scene access and egress.

Table 8

Example of Complexity Levels used by EMS in Response to Major Incidents/Disasters

Complexity Levels	Description
High	Not routine or it is an infrequently used procedure (e.g. CBRNe, airport emergency, etc.).
Moderate	Multi-agency (e.g. Police, Fire, etc.) or large numbers of personnel are deployed.
Low	Access to patients is difficult due to hazards, environmental or security factors.
None	Unobstructed access to and egress from patients

Note. Adapted with permission

Response matrix

To determine the levels of response and the complexity of an incident, HMCAs uses a scoring matrix, the factors used are the number of high acuity patients, the complexity of the incident as well as the duration:

Table 9 below highlights the three factors used to determine levels of response, the significance is the appropriate use of resources which will be dispatched according to the resource planned determined attendance (PDA) used (HMCAS, 2019).

Table 9*Example of a Response Matrix to Determine Escalation Levels*

Number of High Acuity Patients	Red (P1) & Yellow (P2)		Escalation Level			
	>100	level 3	level 3	level 3	level 3	level 3
	51-100	level 2	level 2	level 3	level 3	level 3
	21-50	level 2	level 2	level 2	level 3	level 3
	11-20	level 1	level 1	level 2	level 2	level 2
	6-10	level 0	level 1	level 1	level 2	level 2
	3-5	level 0	level 0	level 1	level 1	level 2
	Complexity Level	Level 1	low	moderate	high	high
	Time	1hr	-2hrs	-4hrs	-8hrs	-8hrs
	Severity of Incident					

Note. Adapted with permission**Critical tasks**

The requirement and main objective in major incidents are to ensure that lives are saved with the resources that are available, in order to achieve this HMCAS (2019) uses the CSCATT mnemonic as explained in table 10 below (HMCAS, 2019).

Table 10*Explanation of CSCATT (Principles in Major Incident Response)*

CSCATT	Requirement
C: Command	Appoint a Silver Commander, Triage Officer and Parking Officer
S: Safety A, B, C	A - Ensure own safety
	B - Safety of the scene by using cordons/cordon tape & update safety officer of any hazards
	C – the survivors Removed to place of safety
C: Communications	Establish communications including control vehicles, radios, etc.
A: Assessment	Carry out an assessment of the incident
T: Triage	Start primary triage
T: Treat	Start secondary triage
T: Transport	Consider type of transport i.e. road/air

Note. Adapted with permission

Communications

In the event of a mass casualty incident the communication pathways must be clearly understood with regards to an organizations internal and external arrangements, the internal communication will need to be easy to understand, precise, makes use of simple commands and language, and is generally established prior to an incident command system setup (Burgiel, 2020).

The appropriate use of information and the management thereof is an essential component that EMS leaders as well as frontline/first responders should know in the management of mass casualty incidents, lessons gathered from EMS disasters and exercises have often shown that poor communication and information management often is the cause of poor decision making which is responsible for an increase in mortality (Perry et al., 2021).

Communication recommendations include an initial agreement on the mobilization plan, clearly defined objectives which must include information on plans, radio channels to be used and key updates (Burgiel, 2020).

The use of an established communications framework is an aspect that needs to be well understood in order for effective use, these aspects should detail key positions, the flow of communications, technical information such as mapping, GIS information, data access and transmission (Burgiel, 2020).

Kunguma (2020) highlighted in her study that the world as we know it is facing advancements in the development of technology, this technology development has led to various organizations be it private or public to both coordinate and integrate in order to keep up with this advancement.

The “fourth industrial revolution” (4IR) as described is making massive developments and often with breakthroughs in the use of information and electronic technology such as drones

(in disaster surveillance and rescue), 3-D printing, mobile use for disaster awareness and response by making use of social media, GPS technology advancement which recommends fastest routes. The benefits outweigh the downsides of the 4IR as it reduces vulnerabilities as well as increases resilience in the field of disaster management (Kunguma, 2020).

Kunguma (2020) and Rajaraman (2018) defined information technology as “technology that is used to acquire, process and disseminate data in order for it to be used in applications that are specific after processing”, this ultimately leads to information that is produced which is involved in the improvement of knowledge which assists in the decision-making process in a timely manner.

The efforts often pursued by EMS in trying to improve communication challenges are often a challenge, this is largely due to EMS managers trying to acquire and retain huge bouts of information and simultaneously trying to integrate this which often leads to incorrect casualty numbers (Perry et al., 2021).

The integration of this knowledge as described by Perry et al. (2021) is twofold, one as described in the previous paragraph and two is the information that is shared and emerged between teams, the simulation exercises used in the study allowed for the identification of factors in information gaps and the often mismatching of evacuated casualties at mass casualty incidents.

The arrival and leaving of casualties from treatment areas often pose a challenge in patient tracking as well as the consolidating of various information from various pathways in a short period (Perry et al., 2021).

Within HMCAS the command structure will make use of TETRA radios to effect communication within the ICS itself, as well as updating the national command centre (NCC),

the use of TETRA provides a resource channel between vehicles moving to and from scene, NCC control, silver control, gold suite, and the production Team (HMCAS, 2019).

NCC control is ultimately responsible for all communications outside of an incident command infrastructure, the NCC manages and dispatch all resources that are involved in the incident e.g.; deploying of resources to scene as per the pre-determined attendance used by HMCAS, controlling resources both community and those becoming available from hospital, liaise with bronze ambulance commanders to provide updates on the number of remaining casualties and communicate with silver control to obtain situation reports.

An example of radio channels used and to whom they are allocated to can be seen in Table 11 below:

Table 11

Example of a TETRA Radio Talk Groups Adapted to Manage Multiple Incidents/Events

Channels	Talk-group	As major	As event 1	As event 2
		Control Major	Control Event 1	Control Event 2
		Gold Major	Gold Event 1	Gold Event 2
		Silver Major	Silver Event 1	Silver Event 2
		Silver Medical Major	Silver Medical Event 1	Sector Medical Event 2
		Silver Ops Major	Silver Ops Event 1	Sector Ops Event 2
		Silver Support Major	Silver Support Event 1	Sector Support Event 2
		Silver Special Major	Silver Special Event 1	Sector Special Event 2
		Bronze Medical	Bronze Medical Event	Bronze Medical Event
		Major	1	2

Bronze Ops Major	Bronze Ops Event 1	Bronze Ops Event 2
Bronze Support	Bronze Support Event	Bronze Support Event
Major	1	2
Bronze Special	Bronze Special Event	Bronze Special Event 2
Major	1	
Production Major	Production Event 1	Production Event 2
Auxiliary	Auxiliary	Auxiliary

Note. Adapted with permission

EMS personnel have to overcome and address challenges when faced with any emergency and this increases when faced with additional stressors such as a mass casualty incident. Factors such as the location of an incident, weather, lack of information and resource limitations have a role in the communications aspect due to team members having to face complexities and this added with various leader's communication styles present a threat to victims of disasters as well as to responders themselves (Zimmer, Czarniecki, & Sahm, 2021).

These unsafe or inadequate communications which results in errors can be attributed to EMS personnel being stressed (Zimmer, Czarniecki, & Sahm, 2021) which creates confusion when communicating, self-interrogation is heightened which compounds an inaccurate expression of oneself, communication is lessened and incorrect use of tone.

In addition, certain colleague character traits, behaviour in leadership, time pressure, multiple tasks, and a lack of focus are additional factors faced by EMS during stressful situations, in order to overcome these factors and challenges the use of standards and guidelines as well as

closed loop communications are essential for use by EMS to mitigate misunderstandings which can have detrimental effects (Zimmer, Czarniecki, & Sahm, 2021).

A common reason for inappropriate and missed communication can be attributed to approach that to others in a stressful situation,

The use of circular communication and gradual assertiveness in a major incident according to Lorenzi, Zamboni, Gelati, Martino, Pellacani, Barbieri and Baraldi (2023) is seen as an excellent strategy to use when approaching other professionals in a stressful placing, the use of assertive communication methods and standardised techniques make it easier to transfer information in a reliable and shorter time period (Lorenzi et al., 2023).

The use of standard communication tools in briefings as well as debriefings of staff in teams have shown to foster collaboration, clear understanding of roles and responsibilities, lessen self-doubt, foster an environment of questions if teams are unsure as well as emotions are defused as there are clear and concise communications pathways being used. As identified, communication in major incidents encompasses various facets when responding to and working at major incidents, it is said to be a crucial component in ensuring a well-coordinated response to an incident. To effectively manage communications at a major incident requires the use of technology that is modern as well as having systems in place to be able to ensure real time sharing of information, awareness and information flow (Usono et al., 2023).

Being able to command and control a major incident managers and staff would need to ensure that understanding of information that is transferred between agencies and inter agency is crucial, as normal situations in responding to major incidents can prove challenging under normal communication processes and procedures when used at major incidents (Hansen, Mikkelsen, & Rehn, 2023).

The breakdown of communications at major incidents hinders staff in the area of tasks being carried out, command abilities, safety and especially the outcome of patients, whilst methods of communication range from use of verbal exchange or the use of hi-tech methods, the continuous education and training in use of any communication method in a MCI is important for human and technological incorporation and understanding (Hansen, Mikkelsen, & Rehn, 2023).

Hugelius, Becker, and Adolfsson (2020) agreed that communication failure in a mass casualty type incident has the ability to pose a significant challenge and has the ability to impede a response as well as strategic decisions by emergency managers.

A mixed method study by Skyrabina et al. (2021) highlighted factors that hindered responses to mass casualty incidents due to communication failures within an organization, these factors are the lack of communication during the activation and standing down phases of a major incident, a lack of adequate information around the major incident which delayed activation, poor sharing or not sharing of pertinent information as there was a lack of clarity on what information was deemed pertinent, ambiguous terminology and a lack of training in using communication tools.

A response to any major incident is stressful, therefore understanding procedures such as the use of adjuncts in communication e.g. the NATO alphabet, knowledge in modes and methods of communication such as the Shanon Weaver communication model, can vastly decrease stress when communicating at major incidents (Hansen, Mikkelsen, & Rehn, 2023).

If in a MCI there is communication infrastructure compromise according, Hansen, Mikkelsen, and Rehn (2023) indicated that there should be guidelines in place to clearly assist with the maintenance of command and control. The lack of education and training in and around

communication when faced with a major incident would decrease the skill and ability as well as the confidence levels of staff that are responding to or working at major incidents.

The use of technology by EMS over the years have progressed, however a lack of training in technology use can cause usability, technical and organizational challenges. EMS technologies highlighted in a systemic literature review by Zhang, Brazil, Ozkaynak, and Desanto (2020) on the use of technology by EMS personnel from years 2000 to 2019 are ambulance-based telemedicine, Internet of Things (IoT) and wearable handheld devices, the results concluded that although technology has had a high level of acceptance by the end user, various challenges were identified.

The standardization of communication in EMS training is a tool that brings about cohesion in teamwork, this can be achieved by incorporating closed loop communication, vocational training, understanding of the organization's communication tools and the practicing of communication aspects within a team, are aspects that organizations should concentrate on (Zimmer, Czarniecki, & Sahm, 2021).

Training and education in communication when dealing with major incidents according to Goniewicz et al.(2021) are relevant as it provides an instructive level of knowledge needed in communications and not the knowledge that is known in major incident response, the authors of the study went on to elaborate that a pre training evaluation would need to be implemented prior to the actual training in communication strategies to identify gaps at the most basic level. A well formulated proficiency assessment is integral to health care professionals prior to them being skilled and trained in a specific area (Goniewicz et al., 2021).

First arriving responders

Communication and the passing of accurate information within the organization or between organizations are important for accurate information to be shared, the most recognizable acronym that is used to pass on information is METHANE, this acronym is used to update as well as build on information (Nishiyama, Tabata, & Shigeno, 2017).

METHANE is an English acronym which stands for (Kitsuta et al., 2012):

M: major incident declared

E: exact location

T: type of incident

H: hazards

A: access

N: number of casualties

E: emergency services present or required

Although various other models exist in passing on of information, the METHANE model is one that ensures the accurate and consistent transfer of information as well as easy to remember (Nishiyama, Tabata, & Shigeno, 2017).

Command structure roles and responsibilities

The medical command at major incidents would fall under the EMS operations division of the attending organization and it would provide a framework for the management of said incident (Lincoln, Freeman, & McGraw, 2023).

The command structure is there to ensure that provision is made for roles and responsibilities are carried out in a concise manner to ensure that there is organization at an incident, several roles and responsibilities such as operations, logistics and planning are carried

out in line with the organizations policies such as triage, treatment and transportation (Lincoln, Freeman, & McGraw, 2023).

The first vehicle arriving at a major incident is responsible for the set-up of a control point and the personnel on the vehicle are responsible for the initial update and assessment of the scene. Each responding emergency service is responsible for setting up their command structure in line with their organizations policies, these commanders are known as operational commanders (bronze), a tactical commander (silver) and the strategic commander (gold) is there to strategize and liaise with other services on the best plan to adopt when working at the incident, there is usually one person that takes overall command (Lowes & Cosgrove, 2016).

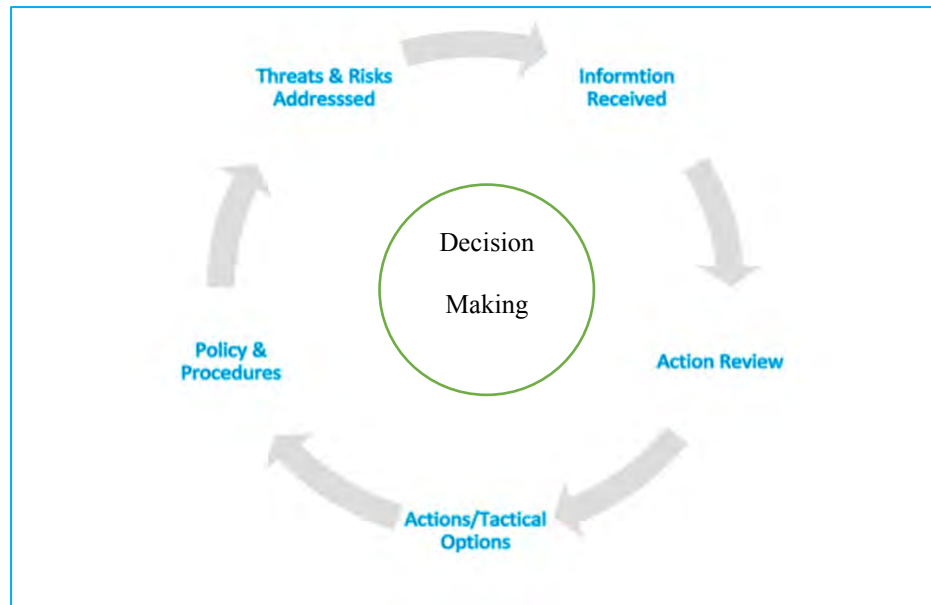
The “zones of command” are referred to as the “incident site” itself, where operational commanders would work, the nature of the incident would dictate if more than one operational site is required and the tactical command would be surrounded by the outer cordon which would be under the responsibility of the organization leading the incident (Lowes & Cosgrove, 2016).

A leader’s ability to achieve their role successfully hangs on them being in a position where they have an understanding of the surroundings and the presented information, effective communication with others (in their team) as well as external organizations, an environment that is suitable from which to exercise their command function.

An example of a decision-making model can be seen in Figure 14 below as adapted from NARU 2019:

Figure 14

A Decision-Making Tool used by Commanders at a Major Incident



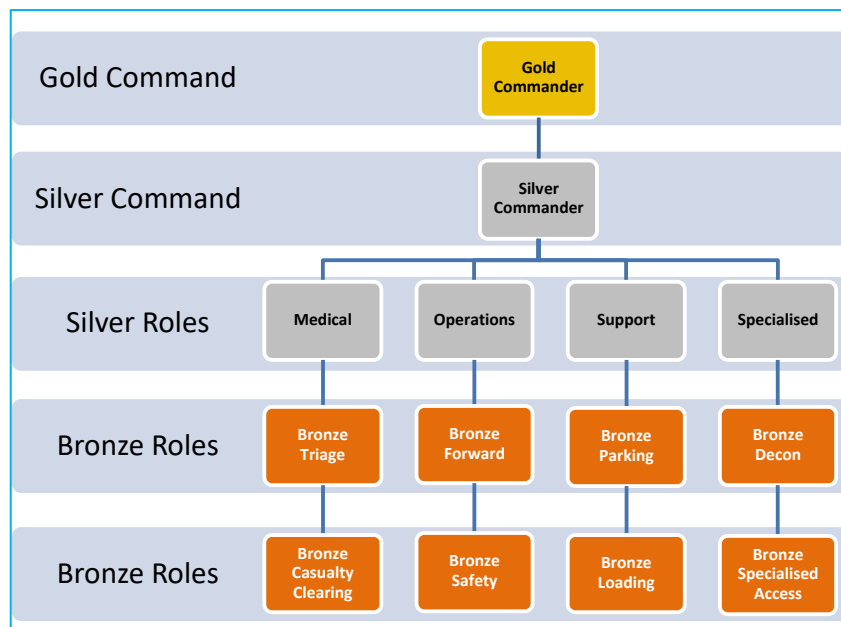
Note. Adapted with permission

The ambulance service has various roles and responsibilities at major incidents, in order to achieve this the ambulance service would need to initiate and effect their command plans at short notice, these plans should include the appropriate command plan in line with the levels of response to an incident, coordination of the communications plan, dissemination of appropriate roles such as triage, attendance of briefings, planning, planning actions etc. by the appropriate commanders, ensuring that all roles are managed as demonstrated by Figure 15 below (NARU, 2019).

Organizations around the world have different command and operational roles in response to a mass casualty incident, the HMCAS uses the following roles to achieve their objectives in major incidents:

Figure 15

An Example of a Command Structure with Depicted Roles



Note. Adapted with permission

Gold commander

The gold commander responsibility is to ensure that policies are adhered to, the decisions that are made must be in unison with other services and communicated, in addition the workload of the service must be considered, and a decision taken to make use of the business continuity plan (HMCAS, 2019).

In addition, the gold commander would need to ensure that lives are protected and preserved, ensure that the impact of the incident is to the best minimized, maintain and ensure public confidence, maintain service delivery, ensure an early recovery phase as well as maintain organizational reputation.

Silver command

The silver commander once established is there to maintain command and control of the incident, all allocated roles will be established under him/her which would include the allocation and use of all resources. The silver commander would manage all operations related to the scene and this would include policies are maintained and adhered to according to the organization (HMCAS, 2019).

Additional silver roles include silver tactical (advises the silver commander on policies/equipment/personnel), silver medical (ensures clinical effectiveness and assign roles such as triage), silver operations (responsible for the scene clinical access and can include safety), silver support, silver specialized, silver control and a silver safety are some of the additional roles that can be allocated depending on an expanded ICS and span of control (HMCAS, 2019).

Bronze allocated roles

Within the command and its structure, various roles and responsibilities exist, of importance are the bronze roles which are seen as the operational roles that are there to effectively manage the incident.

Some bronze roles required are “bronze forward”; usually manages different sectors of an incident, if the incident is spread over a wider geographic area, “bronze primary triage”; is responsible for the primary triaging of patients where they are found as well as organizing the movement of patients in order of acuity to the secondary triage point, and ensuring that basic airway and tagging of patients is done, “bronze secondary triage”; ensures that a secondary triage is appropriately done according to the organizations recommendation, distribute victims according to scores to the appropriate secondary treatment area or casualty clearing station, “bronze clearing”; in agreement with the silver medical officer and bronze primary/secondary

triage ensures that casualties are packaged and ready to be sent to bronze loading for transport to the appropriate receiving hospital, “bronze doctor”; is responsible for the treatment, assessment and discharge of low acuity (green) patients from the incident scene itself, assists with any clinical treatment allocated under the command of silver medical, “bronze loading”; ensures a good ingress and egress for patients to be loaded into ambulances according to their acuity, “bronze parking”; ensures that vehicles coming to the scene are as per the request of the silver commander, he/she ensures crews are in appropriate PPE and crews are briefed on the incident, as well as have an understanding of the resources required, other bronze roles that are established if needed are “bronze equipment”, “bronze production” and “bronze safety” (HMCAS, 2019).

Hazardous materials

Hazardous materials (HAZMAT) is often referred to as substances that are released in an uncontrollable or deliberate manner into the environment that causes injury and or death to (Cooney, 2016).

With the advancement of technological events, terrorist attacks and wars, HAZMAT incidents has increased. According to the United States Department of Transport (DOT) biennial report released in February 2023, there were approximately twenty thousand reported HAZMAT incidents in 2020 alone, with thirty deaths directly related to hazardous materials incidents (U.S DOT, 2023).

Emergency medical services managers and frontline staff to be safe when dealing with hazardous materials would need to undergo a professional training course, such examples of these according to the U.S DOT (2023) are the community safety in hazardous materials, the HAZMAT emergency preparedness course, the assistance for local EMS Training in HAZMAT, HAZMAT instructor and the Emergency Response Guide to HAZMAT.

The challenges and issues faced by emergency medical services personnel in responding to and managing a HAZMAT scenario can be attributed to resistance, were the modern EMS are fully aware and embrace changes related to various systems, there are some experts as well as managers that are resistant to change and challenge EMS systems. Embracing the establishment of a HAZMAT team in a medical service hinders the response systems of such organizations.

The lack of information and data or the access to information and data regarding HAZMAT planning and scenarios or expertise available within the organization hinders the ability for managers and staff to make knowledgeable decisions, to plan for, respond to and work at HAZMAT incidents.

Sharamin et al. (2020) identified scene responsibility and coordination within a country were various agencies that are capable of responding to HAMZAT incidents, they might believe that they are the agency responsible, this can lead to delays in responding as well as confusion at the scene.

Response, firefighters are generally the responsible agency for responding to and dealing with HAZMAT incidents, EMS are generally responsible for the medical decontamination of patients, treatment and transport to a medical facility. Response can be hindered due to detection of the hazardous material, training in the correct type of HAZMAT suit to be used. EMS would therefore need a standard operating procedure (SOP) when responding to and working at incidents involving hazardous materials, there can be a lack of teams that are trained in responding to HAZMAT incidents, this can limit the expertise available to support EMS personnel.

Training in HAZMAT response is a specialised field, the lack of training in this area limits the ability of EMS in the ability to detect, handle, triage decontaminate and decide on the appropriate PPE to use, roles and responsibilities and poor coordination can lead to roles being

dispersed amongst responding organizations, this leads to response delays, setting up of ICS, communication failure and poor clinical care for those patients affected by the HAZMAT incident.

Recent studies have identified that interoperability or a lack thereof in coordination between responding agencies especially fire services and EMS (both are independent with different functions) can lead to a lack in interagency coordination and communication. A lack of ensuring appropriate standards for HAZMAT teams in an EMS environment leads to breakdown in scene management, often these standards are adopted from a fire service perspective and not by EMS, a lack of specialised equipment to be able to protect themselves, triage, decontaminate, treat and transport patients can lead to ineffective management as discussed under roles and responsibilities. Identifying the risks that exposes first responders do pose a health risk or trauma psychologically, the possibility of physical injury exists as well.

Sharamin et al. (2020) further elaborated that policy, protocols and SOP's must exist, inappropriate EMS specific policies, SOP's and protocols may lead to ineffectiveness and may cause more EMS personnel harm than any good for a patient or a community that is involved in the incident, and a lack of having appropriate training and certifications in the area of HAZMAT response in EMS pose a challenge, the continuous development of such training is important.

HAZMAT incidents can be accidental or deliberate and can happen globally, these type of incidents can involve a single person or an entire community (Yeung, Chan, & Ho, 2002). First responders roles and responsibilities at a HAZMAT incident would depend on adequate planning, training, contingencies in place and the understanding of organizational SOP's and policies, drills and exercises should be held regular between agencies to ensure operational plans and communications procedures are well tested (Yeung, Chan, & Ho, 2002).

Cooney (2016) defines a hazardous material as a substance if released can cause harm to the environment, property and people. HAZMAT incidents are known to cause death, injury and harmful health effects, the priority for teams involved in the response to such incidents should be to prevent exposure and injury, and emergency services staff need to be prepared by knowing how to deal with HAZMAT incidents and this includes knowing the standards, processes and standard organizational procedures when responding to such incidents, the training principles developed must adhere to operational and performance levels individually and responding staff must be supervised, receive one instruction which prevents confusion and conflicts, levels of response and incident levels must be adhered to in order to prevent errors, a single command system must be implemented. (Klein & Tadi, 2021).

EMS responders when arriving at HAZMAT incidents although prepared can enter unknown territory, they should be educated in their personal safety as demonstrated by the 1, 2,3 step used by HMCAS (2019):

Step 1: One Casualty, approach using procedures that are normal.

Step 2: Two casualties, consider all options and approach using caution.

Step 3: Three or more casualties, do not approach.

In order to be prepared for such events, organizations require appropriate planning, preparedness, the development of procedures, analysis of the situation and appropriate PPE. HAZMAT incidents are said to be complicated, therefore on identification of a HAZMAT incident by EMS the command system must be established, designation of zones (cold, warm & hot) operational and communication roles (Berry & Perera, 2021).

Madigan (2017) describes the first responder as an important provider in EMS who should have core knowledge as well skills when responding to incidents, however when faced with

HAZMAT incidents those first responders would need to take an assessment of the scene prior to them reaching the scene. The events related to HAZMAT incidents according to FEMA (2021) are those incidents that have no preparation and require a response and those that have plans in place.

First responders in HAZMAT response would need to undertake courses as well as receive approved certification in order to respond to and work in special circumstances, the type of courses undertaken according to Madigan (2017) are, HAZMAT Awareness, HAZMAT Operations, HAZMAT Technician and HAZMAT Specialist. In addition one working in a HAZMAT environment would need to possess technical factors that responders must know, such factors are being able to recognise hazardous materials at various levels, ability to know safety procedures, notification and isolation levels, be able to plan accordingly to manage the scene, protective and containment actions, use of appropriate personal protective equipment (PPE), appropriate decontamination measures, disposal and documentation, types of contamination and equipment.

A vast spectrum of incidents exist with hazardous materials (HAZMAT) being some of them, the incidents itself can vary from a single incident, multi casualty or mass casualty which can involve a range of chemical, biological, radiological, nuclear or explosive incident, key participants such as EMS personnel must be familiar with their organizational plan and capabilities as well as their local emergency services team that would be working in the hot and warm zones in the event of an incident (Berry & Perera, 2021).

Protocols would need to include procedures for handling children, elderly and the physically challenged, antidote use and how to retrieve information.

The Importance of Critical Incident Debriefing

Today, first responders in the whirlwind-like world of emergency medical services (EMS) suffer daily distress and trauma in performing their duties, feel under-appreciated. Critical Incident Debriefing (CID) empowers them with coping mechanisms and resilience.

CID is a comprehensive system whereby emergency medical services professionals unpack and decompress following highly stressful events, promoting healing and emotional processing. These mass casualty events in EMS impose a CID (Critical Incident Debriefing) tool, psychological aid, and comfort, which are the priorities of the level of catastrophe. This allows individuals to have a platform where they can get over the psychological effects that come along with this chaos.

CID enhances self-confidence, helps persist in challenging moments, and helps develop into influential individuals. Therefore, health professionals will have an opportunity to act swiftly, provide better health care, and safeguard community rights, which, over time, will result in the development of a healthy population. This paper covers cognitive informed decision-making (CID) after many civilian injuries and three critical points of the debriefing that contributed to the change of EMS and the need for psychological help for the qualified personnel of this sphere.

EMS and Debriefing: Addressing PTSD/Stress

The EMS (Emergency Medical Services) staff are a primary number of frontline first responders who regularly come across traumatic and stressful situations as part of their work responsibilities (Maiorano et al., 2020).

Schuster and Dwyer (2020) highlight that this incredibly stressful situation, aside from the already stressful deployment period, could combine with the effects of posttraumatic stress disorder (PTSD) and other stress.

PTSD and stress are significant issues for EMS professionals, with the information provided by the research continuously signalling the dangerous level of mental health challenges (Murray et al., 2020).

The whole structure of their job, which happens to expose them to life-threatening conditions, affords them an additional tool called psychological distress (Fusco et al., 2021). Long hours, unpredictable environments, and the constant pressure to perform add further strain, exacerbating the issue.

Mass casualty incidents represent particularly potent triggers for PTSD and stress among EMS personnel (Hruska & Barduhn, 2021). Nader (2022) asserts that these events frequently cause too much destruction and furriness, making people suffer emotionally. The amount and magnitude of cases that medics or responders face in an emergency can be so much that even the most hardened of personnel can be traumatized after the occurrence of an event.

Debriefing, as a proactive and no less essential step, takes on the whole meaning of the therapy addressed and prevented issues related to stress and posttraumatic stress disorder. Through structuring debriefing for reflection as well as normalizing their mental health responses to traumatic events, debriefing allows responders to confront their emotions (Vora et al., 2021). Debriefing eases practical emotional expression, normalizes experiences, and builds a community among people who help people in need, it is also a combination and prevention tool that affords early support and aid before the symptoms aggravate (Mangaoil, Cleverley, & Peter, 2020).

According to Anderson et al. (2020) building a culture that explicitly stresses trauma assists in taking immediate action to avoid the psychological impact of critical incidents long-term. It yields an application of coping strategies, resilience-building techniques, and a support network to the EMS personnel, which gives them the strength to overcome further challenges

with more courage and power. Indeed, it is debriefing that matters majorly for the EMS personnel where they have psychological first aid and farming and engaging workers by pointing out the PTSD and stress factors that can compound the negative stressors.

Types of Debriefing Used in Emergency Services

For emergency workers involved in critical incidents, psychological debriefing involves a vast range of techniques that support staff in understanding and dealing with the aftermath of an event. Each method has an individualistic approach matching responder practices and post-catastrophe characteristics. Commonly used debriefing techniques are “Critical Incident Stress Debriefing (CISD)”, Salik and Paige (2020) stated that Critical incident stress debriefing (CISD) is a customary psychosocial intervention focusing on the impact of critical incidents, as a rule, within the first 24-72 hours after the incident, to negate the antecedents of long-term mental health issues and mitigate the psychological problems for the rapid recovery.

Psychological First Aid (PFA), PFA is a psychological support intervention for emotional stabilization, giving individuals practical assistance and linking them to crises. It is preferred to be conducted in various formats, e.g., group or one-on-one (Wang et al., 2021).

Making use of “Defusing sessions”, in the immediate post-incident, where everything discussed is informal and provides a structure in the relaxed and non-formal setting, ultimately validating experiences and providing a support system through normalizing actions (Ericsson et al., 2021).

A “Group debriefing” is a facilitator-organized discussion between the rescuers who participated in the particular case and is done to create an atmosphere of open dialogue, sharing experiences, and mutual support, which nourish camaraderie and learning through each other's point of view (Verkuyl et al., 2020).

Making use of “An individual debriefing session” is a one-on-one venue where the responders are to be dealt with by a trained mental health professional or any other peer supporter. Confidentiality of the responders is provided with one-on-one support, therefore allowing emotional expression, coping strategies, and addressing any other problems (Arriaga, Szyld, & Pian-Smith, 2020).

Critical Incident Debriefing Procedure Post-Incident Best International Practice

Debriefing critical incidents is vital in psychological care for emergency medical services worldwide, with international bodies adopting best practice approaches for implementing debriefing techniques. They include a review of best practices where International EMS organizations emphasize implementing evidence-based debriefing methods following critical incidents and routinely revising the research blueprint and clinical guidelines (Sharp et al., 2020). A process of being updated and informed in the area of trauma psychology and mental health support strengthens the efficacy of debriefing sessions.

Making use of successful case studies and models especially those tested models from the experience of Scotland, the USA, or the UK's NHS ensures localized models and case studies of their best practices, offering timely intervention, support from peers, and care after an emergency that helps EMS personnel's resilience is built (Gleeson & Mackway-Jones, 2022).

Having standardized protocols and guidelines such as Organisations like the WHO and IFRC, which have international status, share their set rules for breaking critical incidents that refer to psychological safety, absolute confidentiality, and cultural sensitivity. Such a system of rules helps to optimize and monitor the quality of the debriefing practices across organizations, which makes it more beneficial for EMS agencies to comply with it.

Learning and Education Best Practices on Debriefing

Data concerning critical event debriefing for EMS staff , states that the staff must have the mentality of reflection and sound development to receive after-event healthcare. This can be achieved by “Importance of Integration” were providing debriefing sessions in the EMS training program, including study protocols, quick-fix techniques for dealing with critical incidents, and resilience for challenging decisions, are the primary items of integrative psychosocial development approach to the standard medical-related occupations.

“Effective Teaching Methods”, ensures EMS providers receive diverse debriefs that begin with lectures, practical exercises, and even role-playing interventions This includes sharing stories, role-playing exercises, and interactive workshops led by experienced trainers, among other things. This approach gives priority to different learning styles (Baetzner et al., 2022).

Ongoing Professional Development ensures EMS units need to create a culture where the staff doing the debriefs are shown to have the best working practices through regular professional development (Bijani et al., 2021). Advanced courses are offered, motivation is offered through the peer mentorship program, and lab research projects are offered. With these programs, personnel obtain knowledge that has already been established and become aware of the latest trends and strategies for trauma recovery and mental health support.

Benefits of Debriefing

Debriefing is indispensable in providing a basis of emotional support and efficacy for emergency medical services professionals. Key benefits include psychological support and Stress Reduction where debriefing provides a structured environment for EMS crew members to admit and share emotions that are associated with trauma, thus preventing the development of PTSD (Loef et al., 2021). Through debriefing procedures, EMS personnel have experienced mental health improvement and coping ability.

Debriefing improves team cohesion and communication in EMS teams, enables interactions and lowers barriers by encompassing sharing experiences, relationship building, and fostering unity (Lietzke, 2023). Timely communication helps through effective debriefing, improved procedures, and practice change definition.

Enhanced learning and performance improvement briefing is necessary for EMS staff to get training experience and experience areas of possible error. This empowers continuous learning, career advancements, and, in the end, more effective emergency response (Anderson et al., 2021).

CID is a unique intervention tool in the EMS that helps individuals and teams in the ambulances overcome difficulties, support one another, and close the circle around excellent care. It is a mechanism for the speedy recovery of their mental health and, at the same time, promotes their psychosocial wellness and the development of a culture of companionship in society. The integration of debriefing and its transformational value can save individuals from psychological crises and demonstrate genuine commitment to the community. Its significance lies in the professionalization of prehospital care and the genuine commitment of those serving the community.

Training and education disaster management: EMS

Training and education are core aspects in the preparedness phase of mass casualty incidents in EMS. These should include the development of major incident response plans, theoretical understanding and training in all aspects of disaster management with emphasis placed on EMS roles and responsibilities in major incidents and the exercising of plans internally as well as with external organizations (Beyramijan et al., 2020).

Rebmann, Charney, Liux, Abbyad, and Silvestros (2020) said that “EMS personnel reported a lack in training & exercises in the field of disaster management and mass casualty incidents, which has an influence on their willingness to work during disasters resulting in a roll on effect on morbidity and mortality”.

Beyramijan et al. (2020) highlighted strategies that targets the improvement of EMS in responding to mass casualty incidents such as ensuring staff are skilled and trained on how to respond to mass casualty incidents and are involved in the planning and development of guides, improvement of day to day operations by treating all incidents as major incidents and escalate as necessary, have an all hazard approach to incidents, ensure that there is appropriate communication measures in place, ensure role and responsibility clarification, appropriate training courses which is aimed at the enhancement of disaster preparedness and response.

Seddighi, Lopez, Zwitter, Muldoon, Sajjadi, and Yousefzadeh (2023) highlighted that there are distinctive characteristics that disaster education can take in disaster management EMS, these forms can either be formal or informal which can contribute to expanding the areas of preparedness as well as reducing the risks that are associated with disasters/mass casualty incidents.

The formal and in-formal pathways have specific traits and differences within an EMS community, Seddighi et al. (2023) discussed that the formal education structure follows a well-designed and structured curriculum which is regulated by various approved organizations that are specialists in the field of emergency planning/disaster management or mass casualty incident planning whilst informal education does not necessarily have to conform to curricula, it can be flexible and adapted to an organizations requirement.

A formal educational qualification in mass casualty incidents management leads to a well-recognized certification in the field such as a diploma or degree. Informal qualifications can take the form of courses within the organization but not necessarily results in achieving a diploma or degree, a formal education in the field occurs in a formal manner such as a university or class setting with educators educating in a formal and structured method. An informal setting can happen in the field, and can involve educators or facilitators from a variety of previous experience or background. Finally, Seddighi et al. (2023) highlighted compliance and or Flexibility were there are strict fulfilment requirements that is associated with a formal education or qualification, there are strict assessments and standardized regulations. An informal education is said to be flexible and can be adjusted to the requirements that is needed by an organization.

The formal and informal education highlighted by Seddighi et al. (2023) identified the importance of various methods that can be used in providing a foundation, knowledge and skills that are required (formal education) whereas the practicality of experiential learning and targeted learning allows for interventions that addresses specific needs required in a manner that is not formal.

To acquire competencies in disaster management/mass casualty incidents one must possess the necessary skills and knowledge which needs to be reinforced consistently via drills and evaluations (Goniewicz, Goniewicz, Szubzda, Burkle, Hertelendy, Al-Wathinani, & Manesh, 2021).

The goal in emergency preparedness education associated with varying degrees of backgrounds and knowledge is to ensure that the entire group within the organization be increased as a collective due to training and teaching proficiencies being based on an education due to varying profiles of health care specialists (Goniewicz et al., 2021).

The effective management of mass casualty incidents or disasters requires a standard approach to training for healthcare employees which must ensure that skills are acquired in command and control (being a team member that is effective), be able to cope with the crisis at hand, be both ethical and professional, be able to communicate effectively by ensuring that correct mechanisms are used as well as control the flow of information and, to recognize critical events, implement appropriate actions and importantly know your organizations plans, policies and procedures when responding to and working at a major incident (Goniewicz et al., 2021).

The training in mass casualty incidents/disasters to be effective must be effected at regular intervals, linked to quality improvement processes, be tailor made to specific roles within an organization and not generalized, however this training material or curriculum must be designed in an all-embracing manner which must take into account international models and guidelines that must have emphasis placed on roles and responsibilities, functions (triage, treatment, transportation) and resources which must be made mandatory to attend by the organization that one works for (Goniewicz et al., 2021).

Mirzaei, Eftekhari, Sadeghian, Kazemi, and Nadjarzadeh (2020) emphasized that an educational program related to disaster management increased one's knowledge, practice and attitude when responding to and working at major incidents, in addition Mirzaei (2020) quoted Wang et al. (2014) by saying that training programs were effective in the improvement of preparing personnel to work in a disaster or mass casualty management situation.

Okowska, Goniewicz, Hertelendy, Manesh, Wathinani, Alhazmi, and Goniewicz (2020) in their pilot study on preparing future healthcare managers for crises and disasters acknowledged that managers in healthcare settings should be recipients of education and training in the field of disaster management which should include a mixture of theory, practical simulations and tabletop exercises.

Cowling, Swartzberg, and Groenewald (2021) said that although various methods exist in teaching disaster medicine such as lectures, simulations and tabletop exercises they all might not be as useful or practical but it is important as healthcare professionals felt confident due to their sense of preparedness, this was also highlighted by Beyramijam, Khankeh, Farrokhi, Ebadi, Masoumi, and Aminizadeh (2020) who said training offered to healthcare professionals should include mechanisms that are interactive and hands on, easily accessible but competencies must be met.

Okowska et al. (2020) revealed that many in the healthcare setting did not receive any training in order to be prepared for major incidents and this was similar to research conducted by Naser and Saleem (2018) who has shown that insufficient training was done to equip healthcare workers to respond and work in disaster management or mass casualty situations.

Importantly the studies by Naser and Salem (2018) and Okowska et al.(2020) found that managers were deemed to be insufficiently qualified when it comes to emergency planning due

to their knowledge levels being lower than other medical personnel possibly due to differences in daily roles and responsibilities.

The management of disasters, public health emergencies and major incidents is intricate and requires a multidisciplinary approach. Healthcare managers should be taught be trained to communicate cooperate and collaborate when faced with disasters/mass casualty incidents (Okonska et al., 2020).

EMS has an essential part in the response to mass casualty incidents however the management in disasters often has a lack in appropriate management due to a lack in standards in training and education in mass casualty incident response (Beyramijam, Khankeh, Farrokhi, Ebadi, Masoumi, & Aminizadeh, 2020).

With the introduction of evidence based best practice in education and training it is important to use this strategy to better equip and prepare paramedics in disaster management/mass casualty response by creating core standards to support education and training development in order for professionals to be well prepared in their roles (Kunasekaran, Chen, Costantino, Chughtai, & MacIntyre, 2019).

Creating a standard training and education package ensures that paramedics meet core competency levels of expertise, which is paramount in their line of work, this ensures that a foundation is laid in ensuring best practices are achieved and maintained when working and responding to disasters by paramedics (Kunasekaran, Chen, Costantino, Chughtai, & MacIntyre, 2019).

Rowe-Rowe (2019) highlighted that there were indeed limitations in both qualifications and training in the field of disaster management in EMS, however there where positive aspects with an opportunity for both revision and improvement that can make a positive contribution to

managers and supervisors alike in training and education when it comes to disaster management and mass casualty incidents.

Medical personnel who have undertaken training in mass casualty incidents are often times more willing to respond without being an obstruction, this can only be achieved if there is both effective and regular training available for all staff (Cowling, Swartzberg, & Groenewald, 2021).

Disaster and emergency management educational prospects are maturing, with various organizations offering qualifications in the field due to the need for technically trained persons to be able to facilitate the response and recovery when faced with major incidents (Oostlander, Bournival, & O'Sullivan, 2020).

There are various role players that must participate in all the phases of the disaster management continuum and must overcome barriers and vulnerabilities to professionalize the area of disaster management for healthcare professionals to carry out their roles and responsibilities.

The Role of managers & frontline paramedics in mass casualty incidents

Frontline paramedics and managers are there to ensure that prehospital medical care is delivered to the community that they are working in, this covers the response to and management of mass casualty incidents which is seen as a separate entity from the normal responses that they are used to (Walsh, 2012).

Horrocks, Hobbs, Tippet, and Aitken (2018) highlighted that health management in disasters includes aspects from public health, emergency medicine as well as disaster management and therefore contains overlapping knowledge and skill sets to prepare for and respond to health and rescue emergencies when faced with a mass casualty incident.

In using a modified Delphi technique in order to develop a framework to be able to be used by first responders Fitzgerald et al. (2010) suggested that knowledge should be specifically geared towards roles that one undertakes in mass casualty response, this can be achieved by enhancing skills and standardizing training to be able to achieve competencies and objectives required by paramedics (frontline and managers) to achieve proficiency in their specific roles and responsibilities in mass casualty incidents (Horrocks, 2018).

Having fundamental competencies ensures that there is consistency in the acquisition, retention and application of knowledge, abilities as well as skills to optimize response and management (Horrocks, 2018).

According to Blooms taxonomy of learning domains which was used by Horrocks (2018) competency should correspond to learning evaluations, objectives and presentation content as well as “categories of learning outcomes”.

Sedlar and Kassaiova (2022) emphasised that there are certain skills that are required by managers within emergency medical services. Making use of a known framework “cognitive skills elements”, the identification of markers in team leaders within the emergency services was investigated.

Investigating both technical and non-technical skills required by managers to undertake their roles one must be aware of their situation and what is expected of them, i.e. a safe performance in carrying out their duties can only be achieved if medical and technical skills are complemented which ultimately contributes to a decreased unsafe behaviour when critical decisions are needed to be made (Sedlar & Kassaiova, 2022).

Although there are only four studies that currently exist, including the study by Sedlar and Kassaivova (2022) on cognitive behaviour skills in the EMS profession other studies have indicated that there is a requirement of skills needed to fulfil roles and responsibilities.

For effective functioning of carrying out duties within EMS, staff would need to interact using team processes both on a scene and off a scene making use of standards and technical skills, in identifying these skills required a qualitative study conducted by Sedlar and Kassaiova (2022) highlighted two important skills that managers and frontline staff needed, namely the skill of situational awareness and decision making. Within the skills identified elements were discussed and under the elements were specific areas or “markers” that were identified by EMS personnel from the study.

To carry out their roles in the field of mass casualty incidents Sedlar and Kassaiova (2022) indicated that skill play an important role. Situational awareness components required are information gathering skills, the ability to interpret information, being able to anticipate situations. Of importance are being able to conduct an overall situational awareness of the scene, being able to check information and cross check if required, be able to take away distraction from themselves and team members, use a systematic approach in management and information gathering, be able to have an alternate set of plans, be able to communicate a negative sequence of events that may occur to members of the team and be able to discuss and take action.

A skill in the decision making ability according to Sedlar and Kassaiova (2022) requires options that are available, being able to implement decisions, be able to re-evaluate decisions made and be able to maintain a set of standards. Of importance are the indicators associated with decision making is to be in the position to come up with alternate solutions to the situation face, be able to consider solutions from other team members and use it, be able to identify leverage

points and use them in decision making and management of the incident, prepares for tasks, communication of decisions taken to other services and within teams, revises ideas and thoughts when presented with new or changed outcomes/situations, follows guidelines and policies set out by the organization and use experiences and knowledge and be able to participate in learning activities to better themselves.

World Association for Disaster and Emergency Medicine (WADEM), (2017) released two white papers highlighting competencies in the field of disaster management related to health needs, consolidating and refinement, and the development of training programs must teach and demonstrate competencies to health care professionals when responding to and managing major incidents. These competencies are supported by Sedlar and Kassaiova (2022) these according to WADEM (2017) are core competencies. The core competencies required ideally be non-technical but general with an all hazard approach being understood and applied by all health care staff responding to and managing mass casualty incidents. Clinical core competencies and clinical practice must be aligned to professional group categories i.e. paramedics must practice within their scope such as triage, management of contaminated patients, basic principles in disaster management goals and an overview of response critical tasks and specialist or technical competencies must be applied to those individuals that have specific roles and responsibilities at a major incident, these can include but limited to initial actions that need to be undertaken such as Command and control, incident levels (organization specific), triage, treatment and transport arrangements, and an in depth understanding of organizational policies and procedures that is associated with major incident response and management.

Core competencies that both frontline and managers should have according to Horrocks (2018) are flexibility, adaptability, self-care (psychological & physical), be able to work as part of a team, effective communication and be able to think critically, be creative and solve problems, being able to solve conflicts, have a sense of situational awareness, an understanding of mass casualty/disaster management related to health and understand organizational triage systems.

In addition to the competencies identified in the previous paragraph, managers would need the added core competencies of having an understanding of event and event types with a high degree of recognition in management of events related to planning and preparation, response and communication systems, definitions, terminology, Incident management systems, local law and ethics, overview of both clinical and public health, equipment use and distribution, planned resources including pre-determined attendance related to the level that an incident is declared and a knowledge of the recovery phase and organizational requirements.

Existing training

HMCAS factors that affect acquisition & retention in major incidents

HMCAS since the implementation of the major incident response guide have undertaken various awareness courses with time being spent on lectures as well as field-based scenarios. Literature has proven that EMS has a vital role to play in the event of a major incident especially in areas of response, triage, command and control to name a few, the lack of a formalized major incident training module in HMCAS especially in the light of big events with mass gathering of people is the biggest disaster risk the organization can be exposed to both nationally and internationally.

Various authors have presented studies and advocated for the teaching of and enhancement of education in disaster management and major incident response. Various organizations such as the World Health Organization (WHO), The World Association for Disaster and Emergency Medicine (WADEM), SPHERE and the Humanitarian charter for minimum standards have advocated the same.

There are various principles that organizations must adopt which results in the effective training in major incident response, one of these are the standardization of guidelines which must be evidence based, internationally applicable, cover all members of the organizations role and responsibilities.

Figure 16

The Core Humanitarian Standards set by SPHERE



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Highlighting in Figure 16 is the core humanitarian standards set by SPHERE, these indicate that there are various commitments which must be adhered to, for the purpose of this thesis commitment, number seven (learn and improve) highlights that the following should be adopted by organizations (SPEHERE, 2018).

These are the learn, remodel and effect changes based on monitoring and evaluation current model's complaints and feedback, sharing of innovation and learning internally, ensure learning policies are in place, and means are available to learn from to improve practices and experiences by ensuring that improvement plans and performance reviews are specific, measurable, attainable, reliable and within a time frame (SMART) in the organizations and staff understand and know their areas of responsibilities in relation to their job requirement and self-growth.

Mechanisms must be in place to ensure that knowledge and experience is accessible within the organization such as organizational learning can lead to changes that are practical (e.g.: the carrying out of assessments, improved team response, and decision-making responsibilities). The organization influences learning and innovation in humanitarian response among colleagues by placing an emphasis on learning from policies and evaluations, compiling and publishing reports (debriefing) on responses, these must include lessons learned and recommendations for future responses by the organization, these lessons and recommendations need to be demonstratable. Organizational learning and knowledge management according to Sedlar and Kassaiova (2022) is an organization being involved in the collecting, assigning, gathering, growing and the making use of organizational learning.

Evidence based best practice

Mustaquim (2020) highlighted that EMS has to be continually involved in continuous education, with effort needed in areas to design and deliver an education program in areas that are required such as major incident response.

EMS has been at the forefront of saving lives in the field for years and has been associated with transport of the injured with no emphasis being placed on treatment of any sorts by other health care professions as well as the community the EMS organization is in, the modern EMS practitioner practices the profession as a clinician and not as a technician as done in the past, this is largely due to clinicians understanding what they are doing and why they are doing it, the role of a clinician goes beyond what is taught in anatomy, physiology and pathophysiology, a current EMS clinician must understand the dynamics of the situation they are in, be effective in their communication skills, understand the latest evidence based practice and incorporate them into their daily duties (Leggio, Grawey, Stilley, & Dorsett, 2021).

Organizations should ensure that staff have the necessary opportunities and be assessed in methods that are appropriate, these competencies should include but not limited to communication skills, awareness, clinical reasoning and procedural skills, management and information technology (Al Elq, 2010).

It must be remembered according to Al Elq (2010) that the “see one, do one, and teach one” method of learning is not accepted in the current setting of teaching and learning as it no longer provides the skills needed by medical personnel to carry out and develop in their chosen path way. Evidence based best practice as indicated by Connor et al. (2023) is the understanding and the ability to apply terminology as well as methodology in a correct manner. This allows for professionals in the field of healthcare to be knowledgeable, organizations offering training that

is current and accurate to reduce the adverse effects of poor outcomes by ensuring that there is no variations in practice, this ultimately improves the quality in the area being worked in.

Evidence based practice encompasses there being a mechanism in place to critique procedures that are standardised, this allows for continued evaluation of processes and policies in place. The use of a centrally introduced interventions that are standardised should not be the only avenue in ensuring knowledge, values and needs of situations that are deemed complex, evidence based practice should ensure that there is a balance between the various sources of knowledge and, simultaneously avoid being caught up in the direct implementation of evidence based practices methods that are used whilst ensuring that when making use of evidence based practice there are discussions around the system which is often seen as hierarchical.

When classifying evidence and being able to address the limitations that are associated with traditional evidence based systems, ensure that there is a larger range of source's that involves multiple persons in the process of establishing decisions in health care (Pistone, Anderson & Sager, 2023).

For one to be an effective clinician within the EMS system, they would have to trained and educated in the chosen field that would prepare them to respond to and manage any situation that they are called for. This training and education must extend to and include technical aspects that would require them to participate in complex activities, gaps in education and training must be identified and rectified to improve foundational knowledge to expand their roles and responsibilities and adapt rapidly to the communities need, this would require the organization to be dynamic and prepare their workforce in knowledge that is evidence based and have improvement qualities which is not merely protocol driven (Leggio, Grawey, Stilley, & Dorsett, 2021).

The current EMS clinician would need to possess technical skills, be able to solve problems that are complex, have a higher degree of confidence, be able to verbalize and communicate effectively both written and verbal, and have an attitude of lifelong learning, EMS education standards advocate for Ems education programs to put in more effort into non-technical education and increase instruction in programs that assist the community (Leggio, Grawey, Stilley, & Dorsett, 2021).

Conclusion

Over the years there has been a dramatic increase in both natural and man-made disasters that includes floods, structural fires, earthquakes and disease outbreaks that has an economic, social and environmental impact on society. Various standards exist that must be adhered to when planning for and responding to major incidents associated with mass gathering events in any EMS organization.

EMS has been increasingly become more active in the training and development of staff to enable skill development, response and management of major incidents, mainly due to the unpredictability of such events in spite of mitigating disaster risk.

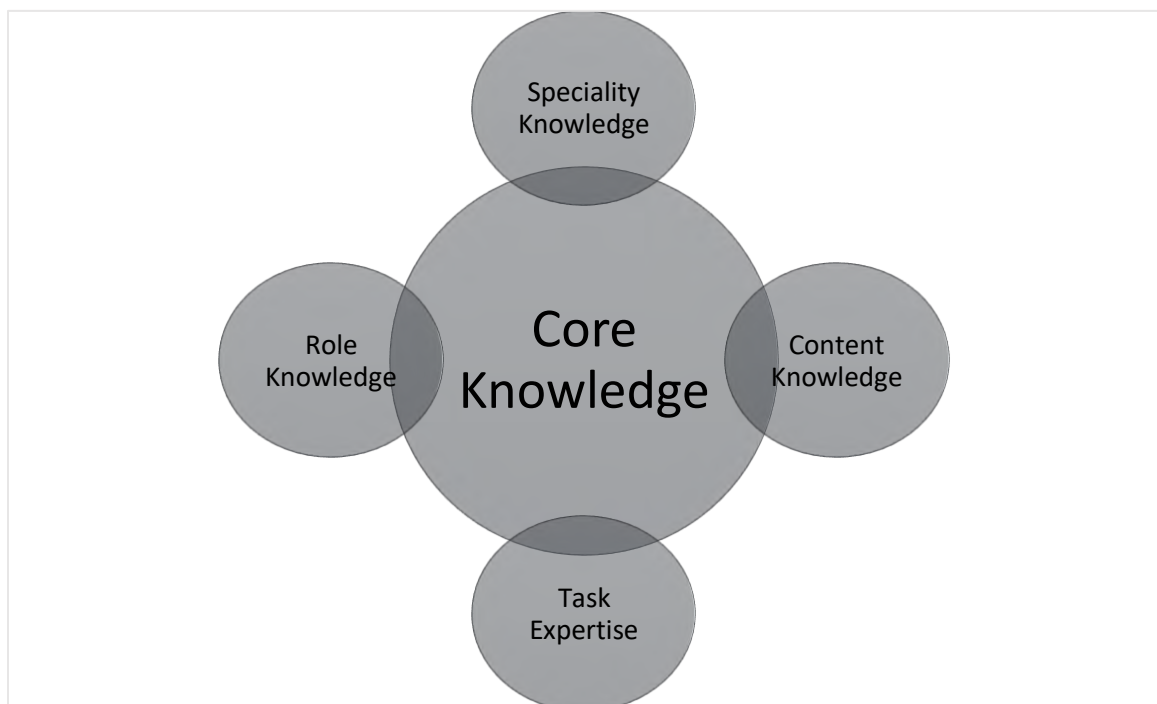
The standardisation of training and curriculums used according to Alexander (2013) has become evident within organizations and experts in the field, this was further highlighted by WADDEM (2021) who over the years has led with guidelines in the education and training of those in the health field related to disaster medicine.

Various roles and responsibilities must be covered by first responders in various areas in the event of a major incident, the coverage of such areas might not be optimal and go according to plan if there is a lack in education and training (Svensoy, Nilsson, & Rimstad, 2021).

In addition to the standardisation of training in EMS there are concepts that must be adhered to, such as tasks being specific to knowledge in relation to function, these knowledge areas are specific roles related responsibilities within the organization and specific content knowledge as well as knowledge in speciality areas in relation to the disaster management continuum or expertise such as triage (Fitzgerald, Rego, Ingham, Brooks, Cotrell, Manock, Surjan, Mayner, Webb, Macguire, Crawley, Mooney, Toloo, & Archer, 2017).

Figure 17

Demonstration of the Interaction Between Areas of Knowledge and Skills



Note. Adapted with permission

There need to be standards in the field of disaster management especially associated with EMS , as discussed by Fitzgerald et al. (2017) who indicated that knowledge and skill development is key, they went on further highlighting that policies and governance frameworks,

conceptual and theoretical practice, and current understanding of disaster management are also key in ensuring knowledge standards are upheld especially in the area of skills, the authors mentioned that collaboration, leadership and communication are aligned with critical thinking and professional practice being the glue that binds education and skills.

It is interesting to note that studies conducted by Najafi et al. (2015); Gladstone and Nayak (2017) and Martono, Satino, Nursalam, Efendi, and Bushy (2018) who also agreed that skills and knowledge are consistent criteria that must be developed in responding to disasters by EMS responders, perceptions on age, levels of knowledge, education as well as the time or experience in managing disasters are secondary factors.

Martono et al. (2018) highlighted studies which reinforced that preparation is key in responding to mass casualty or disaster incidents, this can be achieved by preparing staff in strategies that can assist them when needed, they went on to say that the responsibility lies with organizations in emphasizing the importance of training and education and enhancing skills in the field of disaster response and management.

Alrazeeni (2015) in his study showed that EMS often lack information in the area of disaster management preparedness and further discussed the perception of EMS on disasters on skill acquisition and knowledge, the importance of this study is that similar staffing methods are used in Saudi Arabia (where the study was conducted) as it is in Qatar. Outcomes highlighted that EMS lacked the skills and knowledge which made response and management inadequate in the area of disaster or mass casualty response. The integration of skills, knowledge and the understanding of disaster response as well as disaster or mass casualty management training exposes EMS perception, preparedness and attitude in the field when faced with the reality of working in such conditions (Alrazeeni, 2015).

The introduction of healthcare in the field of mass casualty response and management has been introduced around 1990 due to the increase in disasters, and would need to incorporate an all hazard approach. This process although on-going should be designed in a manner that ensures a high level of care, functionality and decrease both morbidity and mortality by ensuring that appropriate staff, equipment, policies, procedures, training, education and skills are in place (Khan, Alowais, Nofal, & Alama, 2021).

Various studies related to healthcare and disaster management/mass casualty incidents as highlighted by Khan, Alowais, Nofal, and Alama (2021) have shown that a lack of training, skills and formal education in the field are responsible for the lack in standardization, response and management of mass casualty incidents, they have also highlighted that although the field of mass casualty or disaster management is a challenging one the use of standards that are highlighted by the WHO are important in developing and standardizing preparedness in the healthcare responses.

The standard principles that the WHO (2015) recommends for healthcare to adopt in order to affect a response are divided into command and control, essential services continuity, communications, triage, recovery post incident, logistics, safety, surge capacity and human resources.

In a comparison study between Sweden and Iran the authors noted that it is important for responders to be trained in triage, command, control and communications with competencies in knowledge and training being delineated by the local ministry of health or organizations (Khan, Alowais, Nofal, & Alama, 2021).

The WHO further highlighted that EMS are indeed the first responders in mass casualty or disaster scenarios and is deemed as an integral component of healthcare in ensuring and efficient and effective health system, they went on to further say that disasters will happen and

EMS provides medical care to victims who are in need of medical care during emergency and disaster exposure, the WHO considers EMS as an integral part of any effective and efficient health system due to disasters, especially natural disasters being inevitable and occur almost anywhere in the world and affects communities. Organizations such as the UNISDR, WHO and SFDRR highlight the importance of preparedness especially in healthcare as there is a direct effect on human, economic and environmental factors (Beyramijam, Khankeh, Farrokhi, Ebadi, Masoumi, & Aminizadeh, 2020).

EMS need to be trained and show strength as well as be coordinated to ensure optimum management and response to incidents as they play a critical role in the planning as well as the response and management of the incident prehospitally, included in this training process would be the understanding of incident management, treatment that can be offered based on logistics and equipment availability, triage and transport are core essentials in carrying out duties (Beyramijam et al., 2020).

Preparedness and assessing EMS capabilities in the field of mass casualty incident response is a step in the correct direction in ensuring that outcomes are achieved by the organization, in the same way being under or not prepared at all for such incidents have been associated with undesirable outcomes as described by Beyramijan et al., (2020) who further highlighted that quality in healthcare services is a crucial factor in the preparedness phase to respond to mass casualty incidents.

The measures that must be taken by EMS and health care systems in response to and management of mass casualty incidents must include systems and developed programs that must be initiated, trailed and tested before any possible incident, the measures taken must ensure that maximum care is rendered to victims of mass casualty incidents and disasters as well as ensuring

that there is minimum effect on EMS (Beyramijam, Khankeh, Mehrdad, Abbas, Gholamreza, & Hassan, 2020).

Highlighted in ensuring EMS capability in response to disasters as written by Beyramijam et al. (2020) include training of all staff within the organization, the logistics aspect being understood with available resources, response to major incidents being validated which must include the assessment of responding to such incidents and be able to identify gaps within the organizations major incident response plan with being able to rectify them and identify weaknesses in management functions related to mass casualty incidents. The preparation of tools that are standardized with clearly defined roles, responsibilities and preparation procedures are paramount in ensuring success to respond to and manage incidents, not having such plans ensures chaos.

Increased workload and staff shortages often pose a challenge in recruiting staff to attend training and education sessions especially if the community one works in is not prone to mass casualty incidents or have not had one in years, however organizations should have formal training sessions or plans in order to familiarize staff in procedures that must be known and understood by responders, these sessions should be quick to grasp, easy to understand, have aids and incorporate as many drills in disaster or mass casualty response to be better prepared for the real eventuality if ever faced (Beyramijam et al., 2020).

EMS have challenges as with any other healthcare services with regards to training and ensuring staff are prepared to respond and manage mass casualty incidents, from time to time there are drills, simulations and table top exercises but, according to Beyramijam et al. (2020) this is not enough. The authors went on to say that various peer reviewed articles in the field of disaster management have agreed that there is never enough training when it comes to responding

and managing major incidents or mass casualty incidents, challenges will always be faced as trends in disasters change however, continuous training and the reviewing of the plans is instrumental in the verification of skills needed in mass casualty response and management.

EMS personnel need to be prepared for any eventuality in the event of a mass casualty incident in order to lessen the impact on human loss of life a community is faced with. The application of theories enhance emergency planning as it informs research in the area of disaster management by strengthening the field academically as well as practically. The tools that are used by EMS responders to perform their duty are essentially training, skill practicality and enhancement, the use of technology that is specific to the field that they are in and experience with the added organizational standard operating procedures.

Work done by authors which are highlighted and discussed in this chapter have agreed that the field of disaster management/major incident response in EMS have evolved but it has not kept pace with the change in the field, the very nature of a disaster has changed, various influences exist as a direct product of us being in a complex and global society. Despite these fast changes the organization that one works for must be able to guide their personnel and prepare them to respond to and manage any predictable and unpredictable events whereby those responders must rely on the training that they have received in the area of major incident response that, their organization offers, in order for them to make choices that are both accurate and effective. Staff, need to be sensitized to the field of mass gathering type events, and the possibility of a mass casualty incident at such events, this can be achieved by training staff with the use of a multisectoral approach, whereby first responders and managers are trained and this is sustained with the use of various methods in order to be well prepared in order to keep the level of knowledge acquired.

CHAPTER 3: RESEARCH METHOD

The major incident response (MIR) guide for Hamad Medical Corporation Ambulance Service (HMCAS) was written in 2015 and reviewed in 2017 and 2020 respectively. In writing the guide importance was placed on command and control, triage, treatment, and transportation to hospital. Other topics included in the MIR guide were scene management which encompasses a host of scenarios in the effective management and response to mass casualty incidents (MCI). HMCAS employ personnel from various countries around the world including, Australia, Canada, India, Jordan, Morocco, New Zealand, Philippines, South Africa, Tunisia, United Kingdom and the United States of America. These personnel have received medical, trauma and MIR training at various levels in their home countries. A mechanism to standardize the management of MCIs by HMCAS paramedics was proposed through MIR training and a user-friendly MIR guide.

In addition to Qatar hosting the Fédération Internationale de Football Association (FIFA) Soccer World Cup Qatar 2022™ and other international events, it became apparent that MIR training would need to be delivered to all HMCAS staff. However, to standardize the MIR training for HMCAS staff, an understanding of the current MIR training programme was required. Based on the outcome of this survey, the curriculum may need to be reviewed and revised to remain abreast with the latest evidence-informed practices in disaster and emergency planning. Once the MIR training programme is revised, HMCAS staff knowledge and skills on MIR management must be updated in line with the best practices informed by the evidence.

This study therefore aims to determine if, and to what extent, HMCAS paramedics possessed MIR knowledge, skills and experience prior to completing the MIR training

programme, determine the HMCAS paramedics' knowledge on mass incident response following the MIR training programme, and to evaluate the MIR training programme course content to prepare HMCAS paramedics to deal with major incident responses.

For the purpose of this study the researcher has chosen a descriptive cross-sectional study as this allows for the collection of data from the chosen population in one "specific time", due to the participants being selected on specific variables of interests (Cherry, 2019).

Pandis (2014) observed that cross sectional studies can either be analytical or descriptive, which depends on outcomes being assessed for likely exposures or risk factors. This was further corroborated by Levin (2006) who said that risk factors and characteristics can be exposed by making use of a cross sectional study by providing a "snapshot of the outcomes and associated characteristics at a given point in time".

This study evaluated the current major incident training program within Hamad Medical Corporation Ambulance Services (HMCAS) to improve the acquisition and retention of frontline paramedics in Qatar within the national ambulance services.

This preferred methodology is owed to the sponsors being of a similar group (all paramedics). The investigator would track the acquisition and retention of the major incident response plan since the plan was taught as part of the ambulance services 2020 service deliverable.

This research was conducted through a questionnaire survey as a data collection tool using a sample of randomly selected frontline staff which are either critical or ambulance paramedic qualified. The format of the questionnaire will follow an organized method ensuring that research questions are addressed. The study highlighted the research methods chosen by focusing on and discussing the research approach and design, the population and sample of the research, the

materials or instrumentation of the research tool, variables, ethical assurances and finally the analysis of the data collected.

The capabilities of the country far exceed the planning and response capabilities to major incidents, together with state-of-the-art equipment and response trucks, manned 24/7 for any type of mass casualty incident response. The problem is that there is no standard curriculum or training program that exists within HMCAS with specific outcomes aimed at ensuring that there is an understanding, retention and acquisition of the major incident response guide that is used by HMCAS as seen by other emergency services around the world. This is partly attributed to the ambulance service having their own major incident response guide which has been specifically developed for HMCAS. With the majority of staff not having been exposed to or working in the field as ambulance paramedics prior to joining the service (majority are nursing trained) or having worked at mass casualty incidents in the field exposes them to shortfalls such as the use of emotions when working these type of incidents. The lack of evidence in a robust training curriculum which addresses specific areas and needs disadvantage frontline staff, addressing these concerns can be beneficial to those managers that are expected to manage the incident and frontline paramedics that are expected to work at the incident has led to the researcher exploring this study.

Goniewicz, Goniewicz, Szubzda, Burkle, Hertelendy, Wathinani, Molloy, and Manesh, (2021) best explained the resilience of having a robust mass casualty incident plan which ultimately depends on infrastructure, redundancy, plans and strategies and finally competencies of health care personnel benefits an organization in being effective when dealing with incidents.

Overall management and response to major incidents should be done regularly within a planned framework, thus ensuring competencies and resilience which improves the process with interest placed or emphasized on staff (Goniewiza et al., 2021).

The overarching goal is to evaluate the current major incident training plan in order to improve the acquisition and retention of paramedics when working at major incidents or mass gatherings so that all work from the same background and knowledge base. This study is projected at observing the attitude towards mass gathering and major incident response among first response paramedics in the national ambulance service, with the aim being to develop a training curriculum that is both recognized and acknowledged as the standard for both present and impending staff as part of an improvement project within the ambulance service. This program that would be established, would allow for a common understanding with all working in HMCAS which would also become a core component of training when one is employed.

The study places significance on roles and responsibilities enabling paramedics to understand what is expected of them (Gregory, 2010).

Waller et al. (2011) highlighted that staff attending mass casualty incidents are inclined to being emotionally led due to the nature of the incident which results in the overlooking of many cores basic training that one might know.

Mass casualty response or major incident response be it at mass gatherings or any other type of scenario requires a specific type of response and requirements by emergency services to be understood in order for an effective incident management such as establishing a command structure, delivering a structured incident report to potential responders, identifying types of triage that decisions would be required and where to set up triage areas, the correct communications procedure and protocol to follow.

Research Approach and Design

In the article by Nakano and Yamori (2021) on disaster risk reduction (DDR) education it was highlighted that a relationship need to exist in order to bridge the gap between knowledge and behaviour as well as between learners and educators in the field of disaster management.

A common theme that surfaced was that there is an expectation that educators would teach learners both skills and knowledge in order to actively engage in disasters and DRR in the event of an actual disaster, however stated objectives in learning and understanding disaster response does not necessarily improves the attitude of learners on the subject.

Torani, Majd, Maroufi, Dowlati, and Sheikhi (2020) emphasised that disasters over the years have been increasing, the acquisition and retention of disaster management training and education is regarded as the only effective way in ensuring that response to such disasters are effective, disaster education is seen as the most effective in understanding all stages of the disaster management continuum.

A descriptive cross-sectional study

For the purpose of this study the researcher has chosen a descriptive cross-sectional study, as this allows for the collection of data from the chosen population in one “specific time”, due to the participants being selected on specific variables of interests (Cherry, 2019).

Whilst cross sectional studies are used in various areas of research, education is one of the areas that this method is used. Cross sectional studies are also known as “observational” and therefor considered as descriptive research which lends to finding the cause of a phenomena in the present and therefore does not allow for manipulation in variables (Cherry, 2019). A cross sectional study is regarded as being important in education research due to it being able to have a focus on a single point in time, variables cannot be manipulated by the researcher, various

analysis can be performed on characteristics such as population group, age and educational levels in a specific field of study (Kumar, 2020).

An investigation can be conducted on important characteristics of the population chosen as well as it serves as a “snapshot “of what the event being studied is in the present moment (Kumar, 2020).

The use of a cross sectional study in the field of health education helps the researcher examine various variables of interest, is seen as less expensive to conduct as data can be gathered relatively easily as its non-time consuming, and more importantly it enables further research (Kumar, 2020).

Karnjus, Prosen, and Lichen (2021) summed up the use of using a cross sectional study by highlighting that it is vital for workers in the field of health to be ready for disasters to both protect themselves and the community that they are involved in. Trying to summarize competencies that is core in disaster management/major incident response is still not clear as the current consensus stands on exactly what are these competencies as it is not yet defined across the world for various health groups (Karnjus, Prosen, & Lichen, 2021).

Karnjus, Prosen, and Lichen (2021) further highlighted, “presently the education and training in the field of health do not provide health care workers the skills that is required to develop in the field of disaster management”.

Being descriptive in nature, the study describes the “distribution of variables, without concern to causal or other hypothesis” (Aggarwal & Ranganathan, 2019).

A descriptive study is one that is designed to describe the distribution of one or more variables, without regard to any causal or other hypothesis. A descriptive study has various types

that are associated with it, one of them being a case report where the collection of data is on an individual.

According to Cherry (2019) there are several benefits that are associated with a cross sectional study, such as, allowing for an inexpensive method of collecting data, the collection of data with making use of various variables and then correlating them with the main variables being tested and allows for further research in the field chosen to study. The method chosen does have challenges such as the inability to differentiate between cause and effect and report biases.

In studies that are cross sectional measurements are done at the same time without the follow up process, this is largely due to it being suited in describing distribution patterns and variables (Hulley, Cummings, Browner, Grader, & Newman, 2013).

An example of this would be the study conducted by King, Spritzer, and Azzeh (2019) where they investigated the knowledge, skills and preparedness amongst health care professionals amongst the United States military personnel in the various Corps, the authors had recruited 300 personnel for the study and the conclusion of the study provided them with valuable information about the weakness in the preparation in disasters amongst health care providers that were to be deployed in the Indo-Asia-Pacific region and further highlighted that there were opportunities in training, promotion of international cooperation to enhance disaster readiness in the region.

Crowe, Cresswell, Robertson, Huby, Avery, and Sheikh (2011) described a case study as an approach that is used in research when a multi-faceted and in-depth understanding is needed in a real-life environment to try and understand an issue that is multifaceted. This is therefore seen as an opportunity (based on it being used in various disciplines) to investigate in depth areas in its natural context, this type of research method used is also known as “naturalistic” according

to Crowe et al. (2011) due to the researcher not seeking to manipulate and control variables being researched.

Whilst case studies are used to explore, describe and explain phenomena in the context that they appear in, in order to explain links and pathways in a new organizational development, it also allows for the information to be captured by answering the “why”, “how”, and “what”, questions, by offering an insight gaps that exist in order to further develop the area being investigated (Crowe et al., 2011). Similarly a cross sectional study answers the “why”, “how”, and “what” by addressing data being analysed in a specific time by a specific population (Crowe et al., 2011).

For this study analysis, HMCAS was used where an MIR training plan was developed based on the MIR guide in 2014. This was implemented to ensure the readiness of pre-hospital medical responders for potential major incidents that could occur at mass gathering events such as the FIFA World Cup 2022, the approaching Basketball World Cup 2027, World Swimming Championships 2024, Expo 2023-2024 and the Asian Games in 2030. There needs to be a more representational understanding of an issue which allows for various “epistemological standpoints” that organizations would need to investigate i.e. interpretivist, critical or positivist approach (Crowe et al., 2011). The focus being on the various stages when designing and carrying out the study with important stages being the defining of the case, selection of the case (s), the appropriate collection and analysing of data, interpretation and reporting of the data findings (Crowe et al., 2011).

These elements are further supported by Yazan (2015) in which the author highlights the perspective taken by Yin (2002) by saying that “research designs consists of five elements”, namely, the questions of the study, the propositions, the analysis, linking of data to propositions

and finally what criteria were used in the interpretation of the findings, whilst the researcher needing to ensure that the elements are both dependable and well thought-out, which supports the view taken by Crowe et al. (2011).

Crowe et al. (2011) explained that prudently formulated research questions must be developed in order to inform current literature in order to appreciate settings and issues that helps to define the case study, the aspects of boundaries being pre-defined (nature and time period) as well as chosen organization, the type of evidence that the researcher needs to collect as well as the areas that would need attention or priority in order for accurate data analysis, making use of theory determined approaches ensures there is an appetite for understanding why interventions such as why and how have either failed or succeeded in one's research.

Slick (2016) highlighted that the elements used in her research reflected on outcomes based education and must incorporate experience, be authentic, be team based as well as engaging and integrative with knowledge development in the field of disaster management being developed in a systematic manner which reduces risk as well as improves on practice. Slick's 2016 study highlighted that in order to develop knowledge in the field, learning theories must support a study by making use of research literature as a tool to further support learning principles to ensure prescriptive application.

This idea is collaborated by the researcher by making use of constructivist learning theories to enhance the knowledge and learning process in disaster/mass casualty incident response.

Following on from Slick (2016) the choice of study chosen for the purpose of this research incorporates the following:

The design of an authentic activity, which makes use of engagement in the types of activities that would need engage the chosen population in order validate their professional practice, this can be further be broken down into analysing the needs and problems of the population in the study in relation to a chosen context, determining the outcomes and ensuring that the strategies can be developed in order to achieve outcomes whilst making certain that there is knowledge generation with human experiences.

Problem analysis was looked into with much detail. Each component of disaster management/major incident response has a different knowledge gap related to specific problems that has to make sense in the field, therefore the inclusion of specific tasks needed to be highlighted to analyse the problem in order to achieve on the deliverable.

Outcome development, was highlighted by Slick (2016) which highlights that in making use of a cross sectional study in the field of disaster management draws from “professional practice”, were, making use of logic model programs as identified by Shakman and Rodriguez (2015) is the “road map or graphic depiction that is presented in order to share activities, outcomes, outputs to ensure that there is an impact in ones program to ensure an intended effect”.

The intention of making use of this study was to ensure there is support in the development of disaster management/major incident response education by learning about current educational problems in order to find resolutions to ensure continued development in the professional practice in the field.

In selecting the study the researcher should have access to the organization chosen in order to access personnel that would participate in the study, aspects such as ethics, risks and burdens that participants might face must be investigated thoroughly by the researcher, in addition other

aspects such as policy interventions, policy developments allows for being investigated in the context of it being “real life” (Hulley et al. 2013).

Hafiz (2008) argued that part of a study involves the identifying of propositions which assists the researcher in placing limits on the studies scope thereby increasing the studies likelihood limits. The proposition of the study comes from empirical data which is derived from professional experiences, generalizations and theories. An example of this is seen in the climate change loss and damage by Mechler et al. (2019) were three proposition’s where discussed in order to enhance the study that was undertaken in the field of disaster risk management and climate change.

With the researcher choosing a study which follows the descriptive cross sectional route does not mean that the various other methodological frameworks that exist are not or less effective in investigating the acquisition and retention of disaster management themes by frontline paramedics and managers in the organization that was chosen to do research in by the researcher. A cross sectional study approach according to Rowley (2002) is useful in researching human interactions amongst the chosen population experiences in the workplace on a modest scale with the intention of adding new knowledge in the field chosen.

Mukherji and Albon (2014) highlighted that to understand research, one must first understand “paradigm”, which is the asking of questions in order to gather information on questions that are specific i.e., it is a model or better known as a theoretical framework.

Essentially, one can describe a paradigm as “a way of seeing the world that frames a research topic”, Hughes (2010) as or according to Fraser et al. (2004) it can be viewed as “beliefs in which problems exist and arrangements on the how these problems can be examined”.

Hughes (2010) describes that the positivist paradigm is embedded in the area of sciences and often uses an approach that is systematic by viewing the world as being unable to change but everything that happens is explained by knowledge, to further understand this, the researcher needs to understand universal laws in order to witness and then record experiences.

The actual knowledge that one would benefit from is that of the senses i.e. observation and only will knowledge that is factual is attained.

Positivism is one that depends on the researcher being an analyst that is objective and is therefore restricted to the collection of data and its interpretation thereof, making the study quantifiable and observable which can then be analysed statistically (Smith, Thorpe, & Jackson, 2008).

The reason the researcher had chosen this research paradigm is due to the assumption that the researcher would be seen as independent from this study and concentrate on the facts that is presented. Using the principles of positivism according to Smith et al. (2008), no differences are observed in the logic of inquiry i.e., from theory to findings, explanations and predictions are discussed in the research and the hypothesis were developed and tested during the process of the research.

Within the framework highlighted one can identify two approaches which are exploratory and confirmatory (Mukherji & Albon, 2014). In the confirmatory approach the researcher will introduce a theory on a particular phenomenon, introduces a hypothesis based on a theory, embarks on an investigation to test the hypothesis. If the data collected sustains the hypothesis, then the theory is said to be sustained.

Methods

Population and Sample of the Research Study

Population Description

Design & Participants

As a service delivery unit of HMC, the ambulance services provides operational delivery of the Corporate Major Incident Preparedness and Resilience Program (CMIPRP). This service is provided with due consideration of required resources, maintenance of infrastructure and communication channels required, monitoring for situational awareness and governance of day to day major incidents as well as planning and exercises. The Corporate Major Incident Preparedness and Resilience Program (CMIPRP) makes use of an all hazard approach and thus the ambulance services would need to adopt such an approach. This approach ensures that the ambulance services would need to understand all aspects of responding to and working at a major incident. These aspects broadly incorporates, command, control, communication and coordination.

Ongoing risk and hazard assessments ensure necessary preparedness and resilience is in place for any major incident. With hundreds of events planned to take place in 2022 to 2030 ranging from large to small, the daily engagement with event organizers to undertake a comprehensive risk assessment of said event is required to ensure that HMCAS is well placed to provide cover as required for such events and in the process ensuring that the community is appropriately covered for any major incident should the need arise.

The all hazard approach is said to be an all-inclusive emergency preparedness framework that incorporates planning for response to a disaster/mass casualty incident and the mitigation

efforts which ensures that the ambulance service is ready for any type of eventuality (Pan American Health Organization, 2019).

An all hazard approach does not mean that every eventuality would need to be planned for instead it means that the focus would be on developing capabilities and capacities by ensuring that training and leadership issues are addressed by allowing for a standard protocol to be followed in major incidents as well as making any disaster/mass casualty incident management and response more scalable and effective (Pan American Health Organization, 2019). It is therefore in line with this that the study population was chosen.

The study made use of a descriptive cross-sectional design, with the questionnaire developed in line with current major incident guideline used by the ambulance service being kept in mind. The questionnaire was answered by all frontline ambulance services staff as well as those that undertake roles in the weekly “ON CALL” roster for major incident response and management. HMCAS is currently made up of 1700 personnel, of these there are approximately 871 personnel in frontline emergency roles from the emergency services, critical care services and planned patient transport divisions within the ambulance service. Non patient facing personnel from fleet management, production, facilities management, pharmacy, events and emergency planning, health care coordination centre and the national command centre were omitted from the study of which a detailed description is discussed under “research tool”.

Sampling technique

For the purpose of this study the data collection technique followed through with the probability sampling method, as this method affords the researcher for data to be collected by an available pool of respondents ($N=871$), in this case it would be the frontline staff in the ambulance

services comprising both of ambulance and critical care paramedics who are patient facing staff and involved in responding to and managing major incidents for the ambulance service.

Stratified random sampling (also known as probability sampling) essentially allows for the population chosen from which data is required to be grouped according to certain characteristics which can be referred to as subgroups (University of Central Arkansas, 2013). Probability sampling are more precise in embodying the population, it requires more effort, and there is a sensible threshold to the number of strata used, although representative of the population it has limitations in that it can be expensive or difficult to obtain.

Etikan, Musa, and Alkassim (2016) highlighted, “probability sampling can be used for both quantitative and qualitative research”, its use in a quantitative study is used most often as its uncomplicated, economical if used correctly, and quick.

Stratton (2021) on sampling strategies said that “making use of probability sampling when undertaking research in the field of disaster and prehospital research is popular” due to a variety of reasons such as being able to identify probable hypothesis and or study objectives.

The ambulance services have a workforce management section that is responsible for the daily scheduling of staff within their respective divisions on a daily basis. A detailed staff list exists for the three sections highlighted from which the researcher intends to collect data from, this list includes mobile numbers as well as email addresses. In addition to this, staff are divided into teams A, B, C and D and are on their team specific WhatsApp groups/Microsoft teams and grouped team emails which allows for the invite to not be extended beyond their family teams. Managers on call (ambulance or critical care paramedic) are on a specific Microsoft team as well as a group email address which allows for easy dissemination of the data collection tool.

The data collection tool itself would be sent out via email to the various email groups i.e. CCS - Management Mail Group; CCS Management Team Mail Group; EMS Critical Care Paramedics Email Group; AS-Retrieval Service Staff Mail Group; EAS-Supervisors Mail Group Ambulance Service Operations Mail Group, and team A, B,C & D mail groups as well as all Microsoft chat groups respectively.

All staff (as described in the above paragraph) were given the gatekeeper letter and the informed consent form which details the study. This gave the participants the opportunity to participate in the study or not. A reminder was sent out via email to the same email groups listed above exactly one week after initial dissemination of the data collection tool reminding staff to participate if they have not done so already.

This study made use of inclusion and exclusion criteria to ensure a “quality study”. Inclusion and exclusion criteria’s must be clearly described and rationally reasoned (Gray, Grove, & Sutherland, 2017). The simple indication of a study meeting both criteria’s according to Gray et al. (2017) is not sufficient and validity can be questioned.

In research, the inclusion of both criteria helps in determining certain descriptions and fundamentals of the study at hand, by ensuring that the study is of an accepted quality, balance is achieved, and it is generalized to a larger population set (Connelly, 2020).

Inclusion criteria, are there to underscore characteristics of respondents needed in a study, these inclusion criteria can include geographic and occupational group and, assists a researcher to determine if certain people from the chosen study population should be excluded or included in the study (Polit & Beck, 2018).

According to Gray et al. (2017) exclusion criteria is not the opposite of an inclusion criteria, however an exclusion criterion is there to assist a researcher in describing elements that

precludes a subject from participating in a study. These exclusion criteria's chosen can be age, not participating in a training program (as in the case of this study).

A balance need to exist between inclusion and exclusion criteria in order to cater for a large population set that can be useful, ensure external validity and knowledge in the area of research chosen (Connelly, 2020).

Inclusion Criteria

All frontline paramedics (both critical care and ambulance paramedics) were included in this study. All managers who rotate on the “ambulance services on call” rota was included in the study (managers within HMCAS are either ambulance paramedic or critical care paramedic qualified).

Exclusion Criteria

The following participants were excluded from the study:

Managers who are not frontline staff, managers who are not on the “Weekly On Call Rota”, non – operational frontline staff (i.e. those that are in production roles, administration roles that do not respond to patients or are not involved in major incident response), non-ambulance paramedic or critical care paramedic staff and the major incident response & HAZMAT team.

HMCAS is made up of approximately 1700 staff of which 871 are frontline paramedics, made up of both critical care and ambulance paramedics with some of these in middle management and senior management positions.

For the data tool (questionnaire) to be completed clinical staff in both the emergency and non-emergency services would be recruited which would exclude the ambulance services specialised team that work full time in the major incident and hazardous materials team (HAZMAT).

Slovan's formula was used to establish the number of required participants for the sample size (s) in order to complete the assessment (Adam, 2020):

$$S=N/(1 + N \times a^2)$$

N = Total population and a = Error tolerance (a = 0.05).

Taking into consideration that the population targeted was N = 871, the lowest number of the responses that was required is 274, for an error tolerance of a = 0.05.

According to Perneger, Courvoiser and Hudelson (2015) the highest error tolerance of a = 0.1 is tolerable. Tejada and Punzalan (2012) also highlighted that a smaller sample size would also be satisfactory in order to warrant a sample that is deemed to be represented appropriately with a 90% confidence interval (CI), for this subset of the population chosen (for the purpose of this study the minimum sample size was 274).

The respondents' Likert scale responses were coded to 1, 2, 3 and 5 with 1 = not satisfied, 2 = slightly satisfied, 3 = neutral, 4 = Satisfied and 5 = Highly satisfied.

The binary responses were also coded to 1 and 2 with 1 = yes and 2 = no.

When performing the binary logistic regression. The overall satisfaction scores were coded into two groups: Group 1 = Low satisfaction groups (satisfaction scores = < 2.5), Group 2 = High satisfaction group (Satisfaction scores > 2.5).

Materials/Instrumentation of Research Tools

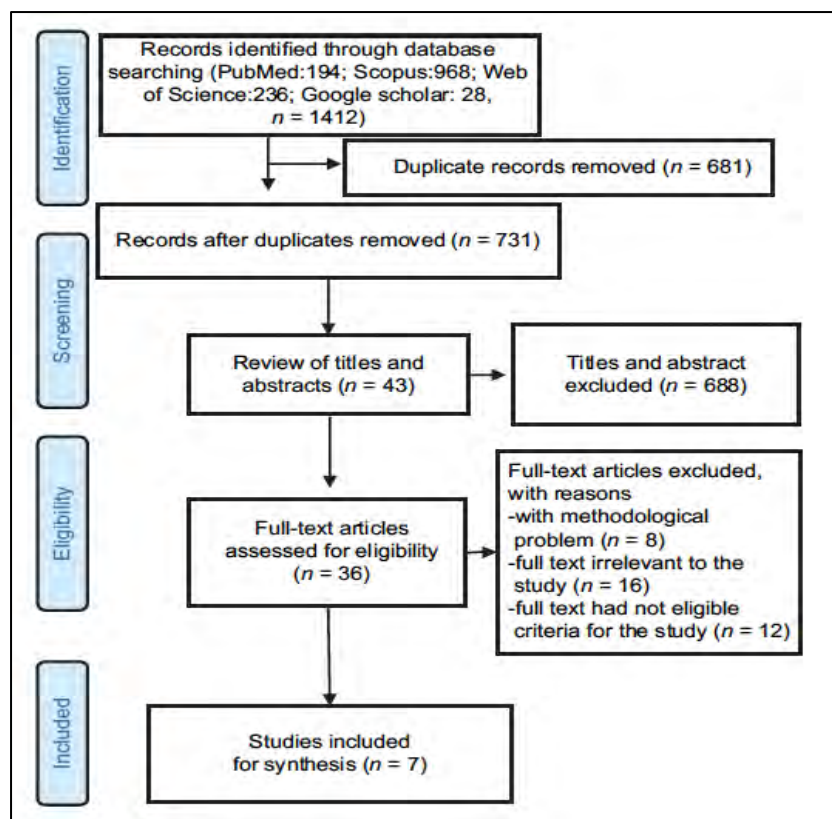
Over the past decade there has been a steady increase in major incidents both man-made and natural, this increase has led to various studies that aimed at contributing to the field of disaster management (Hamilton, Sodergard, & Liverani, 2022).

Education and training in the area of disaster management response and management is said to be the very core of emergency medical services (EMS) worldwide which should include

preparedness and response to disasters (Beyramijam, Farrokhi, Ebadi, Masoumi, & Khankeh, 2021).

The provision of a standardized course in the field of disaster management according to Beyramijam et al. (2021) is fundamental in ensuring EMS being prepared for any disaster. Having previous experience in the field of disaster management perceived a higher level of confidence in dealing with major incidents (Alotaibi & Khan, 2019).

In a systematic review on “disaster preparedness in emergency medical services”, Beyramijam et al. (2021) searched various data bases which included Pubmed, Google Scholar, Web of Science and Scopus from the years 2000 to 2019 using key words “EMS”, “Disasters”, “Emergency Preparedness”, “Readiness”, “Disaster Preparedness” and “Disaster Types”, “Mass Casualty” and “CBRNE”, to find articles. In this search the authors had found 1412 articles and of this 7 were used in their systematic review due to others not meeting the selection criteria due to “lack of relevance”, and duplicate studies.

Figure 18*Selection Process of Articles*

Note. Adapted from Disaster preparedness in emergency medical services: A systematic review by Beyramijam et al. 2021, p.3.

The articles that were initially selected (1412) originated from 1932 EMS agencies across various countries, from the 7 articles that were included in this study as shown in Figure 1, there was a mix from the United States, Saudi Arabia, Iran and Finland. The studies investigated where quantitative or a mixed method approach with questionnaires being used for the gathering of the data (Beyramijam et al., 2021).

According to Beyramijam et al. (2021) there is no standard tool that can be used in the evaluation of EMS being prepared for disaster response and management.

Where the authors show that one study had used the emergency medical specialists (EMS) incident response and readiness assessment (EIRRA) tool, which was modified, one author had used a tool developed by the Centre of Disease Control (CDC) and the remaining 5 articles included in the systematic review had developed their own questionnaire.

Figure 19*Summary of Selected Studies*

Author	Settings	Samples	Sampling method	Research purpose	Research design	Instrument	Results
Alotaibi <i>et al.</i> (2019)	Saudi Arabia	EMS agencies from 13 regions	A convenience sample sampling size not computed	To assess the MCI preparedness of EMS in Saudi Arabia and to identify their strengths and weaknesses when responding to MCIs	A cross-sectional, quantitative study	The modified version of the EIRRA tool was used in this study	The study results indicated that overall, the Saudi Arabia emergency medical system is limited prepared for managing MCIs in 13 regions
Maguire <i>et al.</i> (2007)	USA	EMS agencies from nine counties	Purposive sample (convenience sampling)	To determine the preparedness of EMS agencies in one US state to cope with a massive epidemic event	Nominal group	Researcher-made study-specific questionnaire	The findings indicate that most of the EMS agencies do not have broad, formal plans for response to large-scale bioterrorist or pandemic events. So, EMS agencies in this state fundamentally are unprepared for a large-scale bioterrorism or pandemic event
Jadidi <i>et al.</i> (2019)	Iran	EMS agencies in 31 provinces	Census method	To evaluate the efficacy and preparedness of EMS in Islamic Republic of Iran to face Ebola	A cross-sectional, quantitative study	"EMS checklist for Ebola preparedness" designed by CDC	The preparedness average score in this study is higher than standards
Phelps <i>et al.</i> (2007)	USA	70 after-action reports from 70 city-base EMS	Convenience sampling	To examines the preparedness of the EMS to respond to, treat, and transport victims of a MTCWA	A cross-sectional, quantitative study	Researcher- made questionnaire/ check list	Of the 50 after action reports that mentioned about EMS personal protective equipment, only six (12%) EMS agencies equipped their staff with personal protective equipment Results indicate that EMS responders are not prepared to safely respond to MTCWAs, which may result in a significant loss of life of victims and responders
Shirm <i>et al.</i> (2007)	USA	1932 state EMS agencies	Random sampling	To document the preparedness of EMS agencies in the United States for the care of children who are involved in mass-casualty events	A cross-sectional, quantitative study	Researcher- made questionnaire	Most (72.9%) agencies reported having a written plan for response to a mass-casualty event, but only (13.3%) reported having pediatric-specific mass-casualty event plans

Note. Adapted from Disaster preparedness in emergency medical services: A systematic review by Beyramijam *et al.* 2021, p.5.

Figure 20*Summary of Selected Studies*

Author	Settings	Samples	Sampling method	Research purpose	Research design	Instrument	Results
Jama <i>et al.</i> (2016)	Finland	20 hospital districts EMS	Census method	To survey the preparedness level of EMS systems for managing and handling mass-casualty chemical incidents in the prehospital phase	A cross-sectional, quantitative study	Researcher-made questionnaire	There are substantial deficiencies in the preparedness plans of EMS agencies in the United States for the care of children in a mass-casualty event EMS capacity in Finland for treating chemically affected patients in the field needs to be improved. Preparedness for administering antidote therapy for cyanide gas exposure was, in general, low. Overall, there was a good level of preparedness for treating chemical accident patients with supplemental oxygen, broncho-dilators, and inhaled corticosteroids
Furbie <i>et al.</i> (2006)	USA	768 rural EMS agencies	Census method Sampling	To determine the preparedness of rural EMS agencies for emergencies and disasters	A mailed, written survey	Researcher-made questionnaire	Many rural EMS organizations reported that incidents involving a greater number of victims inspired less confidence in their preparedness. Respondents were less confident in their level of preparedness for a terrorist bombing. In general, these organizations have limited resources and surge capacities. Their ability to respond adequately to mass-casualty events involving dozens of patients is questionable, and that they do not have the ability to respond effectively to large-scale disasters

Note. Adapted from Disaster preparedness in emergency medical services: A systematic review by Beyramijam *et al.* 2021, p.6.

EMS Incident response and Readiness Assessment (EIRRA) tool

The researcher omitted the use of the EMS Incident response and Readiness Assessment (EIRRA) tool for this study as it is a tool that was primarily developed for EMS systems within the United States, this tool makes use of indicators and the person completing the tool would then have to “tick” or include a prescribed score.

(0 = Unknown, 1 = None, 2 = Minimum, 3 = Limited, 4 = Substantial and 5 = Comprehensive) against each subcategory under the main category.

The tool includes seven categories: “Personnel”, “Infrastructure”, “Emergency Care System”, “Public Awareness and Notification”, “Evaluation”, “Mass Casualty Planning” and “Governance”, with 31 subcategories under each category.

Since this study evaluates the training in MIR within the ambulance services to ascertain acquisition and knowledge in the field of MIR against a program being offered by the organization, the EIRRA tool will not be able to evaluate outcomes as it concentrates on the EMS as a whole in being prepared for major incidents and not specific to education and training.

The EIRRA tool does however has a category on “Education and Training”, with subcategories including the following: incident command training, mass casualty training, disaster exercise, patient communications and training for special needs patients.

With no acceptable tool being available for the purpose of this research, a tool had to be therefore developed in line with the objectives and hypothesis development of this study.

The author had developed a tool that was specific in gathering quantitative data.

Gürbüz (2017) highlighted that a survey cannot be seen as an unassuming data collection tool, as its accuracy would depend on the chosen methods used, these methods must be independent which reduces error failures and increase the accuracy results which can be used to

obtain data statistically. The importance of obtaining accuracy in a survey would depend participants in the study give answers that are correct, questions are perceived correctly, hypotheses are not known and, variables conceptualization on measurements are done by the researcher (Gürbüz, 2017).

In deciding on developing the questionnaire various steps were followed:

Step 1: the research problem was identified, with factors and interactions as well as the identification of variables.

Step 2: The core research problem was identified, these included factors being identified and relating these to the research problem, related factors were organized and categorized.

Step 3: The factors that were identified and organized were tabled into themes.

Step 4: Identification of variables by asking the question “what information is required to be collected in the study to allow objectives to be met”, the factors that were negatively phrased were rephrased into variables that were neutral.

Measurements were identified, those variables that can be measured directly (e.g., 12 demographic questions), other variables that need indirect measures were identified (e.g., perception, knowledge, and confidence), these variables relied on indirect measures from variables that can be directly measured.

The process of operationalization was used to define variables into scale/index measures both quantitatively and empirically (e.g., knowledge-based questions) a series of knowledge-based questions was developed and categorized (17 questions).

Step 5: Questions were formulated that provided information on each variable, questions were identified into parts and specific in measuring only one item at a time, leading questions

were avoided, emotional, complex and vague questions were avoided and no sensitive questions were formulated with the questions being sequenced into a logical manner.

Step 6: The questionnaire developed would need to be measured for validity, validity being defined as what does the instrument is intended to measure, is it credible and believable. Measures used are content validity, construct validity and criterion validity.

Content validity, assesses the tool covering the subject being studied. Each of the item must be assessed for relevance, experts in the field being studied can rate the relevance of each item according to the content validity index (Haradhan, 2017). Criterion validity according to Haradhan (2017) speaks on tool comparisons, this can be achieved by testing the tool with a group of participants and comparing said results with a tool that exists by correlating results, and construct validity is the level in which the tool can gauge the theoretical construct that it is envisioned to measure.

Step 7: The tool in question being developed would have to be tested for reliability, which is described as the level in which the questionnaire can generate the same outcome if the test was repeated, in doing so the internal consistency, stability and equivalence must be considered (Haradhan, 2017).

Stability is understood as the same results being achieved with repeating the test using the same tool, this is known as test-retest reliability, it must be remembered that to test the tool the same group of participants need to be enrolled with a gap in between. The internal consistency is understood by similarity of the different elements that is located within the instrument, meaning that the instrument reliably measures the same descriptions and generate the same results, numerous measures can be used such as Cronbach's Alpha (Haradhan, 2017).

Haradhan (2017) explains that the “coefficient of reliability would need to fall between 0 and 1, 1 meaning that reliability is perfect and 0 is no reliability”. The test-retest calculates reliability by making use of statistical tests of correlation, reliability is used in evaluating the “stability of measures”, which are managed at different times to the same group of participants and yield same results, reliability is more accurate if it is performed superiorly, whilst reliability is deemed necessary, it is not sufficient in ensuring validity of research (Haradhan, 2017).

Inter-rater reliability according to Haradhan (2017) is allowing for data to be collected consistently, as equivalence of rating is gathered with the data collection tool by different observers, and a score is given by at least two impartial persons.

The most common internal consistency measure is the Cronbach’s alpha (α), it is used in social sciences and medical disciplines most often, this score diverges between 0 and 1, 1 indicating complete internal dependability and 0 indicating no association among the items on a specified scale, scores above 0.7 are acceptable,), 0.8 is considered as “quite good”, with a score of 0.9 identifying as exceptional internal consistency (Haradhan, 2017).

Haradhan (2017) defines validity as “the extent in which an instrument measures what it set out to measure”, i.e., how accurate and truthful the instrument is by ensuring the results meet the requirements of scientific research methods. Validity is made up of two parts: (1) internal and (2) external with the former speaking of credibility and the latter of transferability.

Internal validity is indicative of results being authentic and can be replicated, by the researcher being able to explain strategies such as peer review whereas external validity can be achieved by using specific narratives and non-reactive measures across different populations or settings, this however requires that the data collection tool be reliable (Haradhan, 2017).

The questionnaire was developed as a pilot questionnaire with the intent being to recruit a core group of specialists in the field to review and highlight inconsistencies in terminology, flow of questions, spelling, type of questions being asked i.e., relevance (detailed requirements tabled)

This was sent to six specialists in EMS with an understanding of EMS systems, disaster management, training and education and research who assessed the questionnaire for face validity and content validity.

The instruction given to the six experts were to take note of the time required to fill in the questionnaire, comment on the ease of using hyperlinks on Microsoft teams and email and highlight any difficulties in accessing the data collection tool as well as the information and consent to participate in the study documents, highlight inconsistencies if any on the “clarity to complete the questionnaire”, assess the questions by commenting on ease of interpretation, content and simplicity, highlight unclear or ambiguous questions, feedback on relevance to the study objectives, comment on layout of the form, colour, font and size i.e., aesthetically pleasing, answer all questions, return questionnaire with comments within one week of receiving it and finally, the researcher had checked the questionnaires received from the panel experts, made required to changes in line with consistency and validity.

The questionnaire developed provided the participants a “structured” format to answer each question by marking the most appropriate answer. The questions were developed through literature that was related to EMS major incident response, education and training in EMS major incident response literature.

Questions were themed according to demographics (12 questions), satisfaction with MIR training format (6 questions), satisfaction with the confidence earned after participation in the

training offered by the ambulance service (9 questions), satisfaction with the level of MIR concepts understanding after participating in MIR training offered by the ambulance services (8 questions) and future suggested topics that can be included in MIR training (1 question).

The questionnaire was created by Microsoft forms and hosted by Microsoft teams (chat function). The Microsoft service is a paid for use service by the corporation that the researcher and participants work in, however it is available free for all employees within the organization, internet connectivity is available free for all employees on any of the organizations campuses.

On completion of the online questionnaire with all fields filled in, the questionnaire was submitted online. Microsoft forms collated results and presented on a spreadsheet. The questionnaire provided the numerical data required to be inputted into SPSS for calculation, comparison and statistic testing.

There are both advantages and disadvantages in making use of a questionnaire in research, the advantages according to Gürbüz (2017) are the identification of broader satisfaction and understanding in MIR within EMS, ease of distribution and collecting of data simultaneously to a large group of participants, the researcher does not have to be present which reduces researcher bias and response reliability is increased.

Similarly the disadvantages associated with a questionnaire include no scope for nonverbal or verbal cues, data from the questionnaires can be affected by participant characteristics such as personality, experience, motivation and memory, participant experience cannot be gauged (Gürbüz, 2017).

The final questionnaire was then sent to a group of specialists in the field of major incident response and HAZMAT specialists to answer as part of a pilot study (this was excluded) from final results of the study.

Operational Definition of Variables

Operational definitions should be specific and precise on how to measure various variables so that anyone else would be able to repeat the steps and the output obtain the same measurements (Slife, Wright, & Yanchar , 2016).

The best practice approach to adopt is to translate paradigms into recognizable and quantifiable operations, and this according to Slife, Wright, and Yanchar (2016) would be to focus on translation validity (i.e., constructs matching operationalization).

Authors such as Furlong et al. (2000), Morling (2015) and Hoyle et al. (2002) according to Slife, Wright, and Yanchar (2016) concurred that operational definitions are not adequate, due to the inability to capture complex and rich ideas that are often contained in constructs, failing to measure the “right thing” in the “right way” entails not being able to answer questions which can lead to overlooking construct validity.

The main issues that would need to be highlighted is the following (Slife, Wright & Yanchar, 2016):

Issue 1: Operational definitions not matching their constructs.

Issue 2: Constructs that do require operationalization in principle are not measured, this makes their link to operationalization not being directly measured and,

Issue 3: The relationship among various operationalization to the same construct cannot be measured.

There are solutions to issues 1, 2, and 3 respectively, these according to Slife, Wright and Yanchar (2016) are:

Solution to Issue 1: researchers in their reports cannot simply assume that the construct is being investigated in any straightforward or measurable manner via its operationalization, researchers would therefore be specific on what is being studied.

Solution to Issue 2: higher correlations does not mean better correlations, both internal and external validity must provide steps of operational credentials (i.e. translation validity).

Solution to Issue 3: pursue operational definitions in conjunction with other means by exempting alternate explanations “why a given set of operationalizations, provide a defensible way to collect empirical data which is related to the construct in the question).

In order to accurately approach the operationalization issues, the researcher would have to revisit the design phase of this study reviewing the aim, objectives, research questions and hypothesis of this study.

Review of the Research questions and Hypothesis

Research Questions

The research aimed at answering the below research questions which were also a basis for the investigation.

Q1. What are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance service?

Q2. What are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?

Q3. What current major incident response aids need to be revised in order to better assist ambulance and critical care paramedics to work confidently at a major incident?

Sub Questions

Q1.1. What are the most important factors that influence decision making by ambulance and critical care paramedics when working at a major incident?

Q2.1. Do the number of major incidents that an ambulance paramedic and a critical care paramedic respond to have an influence on their knowledge retention of major incident response?

Q3.1. How often would an ambulance paramedic and critical care paramedic require training and updates on working at and managing major incident response?

Q4.1. What aspects of the current major incident response training improved skills and knowledge of ambulance paramedics and critical care paramedics?

Research Hypothesis

The following were the presuppositions which were stated in the form of hypotheses. The hypotheses stated in the null (Ho) and omitting the alternative (H1) hypotheses:

H1o. Managers and frontline paramedics within HMCAS are not subjected to factors that inhibit the acquisition and retention of major incident knowledge when it comes to working and managing a mass casualty incident which does not affect their ability to work and manage a mass casualty incident as per HMCAS policies and procedures.

H1o. Frontline paramedics and managers within HMCAS are not subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

H1a. Frontline paramedics and managers within HMCAS are subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

H2o. Pertinent, core essential topics do not need to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

H2a. Pertinent, core essential topics needs to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

H3o. Frontline paramedics and managers within HMCAS do not need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

H3a. Frontline paramedics and managers within HMCAS do need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

The above objectives and hypotheses yield the variables that were described in the conceptual framework of chapter 2. There are 31 explanatory variables. They were grouped into five main groups as follows:

Study variables

Group 1: Demographics.

Group 2: Satisfaction with the MIR Training format.

Group 3: Satisfaction with the confidence earned after participation in the training.

Group 4: Satisfaction with the level of MIR concepts understanding post MIR training.

Group 5: MIR training program suggested new content.

Construct/Variable 1

In operation of variable 1, demographics would be discussed. Demographics variables have the ability to predict and solve problems, the use of demographics as a variable by researchers are constructed as control factors or moderators (Naseri & Elliot, 2011).

There were 12 questions related to demographics which described the intended data to be collected, these questions ranged from gender, age, qualifications, department that the participants work in, previous experience in in other EMS systems, other MIR training received, previous exposure to major incidents (in hospital and prehospital), HMC experience, number of MIR scenes attended both prior and post MIR training offered by the ambulance service. The data source used was a data collection tool that was specifically created for the purpose of this research.

Gender related to variable 1: gender was required and categorized into male or female; the testing method used was the distribution in gender.

Age related to variable 1: Age was required, the participant had to input their age on the data collection tool and then this would be categorized into groups, the Kruskal Wallis confidence distribution would be used with regard to MIR training, if p is significant then Tukey/Benforonni would be used.

Qualification related to variable 1: HMCAS medical qualification would be the dependent variable which is categorized into ambulance paramedic and critical care paramedic.

Employment related to variable 1: HMCAS employment was categorized into ranges 1 to 5, with the Kruskal Wallis Confidence distribution with regard to MIR training, if p is significant then Tukey/Benforonni would be used.

Previous experience in in other EMS systems related to variable 1: was categorized into yes/no: binary, with Chi-Square being used as the test.

Previous exposure to major incidents (in hospital and prehospital) related to variable 1: was categorized into ranges 1 to 5, with the Kruskal Wallis Confidence distribution with regard to MIR training, if p is significant then Tukey/Benforonni would be used.

MIR scenes attended both prior and post MIR training offered by the ambulance service related to variable 1: was categorized into ranges 1 to 5, with regard to MIR training.

Construct/Variable 2

HMCAS paramedics prior MIR knowledge, skills, and experience related to variable 2:

Four of the questions related to variable 2 used the Yes/No category with the testing of the variable.

Two of the questions related to skills and knowledge used the five-point Likert scale option. The need for emphasis to be placed on knowledge and skills amongst the paramedic profession is paramount, arguably the most effective form of teaching is involving paramedics in strategies that has them engaged, humanistic skills is best evaluated with the use of evaluation tools that one can self-report on (Ross, 2012).

Construct/Variable 3

Satisfaction with the confidence earned after participation in the training.

Confidence level variables.

The satisfaction with the confidence earned post participation in the MIR training included 6 questions in the data collection tool. These questions included aspects such as confidence level in managing major incidents prior to MIR training, confidence to work in major incidents post MIR training, confidence in giving a METHANE report, performing as a silver

commander, confidence in triaging, confidence in establishing command and control, confidence in MIR radio communications, confidence in donning and doffing procedures and confidence in choosing the correct HAZMAT PPE to use.

Waltrich, Sheen, and Ling (2021) highlighted that confidence levels amongst the paramedic group requires training and education to address their concerns, a clear definition needs to exist with role and goals which need to focus on identifying areas within a paramedic's role to improve care and performance.

Of all the confidence level questions used in the data collection tool under the variable 3, 1 question used the YES/No.

The remaining 8 questions had 5 options in each of the questions asked and therefore made use of the 5 point Likert Scale.

Construct/Variable 4

Satisfaction with the level of MIR concepts understanding post MIR training.

Satisfaction with the level of MIR concept.

In this variable there were 8 questions that was included, these questions ranged from the understanding of command and control, understanding of MIR terminology, making use and understanding of Action cards, Hazmat understanding, understanding bioterrorism and interest in furthering MIR knowledge.

Seven of the question identified in the data collection tool that fell under the satisfaction with the level of MIR concept used the 5-point Likert scale, (e.g., very confident, somewhat confident, fairly confident, slightly confident, not confident at all) whilst one made use of the Yes/No category.

Construct/Variable 5

MIR training program suggested new content.

This variable identified one question, that gave the participant 5 options to choose from. These options are part of the disaster management continuum. The 4 point Likert scale was used together with the Kruskal Wallis Confidence distribution to MIR training.

Study Procedures and Ethical Assurances

This study received approval from the University Research Ethics Committee (UREC) prior to any collection of data. In addition, approval had to be granted by the organization that the researcher is employed in, and where the data for this study was collected from. This process entailed various steps of approval prior to being allowed to collect data from the organization.

This process included the following steps:

Step 1: Application to The Collaborative Institutional Training Initiative (CITI) and undertake the courses in Health Information Privacy and Security (HIPS), Social and Behavioural Researcher (SBR), Conflict of Interest and Good Clinical Practice (GCP) – Clinical Trials Investigator was undertaken.

Step 2: Application to the Group Research Oversight Committee (GROC): which is a committee that approves all research that is being conducted by the HMCAS. On approval of the study proposal permission would be granted from the Medical Director of the ambulance services.

Step 3: Application to the Medical Research Committee (MRC): which is responsible for all research being conducted in the corporation under which the ambulance services sit. This process entails a very stringent process where details need to be submitted on the synopsis of the study, background and introduction to the study, objectives, indication if

there will be any retrospective collection of data, the methodology of the study, the location, population and setting of the study, study procedures which detail timelines, consent, risk, sample collection, outcomes, data collection and confidentiality and withdrawal consent procedures, statistical and data analysis process, adverse event reporting, ethical consideration, sponsor funding and result dissemination process.

On approval of step 2, approval is granted by MRC, this is then sent to the Executive Director of the ambulance services who then writes and disseminates a memo to all staff informing them that approval has been granted for the researcher to undertake his/her study within the organization.

This study did involve the participation of “personnel”, as data was required from them by filling in of a questionnaire. When humans are involved in any type of research certain steps would need to be followed to ensure that the participant is willing to participate in the study by ensuring that the researcher is truthful, respectful and answers all concerns which includes dissemination of information that the participant would need to understand; what it is they are participating in. This can only be achieved if the researcher conducts research in a manner which is ethical, from the start of the study through all phases of the study, this can be done but not at the expense of participants (Brink, van der Walt, & van Rensburg, 2018).

For the purpose of this study data were collected from frontline workers within the ambulance service. The frontline workers are those personnel that are either ambulance or critical care paramedic trained in the country they are from and working full time for the organization that they are currently working in. According to the National Health Services (NHS) (2023) frontline workers are known as ambulance paramedic (AP) or critical care paramedic (CCP) who

work a certain amount of shifts pre-hospital and deal with any emergency in an equipped ambulance.

AP's and CCP's are clinicians that are university trained who are responsible for the assessment and treatment of patients by making use of skills that they have been taught. The national ambulance services where data would be collected are made of AP's and CCP's that follow similar or higher training as that of their counter parts in the NHS. In ensuring the data collection would be ethically and morally completed the researcher ensured that stringent steps be followed as highlighted by the university that this study would be completed in as well as the organization staff participating from are working in.

These processes are the following which were done in writing:

Informed consent from the participant, that highlighted the purpose of the study, why the participant has been invited to participate, information on do they have to participate, what will happen if they do decide on participating, information on expenses and payment or costs, benefits of participating, confidentiality, what happens if participants do not want to continue in participating, results of the study, what happens if there is a problem with the study (if they have any concerns) and, who to contact.

In addition, a research participant consent for was administered prior to a participant completing the data collection tool and finally

An understanding that participation is purely voluntary with either agreeing or disagreeing to participate.

Specific collection of data was adhered to, the organization only allows for the use of Microsoft forms for quantitative data collection, these had to be disseminated on Microsoft teams or Microsoft chat where the participant has an account registered (which is provided by the

organization) and protected by a password that is known only to the user. On completion of the tool, the researcher would get notified that a document has been completed with no identifying details. This data is then stored on Microsoft cloud which is accessible only to the researcher (password protected), this ensures that data collected would not be leaked but accessible to the researcher only.

On approval from the various institutions the consent forms as well as the data collection was disseminated to frontline staff on various teams (A, B, C, and Team D), via email and these teams comprise both AP and CCP. Staff were given the opportunity for seven (7) days to complete the questionnaire and on day seven, another reminder was sent to all staff. This was opened for a further seven days.

The researcher ensured ethically sound principles were followed by ensuring that the research was conducted proficiently, meticulously, and was methodologically thorough. Truthfulness and high regard were used to manage resources, accurate communication used at all times, fair use of acknowledgment to those that participated in the study, and consequence consideration being considered throughout the study.

Whilst there was no risk to the participants involved in the study, the researcher approached the study by ensuring that there was respect for persons, by ensuring that certain principles were followed as described by Brink, van der Walt and van Rensburg (2018).

These were:

Principles of respect for persons

Ensuring that no persons with disabilities were enrolled in the study, the ambulance services require that all personnel are fit in body and mind to work in a high demanding environment, so this was achieved with no additional protection.

The researcher is employed for the ambulance service however is not involved in the management of frontline staff, so participants were not vulnerable in that they “had to” participate in the study. They had full autonomy of participating or not.

Participants were afforded the right to withdraw from the study, in addition participants were afforded the right to not give information or seek clarification on the study.

Principle of beneficence

The principle of beneficence was ensured by the researcher with securing the well-being of the participants who were not subjected to harm and or discomfort (legal, emotional and psychological), no participant were subjected to physical harm, in addition the researcher ensured that there were no manipulation in the study and the organization that research was conducted in was not subjected to harm or discrimination (Brink, van der Walt, & van Rensburg, 2018). Research is there to benefit both researchers and organizations, this can however work against an organization from which the “study population was chosen”, for this reason due respect was given to the organization by ensuring no reputational harm would befall them as well as the culture and ethos of the organization being considered by the researcher (Brink, van der Walt, & van Rensburg, 2018).

Principle of justice

The principle of justice according to Brink, van der Walt, and van Rensburg (2018) makes reference to those that are participating in the study and ensuring that they have a right to fairness by the researcher making sure that the participants chosen are directly related to the field of the research (research problem) and not at random, the participant must be assured that data collected would remain anonymous, as well as kept confidential. This process should also ensure that the researcher themselves would not be able to make any links between the data collected and the

participants data (direct link), this process must ensure that collection toll data should not be made available to anyone else but kept in a safe place.

According to Simundic (2013) bias is the deviation from the truth in data collection. Analysis and interpretation of one's research can lead to conclusions that are not correct, bias is further described as being unintentional or intentional which can either lead to immoral conclusions in research, and this is seen to be irresponsible.

Simundic (2013) further indicated that all forms of bias be identified with appropriate actions taken to rectify them.

In order to eliminate forms of data bias, the research question should be addressing the population chosen or representative of the population in order to achieve external validity. To avoid selection bias all AP's and CCP's in the organization who are frontline staff was invited to participate in the study. This enabled the sampling to be random i.e., every subject had an equal opportunity of being included in the study, case control or cross sectional studies according to Simundic (2013) have potential of being biased but these can be avoided if the respondents are made aware of confidentiality in the study, which makes them less vulnerable in choosing an answer that can be identified back to them (Simundic, 2013).

Finally, "This study was approved by the Hamad Medical Corporation Ambulance Service Group Quality, Patient Safety and Risk Management as a quality improvement project under reference number QI-HMCASG-2023-002."

Data Collection and Analysis

The data collection for this study was achieved by making use of one data collection instrument. The questionnaire which was specifically developed to assist the researcher in collecting pertinent information from participants that enrolled for this study from HMCAS. The

participants comprised of frontline paramedics who are either ambulance paramedic or critical care paramedics. The questions in the data collection tool addressed each of the questions raised in the research which ultimately gave way to the testing of the hypothesis.

The data collection was coded, this coding was in the form of Yes or No for all demographic related questions, multiple choice questions ranging from strongly agree to strongly disagree for those questions related to skills, training and understanding, and from very confident to not confident at all for questions linked to confidence.

There were no open-ended questions that made up the questionnaire, however, questions were separated into themes according to pre-set variables. The data collected, were analysed according to tests suited for each of the variables discussed.

In order to analyse the data collected, two software packages were utilized, one being Microsoft excel which translated all data collected to be able to be captured on Version 22 of Statistical Package for the Social Sciences (SPSS).

The statistical facet of the research was first preceded by frequency tables and then the matching of cross- tabulations for each of the research questions and hypothesis of the study. The description of the data determined the technique or mean used to test the hypothesis and the type of the pair of the independent variable (predictor or explaining variable) and the dependent variable. All questions in this study were assessed individually, and then matched with the research hypothesis for testing.

Reliability analysis was conducted by determining the Cronbach Alpha coefficient for the Likert scale and binary items. This aimed to determine whether we would have the same results if the same survey was repeated on another population with the same characteristics. It ranges between 0 and 1. The closer to 1 the better. The normality distribution analysis was

performed by using the Shapiro and Kolmogorov tests. Then according to the normality analysis results, bivariate analysis was performed using the Mann-Whitney-U-Test for the continuous variables and the Chi-square test for the categorical variables. Multivariate analysis was performed using the Kruskal-Wallis test adjusted with the Tukey test for the significant variables. Further, binary logistic regression analysis with a backward method was performed to identify the determinants model of the satisfaction level. The backward method allowed for removing the non-significant variables from the model on multiple steps according to their p-value.

The statistical aspect of the research encompassed the following as described in part/chapter 3 of this study:

- (a) Testing of the hypothesis, using the Chi-Square test for nominal data.
- (b) Testing of hypothesis, using multivariate analysis.
- (c) Inferential statistics, using correlations.
- (d) Descriptive statistics, making use of frequency and cross tabulation tables with various bar graphs and control charts.
- (e) Reliability analysis for all questions with binary responses.
- (f) Reliability analysis for all Likert scale questions.
- (g) Normality distribution was tested using the Shapiro test and if data was distributed normally, it would be followed with non-parametric testing.
- (h) If there was a difference in themes from the testing, a post-hoc test was done (Bonferroni, in the event that themes are different).
- (i) Confidence type themes was tested using the Kruskal-Wallis test.

In using the quantitative approach, the aim was to examine the relationship between variables so that the hypothesis can be evaluated objectively, in doing so the following designs were used.

Case study: (in-depth objective analysis of units of variables to explain a complex condition). A limited geographical area was chosen to capture a feasible part that would represent the situation in the organization that the study would be conducted in. Case study research allows the understanding and to explore complex issues that a researcher would want to be investigated, it is considered robust, recognised as a tool in various settings such as education, community problems and sociology (Zainal, 2007). The use of case studies as a research method is that researchers are able to go beyond the statistical results and appreciate behavioural conditions in a study, these methods also enable a close examination of data within a set context, by selecting a small area or a limited number of participants that explore phenomena that are real and affect conditions or relationships (Zainal, 2007).

Correlational (establish the relationship between two or more variables): This test was done by coupling the variables to see the association in the relationship between variables in question.

Correlational studies have various definitions, however all analyses are correlational due to all conventional parametric analyses (e.g. t-test tests) yielding correlational evidence (Thompson, Diamond, McWilliam, & Snyder, 2005).

Research questions must be matched with research designs, although correlational studies might not best deliver the evidence with regards to causal mechanisms, it can be used to appraise causal inferences and therefore best practice (Thompson, Diamond, McWilliam, & Snyder, 2005).

Descriptive: Descriptive designs are there to collect information about variables, this must be done without any manipulation of variables so cause and effect does not need to be looked into, one has to ensure that a linear relationship and a decision on how the outliers would be handled, these need to follow the characteristics outlined by Baker (2017) being variables must be identified and defined, data for each of the variables must be collected, one group of participants must exist and collection of data must occur at one point in time.

This detailed description of the data collected and the process was identified and tied to the research variables and hypothesis to the study, in addition methods of collecting data, identification of said data and analysis using statistical methods were highlighted.

Summary

Chapter 3 of this study looked at the research methodology chosen, this included the design and approach, population and sample of the study, the research tool, ethical assurances and finally the data collection and the analysis thereof.

Due to the writing of the HMCAS MIR guide back in 2015 and the number of major incidents the service had responded to over the years, including the many high profile international events, it became imperative to evaluate the MIR guide and training that staff in the service receive. This evaluation needed to be done for a few reasons i.e. staff turnover over the years, change in infrastructure in the country, development of the metro, tram, an additional international airport, stadiums, new ports of entry, endemics and pandemics experienced worldwide (e.g., COVID 19), changes in emergency and disaster management approach, increase in both natural and man-made disasters worldwide as well as some exposure within the country.

A standard approach to teaching major incident response and management was needed however, this could only be done/recommended if frontline staff within the service displayed or

showed to have no understanding with MIR, and demonstrated requisition and retention of MIR principles or not.

The study placed emphasis on roles and responsibilities that frontline emergency staff would need to know as required by the organization that they work for.

To bridge the gap on DDR education there needs to be understanding of behaviour and knowledge in the field of disaster management response (Nanano & Yamori, 2021). This according to Torani et al. (2020) is the only way to increase the acquisition and retention of disaster management.

The study made use of a descriptive cross-sectional study, as it required a specific group of participants in a specific time based on specific variables that the researched needed to investigate (Cherry, 2019).

Karjus et al. (2021) demonstrated staff competencies in the area of disaster management need to be understood in order to be ready for any major incident, therefore the participants of the study were chosen from the organization that the research is currently employed in. HMCAS is currently made up of just over 1700 personnel, however, of this there are approximately 800 frontline ambulance and critical care paramedics who are responsible for the immediate care of the sick and injured pre-hospital, part of this function is the response to and management of major incidents in the country.

Probability sampling according to Etikan, Musa, and Alkassim (2016) in the field of disaster management is a popular choice as its not complicated and economical, this is further supported by Stratton (2021). Various inclusion and exclusion criteria were used in the study. In order to achieve the required number of participants that would be needed to participate in the

study, Slovan's formula was used, which indicated that 274 people would need to participate for the study to be regarded as satisfactory.

A data collection tool was specifically created for this study as there is no current acceptable tool in the field of evaluating current guides and teaching practices in the field of major incident response (Beyramijam et al., 2021).

In the development of the tool, various researched steps were followed to ensure validity and reliability (Haradhan, 2017).

As described by Slife, Wright, and Yanchar (2016) and Krathwohl (2009) operational definitions and variables would be needed to ensure that "something of interest would be able to be computed", these operational definitions needed to be both clear-cut and precise. Thirty one construct variables were themed into five according to gender, satisfaction, skills and knowledge and new content in the MIR training program.

Various steps had to be followed to obtain ethics for the study, this entailed both organizational and university ethics approval. The steps taken are discussed in detail within the chapter under part 3.4. of the study, the processes required for participants ensured that principles of respect, beneficence and justice were followed (Simundic, 2013).

Bias was eliminated from the study by allowing for the research questions to address the population of the study, selection bias was eliminated by ensuring that all frontline staff were enrolled in the study so that an equal opportunity was given to all frontline staff.

Confidentiality, informed consent, purpose of the study allowing for participants to willingly participate or not was disseminated in the form of letters to all that enrolled (Simundic, 2013).

Data collection and analysis of the data was achieved through a specific process, data was coded, both Microsoft Excel and SPSS software was used, the researcher reviewed data specifically to reviewing that the research questions, hypothesis and the study design was tied appropriate to the tests being used to analyse the collected data (Baler, 2017).

CHAPTER 4: FINDINGS

Discussion of Research Findings

Introduction to the Section

Chapter four addresses the reasoning behind this study and the discussion of the findings was to keep track and direct this research. This study is aimed at reviewing the current attitude in responding to major incidents as well as mass gathering type events or scenarios amongst frontline paramedics in the ambulance service. Disasters and significant incidents have become more prevalent over the years i.e., artificial and natural disasters worldwide.

Organizations such as the World Health Organization (WHO) have since changed their approach from response to an all-hazard type approach, which makes it imperative for staff involved in disaster response to keep up with the trend and changes that have been researched and implemented elsewhere around the world (WHO, 2023). This study, therefore, aimed at gathering data from the organization being studied (HMCAS) in particular frontline paramedic staff and managers, with the aim being to understand their current knowledge of primary incident response and then investigating areas that need to be improved on within the current training to improve on knowledge acquisition and core knowledge retention of major incident response understanding.

The sections that follow in this chapter explain applicable issues that are fundamental in this research and the process thereof. Part one will cover the trustworthiness of the data and elaborate on trustworthiness, credibility of data, triangulation, data checks, and coding. Part two of this research chapter will present the findings in tables and graphs and relate them to the study's objectives, hypothesis, and variables (which were grouped). These would not be detailed but would present an overview of the population studied, i.e., demographics.

Data would be discussed and linked to research questions and hypotheses; these would be relatable to the conceptual framework(s) or theories which are described in the first chapter (chapter one). This chapter (four) will be finalized by summarizing all the main themes addressed.

The transferability of the findings in this research will be discussed to compare research in the field of MIR in the past, current research, and areas for future research.

Trustworthiness of Data

This section will highlight and cover the trustworthiness of data by assuring that the data reported and aims were secured. Trustworthiness of the data collected would highlight the threats, if any, to the internal validity being controlled, as well as validity of the instrument and the measurements that were used in the study. According to De Vos, Strydom, Fouche, and Delport (2005) the methods that can be employed in ones study to ensure trustworthiness are objectivity, reliability, external validity and internal validity.

Validity

Heale and Twycross (2015) highlighted in their study that validity can best be defined as “the accurate measurement of a concept in a quantitative study”, with the main forms of validity being used were, “content validity”, where the instrument is observed in detail, i.e., does the instrument being used cover all the content that it needs to concern the variables of the study that it intended to or designed to measure, the researcher measured content (face) validity by asking experts in the field their opinion and review of the instrument and the concept that it was intended for (discussed in chapter three).

Construct validity refers to the researcher deducing that the outcome of test results is associated to the model being investigated (Heale & Twycross, 2015).

The researcher made use of three pieces of evidence thus ensuring construct validity, these were:

Homogeneity: The researcher ensured that the instrument developed measured one construct.

Convergence was ensured by looking at similar instruments in the field of major incident response and education.

Theory evidence: This is evident or somewhat comparable to theoretical proposals of the hypothesis measured in the tool; the instrument measured various aspects of MIR and can be demonstrated by the scores observed on specific questions related to the hypothesis in the instrument.

Criterion validity was measured in three ways by ensuring that the criterion measured in another instrument measured the same variable (Heale & Twycross, 2015). The measurements were “Convergent validity”, highlighting that the instrument constructed and used is highly correlated with other instruments that measure similar variables, i.e., the instrument used measured aspects of training, confidence, MIR concepts and understanding as well as new content in MIR. The instrument developed was similar to the one used by Alruwailim, Islam, and Usher in their research on "Hospitals Disaster Preparedness and Management: A Cross-sectional study," as it measured similar variables.

Divergent validity showed that the instrument needed to be better interrelated to other instruments that measured altered variables. There was a low correlation between an instrument that measured prehospital MIR response and an instrument that solely measured in-hospital major incident response criteria.

Predictive validity gives the researcher and others the understanding that the tool would contain extraordinary associations with future measures (Heale & Twycross, 2015). An example from the instrument is questions related to METHANE and the answers predicting the likelihood of a respondent achieving the related task.

According to Baldwin (2018) external validity is the degree to which a study's results can be reasoned from a "sample population. " The instrument used in this research was specifically designed and tested to address external validity, starting with the sample selection. The sample was a true reflection of the target population (i.e., frontline paramedics in HMCAS).

Reliability

The Reliability of measurements in a study is essential when undertaking quantitative research; this can be verified by performing multiple measurements for the same sample (Zulle et al., 2008).

Reliability in a study should be undertaken/checked for in more than a single way; intra-observer reliability testing is when the researcher uses the same sample at different times; this shows the reliability of the researcher as well as consistency in repeated measurements (Zulle et al., 2008).

Interobserver reliability was assessed by repeating the measurements performed by an independent researcher using the same sample, which yielded the same result. Intraexperimental reliability was tested by replicating the measurements in the identical sample under identical conditions; stability of the sample was tested by measuring the same characteristic by a changed but equal method (Zulle et al., 2008).

Reliability was assessed by assessing the data's satisfactory reliability to deduce correct inferences. The large indicators or output of the study, therefore, assisted with the reliability of this study.

The Test-Retest reliability is said to be common practice in obtaining reliability, this is done to test the dependability and the duplicability of the results obtained in a study, it is therefore assessed over time and is a theory that quantifies the measure and its stability under a recurring measurement (“Understanding Test-Retest Reliability: What is it and Why it Matters”, 2023).

The instrument used in this study was tested in a similar study on HAZMAT response in HMCAS and was verified to be good. Reliability accepts regularity, i.e., methods chosen to test Reliability should produce equal and repeatable results (Zulle et al., 2008).

Objectivity

Objectivity in research refers to the researcher being un-influenced and unbiased by feelings, prejudices, and opinions (Kishan, 2021). The strategies explained by Reis and Sprenger (2014) according to Kishan (2021) on maintaining objectivity are that data should not reflect the values of the researcher as researcher values can influence the research. This can be omitted by developing a "stated value premise". The researcher should focus on the data collected and the facts; the interpretation of the data should be based on factual data to prove the research hypothesis.

Green (2005) highlighted that if research is cross-checked systematically and verified, it can be implied that the research is solid. If other researchers can repeat the observations and obtain the same or similar results, then data collected for the research is "intersubjectively reproducible and testable." In this manner, it is understood that for this research, the researcher

was respectful towards the respondents and did not allow for the instruments used to distort respondents' views.

Reliability analysis

Table 12

Reliability Analysis for the Questions with Binary Responses

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.653	0.633	6

Table 13

Inter-Item Correlation Matrix

	Binary1	Binary2	Binary3	Binary4	Binary5	Binary6
Binary1	1.000	0.328	0.220	0.533	-.023	0.041
Binary2	0.328	1.000	0.535	0.437	0.012	0.012
Binary3	0.220	0.535	1.000	0.303	0.008	0.008
Binary4	0.533	0.437	0.303	1.000	0.063	0.126
Binary5	-.023	0.012	0.008	0.063	1.000	0.746
Binary6	0.041	0.012	0.008	0.126	0.746	1.000

Table 14*Reliability Analysis for the Likert Scale Questions*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.961	0.959	21

Note. This table did not fit on the previous page. Therefore, the entire table was moved to the next page, as required by APA Referencing Guide.

Table 15*Inter Item Correlation Matrix*

	Likert 1	Likert 2	Likert 3	Likert 4	Likert 5	Likert 6	Likert 7	Likert 8
Likert 1	1.000	0.573	0.544	0.566	0.529	0.483	0.479	0.451
Likert 2	0.573	1.000	0.534	0.634	0.732	0.644	0.738	0.658
Likert 3	0.544	0.534	1.000	0.856	0.570	0.565	0.511	0.469
Likert 4	0.566	0.634	0.856	1.000	0.657	0.640	0.623	0.578
Likert 5	0.529	0.732	0.570	0.657	1.000	0.827	0.809	0.812
Likert 6	0.483	0.644	0.565	0.640	0.827	1.000	0.762	0.787
Likert 7	0.479	0.738	0.511	0.623	0.809	0.762	1.000	0.765
Likert 8	0.451	0.658	0.469	0.578	0.812	0.787	0.765	1.000
Likert 9	0.539	0.759	0.511	0.601	0.816	0.734	0.847	0.704
Likert 10	0.524	0.569	0.637	0.571	0.608	0.555	0.660	0.474
Likert 11	0.376	0.414	0.458	0.458	0.521	0.468	0.455	0.428
Likert 12	0.335	0.315	0.543	0.428	0.539	0.544	0.429	0.450
Likert 13	0.232	0.205	0.512	0.386	0.351	0.419	0.312	0.283
Likert 14	0.418	0.528	0.404	0.506	0.693	0.723	0.679	0.711

Likert 15	0.658	0.728	0.627	0.703	0.703	0.706	0.718	0.662
Likert 16	0.625	0.750	0.558	0.653	0.635	0.619	0.670	0.613
Likert 17	0.586	0.755	0.620	0.692	0.712	0.705	0.726	0.663
Likert 18	0.529	0.475	0.553	0.513	0.426	0.430	0.431	0.414
Likert 19	0.637	0.570	0.621	0.605	0.551	0.482	0.521	0.490
Likert 20	0.656	0.559	0.563	0.562	0.523	0.516	0.544	0.488
Likert 21	0.401	0.227	0.225	0.279	0.213	0.245	0.178	0.226
	Likert 9	Likert 10	Likert 11	Likert 12	Likert 13	Likert 14	Likert 15	Likert 16
Likert 1	0.539	0.524	0.376	0.335	0.232	0.418	0.658	0.625
Likert 2	0.759	0.569	0.414	0.315	0.205	0.528	0.728	0.750
Likert 3	0.511	0.637	0.458	0.543	0.512	0.404	0.627	0.558
Likert 4	0.601	0.571	0.458	0.428	0.386	0.506	0.703	0.653
Likert 5	0.816	0.608	0.521	0.539	0.351	0.693	0.703	0.635
Likert 6	0.734	0.555	0.468	0.544	0.419	0.723	0.706	0.619
Likert 7	0.847	0.660	0.455	0.429	0.312	0.679	0.718	0.670
Likert 8	0.704	0.474	0.428	0.450	0.283	0.711	0.662	0.613
Likert 9	1.000	0.620	0.433	0.421	0.289	0.651	0.744	0.697
Likert 10	0.620	1.000	0.634	0.647	0.326	0.490	0.610	0.535
Likert 11	0.433	0.634	1.000	0.653	0.260	0.431	0.437	0.400
Likert 12	0.421	0.647	0.653	1.000	0.416	0.461	0.441	0.375
Likert 13	0.289	0.326	0.260	0.416	1.000	0.356	0.207	0.154
Likert 14	0.651	0.490	0.431	0.461	0.356	1.000	0.612	0.542
Likert 15	0.744	0.610	0.437	0.441	0.207	0.612	1.000	0.870

Likert 16	0.697	0.535	0.400	0.375	0.154	0.542	0.870	1.000
Likert 17	0.740	0.618	0.429	0.467	0.218	0.613	0.890	0.834
Likert 18	0.467	0.509	0.463	0.460	0.160	0.389	0.659	0.577
Likert 19	0.598	0.577	0.520	0.466	0.215	0.430	0.720	0.647
Likert 20	0.634	0.601	0.491	0.449	0.276	0.500	0.704	0.599
Likert 21	0.162	0.168	0.296	0.209	0.116	0.206	0.291	0.298

Reliability was evaluated **by** determining the Cronbach alpha coefficient and the inter-item co-efficiency in Tables 12 and 13 for the binary questions and 14 and 15 for the Likert scale questions. Further, in Tables 12 and 13, the Cronbach alpha is 0.65, indicating good reliability and an excellent inter-item correlation coefficient for most items (co-efficient >0.3 in Table 2). The Cronbach alpha in Tables 14 and 15 was 0.96, indicating solid reliability and excellent inter-item correlation (Table 14 co-efficient is >0.3).

Demographic information

Table 16

Summary Statistics of the Continuous Variables

	Mean	Standard Deviation	Median	Minimum	Maximum	Percentile 05	Percentile 25	Percentile 75	Percentile 95
Age	38.45	6.88	37.00	21.00	60.00	27.00	34.00	43.00	50.00
Experience in HMC	9.26	5.41	9.00	1.00	35.00	3.00	5.00	11.00	20.00
Number of MIR Sessions Attended	2.72	1.82	2.00	1.00	9.00	1.00	1.00	4.00	6.00
Number of major incidents before MIR Training	4.48	5.87	3.00	0.00	50.00	0.00	1.00	5.00	20.00
Number of major incidents attended after MIR Training	2.21	3.33	1.00	0.00	40.00	0.00	3.00	3.00	7.00

Table 16 indicates the summary statistics of the continuous variables i.e. Age ($M = 38.45$, $SD = 6.88$), experience ($M = 9.26$, $SD = 5.41$), number of MIR sessions attended ($M = 2.72$, $SD = 1.82$), number of major incidents before MIR training ($M = 4.48$, $SD = 5.87$) and the number of major incidents attended after MIR training ($M = 2.21$, $SD = 3.33$).

Figure 21

Age Distribution per Gender

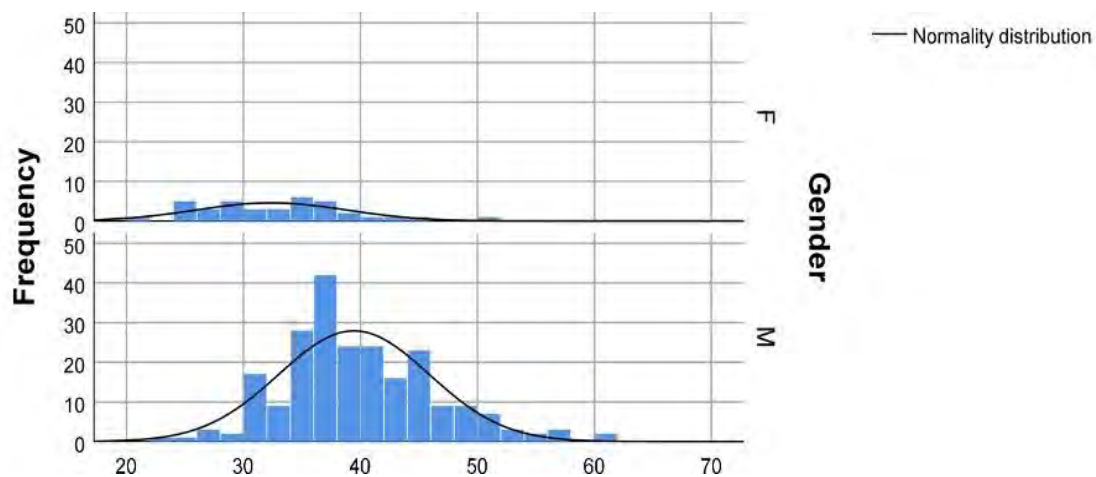


Figure 21 shows the distribution of age according to gender. Most male respondents are between the ages of 35 and 40. A few females participated in the study, with their ages being mainly between 20 and 40. Moreover, Figure 22 highlights the distribution of age and experience in HMC according to gender, showing that the respondents of both genders have experience within HMC between 2 and 10 years.

Figure 22
Experience in HMC per Gender

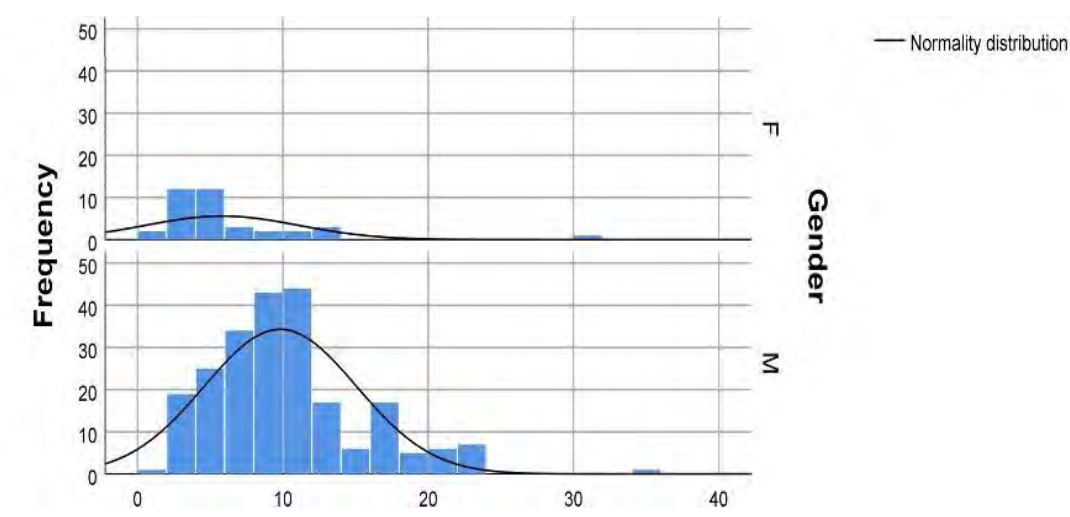


Table 17
Summary Statistics for Categorical Variables

		Count	%
Gender	Female	37	14.1
	Male	225	85.9
Department	CCS	38	14.5
	EAS	188	71.8
	ED	5	1.9
	EEP	4	1.5
	NCC	4	1.5
	Other	5	1.9
	SAS	7	2.7

	SEM	5	1.9
	SS	6	2.3
Qualification	AP	222	84.7
	CCA	1	0.4
	CCP	39	14.9
Experience in	Missing Values	9	3.4
another EMS	No	149	56.9
	Yes	104	39.7
Other MIR	Missing Values	9	3.4
training received	Yes	179	68.3
	No	74	28.2
In Hospital	Missing Values		
exposure to major			
incidents	No		
	Yes		
Prehospital	Missing Values		
Exposure to Major			
Incidents	No		
	Yes		

Table 17 highlighted that respondents where from various departments within HMCAS, critical care services (CCS) accounted for (n = 38, 14.5%), emergency ambulance services (EAS), accounted for (n = 188, 71.8%), emergency department ambulance staff (ED) accounted for (n = 5, 1.9%), events and emergency planning (EEP) accounted for (n = 4, 1.5%), the national command center (NCC) accounted for (n = 4, 1.5%), other (n = 5, 1.9%), scheduled ambulance services (SAS) accounted for (n = 7, 2.7%), specialized emergency management (SEM) accounted for (n = 5, 1.9%) and scheduling services (SS) accounted for (n = 6, 2.3%). Besides that, their qualifications ranged from ambulance paramedics (AP), which were the most significant group (n = 222, 84.7%), critical care assistant (CCA) accounted for (n = 1, 0.4%), and critical care paramedics (n = 39, 14.9%).

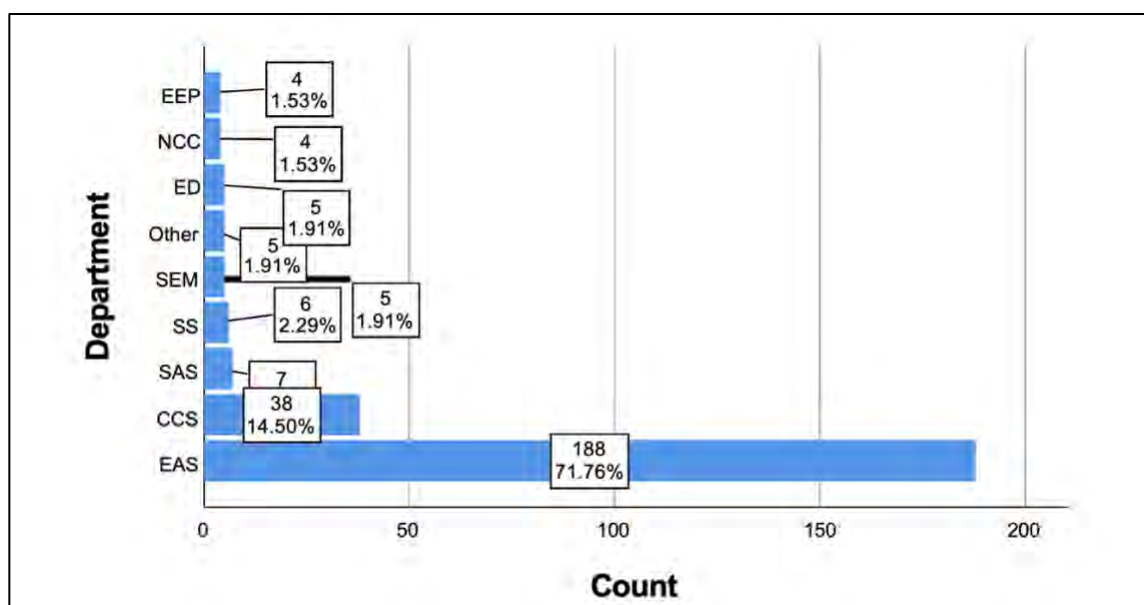
The categorical variable related to experience in other EMS yielded missing values (n = 9, 3.4%), (n = 149, 56.9%) answered no, while (n = 104, 39.7%) answered yes.

Other MIR training received indicated missing values (n = 9, 3.4%), (n = 179, 68.3%) had received previous training with (n = 74, 28.2%) had answered “no” to having received previous training. There were missing values for in-hospital exposure to major incidents and prehospital exposure to major incidents.

Figure 23*Exposure to Major Incidents*

		Count	Column N %
In Hospital Exposure to Major Incidents		9	3.4%
	No	183	69.8%
	Yes	70	26.7%
PreHospital Exposure to Major Incidents		9	3.4%
	No	127	48.5%
	Yes	126	48.1%

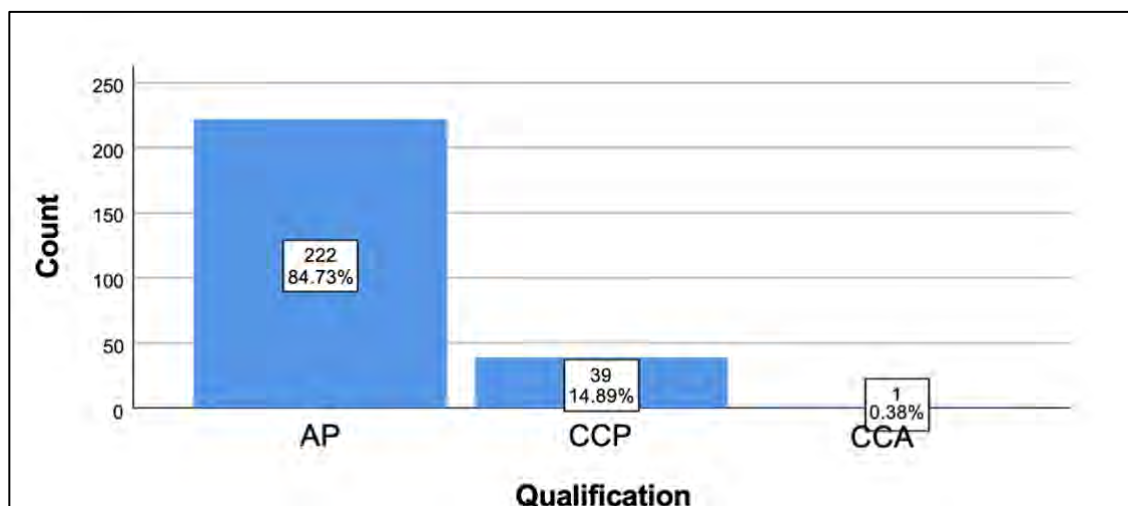
The exposure to significant incidents yielded the following: (n = 183, 69.8%) has not had previous in-hospital exposure to major incidents. In contrast, (n = 70, 27.7%) answered yes to having received previous in-hospital exposure to significant incidents. Responding to the prehospital exposure to major incidents question, (n = 127, 48.5%) had answered no, while (n = 126, 48.1%) had answered yes to having prehospital exposure to major incidents.

Figure 24*Repatriation of Respondents Staff per HMCAS Department*

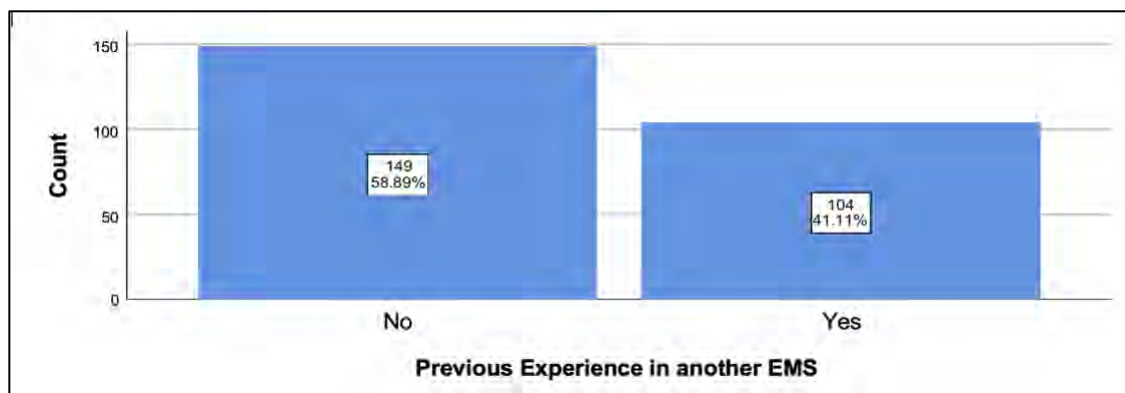
Repartition of respondents staff per HMCAS department accounted for the following (n = 4, 1.53%) events and emergency planning (EEP), (n = 4, 1.53%) national command center (NCC), (n = 4, 1.53%), emergency department ambulance services staff (ED), (n = 5, 1.91%), other (n = 5, 1.9%), specialized emergency management (n = 5, 1.9%) scheduled ambulance services (n = 7, 2.7%), critical care services (n = 38, 14.50%) and emergency ambulance services (n = 188, 71.76%).

Figure 25

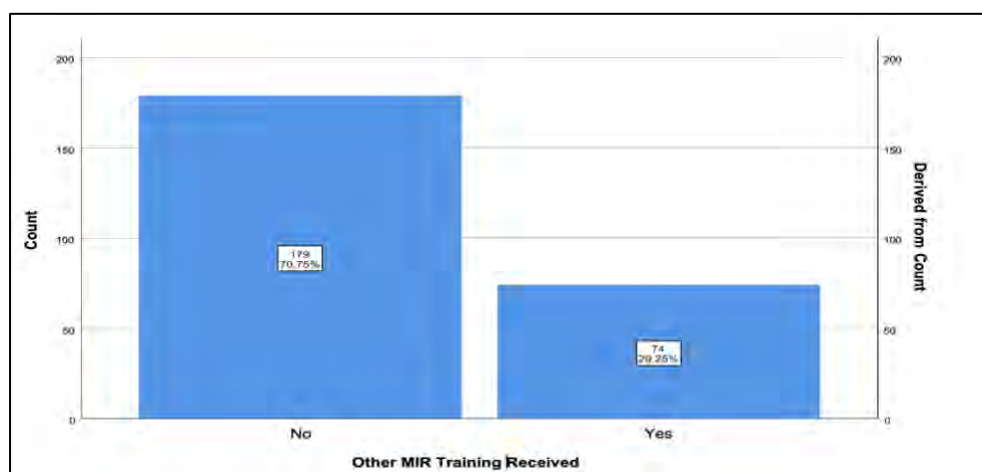
Respondents per DHP Qualifications



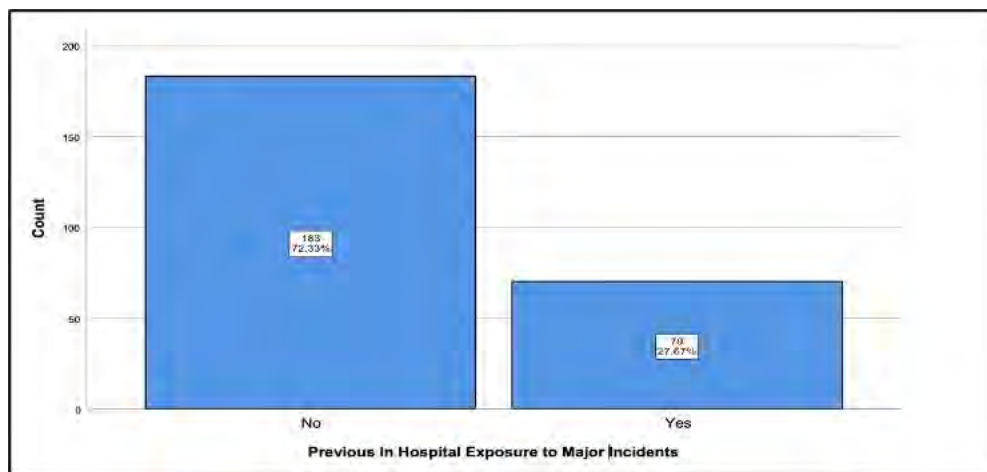
All respondents working within HMCAS hold a department of healthcare professions (DHP) license, majority (n = 222, 84.73%) are ambulance paramedics (AP), (n = 39, 14.89%) are critical care paramedics and (n = 1, 0.38%) critical care assistant (CCA).

Figure 26*Previous Experience in EMS*

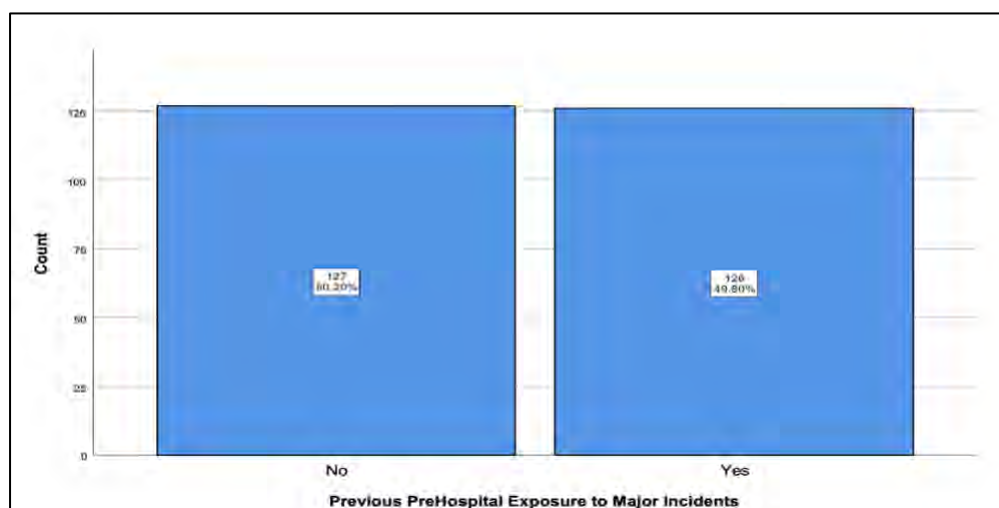
Of all respondents (n = 149, 58.9%) have no previous EMS experience whilst (n = 104, 41.11%) worked or came from a previous EMS background.

Figure 27*Other MIR Training received*

(n = 179, 70.75%) of respondents answered no to having received previous MIR training whilst (n = 74, 29.25%) has had previous MIR training.

Figure 28*Previous in Hospital Exposure to MIR*

(n = 183, 72.33%) of respondents has no previous exposure to MIR in hospitals whilst (n = 70, 27.67%) has received previous MIR training in hospital.

Figure 29*Previous Prehospital Exposure to Major Incidents*

(n=127, 50.20%) of respondents answered no to having prehospital exposure to major incidents whilst (n = 126, 49.80%) has had previous prehospital exposure to major incidents.

Satisfaction Themes

The following control charts were divided according to themes i.e.:

- (a) **Theme 1:** Satisfaction with the level of understanding
- (b) **Theme 2:** Satisfaction with the confidence.
- (c) **Theme 3:** Satisfaction with MIR training received.

The Shewhart control charts was used to understand that the level of satisfaction was acceptable within the control limits except for those highlighted.

Figure 30

Overall Understanding Question Score

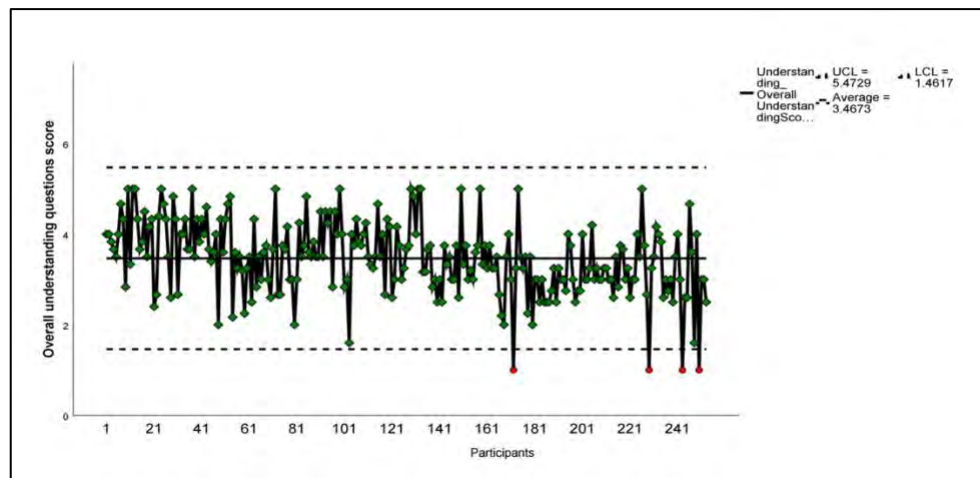


Figure 31
Overall level of Confidence Question Score

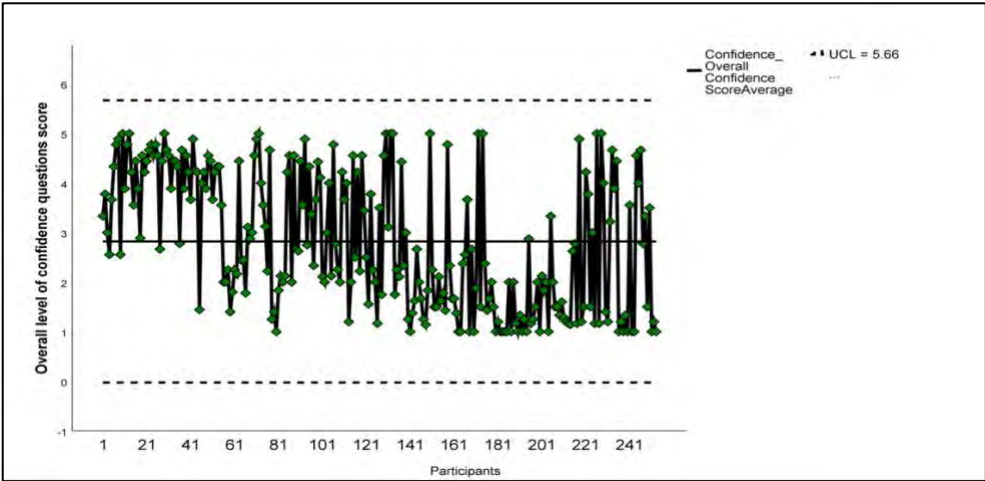


Figure 32
Overall Level of MIR Training Format Satisfaction Question Score

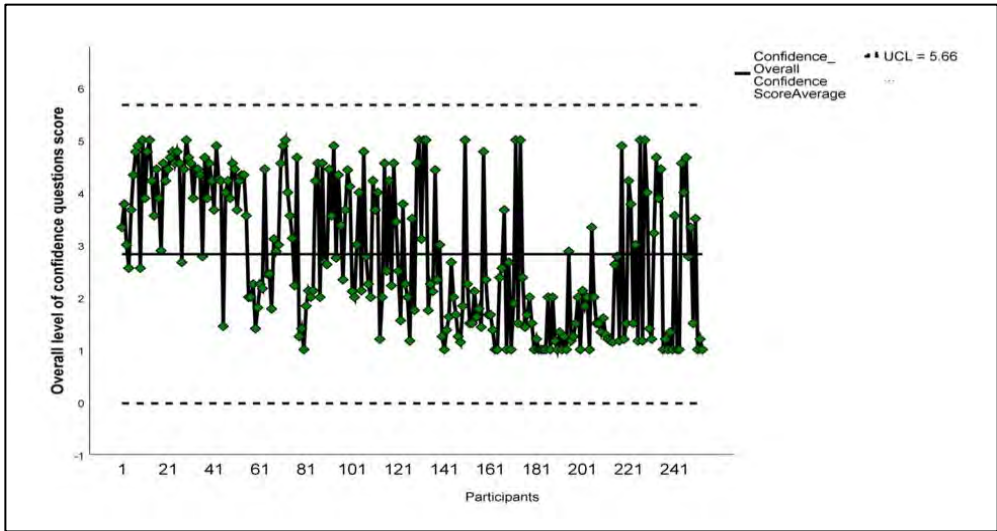
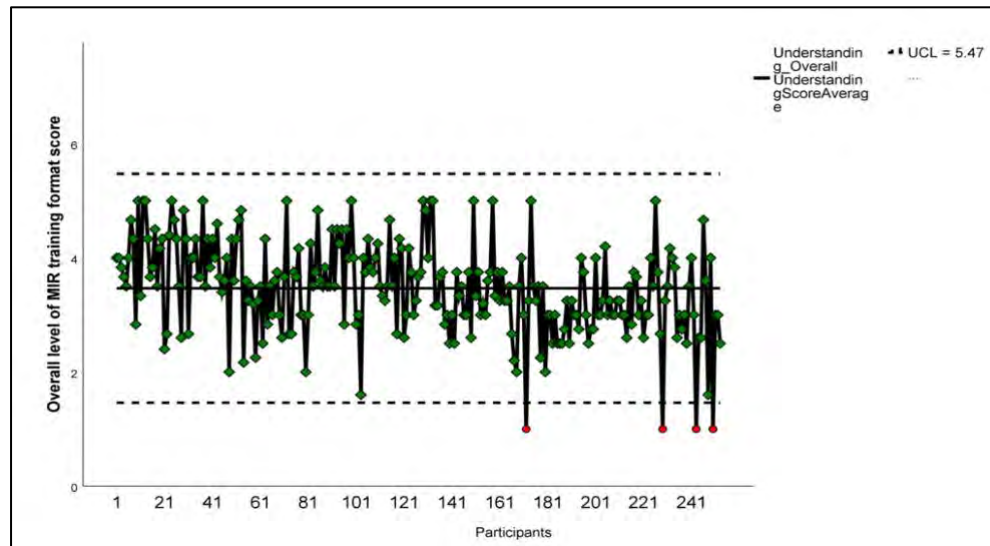


Figure 33

Overall Level of MIR Training Format Score



The Shewhart control chart used in Figures 30 to 33 indicates the variation of the satisfaction scores of the overall questionnaire and across each of the themes. The variation of the satisfaction scores was mostly within the control limits, except, which indicate that that majority of the respondents have high satisfaction with the training themes. Majority of the satisfaction score for the overall and for each theme were above the mean, indicating a high satisfaction of the respondents with the training provided.

Table 18

Summary of the respondents for the overall and across each theme

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
MIR Training Format Overall Satisfaction Questions Scores Average	253	96.6%	9	3.4%	262	100.0%
Confidence Overall Satisfaction Questions Scores Average	253	96.6%	9	3.4%	262	100.0%
Understanding Overall Satisfaction Questions Scores Average	253	96.6%	9	3.4%	262	100.0%
Overall score average	253	96.6%	9	3.4%	262	100.0%

Table 18 summarizes the satisfaction scores in overall and in each theme overall and across each theme which are MIR training format satisfaction score, confidence satisfaction score, understanding satisfaction score and the score average.

Bivariate and Multivariate Analysis

Normality distribution analysis

Table 19

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MIR Training Format Overall Satisfaction Questions Scores Average	0.112	253	0.000	0.967	253	0.000
Confidence Overall Satisfaction Questions Scores Average	0.120	253	0.000	0.903	253	0.000
Understanding Overall Satisfaction Questions Scores Average	0.072	253	0.003	0.976	253	0.000
Overall score average	0.114	253	0.000	0.945	253	0.000
a. Lilliefors Significance Correction						

The normality distribution of continuous variables was assessed using was the Shapiro and Kolmogorov tests using the Q-Q plots in Figure 34, Figure 35, Figure 36 and Figure 37.

The hypotheses were:

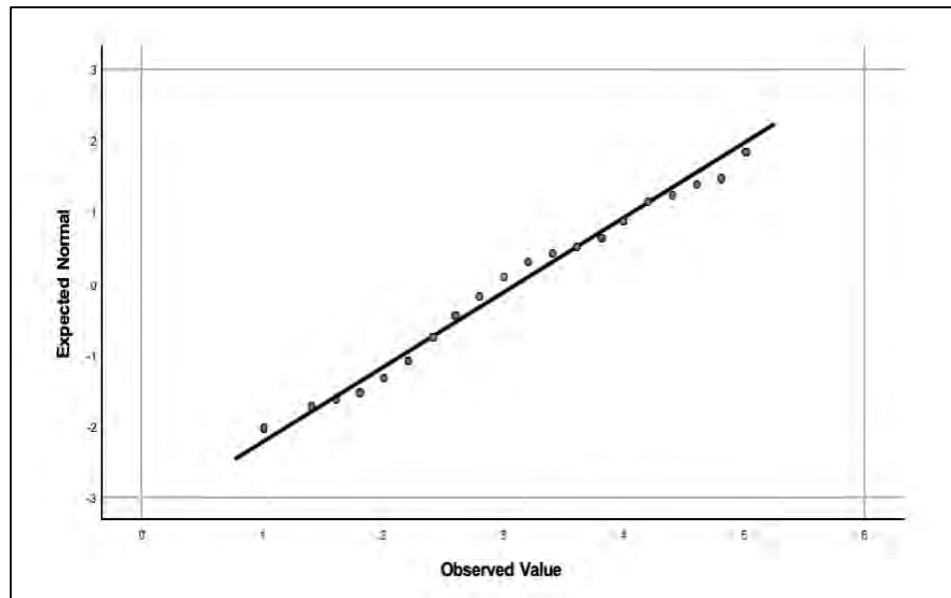
H0: Normally distribution of the data.

Ha: Data distribution that is not normal.

Accordingly the p-values in Tests of Normality table, $p < 0.05$ and all of the Q-Q plot indicates data distribution that is not normal, accordingly the non-parametric tests were then utilized.

Figure 34

Normal Q-Q Plot of MIR Training Format Overall Satisfaction Questions Scores Average

**Figure 35**

Normal Q-Q Plot of Confidence Overall Satisfaction Questions Scores Average

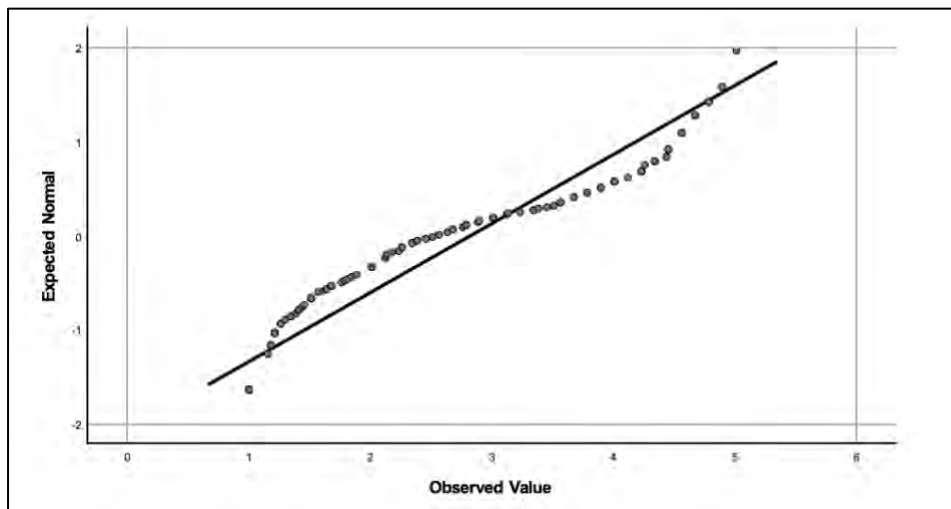


Figure 36
Normal Q-Q Plot of Understanding Overall Satisfaction Questions Scores Average

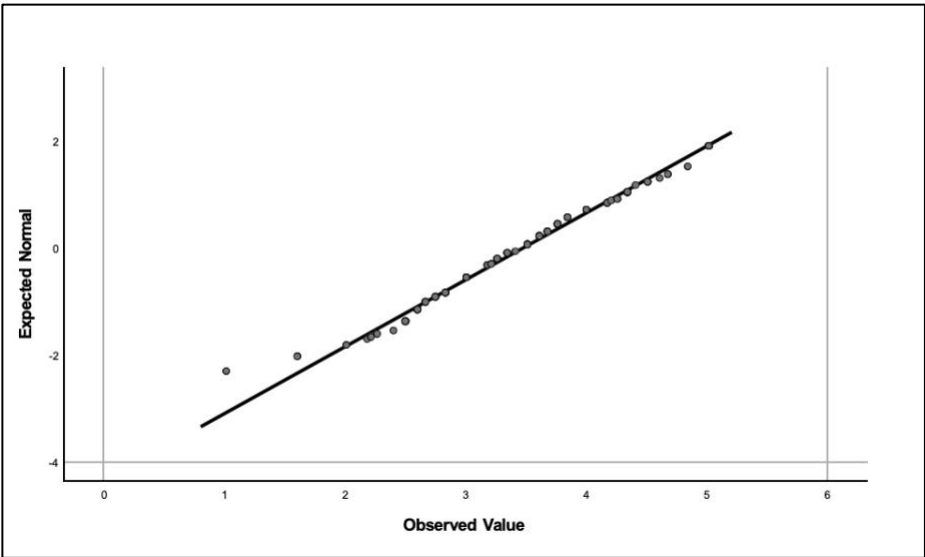
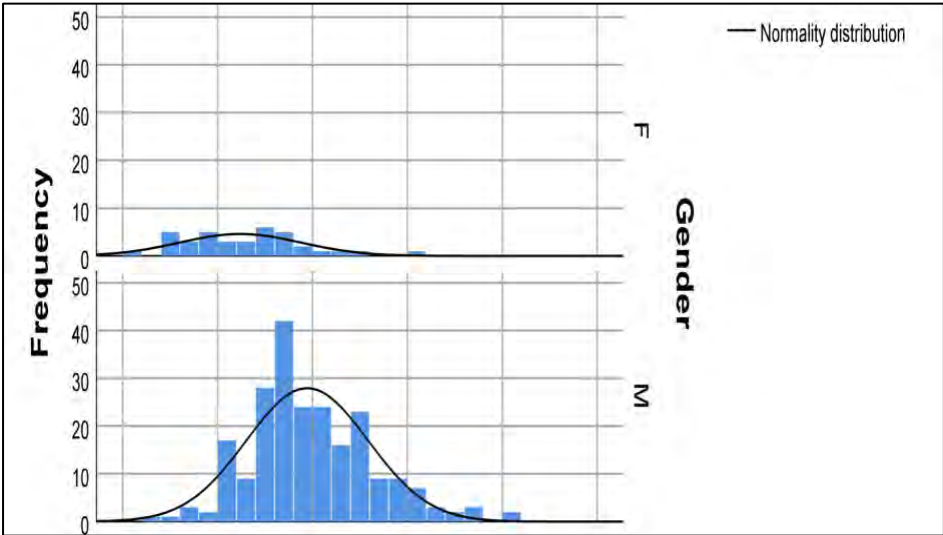


Figure 37
Normal Q-Q Plot of Overall Score Average



Bivariate Analysis

The chi-square test was used to assess the association between the categorical variables (Gender , previous prehospital exposure , previous in hospital exposure , interest in furthering knowledge, interesting in participating in further MIR knowledge). Table 20 to Tables 128 show these result with either a < 0.05 significant association or > 0.05 no significant association.

Bivariate analysis: Chi-square test of each theme's question with the following hypotheses were assessed:

Ho: There is no association between gender or previous prehospital exposure to previous in hospital exposure or interest in furthering knowledge or interest in participating in further MIR knowledge and response to the themes question.

H1: There is association between gender or previous prehospital exposure to previous in hospital exposure or interest in furthering knowledge or interest in participating in further MIR knowledge and response to the themes question.

The interpretation of the results according to the p-value: - p-value < 0.05 ; this indicates that there is a significant association between gender and the responses to the theme's questions, p-value ≥ 0.05 .

Gender and the responses to the theme's questions are independent (not associated).

MIR training format questions (Chi-Square Tests)

Table 20

MIR Training Duration & Previous in Hospital Exposure to Major Incidents

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	27.590 ^a	4	0.000
Likelihood Ratio	28.518	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.09.

The p-value is < 0.05 , the result is statistically significant with the association in MIR training duration and previous in hospital exposure to major incidents.

Table 21

MIR Training Duration & Previous Prehospital Exposure to Major Incidents

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	40.760 ^a	4	0.000
Likelihood Ratio	42.145	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.96.

The p-value is < 0.05 , indicating a statistically significant result with the association in MIR training duration and previous prehospital exposure to major incidents.

Table 22*MIR Training Duration & Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	13.625 ^a	4	0.009
Likelihood Ratio	11.902	4	0.018
N of Valid Cases	253		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 3.22.

The p-value is > 0.05 , indicating a result that is statistically not significant between MIR training and gender.

Table 23*MIR Training Duration & Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.673 ^a	4	0.225
Likelihood Ratio	7.025	4	0.135
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.35.

The p-value is > 0.05 , indicating no statistical significant from the result between MIR training duration and interest in furthering MIR knowledge.

Table 24*MIR Training Duration & Interest in participating in other MIR Training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.673 ^a	4	0.225
Likelihood Ratio	7.025	4	0.135
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.35.

The p-value is > 0.05 , indicating no statistical significance with the result in MIR training duration & interest in participating in other MIR training..

Table 25*MIR Training Information Provided & Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	39.857 ^a	4	0.000
Likelihood Ratio	42.109	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.09.

The p-value is < 0.05 , indicating a statistically significant result with MIR training information provided and previous in hospital exposure to major incidents.

Table 26*MIR Training Information Provided & Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	47.366 ^a	4	0.000
Likelihood Ratio	50.603	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.96.

The p-value is <0.05 , the result is statistically significant with MIR training information provided and previous prehospital exposure to major incidents.

Table 27*MIR Training Information Provided * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	1.877 ^a	4	0.758
Likelihood Ratio	2.007	4	0.734
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 3.22.

The p-value is >0.05 , indicating no statistical significance between MIR training information provided and gender as indicated by the results.

Table 28

MIR Training Information Provided & Interest in furthering MIR Knowledge

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	4.368 ^a	4	0.358
Likelihood Ratio	5.679	4	0.224
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.35.

The p-value is > 0.05 , indicating a result that is statistically not significant in MIR training information provided and interest in furthering MIR knowledge.

Table 29

MIR Training Information Provided & Interest in participating in other MIR Training

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	2.169 ^a	4	0.705
Likelihood Ratio	2.450	4	0.654
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.35.

The p-value is > 0.05 , indicating that the result is statistically not significant in MIR training information provided and interest in participating in other MIR training.

Table 30

MIR Training Skills Acquired & Previous in Hospital Exposure to Major Incidents

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	37.443 ^a	4	0.000
Likelihood Ratio	39.649	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.81.

The p-value is < 0.05 , indicating a statistically significant result between MIR training kills acquired and previous in hospital exposure to major incidents.

Table 31

MIR Training Skills Acquired & Previous Prehospital Exposure to Major Incidents

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	50.225 ^a	4	0.000
Likelihood Ratio	54.116	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.46.

The p-value is < 0.05 , indicating statistically significance from the result in MIR training skills acquired and previous prehospital exposure to major incidents.

Table 32*MIR Training Skills Acquired * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	2.532 ^a	4	0.639
Likelihood Ratio	2.628	4	0.622
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 3.07.

The p-value is > 0.05 , indicating that there is no statistical significance between MIR training and skills acquired and gender.

Table 33*MIR Training Skills Acquired & Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.215 ^a	4	0.523
Likelihood Ratio	3.955	4	0.412
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.33.

The p-value is > 0.05 , indicating that there is no statistical significance between MIR training skills acquired and interest in furthering MIR knowledge.

Table 34*MIR Training Skills Acquired & Interest in Participating in other MIR Training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.215 ^a	4	0.523
Likelihood Ratio	3.955	4	0.412
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.33.

The p-value is > 0.05 , indicating that there is no statistical significance between MIR training skills acquired and interest in participating in other MIR training.

Table 35*MIR Training Educational Outcome & Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	26.455 ^a	4	0.000
Likelihood Ratio	27.695	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.19.

The p-value is < 0.05 , highlighting a statistical significance between MIR training educational outcome and previous in hospital exposure to major incidents.

Table 36*MIR Training Educational Outcome & Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	37.802 ^a	4	0.000
Likelihood Ratio	39.251	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.95.

The p-value is <0.05 , highlighting a statistical significance between MIR training educational outcome and previous prehospital exposure to major incidents.

Table 37*MIR Training Educational Outcome & Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	2.661 ^a	4	.616
Likelihood Ratio	2.718	4	.606
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 3.80.

The p-value is >0.05 , indicating that there is no statistical significance between MIR training educational outcome and gender.

Table 38*MIR Training Educational Outcome & Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.633 ^a	4	0.228
Likelihood Ratio	6.271	4	0.180
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.41.

The p-value is >0.05 , indicating that there is no statistical significance between MIR training educational outcome and interest in furthering MIR knowledge.

Table 39*MIR Training Educational Outcome & Interest in participating in other MIR Training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	7.291 ^a	4	0.121
Likelihood Ratio	8.186	4	0.085
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.41.

The p-value is >0.05 , indicating that there is no statistical significance between MIR training educational outcome and interest in participating in other MIR training.

Table 40*MIR Training Format & Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	24.674 ^a	4	0.000
Likelihood Ratio	25.372	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.58.

The p-value is <0.05, indicating a result that is significant statistically between MIR training format and previous in hospital exposure to major incidents.

Table 41*MIR Training Format & Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	56.734 ^a	4	0.000
Likelihood Ratio	60.018	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.44.

The p-value is <0.05, indicating a result that is significant statistically between MIR training format and previous prehospital exposure to major incidents.

Table 42*MIR Training Format * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	7.783 ^a	4	0.100
Likelihood Ratio	7.184	4	0.126
N of Valid Cases	253		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 4.53.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training format and gender.

Table 43*MIR Training Format & Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	8.170 ^a	4	0.086
Likelihood Ratio	8.717	4	0.069
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.49.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training format and interest in furthering MIR knowledge.

Table 44

MIR Training Format & Interest in participating in other MIR Training

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	8.170 ^a	4	0.086
Likelihood Ratio	8.717	4	0.069
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.49.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training format and interest in participating in other MIR training.

Table 45

MIR Training: Understanding the MIR Guidebook & Previous in Hospital Exposure to Major Incident

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.002 ^a	4	0.287
Likelihood Ratio	5.727	4	0.220
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 3.87.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training and understanding of the MIR guidebook to previous in hospital exposure to major incidents.

Table 46

MIR Training: Understanding the MIR Guidebook & Previous Prehospital Exposure to Major Incidents

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	20.958 ^a	4	0.000
Likelihood Ratio	21.513	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.97.

The p-value is <0.05 , indicating a statistically significant result between MIR training and understanding the MIR guidebook with previous prehospital exposure to major incidents.

Table 47

*MIR Training Understanding the MIR Guidebook * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	4.929 ^a	4	0.295
Likelihood Ratio	4.719	4	0.317
N of Valid Cases	253		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 2.05.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training and understanding of the MIR guidebook related to gender.

Table 48

*MIR Training & Understanding the MIR Guidebook * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	11.263 ^a	4	0.024
Likelihood Ratio	7.276	4	0.122
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.22.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training and understanding the MIR guidebook with interest in furthering MIR knowledge.

Table 49

*MIR Training Understanding MIR Guidebook * Interest in participating in other MIR Training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	11.263 ^a	4	0.024
Likelihood Ratio	7.276	4	0.122
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.22.

The p-value is >0.05 , indicating a non-significant statistical result between MIR training and understanding the MIR guidebook with interest in participating in other MIR training.

Questions addressing Confidence in MIR

Table 50

*Confidence Level in Managing Major Incidents prior to MIR Training * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	312.482 ^a	10	0.000
Likelihood Ratio	128.795	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , indicating a statistically significant result between the confidence level in managing major incidents prior to MIR Training and previous in hospital exposure to major incidents.

Table 51

*Confidence Level in Managing Major Incident prior to MIR Training *Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	358.786 ^a	10	0.000
Likelihood Ratio	183.416	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , indicating a statistically significant result between the confidence level in managing major incidents prior to MIR Training and previous prehospital exposure to major incidents.

Table 52

*Confidence Level in Managing Major Incident prior to MIR Training * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	4.383 ^a	5	0.496
Likelihood Ratio	5.704	5	0.336
N of Valid Cases	262		

a. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is >0.05 , indicating a non, non-significant statistical result between confidence levels in managing major incident prior to MIR training and gender.

Table 53

Confidence Level in Managing Major Incidents prior to MIR Training Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	265.540 ^a	10	0.000
Likelihood Ratio	82.274	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is >0.05 , indicating a non-significant statistical result between confidence level in managing major incident prior to MIR Training and interest in furthering MIR knowledge.

Table 54

Confidence Level in Managing Major Incidents prior to MIR Training Interest in participating in other MIR training

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	262.893 ^a	10	0.000
Likelihood Ratio	79.635	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with the confidence level in managing major incident prior to MIR Training and interest in participating in other MIR training.

Table 55

*Confidence to work in Major Incidents after receiving MIR Training * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	284.226 ^a	10	0.000
Likelihood Ratio	100.372	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with the confidence to work in major incidents after receiving MIR training and previous in hospital exposure to major incidents.

Table 56

*Confidence to work in Major Incidents after receiving MIR Training * Previous Prehospital Exposure to major incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	344.220 ^a	10	0.000
Likelihood Ratio	165.346	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant with confidence to work in major incidents after receiving MIR training and previous prehospital exposure to major incidents.

Table 57

*Confidence to work in Major Incidents after receiving MIR Training * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.100 ^a	5	0.685
Likelihood Ratio	4.303	5	0.507
N of Valid Cases	262		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27.

The p value is >0.05 , the result is statistically not significant with the confidence to work in major incidents after receiving MIR Training and gender.

Table 58

*Confidence to work in Major Incidents after receiving MIR Training * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	265.224 ^a	10	0.000
Likelihood Ratio	82.557	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with the confidence to work in major incidents after receiving MIR training and interest in furthering MIR knowledge.

Table 59

*Confidence to work in Major Incidents after receiving MIR Training * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	268.989 ^a	10	0.000
Likelihood Ratio	84.199	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with the confidence to work in major incidents after receiving MIR training and interest in participating in other MIR training.

Table 60

*Confidence in giving METHANE * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	289.415 ^a	10	0.000
Likelihood Ratio	105.208	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with the confidence in giving a METHANE and previous in hospital exposure to major incidents.

Table 61

*Confidence in giving a METHANE * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	343.129 ^a	10	0.000
Likelihood Ratio	163.533	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with the confidence in giving a METHANE with previous prehospital exposure to major incidents.

Table 62*Confidence in giving a METHANE * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.521 ^a	5	0.356
Likelihood Ratio	6.710	5	0.243
N of Valid Cases	262		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is >0.05 , the result is not statistically significant with the confidence in giving a METHANE and gender.

Table 63*Confidence in giving a METHANE * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	264.465 ^a	10	0.000
Likelihood Ratio	81.299	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05 , the result is statistically significant with the confidence in giving a METHANE with an Interest in furthering MIR Knowledge.

Table 64

*Confidence in giving a METHANE * Interest in participating in other MIR Training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	264.444 ^a	10	0.000
Likelihood Ratio	81.264	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with the confidence in giving a METHANE with an interest in participating in other MIR Training.

Table 65

*Confidence in performing silver commander role * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	293.223 ^a	10	0.000
Likelihood Ratio	108.248	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is < 0.05 , the result is statistically significant with the confidence in performing silver commander role with previous in hospital exposure to major incidents.

Table 66

*Confidence in performing silver commander role * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	360.516 ^a	10	0.000
Likelihood Ratio	186.127	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is < 0.05 , the result is statistically significant with the confidence in performing silver commander role with previous prehospital exposure to major incidents.

Table 67

*Confidence in performing silver commander role * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	6.704 ^a	5	0.244
Likelihood Ratio	8.516	5	0.130
N of Valid Cases	262		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is > 0.05 , the result is not statistically significant in performing silver commander role and gender.

Table 68

*Confidence In performing silver commander role * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	265.669 ^a	10	0.000
Likelihood Ratio	83.052	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with confidence in performing silver commander role and an interest in furthering MIR knowledge.

Table 69

*Confidence in performing silver commander role * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	268.826 ^a	10	0.000
Likelihood Ratio	86.162	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with confidence in performing silver commander role and an interest in participating in other MIR training.

Table 70

*Confidence in triaging * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	282.514 ^a	10	0.000
Likelihood Ratio	98.171	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with confidence in triaging with previous in hospital exposure to major incidents.

Table 71

*Confidence in triaging * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	334.441 ^a	10	0.000
Likelihood Ratio	154.568	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with confidence in triaging with previous prehospital exposure to major incidents.

Table 72*Confidence in triaging * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.556 ^a	5	0.615
Likelihood Ratio	4.727	5	0.450
N of Valid Cases	262		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is >0.05 , the result is not statistically significant with confidence in triaging and gender.

Table 73*Confidence in triaging * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	264.171 ^a	10	0.000
Likelihood Ratio	81.470	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05 , the result is statistically significant with confidence in triaging and an interest in furthering MIR knowledge.

Table 74

*Confidence in triaging * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	269.228 ^a	10	0.000
Likelihood Ratio	85.737	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with confidence in triaging and an interest in participating in other MIR training.

Table 75

*Confidence in establishing Command & Control * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	286.819 ^a	10	0.000
Likelihood Ratio	104.117	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant with confidence in establishing command and control with previous in hospital exposure to major incidents.

Table 76

*Confidence in establishing Command & Control * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	365.311 ^a	10	0.000
Likelihood Ratio	192.630	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant with confidence in establishing command and control with previous prehospital exposure to major incidents.

Table 77

*Confidence in establishing Command & Control * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.659 ^a	5	0.341
Likelihood Ratio	7.182	5	0.207
N of Valid Cases	262		

a. 2 cells (16.7%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is <0.05 , the results are not statistically significant with confidence in establishing command and control with gender.

Table 78

*Confidence in establishing Command & Control * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	266.422 ^a	10	0.000
Likelihood Ratio	83.677	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with confidence in establishing command and control with an interest in furthering MIR knowledge.

Table 79

*Confidence in establishing Command & Control * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	266.422 ^a	10	0.000
Likelihood Ratio	83.677	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with confidence in establishing command and control with an interest in participating in other MIR training.

Table 80

*Confidence in MIR Radio Communication * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	276.199 ^a	10	0.000
Likelihood Ratio	92.495	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with confidence in MIR radio communication and previous in hospital exposure to major incidents.

Table 81

*Confidence in MIR Radio Communication * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	315.117 ^a	10	0.000
Likelihood Ratio	132.277	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with confidence in MIR radio communication and previous prehospital exposure to major incidents.

Table 82*Confidence in MIR Radio Communication * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	8.039 ^a	5	0.154
Likelihood Ratio	9.256	5	0.099
N of Valid Cases	262		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is >0.05 , the result is not statistically significant with confidence in MIR radio communication and gender.

Table 83*Confidence in MIR Radio Communication * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	264.205 ^a	10	0.000
Likelihood Ratio	81.473	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05 , the result is statistically significant with the confidence in MIR radio communication and an interest in furthering MIR knowledge.

Table 84

*Confidence in MIR Radio Communication * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	264.496 ^a	10	0.000
Likelihood Ratio	82.005	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant with the confidence in MIR radio communication and an interest in participating in other MIR training.

Table 85

*Confidence in donning doffing * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	301.635 ^a	10	0.000
Likelihood Ratio	120.488	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant with the confidence in donning doffing with previous in hospital exposure to major incidents.

Table 86

*Confidence in donning doffing * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	333.460 ^a	10	0.000
Likelihood Ratio	151.354	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant with the confidence in donning doffing with previous prehospital exposure to major incident.

Table 87

*Confidence in donning doffing * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.333 ^a	5	0.649
Likelihood Ratio	4.443	5	0.488
N of Valid Cases	262		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27.

The p - value is >0.05 , the result is statistically not significant with confidence in donning doffing and gender.

Table 88

*Confidence in donning doffing * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	268.320 ^a	10	0.000
Likelihood Ratio	85.643	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant in the confidence in donning doffing and an interest in furthering MIR knowledge.

Table 89

*Confidence in donning doffing * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	267.409 ^a	10	0.000
Likelihood Ratio	84.792	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant in the confidence in donning doffing with an interest in participating in other MIR training.

Table 90

*Confidence in choosing HazMat PPE * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	13.151 ^a	4	0.011
Likelihood Ratio	13.021	4	0.011
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.36.

The p-value is >0.05 , there is not statistically significant in confidence when choosing HazMat PPE and previous in hospital exposure to major incidents.

Table 91

*Confidence in choosing HazMat PPE * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	30.918 ^a	4	0.000
Likelihood Ratio	32.095	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.45.

The p-value is <0.05 , the result is statistically significant in choosing HazMat PPE and previous prehospital exposure to major incidents.

Table 92*Confidence in choosing HazMat PPE * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	6.537 ^a	4	0.162
Likelihood Ratio	6.789	4	0.147
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 3.36.

The p-value is >0.05 , the result is statistically not significant confidence in choosing HazMat PPE and gender.

Table 93*Confidence in choosing HazMat PPE * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	4.174 ^a	4	0.383
Likelihood Ratio	5.175	4	0.270
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.36.

The p-value is >0.05 , the result is statistically not significant with confidence in choosing HazMat PPE with an interest in furthering MIR knowledge.

Table 94

*Confidence in choosing HazMat PPE * Interest in participating in other MIR Training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	1.631 ^a	4	0.803
Likelihood Ratio	2.692	4	0.611
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.36.

The p-value is >0.05 , the result is statistically not significant confidence in choosing HazMat PPE with an interest in participating in other MIR training.

Concepts understanding questions

Table 95

*Understanding Command & Control * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	19.487 ^a	4	0.001
Likelihood Ratio	23.512	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.41.

The p-value is <0.05 , the result is statistically significant confidence in understanding command and control in previous in hospital exposure to major incidents.

Table 96

*Understanding Command & Control * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	79.919 ^a	4	0.000
Likelihood Ratio	93.950	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 16.93.

The p-value is <0.05 , the result is statistically significant confidence in understanding command and control in previous prehospital exposure to major incidents

Table 97

*Understanding Command & Control * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.243 ^a	4	0.518
Likelihood Ratio	3.418	4	0.490
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.97.

The p-value is >0.05 , the result is statistically not significant understanding command and control with gender.

Table 98

*Understanding Command & Control * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	7.222 ^a	4	0.125
Likelihood Ratio	7.795	4	0.099
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.54.

The p-value is >0.05 , the result is statistically not significant understanding command and control with an interest in furthering MIR knowledge.

Table 99

*Understanding Command & Control * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	7.222 ^a	4	0.125
Likelihood Ratio	7.795	4	0.099
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.54.

The p-value is >0.05 , the result is statistically not significant understanding command and control with an interest in participating in other MIR training.

Table 100

*Understanding the principles of declaring Major Incident level * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	12.396 ^a	4	0.015
Likelihood Ratio	13.524	4	0.009
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.19.

The p-value is >0.05 , the result is statistically not significant understanding the principles of declaring major incident level and previous in hospital exposure to major incidents.

Table 101

*Understanding the Principles of declaring a Major Incident * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	45.663 ^a	4	0.000
Likelihood Ratio	51.014	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.95.

The p-value is <0.05 , the result is statistically significant understanding of the principles in declaring a major incident and previous prehospital exposure to major incidents.

Table 102

*Understanding the Principles of declaring Major Incident level * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	2.413 ^a	4	0.660
Likelihood Ratio	2.475	4	0.649
N of Valid Cases	253		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 3.80.

With the p-value being >0.05 , the result indicates a statistically non-significant understanding of principles that are involved when declaring a major incident level and gender.

Table 103

*Understanding the Principles of declaring a Major Incident * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	6.550 ^a	4	0.162
Likelihood Ratio	6.797	4	0.147
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.41.

The p-value is > 0.05 , the result is statistically not significant understanding the principles of declaring a major incident with an interest in furthering MIR knowledge.

Table 104

*Understanding the principles of declaring Major Incident level * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	5.312 ^a	4	0.257
Likelihood Ratio	4.446	4	0.349
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.41.

The p-value is >0.05 , the result is statistically not significant understanding of the principles of declaring a major incident level with interest in participating in other MIR training.

Table 105

*Understanding MIR Terminology * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	17.004 ^a	4	0.002
Likelihood Ratio	17.583	4	0.001
N of Valid Cases	253		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 3.60.

The p-value is < 0.05 , the result is statistically significant understanding MIR terminology and previous in hospital exposure to major incidents.

Table 106

*Understanding MIR Terminology * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	49.431 ^a	4	0.000
Likelihood Ratio	54.223	4	0.000
N of Valid Cases	253		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.47.

The p-value is <0.05 , the result is statistically significant understanding MIR terminology and previous prehospital exposure to major incidents.

Table 107

*Understanding MIR Terminology * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.785 ^a	4	0.436
Likelihood Ratio	3.827	4	0.430
N of Valid Cases	253		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 1.90.

The p-value is >0.05 , the result is statistically not significant understanding of the MIR terminology and gender.

Table 108

*Understanding MIR Terminology * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	8.343 ^a	4	0.080
Likelihood Ratio	7.324	4	0.120
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.21.

The p-value is >0.05 , the result is statistically not significant understanding of MIR terminology with an interest in furthering MIR knowledge.

Table 109

*Understanding MIR Terminology * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	7.506 ^a	4	0.111
Likelihood Ratio	5.566	4	0.234
N of Valid Cases	253		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 0.21.

The p-value is >0.05 , the result is statistically not significant understanding of the MIR Terminology and interest in participating in other MIR training.

Table 110

*Understanding ACTION CARDS (reference cards) * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	271.095 ^a	10	0.000
Likelihood Ratio	87.066	10	0.000
N of Valid Cases	262		

a. 10 cells (55.6%) have expected count less than 5. The minimum expected count is 0.07.

The p-value is <0.05, the result is statistically significant understanding of ACTION CARDS (reference cards) and previous in hospital exposure to major incidents.

Table 111

*Understanding ACTION CARDS (reference cards) * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	289.660 ^a	10	.000
Likelihood Ratio	106.317	10	.000
N of Valid Cases	262		

a. 10 cells (55.6%) have expected count less than 5. The minimum expected count is .07.

The p-value is <0.05, the result is statistically significant in with understanding of ACTION CARDS (reference cards) and previous prehospital exposure to major incident.

Table 112

*Understanding ACTION CARDS (reference cards) * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	6.895 ^a	5	0.229
Likelihood Ratio	6.888	5	0.229
N of Valid Cases	262		

a. 5 cells (41.7%) have expected count less than 5. The minimum expected count is 0.28.

The p-value is >0.05 , the result is statistically not significant understanding of the ACTION CARDS (reference cards) and gender.

Table 113

*Understanding ACTION CARDS (reference cards) * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	273.214 ^a	10	0.000
Likelihood Ratio	85.937	10	0.000
N of Valid Cases	262		

a. 13 cells (72.2%) have expected count less than 5. The minimum expected count is 0.03.

The p-value is < 0.05 , the result is statistically significant understanding of the ACTION CARDS (reference cards) and interest in furthering MIR knowledge.

Table 114

*Understanding ACTION CARDS REFERENCE CARDS * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	276.749 ^a	10	0.000
Likelihood Ratio	87.762	10	0.000
N of Valid Cases	262		

a. 13 cells (72.2%) have expected count less than 5. The minimum expected count is 0.03.

The p-value is <0.05, the result is statistically significant understanding of ACTION CARDS (reference cards) and an interest in participating in other MIR training.

Table 115

*Understanding HazMat * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	292.089 ^a	10	0.000
Likelihood Ratio	109.518	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05, the result is statistically significant understanding of HazMat with previous in hospital exposure to major incidents.

Table 116

*Understanding HazMat * Previous Prehospital Exposure to Major Incident*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	332.198 ^a	10	0.000
Likelihood Ratio	150.330	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant in the understanding of HazMat with previous prehospital exposure to major incidents.

Table 117

*Understanding HazMat * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	1.990 ^a	5	0.850
Likelihood Ratio	3.227	5	0.665
N of Valid Cases	262		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is >0.05 , statistically not significant in the understanding of HazMat in relation to gender.

Table 118

*Understanding HazMat * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	271.688 ^a	10	0.000
Likelihood Ratio	87.753	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant in the understanding of HazMat with an interest in furthering MIR knowledge.

Table 119

*Understanding HazMat * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	266.696 ^a	10	0.000
Likelihood Ratio	84.327	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is <0.05, the result is statistically significant in the understanding of HazMat with an interest in participating in other MIR training.

Table 120

*Understanding bioterrorism * Previous in Hospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	298.800 ^a	10	0.000
Likelihood Ratio	114.938	10	0.000
N of Valid Cases	262		

a. 7 cells (38.9%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant in the understanding of bioterrorism and previous in hospital exposure to major incidents.

Table 121

*Understanding bioterrorism * Previous Prehospital Exposure to Major Incidents*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	325.619 ^a	10	0.000
Likelihood Ratio	143.009	10	0.000
N of Valid Cases	262		

a. 8 cells (44.4%) have expected count less than 5. The minimum expected count is 0.31.

The p-value is <0.05 , the result is statistically significant in the understanding of bioterrorism and previous prehospital exposure to major incidents.

Table 122*Understanding bioterrorism * Gender*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	3.275 ^a	5	0.658
Likelihood Ratio	4.398	5	0.494
N of Valid Cases	262		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is 1.27.

The p-value is >0.05 which is not statistically significant in the understanding of bioterrorism and gender.

Table 123*Understanding bioterrorism * Interest in furthering MIR Knowledge*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	274.905 ^a	10	0.000
Likelihood Ratio	89.738	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p - value is < 0.05 , the result is statistically significant understanding of bioterrorism and an interest in furthering MIR knowledge.

Table 124

*Understanding bioterrorism * Interest in participating in other MIR training*

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	270.668 ^a	10	0.000
Likelihood Ratio	87.293	10	0.000
N of Valid Cases	262		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is 0.14.

The p-value is < 0.05 , the result is statistically significant in understanding bioterrorism and an interest in participating in other MIR training.

The Mann-Whitney-U Test

Utilizing the Mann-Whitney-U test to assess the distribution of each theme's satisfaction score between the qualifications group.

The following hypotheses were tested:

- H0: There is no significant difference in satisfaction score distribution between the qualification groups.
- H1: There is a significant difference in satisfaction score distribution between the qualification groups.

Table 125

MIR Training Overall Satisfaction Score Average across Qualification

Mann-Whitney-U Independent-Samples Mann-Whitney-U Test

Total N	253
Test Statistic	6.508 ^{a,b}
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	0.011

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.

The p-value is significant < 0.05 , there is satisfaction in the score between AP & CCP's.

Table 126

Confidence Score across Qualification

Independent-Samples Mann-Whitney-U Test

Total N	253
Test Statistic	0.043 ^{a,b}
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	0.835

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

The p-value is >0.05 , indicating no significance in the confidence score across qualifications.

Table 127*Understanding Overall Understanding Score Average across Qualification***Independent-Samples Mann-Whitney-U Test**

Total N	253
Test Statistic	3.898 ^{a,b}
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	0.048

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because there are less than three test fields.

The p-value is < 0.05 indicating statistical significance in the understanding score average across qualifications.

Table 128*Overall score average across Qualification***Independent-Samples Mann-Whitney-U Test**

Total N	253
Test Statistic	0.039 ^{a,b}
Degree Of Freedom	1
Asymptotic Sig.(2-sided test)	0.844

a. The test statistic is adjusted for ties.

b. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

The p-value is > 0.05 , there is no statistical significance in the overall score average across qualifications.

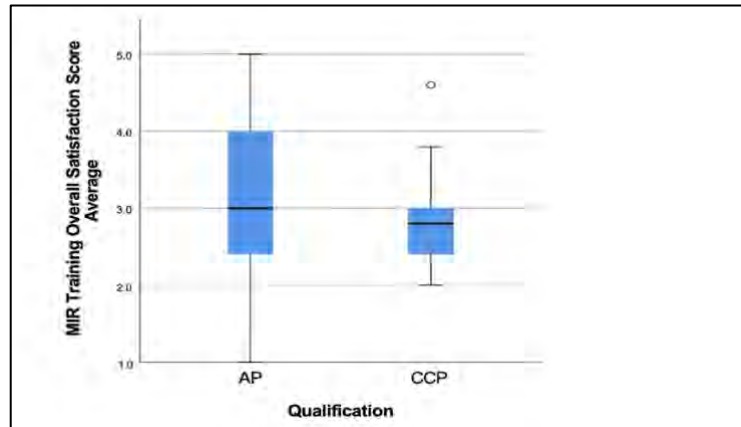
Figure 38*Overall Confidence Score Average*

Figure 38 illustrates the box plot for the overall confidence score average between AP and CCP's, indicating that the AP group having a greater satisfaction distribution than the CCP group.

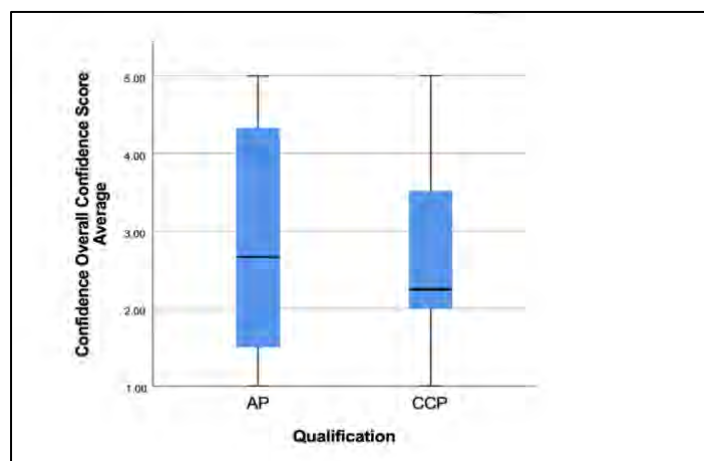
Figure 39*Overall Confidence Score Average***Independent-Samples Kruskal-Wallis Test**

Figure 39 illustrates the box plot for the overall confidence score average between AP and CCP's, indicating that the AP group having a greater satisfaction distribution than the CCP group.

Figure 40

Overall Understanding Score

Independent-Samples Kruskal-Wallis Test

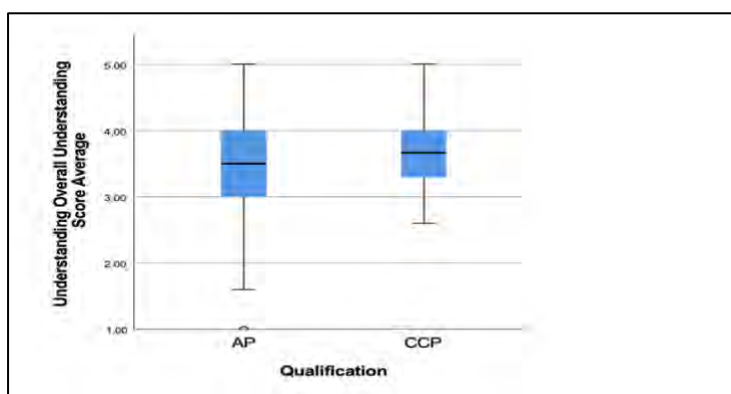


Figure 40 illustrates the box plot for the overall understanding score average between AP and CCP's, indicating that the CCP group having a greater satisfaction distribution than the AP group.

Figure 41

Overall Score Average

Independent-Samples Kruskal-Wallis Test

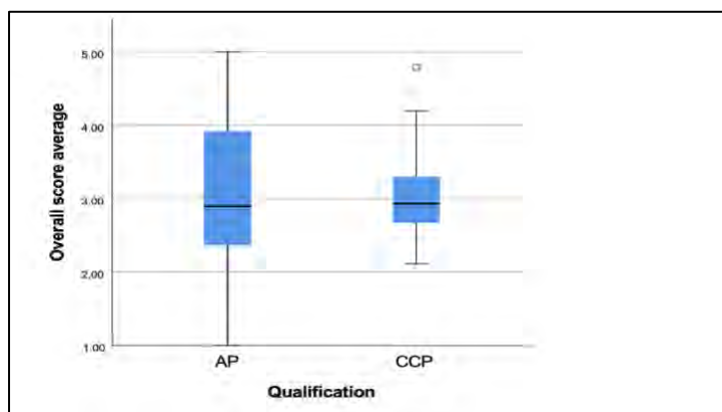


Figure 41 illustrates the box plot for the overall score average between AP and CCP's, indicating that mean/average score is equal, however there is more variation in the AP overall score than the CCP's. The average would not always give depth of information.

Multivariate analysis

To test the difference in the distribution of the scores across groups, the Kruskal-Wallis test was used, followed by a post hoc test adjusted with the Bonferroni test for those with a significant p-value obtained from the Kruskal-Wallis test.

Difference between scores groups: Kruskal-Wallis Test

The non-parametric test of Anova was utilized for the following hypothesis:

Ho: There are no differences in satisfaction scores across the three themes.

H1: There is a difference in satisfaction scores across at least two of the three themes.

The p-value in the test statistics table below shows $p < 0.05$, which rejects the null hypothesis. There is a statistically widespread distinction in delight scores between at least two of the survey's three questions themes.

Table 129*Kruskal-Wallis Test analysis (Part I)*

Ranks			
	Overall score average	N	Mean Rank
MIR Training Format Overall Satisfaction Questions Scores Average	1.00	11	32.00
	2.00	125	82.34
	3.00	65	157.23
	4.00	46	212.97
	5.00	6	245.00
	Total	253	
Confidence Overall Satisfaction Questions Scores Average	1.00	11	25.59
	2.00	125	79.07
	3.00	65	162.41
	4.00	46	215.75
	5.00	6	247.50
	Total	253	
Understanding Overall Satisfaction Questions Scores Average	1.00	11	16.41
	2.00	125	89.00
	3.00	65	144.05
	4.00	46	217.03
	5.00	6	246.50
	Total	253	

Note. The satisfaction Likert scaled were coded to 1 (Extremely dissatisfied), 2 (dissatisfied), 3 (neutral), 4 (satisfied) and 5 (extremely satisfied).

Table 130*Kruskal-Wallis Test analysis (Part II)*

	MIR Training Format Overall Satisfaction Questions Scores Average	Confidence Overall Satisfaction Questions Scores Average	Understanding Overall Satisfaction Questions Scores Average
Kruskal-Wallis H	156.353	174.184	148.808
df	4	4	4
Asymp. Sig.	0.000	0.000	0.000
a. Kruskal Wallis Test			
b. Grouping Variable: Overall score average			

To determine which specific themes were different with the satisfaction score, a post-hoc test (Bonferroni adjustment) was carried out.

Table 131*Post Hoc test with Benfornni Adjustments*

Test of Between Subjects Effects						
Source	Dependent Variable	Type III	df	Mean	F	Sig
		Sum of		Square		
		Squares				
Corrected	MIR Training Format Overall	222.946a	192	1.161	10.316	0.000
Model	Satisfaction Questions Scores Average					
	Confidence Overall Satisfaction	448.196b	192	2.334	6.634	0.000
	Questions Scores Average					
	Understanding Overall Satisfaction	149.926c	192	0.781	4.255	0.000
	Questions Scores Average					
Intercept	MIR Training Format Overall	2223.077	1	2223.077	19750.934	0.000
	Satisfaction Questions Scores Average					
	Confidence Overall Satisfaction	1885.531	1	1885.531	5358.779	0.000
	Questions Scores Average					

	Understanding Overall Satisfaction	2670.688	1	2670.688	14552.169	0.000
	Questions Scores Average					
Total	MIR Training Format Overall	222.946	192	1.161	10.316	4.997x10-
Satisfaction	Satisfaction Questions Scores Average					19
Questions	Confidence Overall Satisfaction	448.196	192	2.334	6.634	3.954x10-
Scores	Questions Scores Average					14
	Understanding Overall Satisfaction	149.926	192	0.781	4.255	1.196x10-
	Questions Scores Average					9
Total	MIR Training Format Overall	2694.000	253			
	Satisfaction Questions Scores Average					
	Confidence Overall Satisfaction	2483.650	253			
	Questions Scores Average					
	Understanding Overall Satisfaction	3202.591	253			
	Questions Scores Average					
Corrected	MIR Training Format Overall	229.699	252			

Total	Satisfaction Questions Scores Average		
	Confidence Overall Satisfaction	469.307	252
	Questions Scores Average		
	Understanding Overall Satisfaction	160.938	252
	Questions Scores Average		
a. R Squared = 0.971 (Adjusted R Squared = 0.877)			
b. R Squared = .955 (Adjusted R Squared = .811)			
c. R Squared = .932 (Adjusted R Squared = .			

Table 132*Testing Hypothesis Summary***Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	
1	The distribution of MIR Training Overall Satisfaction Score Average is the same across categories of Qualification.	Independent-Samples Kruskal-Wallis Test	0.011	Reject the null hypothesis.
2	The distribution of Confidence Overall Confidence Score Average is the same across categories of Qualification.	Independent-Samples Kruskal-Wallis Test	0.835	Retain the null hypothesis.
3	The distribution of Understanding Overall Understanding Score Average is the same across categories of Qualification.	Independent-Samples Kruskal-Wallis Test	0.048	Reject the null hypothesis.
4	The distribution of Overall score average is the same across categories of Qualification.	Independent-Samples Kruskal-Wallis Test	0.844	Retain the null hypothesis.

Binary Logistic Regression (Backward method)

The binary logistic regression (Backward Method) was utilized to identify the determinants of the willingness to conduct further MIR training. The outcome variable was “Interest to conduct further MIR training (yes/no).” The remaining questions were considered the predictors. The variables that remain included in the last step ($p\text{-value} < 0.05$) allowed for the best prediction (determinants) of interest to be shown or not.

Table 133*Dependent Variable Encoding*

Original Value	Internal Value
No	0
Yes	1

Table 134*Variable in the equation*

Variable in the Equation ^c						
	B	S. E	Wald	df	Sig.	
Step33b	Previous experience in another EMS (1)	35.453	2954.57	0.000	1	0.990
	Age	3.092	194.357	0.000	1	0.987
	Experience in HMC	-6.539	315.965	0.000	1	0.983
	Confidence in giving METHANE	28.905	44824.269	0.000	1	0.999
	Confidence in giving METHANE (1)	12.604	43201.907	0.000	1	1.000
	Confidence in giving METHANE (2)	-13.098	45658.318	0.000	1	1.000
	Confidence in giving METHANE (3)	3.632	25754.999	0.000	1	1.000

Confidence in giving	-31.097		0.000	4	1.000
METHANE (4)					
Confidence in Triaging	-	45191.343	0	1	0
Confidence in Triaging (2)	-64.747		0.000	1	0.999
Confidence in Triaging (3)	-20.897		0.000	1	1.000
Confidence in Triaging (4)	-7.007	26129.626	0.000	1	1.000
Interest in participating in other MIR Training (1)	-110.147	11448.123	0.000	1	0.992
Constant	26.488	7540.825	0.000	1	0.997
95% C.I. for EXP(B)					
	Exp(B)	Lower	Upper		
Previous experience in another EMS (1)	2.496E+15	0.000	.		
Age	22.012	0.000	6.023E+166		
Experience in HMC	0.001	0.000	1.288E+266		
Confidence in giving					
METHANE					
Confidence in giving	3.574+12	0.000	.		
METHANE (1)					
Confidence in giving	297695.712	0.000	.		
METHANE (2)					
Confidence in giving	0.000	0.000	.		
METHANE (3)					
Confidence in giving	37.785	0.000	.		

METHANE (4)			
Confidence in Triaging			.
Confidence in Triaging (1)	0.000	0.000	.
Confidence in Triaging (2)	0.000	0.000	.
Confidence in Triaging (3)	0.000	0.000	.
Confidence in Triaging (4)	0.001	0.000	.
Interest in participating in other MIR Training (1)	0.001	0.000	.
Constant			
	3.190E+11		

b. Variable(s) entered on step 33: Confidence in triaging.

c. Stepwise procedure stopped because removing the least significant variable results in a previously fitted model.

The variables in Table 134 signifies the determinants of the healthcare provider interested in further MIR training.

The variables in Table 134 i.e. previous experience in another EMS, age, experience in HMC, confidence in giving a METHANE (1, 2, 3, 4) and confidence in triaging (1, 2, 3, 4) are the determinants of the satisfaction with the training that is provided by HMCAS.

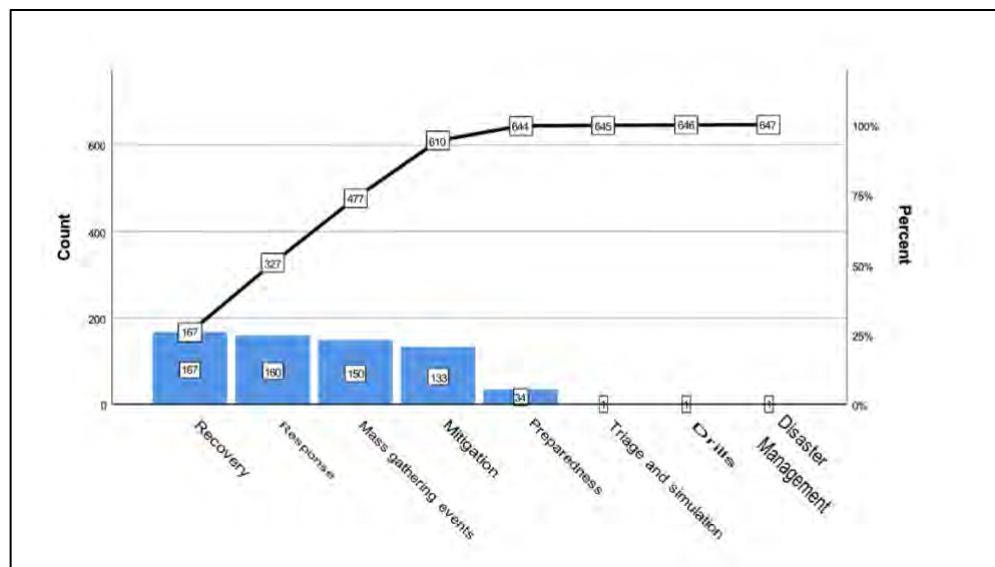
Table 135*Model if Term Removed*

Model if Term Removed ^a					
Variable		Model Log	Change in -2	df	Sig.of the
		Likelihood	Log Likelihood		Change
Questions (Determinants)	Previous Experience	-12.562	25.124	1	0.000
	in another EMS				
	Age	-18.687	37.374	1	0.000
	Experience in HMC	-14.925	29.850	1	0.000
	Confidence in	-17.206	34.412	4	0.000
	giving METHANE				
	Interest in	-198.736	397.473	1	0.000
	participating in other				
	MIR Training				

Based on conditional parameter estimates

Figure 42

Topics Suggested by the Participants



The Pareto Chart in Figure 42 looks at the data set, including the topics the respondents would want to cover in future MIR training in HMC. These included topics on disaster management, drills, triage and simulation, preparedness, mitigation, mass gathering events, response, and recovery. The data was categorized by the respondents filling in a survey. Data was categorized from high to low, with the majority of respondents ($n = 167$) wanting recovery in future training, with the least being disaster management ($n = 1$). If the first four topics are included in future training, 90% of staff working in HMC will benefit from a complete approach to major incident response in HMCAS.

Results Presentation on Research Questions and Hypothesis

Arising from the objectives (detailed in chapter 3) are the research questions as follows:

Q1. What are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance service?

Q2. What are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?

Q3. What current major incident response aids need to be revised in order to better assist ambulance and critical care paramedics to work confidently at a major incident?

Null (H₀) hypotheses presuppositions were:

Hypothesis 1

H1₀. Frontline paramedics and managers within HMCAS are not subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

Hypothesis 2

H2₀. Pertinent, core essential topics do not need to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

Hypothesis 3

H3₀. Frontline paramedics and managers within HMCAS do not need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

Findings on Research Question 1 and Hypothesis 1

Research Question 1: What are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance service?

Hypothesis 1: Frontline paramedics and managers within HMCAS are not subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

A assessment was done in the category exposure to major incidents with specific in-hospital exposure (n = 183, 69.8%) having said no and prehospital exposure having an almost equal score of 48.5% have said no and 48.1% have said yes to previous prehospital exposure to major incidents. This is of particular importance as Figure 25 shows that APs make up (n = 222, 84.73%) of the respondents in the survey; they are employed in HMCAS from various countries, as discussed in chapter one, and do not have EMS experience which is supported in Figure 26 with (n = 149, 58.89%) having no previous EMS experience. Figure 27 highlights that (n = 179, 70.75%) has had no previous MIR training, which is supported by Figure 28, where (n = 183, 72.33%) has had no previous in-hospital exposure to MIR. This supports the statement that AP which are the majority in HMCAS, has no previous in-hospital MIR exposure (they come from a hospital background) and no prehospital exposure.

MIR training provided and previous in hospital and prehospital exposure, Table 20 and Table 21, tested training skills acquired in hospital and prehospital exposure to major incidents, Table 25 and Table 26 measured training skills acquired and an interest in participating in other MIR training, Table 29 and Table 30 measured the training format and previous in hospital and prehospital exposure to major incidents, Table 35 measured the MIR

training and understanding of the MIR guidebook with previous prehospital exposure to major incidents. These showed a p-value of < 0.005 , meaning there is a significant association between MIR training, skills acquired, training format, and the guidebook for prehospital and in-hospital exposure.

Table 50 and Table 51 resulted in a p-value of <0.005 , which is significant in the confidence level in managing major incidents prior to MIR training in both groups of in-hospital and prehospital exposure to major incidents, Table 52 to Table 54 also resulted in a p-value of <0.05 which is significant in the confidence of management major incidents prior to MIR training and after receiving MIR training in both groups for in hospital and prehospital exposure to major incidents. Table 60 to Table 94 looked into confidence levels and METHANE, donning and doffing, MIR radio communications, command and control, triaging, performing of sliver command roles, HAZMAT, and working at major incidents pre and post-MIR training all scored a p-value of <0.05 showing significance in the areas tested both prehospital and in-hospital previous exposure.

Understanding how to work at and respond to major incidents is fundamental for frontline staff, especially in the prehospital setting and out in the field. The following Chi-q tests examined various aspects of MIR.

Table 95 and Table 96 tested the understanding of command and control for both in-hospital and prehospital exposure to major incidents. Table 100 looked at the principles of declaring a major incident. It related to prehospital and in-hospital exposure. Table 105 and Table 106 investigated the understanding of MIR terminology. Table 110, Table 111, Table 112, Table 113, and Table 114 highlighted the understanding of the ACTION CARDS.

In answering question one, what barriers inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the

ambulance service, the themes of experience, training, and confidence were seen as barriers. This is further corroborated by the evidence of the results of the Chi-Square test done for the themes above, which resulted in ($P < 0.005$). This ended in rejecting the null speculation and accepting the alternative hypothesis, which suggests the correct figures.

The null hypothesis (H1o) is that managers and frontline paramedics within HMCAS are not subjected to factors that inhibit the acquisition and retention of major incident knowledge when it comes to working and managing a mass casualty incident, which does not affect their ability to work and manage a mass casualty incident as per HMCAS policies and procedures is therefore rejected. The acceptance of the alternative hypothesis of this research (H1) Frontline paramedics and managers within HMCAS are subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures, is therefore accepted.

Findings on Research Question 2 and Hypothesis 2

Research Question 2: What are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?

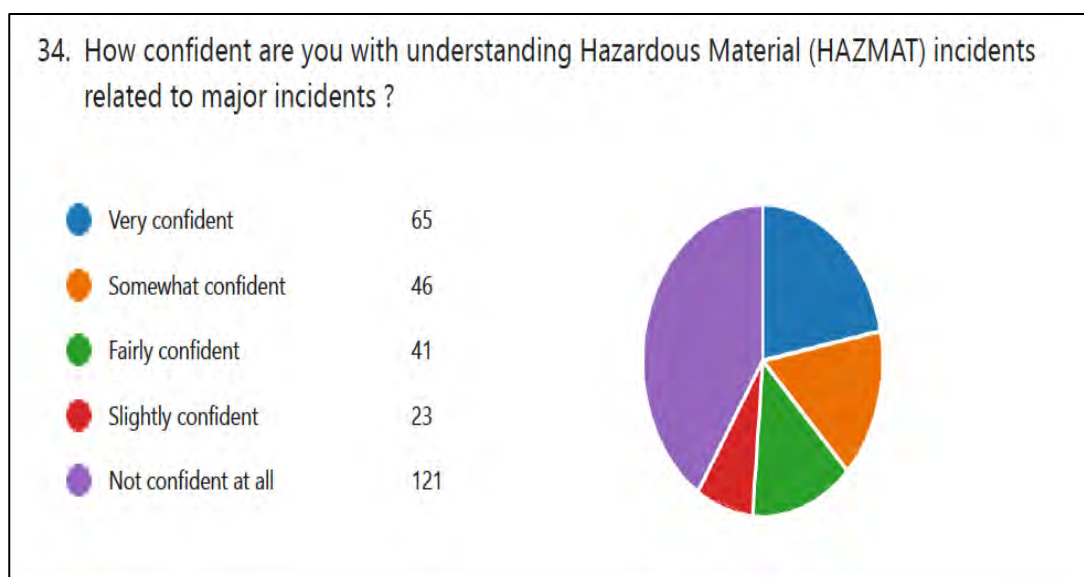
Hypothesis 2: Pertinent, core essential topics do not need to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

The research data output resulted in topics that needed more attention to aid respondents in better understanding misunderstood topics but are relevant in today's mass casualty incident response.

Bioterrorism question 35 and HazMat question 34 within the questionnaire highlighted the following results:

Figure 43

Understanding Hazardous Material (HAZMAT) incidents



Of all the respondents that answered the questionnaire it was interesting to note that (n = 121, 41%) were not confident at all in the understanding of HAZMAT incidents, whilst this figure is less than the respondents that are slightly confident (n = 23, 8%), fairly confident (n = 41, 14%), somewhat confident (n = 46, 16%) and very confident (n = 65, 22%).

It is important to highlight that understanding of hazardous materials and response to these types of incidents although rare but incredibly dangerous require staff reinforcement as the results of the study indicated that knowledge in the field was limited and improvement was required (Farhat, Gangaram, Castle, & Khenissi, 2021).

Other topics that are misunderstood and required additional support so as to not be misunderstood is in the area of command and control, Table 64 and Table 65 highlighted that establishing command and control with both previous in and pre hospital exposure to major

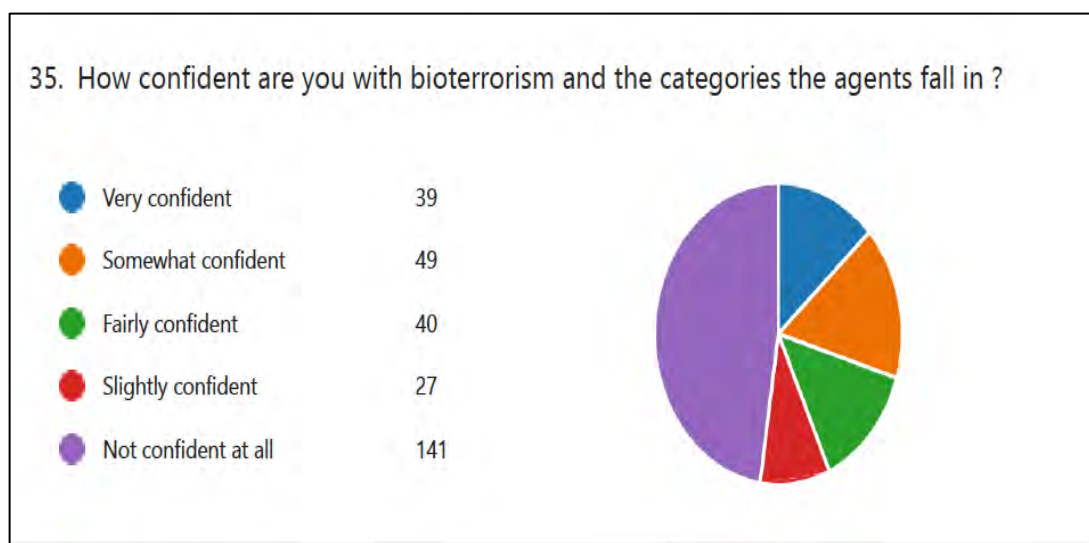
incidents using the (Chi-Square test) produced a p value of < 0.05 , which shows statistical significance in the area of command and control.

Tables 75 and Table 76 concurred with Table 78 and Table 79 as there was also a p value of <0.05 in these two tests around confidence in establishing command and control and furthering MIR knowledge as well as showing an interest in participating in other MIR training in this field.

Table 80 and Table 81 using the Chi-Square once again highlighted that communications is also an area of misunderstanding when it comes to MIR. The confidence in MIR radio communications and previous in hospital as well as prehospital confidence in radio communications highlighted a p value of <0.05 which is statistically significant. Table 83 and Table 84 confirms the statement on misunderstanding radio communications as they too showed a p value of <0.05 .

Figure 44

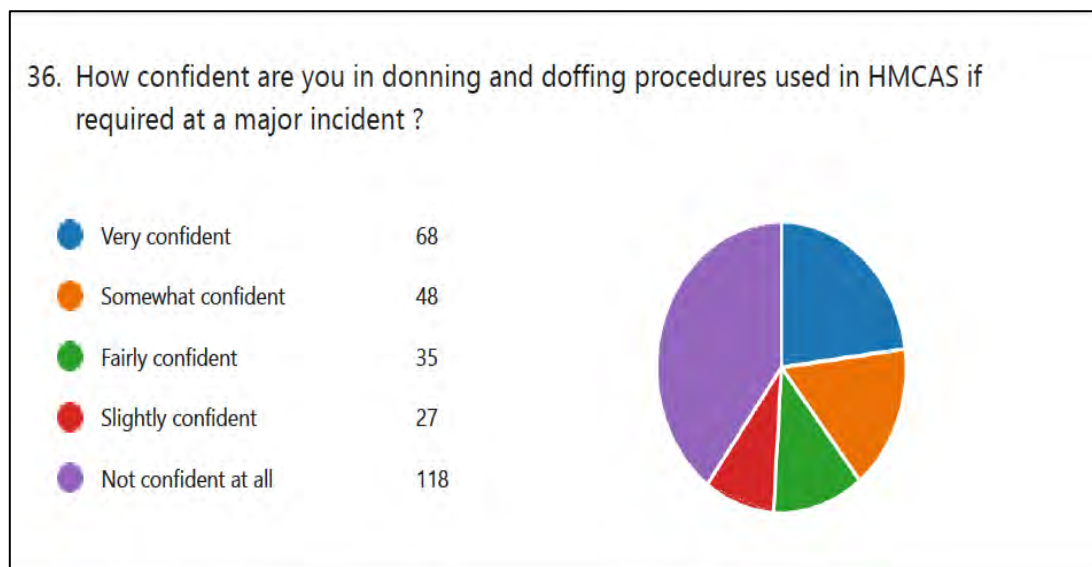
Bioterrorism and Agent Category



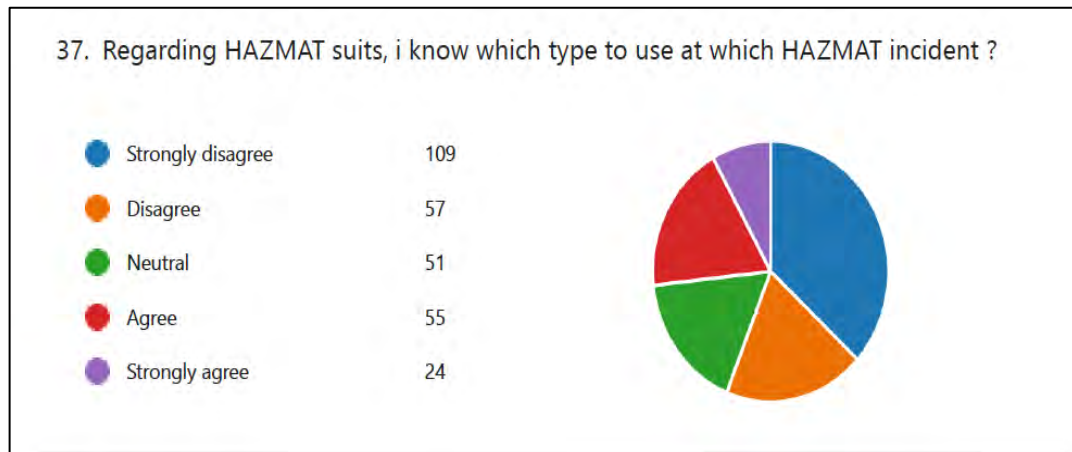
Question 35 in the questionnaire asked about bioterrorism and agent categories, here the respondents answered not confident at all (n = 141, 48%), slightly confident (n = 27, 9%), fairly confident (n = 40, 14%), somewhat confident (n = 49, 17%) and very confident (n = 39, 13%).

Figure 45

Confidence in Donning and Doffing



Question 36 had asked about confidence in donning and doffing of HAZMAT suits in response to HAZMAT incidents, interestingly, not confident at all (n = 118, 40%), slightly confident (n = 27, 9%), fairly confident (n = 35, 12%), somewhat confident (n = 48, 16%) and very confident (n = 68, 23%).

Figure 46*Type of HazMat Suit*

In question 37 of the questionnaire the respondents were asked if they knew which type of suit to choose and use in which type of HAZMAT incident, strongly agree (n = 24, 8%), agree (n = 55, 19%), neutral (n = 51, 17%), disagree (n = 57, 19%) and strongly disagree (n = 109, 37%).

Table 115 and the understanding of HAZMAT in hospital exposure, Table 116 understanding HAZMAT prehospita exposure, Table 107 understanding of HAZMAT and furthering knowledge, Table 118 understanding of HAZMAT and showing an interest in participating in other MIR Training Table 120 understanding bioterrorism with previous in hospital exposure, Table 121 understanding bioterrorism with previous prehospita exposure to major incidents, Table 123 understanding bioterrorism with an interest in furthering MIR knowledge all resulted in a p value of <0.05, highlighting that the areas being tested are statistically significant.

Topics do not need to be known, discussed, or taught in order to respond to major incidents such as mass casualty type incidents at mass gatherings. The null hypothesis for hypothesis two can therefore be rejected (H20) Pertinent, core essential topics do not need to

be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers, and the alternative be accepted.

In addressing research question two, what are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?, the topics misunderstood as extracted from the data are HAZMAT, bioterrorism, donning and doffing, command and control and radio communications

Findings on Research Question 3 and Hypothesis 3

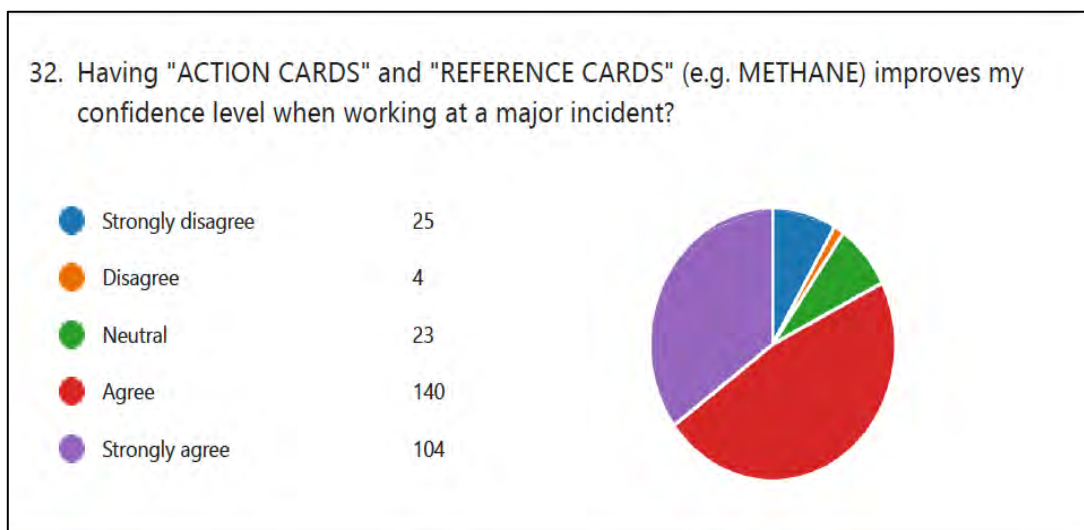
Research Question 3: What current major incident response aids need to be revised in order to better assist ambulance and critical care paramedics to work confidently at a major incident?

Hypothesis 3: Frontline paramedics and managers within HMCAS do not need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

Table 27 in the previous section showed that the respondents were satisfied with MIR training received by HMCAS in the field of major incidents, this is concurred by Farhat, Gangaram, Castle, & Khenissi (2021) in the article on Hazmat response within HMCAS where staff were satisfied with training received but additional topics needed to be included to better facilitate an overall and deeper understanding to holistically understand and be better prepared for major incident response.

Figure 47

Action Cards/Reference cards improve confidence levels when working at a Major Incident



There was an overwhelming response that showed (n = 104, 35%) strongly agreed with making use of action/reference cards, (n = 140, 47%) agreed with the question, (n = 23, 8%) remained neutral, (n = 4, 1%) disagreed and (n = 25, 8%) strongly disagreed.

The use of a METHANE report under normal response to a “significant incident” as termed in HMCAS is expected at all multi-casualty scenes. This METHANE report in the event of a major incident is heightened due to the expectation of escalating the incident to senior management as well as for the National Command Centre (NCC) to deploy resources according to a pre-determined attendance (PDA) list.

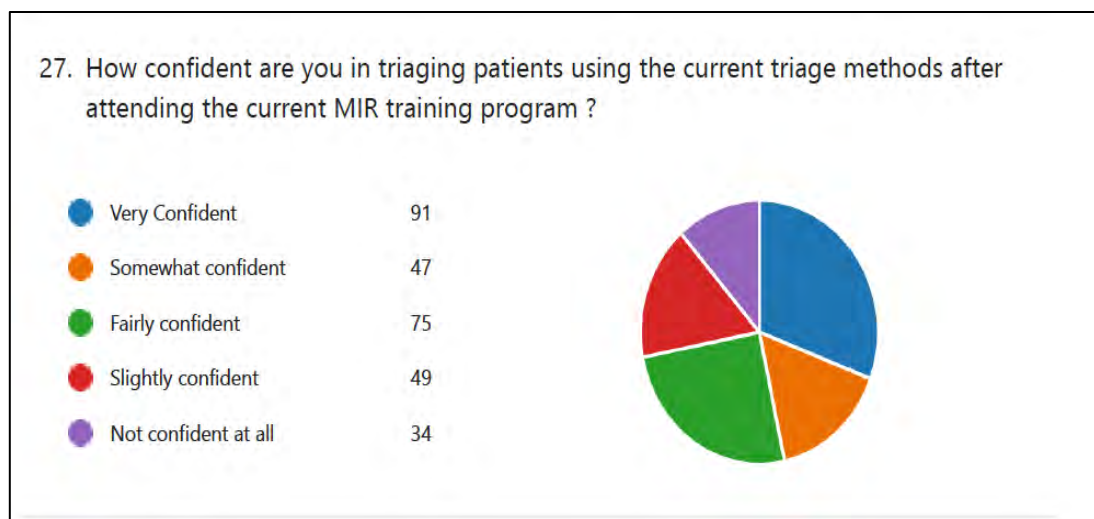
Table 60 and Table 61, confidence in giving a METHANE with previous in hospital and prehospital exposure to major incidents highlighted that the p value is <0.05 which is statistically significant, Table 63 and Table 64, also showed a p value of <0.05, with confidence in giving a METHANE and interest in furthering knowledge as well as interest in participating in other MIR training.

Nunan, Jones, Milne, & Wakefield (2020) highlighted that it is critical that information be drawn out from an early METHANE and be used more frequently to accurately

updated other emergency service responders, this tool must be well developed and evidence based.

Figure 48

Confidence in Triage



Question 27 asked about the confidence in triaging using current methods (i.e. memory) the results showed that (n = 91, 31%) were very confident, (n = 47, 16%) were somewhat confident, (n = 75, 25%) were fairly confident, (n = 49, 17%) slightly confident and (n=34, 11%) not confident at all.

Triage needs to be better understood, practised and trained in when working at major incidents. HMCAS makes use of specific triage categories when triaging patients at major incidents. Table 59 and Table 60 produced a p value of <0.05 when it came to the respondents confidence in triaging for both previous in hospital and prehospital exposure to major incidents, Table 70 and Table 71, produced a p value of <0.05 which is statistically significant for confidence in triaging and an interest in furthering MIR knowledge and participating in other MIR training respectively.

Khan (2018) in a study done within HMC demonstrated that triage demands attention for improving healthcare systems, training is paramount with making use of tools, skills,

workshops and exercising to improve on the triage process as there is a lack of understanding and awareness to maintain this skill. In the area of declaring a major incident, HMCAS makes use of a specific tool i.e. levels of response, this tool is often misunderstood due to the complexity of the tool, however frontline staff are expected to have an understanding of when to declare a major incident (criteria needs to be met).

Table 100 and Table 101 yielded a p value of <0.05 , which is statistically significant in the understanding the principles of declaring a major incident and to which level. Graph 17 highlights the response from question 32 and making use of action cards, Table 110 and Table 111 tested for the understanding and making use of action or reference cards for both in hospital and prehospital exposure to major incidents, Table 113 and Table 114 and action cards with furthering MIR knowledge and participating in other MIR training showed a p value of <0.05 which is statistically significant.

In addition to the topics related to response aids i.e. action cards, triage cards and principles of declaring a major incident, the following were also observed in question 42 of the questionnaire.

Figure 49

Interest in additional MIR Training which is Role Specific



This is of particular importance as majority of the respondents (n = 291, 98%) are interested in taking additional MIR training that is specific to roles when working at major incident. These roles have standard action/reference cards that can be used in the event of major incident.

In answering question three, what current major incident response aids need to be revised in order to better assist ambulance and critical care paramedics to work confidently at a major incident?, the aids related to specific roles, triage, METHANE and levels of response would need to be further studied to ascertain what needs to be changed/adapted to make them more user friendly for use in all major incidents and significant incidents being declared in HMCAS.

Hypothesis (H30) can therefore be rejected as the Null hypothesis: frontline paramedics and managers within HMCAS do not need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident. , and the alternate hypothesis be accepted, frontline paramedics and managers within HMCAS do need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident.

Evaluation of Findings

In this section of the fourth chapter, an evaluation of the findings/results would be presented in a methodical structure as was done in the previous section of the presentation of results. The evaluation would be presented by research questions and hypothesis; however, it would further describe the results obtained in relation to literature that is pertinent to the findings presented by the data. This section would also present on the demographic information that was collected as it observes a pattern.

Highlighted in chapter three were the operational variables as well as the operational definitions that provided benefits in position of both rigor and rationale (Wright & Yanchar, 2016).

The framework for this study was developed using the objectives of the study, it is worth mentioning that although attention was focused on reviewing the HMCAS major incident response guide in attaining acquisition and retention for frontline paramedics in Qatar, references to similar studies conducted elsewhere was made as to elaborate on the understanding and agreement of MIR. The researcher did safeguard that only those studies applicable to the aim (to determine the paramedics prior knowledge on major incident response (MIR) and to determine the paramedics knowledge acquired post MIR training programme to evaluate the content of the MIR training programme) of this study were used.

Demographic Pattern Observed & Explained

In the variable related to demographics according to Naseri & Elliot (2011) have the aptitude of problem solving and are used as control factors. Twelve questions were used in this area which ranged from gender, age, qualifications, and the department from which the respondents are from within HMCAS.

Gender Distribution

Gender was categorized into male and female, the Chi-Square test method used for gender distribution in Table 6 revealed that male respondents made up ($n = 225$, 85.9%) whilst female respondents made up ($n = 37$, 14.1%) indicating a ratio of seven to one male/female. This disparity in the gender distribution is likely due to EMS being seen as more male dominant than female. Macguire and Smith (2013) found that “being female in a male-dominated working environment e.g., ambulance services may be viewed as a risk factor for higher stress levels amongst females”, this was concurred by Govender, Grainger, Naidoo,

and Macdonald (2012) in reporting that physical security was seen as also as a reason for female paramedics not wanting to work in EMS.

Age Distribution

The purpose of using age was to determine the spread of the respondents involved in the research which represents HMCAS. Figure 1 shows majority of the male respondents being between the ages of 35 – 40 years, whilst females ranged between 20 and 40 years. The results in this category provided no statistically significant data towards the distinguishing aspects of the aim and objectives of this study.

Ambulance Paramedic vs Critical Care Paramedic

HMCAS frontline staff are either ambulance or critical care paramedic qualified (see chapter two). Holders of these qualifications within the service are DHP registered however it is important to note that AP's hold a Bachelor of Nursing qualification (not prehospital trained until they have completed the courses set out for employment with HMCAS), and the CCP's are all prehospitally trained, i.e., they hold a degree in emergency medical care prior to joining HMCAS. Of the total number of respondents (n = 222, 84.73%) are AP's whilst (n = 39, 14.89%) are CCP qualified as shown in Figure 25.

Of importance with this is that APs are not trained in prehospital disaster response, whilst CCP's are trained in prehospital disaster/major incident response. Figure 27 (n = 179, 70.75%) have not received previous MIR training whilst in Figure 28 (n = 183, 72.33%) had previous in hospital exposure to major incidents and Figure 29 (n = 127, 50.20%) had answered no has not to previous prehospital exposure to MIR training, indicating that a large portion of AP staff has not had both previous MIR exposure or previous in hospital exposure to major incidents despite holding a nursing qualification and having three years' experience prior to joining HMCAS. The distinguishing factor between the two types of paramedics is the type of training received i.e., competencies.

The performance of an ambulance service are measured in time with one of the Key Performance Indicators (KPI) being how long does the ambulance take to arrive at a scene of an incident, Whilst time is critical there are other drivers that one need to consider one of them being, what is the right or most intervention needed in order to facilitate access to effective care and ensuring that the patient is taken to the most appropriate facility for continued care (Jashapara, 2011). Whilst both AP's and CCP's have both clinical skill sets and can perform medical interventions the CCP have a higher clinical skill above that of an AP. These skills include, advanced airway management, use of mechanical ventilators for transport, chest decompression, intraosseous cannulation, central venous access, an expanded drug/medication use therapy, 12 lead electrocardiogram (ECG) interpretation, synchronized chemical or mechanical cardioversion, pacing of the heart externally, detailed patient assessment to name a few (Jashapara, 2011).

Whilst the on-shift role of an AP is to respond to and stabilize the ill or injured, the CCP covers an enhanced response to an emergency call or render assistance to the AP to treat, stabilize and transfer a patient.

Department Distribution

The respondent distribution by department in the organization highlighted in Figure 24, shows representation across HMCAS. Majority had come from EAS (71.76%) which is made up of all AP, whilst CCS (14.50%) are made up of CCP's. It is worth mentioning that other departments that responded to the survey are made of AP's. This conforms with figure 25 which breaks down the AP and CCP component (DHP qualification) in response to the survey.

The survey aimed to capture as many respondents as possible from across the ambulance service emergency services and management as each department has a significant

responsibility in the response to as well as the management of any significant incident in the State of Qatar.

The findings as discussed in the demographic information gave an overall distribution of the AP's and CCP's within the organization. The findings were congruent with the study problem of reviewing the major incident training program, to improve the acquisition and retention of frontline paramedics in preparation for mass gathering events in Qatar, where various themes were uncovered to assist frontline paramedics to fully understand aspects of major incident response in their activities around major incidents and response. A cross sectional study in Sweden concluded that in order to be better prepared for major incidents, participants in their study had requested additional training to increase preparedness and response to major incidents as it endorses society's expectations, as well as imparting necessary knowledge to promote effective response and working at major incidents (Alex, Lundin, Joansson and Saveman, 2017).

In a study by Wachira & Smith (2013) highlighted that both continuous development and training along with command and control enhances EMS response to in major incidents, having an integrated structured response, an understanding of roles, responsibilities as well as training development programs are key to a standard approach in being prepared towards major incidents.

MIR management within the Organization

The term that is used "Major Incident" was initially used in the 1970, which originated from "Incident Command System" concepts because of fires that occurred in Southern California. Major incident or mass casualty incident response is the model that is used by emergency services throughout the world as a mechanism to respond to incidents that are either natural or caused because of man.

It was observed as well as documented over years that the organizational structure and chain of command (COC) within organizations were unclear and responders did not respond and work in an appropriate manner which resulted in counter effective measures making the management of the incident both time-consuming and challenging (Hulme, Madden, & Reynard, 2020).

HMCAS expansion and development of the major incident plan and training was brought to the forefront in 2013 because of outcomes of both response and management of incidents in the years preceding. The start of developing and implementing the program was the introduction of the HMCAS guide to major incidents which was envisioned as the document and guideline to be able to assist first responders in the management of major incidents. The training adopted in referencing the guide was to be used as an “all hazards” approach so that the organization could better prepare staff should they respond to any mass casualty or major type incidents.

Evaluation of Findings on Research Objective, Question and Hypothesis

The research objectives and questions were stated as follows:

Research Objective 1:

To identify barriers that influence acquisition and retention of information in response to major incidents at mass gatherings.

Research Question 1:

Q1. What are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance service?

In reference to Table 7 in the previous section, specific questions related to in hospital versus prehospital exposure to major incidents were asked, (n = 183, 69.8%) has had no

previous in hospital exposure whilst (n = 70, 26, 7%) had answered yes to previous exposure to major incident exposure in hospital. The question on prehospital exposure highlighted an almost 50/50 split with (n = 127, 48.5%) answering no and (n = 128, 48.1%) answering yes to previous prehospital exposure to major incidents.

This finding revealed that 59.15% of respondents has had no exposure to major incidents at all prior to joining HMCAS. Table 25 and Table 26 investigated training themes for both in hospital and prehospital exposure, whilst Table 40 and Table 41 looked at training format, Table 30 and Table 31 measured training skills, Table 46 measured MIR training and understanding of the current MIR guidebook used in HMCAS. It was noted that all revealed a p value of <0.05 which is significant statistically. These findings underlined a distinct association between MIR training, skills acquired, training format and the guidebook for both prehospital and in hospital exposure to major incidents.

According to Reilly, Markenson, and DiMaggio (2007) numerous studies have emphasized that EMS providers are not ready around training and equipment for responding to major casualty incidents that involves mass number of injured people. In addition, with no structured training and education in some services and the unavailability of equipment, the inclusion of regular training programs that is competency based enhances the opportunity for education, psychomotor skills, and overall comfort in the response to mass casualty incidents (Reilly, Markenson, & DiMaggio, 2007).

In a 2022 qualitative study on factors affecting skill efficiency of EMS staff in mass casualty incidents several themes were uncovered which is like the themes uncovered in this research, i.e., training and skills which supports the 2007 study by Reilly, Markenson and DiMaggio. Sadat, Khodayarian, and Vafaeenasab (2022) highlighted that EMS staff training, and a lack of knowledge deteriorates due to additional stressors when working at

major incidents. The provision of adequate training, practical skill, and improvement of topics (qualifications) in MIR is imperative to improve the competence of staff within an organization (Sadat, Khodayarian, & Vafaeenasab, 2022).

Hypothesis 1:

H1o. Frontline paramedics and managers within HMCAS are not subjected to barriers that inhibit the acquisition and retention of major incident knowledge and response when it comes to working and managing a mass casualty incident as per HMCAS policies and procedures.

In order to prove or disprove the hypothesis stated above, using the non-parametric Chi-Square test, factors that inhibit acquisition and retention of major incidents amongst frontline staff, the results for each of the category tested (discussed in previous section) revealed that in the areas of training, skills, training format and the understanding of the MIR guidebook resulted in the null hypothesis being rejected alternative hypothesis being accepted.

Research Objective 2:

To develop a custom-made major incident response training curriculum that can assist staff (frontline paramedics and managers) in the acquisition and retention of information when faced with mass casualty response at mass gatherings the assessment of specific common topics identified or misunderstood must be addressed, these being able to identify the MIR training topics weakly perceived and paramedics, reduce the knowledge gaps concerning these topics by suggesting improvement interventions, evaluate the perception of the licensed frontline paramedics with the implemented interventions and suggest interventions to improve the licenced paramedics' knowledge about this topic.

Research Question 2:

Q2. What are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?

There were specific areas identified. These areas are as a result of literature that was discussed in the conceptual framework as topics that are misunderstood. The outcomes of the data analysis identified these topics and the section to follow would examine them individually.

HAZMAT, Bioterrorism and type of Suits (Donning and Doffing)

There were several questions related to HAZMAT in the survey tool that was answered by the respondents. These ranged from the understanding of HAZMAT incidents (Figure 43), Bioterrorism (Figure 44), confidence in donning and doffing (Figure 45) and types of Hazmat suits (Figure 46). Figure 43 showed that 41% were not confident at all in the understanding of HAZMAT incidents, Figure 44 showed that 48% were not confident at all in bioterrorism and agents, Figure 45 showed that 40% were not confident at all in donning and doffing procedures and Figure 46 showed that 37% did not agree with knowing types of suits to use in an HAZMAT incident.

To assist HMCAS frontline staff to operate within an environment that is deemed safe and to possibly identify a hazardous material type incident, a 'STEP 1-2-3' protocol was identified when attending to ALL calls by the emergency services staff. The results of this study corroborated on the work done in a study on "Exploring pre-hospital healthcare workers readiness for chemical, biological, radiological, and nuclear threats", it was observed that supporting and strengthening the hazardous materials incident training was advocated.

Donning and doffing of HazMat suits have to be done not only in a particular order but also respondents would need to know what type of suit (Level A, B, C or D) to use in a

HAZMAT incident when it comes to decontaminating a patient. 16% of the respondents were confident in the type of suit to use whilst the majority of the respondents were (40%) reported to be not confident. Studies related to EMS and types of HazMat suit selection indicated that much needs to be done in the field with training of staff on response and personal protective equipment (PPE), skills and knowledge as well as approach to the scene (Trzos, Lyzmski, Jurowski, 2019).

With the State of Qatar being at the forefront in the production and distribution of liquified natural gas, it is imperative that the national ambulance services (the only prehospital service provider) in the country is affair with the latest trends in responding to and working at major incidents of a HazMat nature. HazMat and CBRNe incidents over the years have increased (deliberate or accidental) e.g., the Lebanon explosion due to ammonium nitrate, and the COVID-19 pandemic are just a few that caused extensive loss of life (Farhat, Alinier, Gangaram, El Aifa, Khennissi, Bounouh, Khadhraoui, Gargouri, & Laughton, 2022).

Although satisfied with the current courses offered ($n = 41$, 91.12%) it was advocated that HazMat courses be delivered every year (53.33%). The recommendations as per the outcome of Farhat et al. (2022) study is in line with this study where frontline staff indicated that HazMat Incident Management be recommended for all staff, improve on the current program, reinforce the need for continuous training and encourage a multi-agency training approach in the field.

Command and Control

Table 75 and Table 76 indicated that both in hospital and prehospital exposure to command and control where of concern in both groups, this was further corroborated by Table 77 and Table 78 where the confidence in establishing command and control and furthering MIR knowledge in this area was needed. Command and control in major incidents have been

designed to provide responding agencies with a clear framework to operate in promoting efficient systems (Hugelius, Becker, & Adolfsson, 2020).

The trials encountered in the management of a disaster or mass casualty incident is mainly related to one's ability to manage uncertainty, the use of a structured process in managing an incident in a resilient method is to change one's mindset, in understanding a command-and-control structure both from an individual and from an organizational view (Hugelius, Becker, & Adolfsson, 2020).

There are internal, non-medical, medical and stress factors that influences the managers role in command and control, these factors can be overcome with distinct planning and an understanding of the operations in establishing command and control is vital for an effective mass casualty scene management (Hugelius, Becker, & Adolfsson, 2020).

It is worth mentioning that within a uniformed service role rather than rank is important, although rank is solely responsible and accountable to junior staff for advice and management of an incident. The principles of command and control relies on personal preparedness (mental preparedness, self-confidence, and self-knowledge), understanding the complexities of an incident and having the technical skills (Hugelius, Edelbring, & Blomberg, 2020).

Radio Communications

Communications is key in any response too and management of major incidents. Table 80 and Table 81 highlighted that communications are often misunderstood in the realm of MIR. Table 82 and Table 83 indicated that both confidence levels in radio communication and showing an interest in participating in other MIR training and furthering MIR knowledge, all tables highlighted in this section (radio communications) showed a p value of <0.05 , meaning there is a statistical significance in communications.

Whilst this study used radio communications as a broad topic, communications can lend itself to further detailed research around MIR. The need for guidelines and involvement in further training within communications and the exchange of information were identified as challenges in the response to major incidents as fragmented command systems and the exchange of information were identified (Palmu, 2022).

Hypothesis 2:

H2o. Pertinent, core essential topics needs to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers.

The p value (< 0.05) for the tables mentioned under radio communications, command and control and HAZMAT, bioterrorism and type of suits (Donning and Doffing) as discussed in the previous paragraph showed a statistical significance. This allowed for the null hypothesis being rejected and the alternate being accepted. This proved consistent with other studies discussed in each of the headings mentioned.

Research Objective 3:

Understand expectations of major incident response around mass gatherings by frontline paramedics and managers in the use of response aids or action cards to boost confidence when working at mass casualty incidents, assess the emotions and attitude of the licensed paramedics for any potential major incident and to suggest interventions to reduce the impact of the identified factors on their readiness for potential major incidents.

Research Question 3:

Q3. What current major incident response aids need to be revised in order to better assist ambulance and critical care paramedics to work confidently at a major incident?

Although frontline staff were overall satisfied with the MIR training received by HMCAS as seen in Table 8 which summarized the satisfaction scores in each of the themes identified and produced an overall score average of 96.6%, indicating that the MIR training format, confidence and understanding were satisfactory. However, in testing the continuous variables using the Shapiro and Kolmogorov tests, the Q-Q plots revealed that data was not normally distributed.

In quantifying the data from the questionnaire, four areas were identified:

Use of Action Cards

Area 1 and the use of action cards was first advocated in 1972, where it was highlighted that in the event of MCI (hospital setting) there is a limited time for responding staff to think on what to do next even if they have trained, in order to avoid confusion having a reference/action card ensures a responder is effective in carrying out their duty by taking out the stress factor (Savage, 1972).

This can be seen in Figure 47 were 35% of respondents strongly agreed and 47% agreed that use of action cards improved their confidence when working at major incidents. Action cards have clear concise information, advice and sequence of order that is written (Savage, 1972).

Winters, Gurses, Lehmann, Sexton, Rampersad, and Pronovost (2009) indicated that having checklists (action cards) are tools that every industry uses, and can hugely influence best practice, easy to use, democratize knowledge, ensure quality and safety, be consistent to decrease errors and generate objective instructions for key activities (Winters et al., 2009).

Triaging

Area 2 pertained to the confidence in triaging of patients at a mass casualty incident varied in the response to the question (question 27) of the questionnaire. It highlighted that 34% were not confident at all, 17% were slightly confident, 25% being fairly confident, 16% somewhat confident and 31% being very confident. However, entering variables on step 33b, Table 134, confidence in triaging the variable indicated a p value of 0.03 which statistically is significant, as the variables are the determinants of the healthcare provider being interested in further training.

The results are similar to the results of a United Arab Emirates (UAE) study, where the authors conducted pre-deployment training on triage and then repeated the test at day 30 and at day 60. Results from the UAE study conducted by Omar, Saleh, Mubarek, and Ives (2022) revealed that knowledge/information preservation in triage decreased after day 60, therefore the need to conduct regular training and refreshers with topics and skills that are not done routinely should be done.

Cuttance, Dansie, and Rayner (2017) concluded that frontline staff that made use of an aid/action card, accuracy was higher compared to not using aids, over and under triage was evident in the non-use of aids, therefore making use of an action card/aid is advocated for triage accuracy.

Levels of response

Area 3 looked in responding to a major incident, the first unit on scene would need give a METHANE report, based on the report a suggested number of resources would be called for based on a pre-existing PDA as in the case of HMCAS. The response is not casualty number but acuity of patients based. The number of additional resources needed is also based on location and the nature of the incident and must be used as indicators to the command-and-

control structures that need to be established. The additional variable that must be considered in the levels of response decision making is the total time of the incident from onset to approximate end time of the incident. HMCAS makes use of four major incident levels (see appendix 1).

In determining levels of response, the frontline staff would need to additionally consider the complexities of the incident, high (not a routine type of incident, e.g., HazMat), moderate (large numbers of deployed personnel e.g., aircraft incident), low (difficult access to patients e.g., hazards) and none (there is access and egress to and from patients). They would further need an understanding of the response matrix to be able to declare the correct type of escalation level (see appendix 2).

To understand levels of response the frontline staff would therefore have to first understand appendix 1 (complexities of the incident) as well as appendix 2.

Table 102 highlighted a p value of < 0.05 indicating a result deemed to be statistically significant.

Role Specific Training

Finally, when respondents were asked (question 42) if they would be interested in taking additional MIR training that is specific to expected roles e.g., AP's primary triage, bronze loading or bronze parking, and CCP's e.g., secondary triage, operations officer takes on the role of silver commander, majority had answered yes ($n = 291$, 98%).

Hypothesis 3:

H3o. Frontline paramedics and managers within HMCAS do not need teaching aids and resources to be revised and used to better assist them when working at a mass casualty incident. The hypothesis (H30) according to the data collected and literature observed is rejected as the null hypothesis and the alternate be accepted.

Summary

This chapter focused on explanations as a result of data analysis gathered from respondents answering the questionnaire. Section one of the chapter delved into the factors that were measured to ensure the trustworthiness of the data collected using various processes such as multiple data checks, thematic coding, and, in some areas, triangulation. Highlighted was the transferability of the findings identified by the research conducted and assurances given on the chosen methodology being able to follow patterns established with past, current, and possible future research in the comparable pattern identified within this research.

The section explored the trustworthiness of the research methodology, which allows future researchers to repeat the inquiry in the same area of interest on the same topic of MIR, incorporating the facets identified. The first part of the section in this chapter was completed with confirmability, highlighting the researcher's suppositions; these were then placed to not dilute the findings by ensuring a thorough check on both reliability and validity processes in quantitative research was followed.

In the section on reliability and validity, the processing of and findings of the data were screened, ensuring that these conformed to processes identified in the research. This section revealed that due consideration was allocated to validity, where internal validity was obtained to corroborate or authenticate measurements as well as itself.

External validity was able to generalize the sample from the chosen population. Using test-retest reliability on the research questionnaire/instrument, the study ensured reliability and consistency.

Under the heading evaluation of findings in this chapter, the themes identified were highlighted in the previous section on the evaluation of findings and tied up with the research objective and the research hypothesis, which had to give an appropriate description logically

by ensuring the hypothesis of the question were answered in order to warrant that anyone reading this chapter would be able to make an objective conclusion regarding the analysis of the data, this was achieved without a detailed discussion as recommended by the university guidelines. Chapter four was finally presented and structured around the questions reviewed and included as part of the study in line with the conceptual framework identified. This can be examined in Table 136, which shows a summary of strategic outcomes and assessed validation linked to each finding.

Table 136

Summary of the Variables, Categories, Testing Method, Reference, and Conclusion

Variables	Categories	Testing Method of the variables & Reason	Reference to objectives, RQ & Reference to variables	Conclusion
Gender	Gender	Chi Square Test	Objective 1/Q1	Association level
Theme satisfaction groups	Male	(Categorical variables)	Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. International Journal of Environmental Research and Public Health, 18(3), 1348.	between the categorical variables is strongly associated.
	Female			
	Satisfaction Groups			
	High Satisfaction			
	Low Satisfaction			
			King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. Military medicine, 184(9-10), e548-e554	
Age	Age:	Kruskal Wallis Test	Objective 1/Q1	

Satisfaction scores	18-29 years old	post-hoc (Bonferroni Test)	Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. International Journal of Environmental Research and Public Health, 18(3), 1348.	There is a difference in satisfaction distribution between age groups.
	30-39 years old			
	40-49 years old			
	50-59 years old			
	> years old			
Satisfaction scores			King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. Military medicine, 184(9-10), e548-e554	
High Satisfaction				
Low Satisfaction				
HMCAS staff qualification	Qualifications:	Mann-Whitney-U-Test	Objective 1/Q1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. International Journal of Environmental Research and Public Health, 18(3), 1348.	There is no difference in distribution of satisfaction cores between APs and CCPs
	Ambulance			
Satisfaction scores	paramedic			
	Critical Care			
	Paramedic			
	Satisfaction scores			

	High Satisfaction		King, H. C., Spritzer, N., & Al-Azzeh, N.	
	Low Satisfaction		(2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. Military medicine, 184(9-10), e548-e554	
HMCAS	Employment	Kruskal Wallis Test and	Objective 1/Q1	There is a
employment	< 1 year	Bonferroni Test	King, H. C., Spritzer, N., & Al-Azzeh, N.	difference in
Satisfaction scores	1-5 years		(2019). Perceived knowledge, skills, and preparedness for disaster management among	satisfaction
	6-10 years		military health care personnel. Military	distribution
	10-15 years		medicine, 184(9-10), e548-e554	employment
	> 15 years			period groups.
	2.Satisfaction			
	Scores		Han, S. J., & Chun, J. (2021). Validation of the	
	High Satisfaction		disaster preparedness evaluation tool for	
	Low Satisfaction		nurses—the Korean version. International	
			Journal of Environmental Research and Public	

Health, 18(3), 1348.

Prior exposure to	Prior Exposure		Objective 1/Q1	There is
MCI in	No	Chi Square Test	Han, S. J., & Chun, J. (2021). Validation of the	association
in hospital	Yes		disaster preparedness evaluation tool for	between exposure
environment	2. Satisfaction		nurses—the Korean version. International	to MCI in-hospital
Satisfaction groups	Group		Journal of Environmental Research and Public	and satisfaction
	a. High Satisfaction		Health, 18(3), 1348.	groups
	b. Low satisfaction			
Prior exposure to	Prior Exposure			There is
MCI in pre-hospital	No			association
environment	Yes			between exposure
Satisfaction groups	2. Satisfaction			to MCI pre-
	Group.			hospital and
	a. High Satisfaction			satisfaction groups
	b. Low satisfaction			

Prior MIR training	Prior Exposure		Objective 1/Q1	There is
Satisfaction groups	No	Chi Square Test	Han, S. J., & Chun, J. (2021). Validation of the	association
	Yes		disaster preparedness evaluation tool for	between
	2.Satisfaction		nurses—the Korean version. International	participation in
	Group		Journal of Environmental Research and Public	previous MIR
	a. High Satisfaction		Health, 18(3), 1348.	training and
	b. Low satisfaction			satisfaction group.
Number of mir	MIR Training	Kruskal Wallis	Objective 1/Q1	There is
training sessions	<5	Bonferroni Test)	King, H. C., Spritzer, N., & Al-Azzeh, N.	association
attended.	6-10		(2019). Perceived knowledge, skills, and	between
Satisfaction group	11-15		preparedness for disaster management among	satisfaction group.
	d. 16-20		military health care personnel. Military	And the number
	> 21		medicine, 184(9-10), e548-e554	of mir training
	Satisfaction Group		Han, S. J., & Chun, J. (2021). Validation of the	sessions attended
	High Satisfaction		disaster preparedness evaluation tool for	
	Low Satisfaction		nurses—the Korean version. International	

	Satisfaction Theme	Kruskal Wallis Test	Objective 1 and 3	There is a
The difference of the		Confidence distribution	King, H. C., Spritzer, N., & Al-Azzeh, N.	difference in the
satisfaction scores	Satisfaction Score	regarding MIR training.	(2019). Perceived knowledge, skills, and	satisfaction scores
across all the themes.	Not confident at all		preparedness for disaster management among	across all themes
	Slightly confident		military health care personnel. Military	(see Table 121) of
	Somewhat		medicine, 184(9-10), e548-e554	this chapter.
	confident		Han, S. J., & Chun, J. (2021). Validation of the	
	Fairly confident		disaster preparedness evaluation tool for	
	Completely		nurses—the Korean version. International	
	confident		Journal of Environmental Research and Public	
			Health, 18(3), 1348	
Did the MIR training	1. Knowledge	Chi Square Test	Objective 2/Q1/Q2/Q3	There is
program equip you	a. Yes		Brewer, C. A., Hutton, A., Hammad, K. S., &	association

with the appropriate knowledge?	b. No		Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills, and preparation for disaster management. <i>Australasian emergency care</i> , 23(1), 29-36.	between the satisfaction group and the MIR training program.
Satisfaction groups	2. Satisfaction Group			
	High Satisfaction			
	Low Satisfaction			
Did you learn the necessary skills to deal with MIR?	Skills		Objective 2/Q2/Q3	There is
Satisfaction group	Yes	Chi Square Test	Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.	association between the satisfaction group and skills in managing MIR.
	No			
	Satisfaction Group			
	High Satisfaction		Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural	
	Low Satisfaction			

		emergency departments in New South Wales:		
		Nurses self-assessment of knowledge, skills, and		
		preparation for disaster		
		management. Australasian emergency		
		care, 23(1), 29-36.		
Has the MIR training	Communication	Objective 2/Q2/Q3	There is	
program improved	Yes	Chi Square Test	Brewer, C. A., Hutton, A., Hammad, K. S., &	association
your on-scene	No		Geale, S. K. (2020). A feasibility study on	between the
communication	Satisfaction Group		disaster preparedness in regional and rural	satisfaction group
skills?	High Satisfaction		emergency departments in New South Wales:	and
Satisfaction group	Low Satisfaction		Nurses self-assessment of knowledge, skills, and	communication
			preparation for disaster	skills required in
			management. Australasian emergency	MIR.
			care, 23(1), 29-36.	
Familiarity with the	C & C familiarity	Objective 2/Q2/Q3	There is an	
command-and-	Yes	Chi Square Test	King, H. C., Spritzer, N., & Al-Azzeh, N.	association

control structure (C	No		(2019). Perceived knowledge, skills, and	between C & C
& C)	Furthering		preparedness for disaster management among	and an interest in
Interest in furthering	Knowledge		military health care personnel. Military	furthering MIR
MIR Knowledge	a. Yes		medicine, 184(9-10), e548-e554	knowledge.
	b. No		Tillekaratne, H. I., Werellagama, D. R. I. B., &	
			Prasanna, R. (2021). Command and Control	
			Mechanism for Effective Disaster Incident	
			Response Operations in Sri Lanka. In Multi-	
			Hazard Early Warning and Disaster Risks (pp.	
			615-631). Springer International Publishing.	
Familiarity with MIR	Terminology	Chi square test	Objective 2/Q2	There is an
Terminology	Yes		Tillekaratne, H. I., Werellagama, D. R. I. B., &	association
Interest in furthering	No		Prasanna, R. (2021). Command and Control	between MIR
MIR Knowledge	Furthering		Mechanism for Effective Disaster Incident	terminology and
	knowledge		Response Operations in Sri Lanka. In Multi-	an interest in
	Yes		Hazard Early Warning and Disaster Risks (pp.	furthering MIR

	No		615-631). Springer International Publishing.	knowledge.
Identify the	Interest in		Objective 3/Q3	The questions of
determinants of the	conducting further	Binary logistic regression	King, H. C., Spritzer, N., & Al-Azzeh, N.	their confidence
participants interest	MIR training.	(Backward method)	(2019). Perceived knowledge, skills, and	theme with the
in conducting further	Yes		preparedness for disaster management among	MIR training are
MIR training	No		military health care personnel. Military	the determinants
	All the other		medicine, 184(9-10), e548-e554	of the participants
	remaining variables			willingness to
	in the dataset			conduct further
				MIR training.

Source. Author 2023

CHAPTER 5: IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

IMPLICATIONS

Introduction

In reviewing the problem statement highlighted in chapter one of this study it was evident that a lack of a standard curriculum or regular compulsory continued training program influences understanding, retention and acquisition of the major incident response guide used by HMCAS as highlighted by literature used in chapter 2, based on other emergency services around the world.

The main group of frontline paramedics working within HMCAS are AP's, who are employed from various countries and are not primarily paramedic trained. They do hold a degree in nursing (which is compulsory) when joining HMCAS. This group are then trained as ambulance paramedics (AP) with an overview given to them of the major incident response plan and they then attend an 8-hour workshop. There is a practical application of what has been told to them in the overview session in their orientation on joining HMCAS.

Having a robust mass casualty response plan is fundamental, this needs to include the health care personnel's competencies (Goniewicz et al., 2021). Furthermore, ensuring skills and proficiencies in response to mass casualty incidents regularly within a planned framework ensures and understanding of management in the field (Goniewicz., 2021).

The overall goal was to review the major incident training program currently offered by HMCAS to ascertain the acquisition and retention of frontline paramedics working in Qatar and to establish their readiness and preparedness to respond to and work at major incidents. In doing so, areas could be identified that frontline paramedics would need assistance in to

ensure that all work from the same knowledge base on policies and procedures when working in HMCAS at mass casualty incidents.

This study is intended at observing the attitude towards the understanding of as well as the satisfaction within specific areas of mass gathering and major incident response amongst the first response paramedics in the national ambulance service. Together with the studies intentions, the aim was to review the current training/overview being offered and make adjustments in line with current literature discussed in chapter 2.

Making these recommendations to the current overview and practical session as indicated by conclusions made by the data in this study and as part of future research, develop a training program curriculum that is both recognized and acknowledged as the standard for both present and impending staff. The significance of this study should be able to show the understanding and satisfaction of the HMCAS major incident response plan and the use of suitable procedures of teaching to develop frontline staff and show heighten their confidence in response procedures such as command and control, triage, communications as well as those unusual HAZMAT circumstances in order to be better understood.

Having an understanding on mass casualty response enables HMCAS frontline operational staff to be content and comfortable with the various categories that needs to be understood when working at any mass casualty or major incident, if it should occur at a mass gathering event. This study places importance on roles and responsibilities which enables paramedics to understand what is expected of them as discussed and highlighted by other studies conducted by Gregory (2010) in which the author had investigated similar understanding of training programs amongst frontline paramedical staff.

The purpose and goal of the study in addition to summary above, was to tie in the mission statement of HMCAS which is to “provide a well-planned, resourced and managed emergency response to major incidents and disasters”, (HMCAS, 2023). The researcher in

this study necessitated ethically rigorous values were followed, by ensuring that consequences of the study was considered at all times, resources were managed truthfully, research conducted was done in a proficient, meticulous and methodologically manner and acknowledgment for those that participated and truthful communication was ensured at all times.

As demonstrated by Brink, van der Walt, and van Rensburg (2018) there was no risk involved to the participants of the study. This was done by ensuring that principles were followed. These principles were that of respect for persons by confirming that no persons with disabilities were enrolled, principle of beneficence ensured that no participant was subjected to any harm or manipulation of the study, principle of justice ensured that every participant was directly related to the chosen field of study as well as fairness was observed at all times, Finally the study was approved by the organization that the research was conducted in with reference “QI-HMCASG-2023-002.”

The limitations encountered in the study during the process of the research included the challenge of getting the questionnaire to be completed as this proved challenging to get frontline paramedics to log in to their Microsoft (MS) account to fill it in. The use of MS forms was requested to be used by HMC ethics committee as it is policy in the organization if data is to be collected from staff. The scope of this research was limited to frontline staff only however there are other staff within the organization that has important core functions to do in the event of a major incident. The research implications can be seen in the first chapter, where it is discussed in great detail.

The reminder of this chapter would follow with the implications of the study were the research question and if applicable the hypothesis would be discussed, and conclusions drawn with avoiding the drawing of conclusions that are not based on findings of this study. Limitations would be highlighted that affected the result interpretation (if any), and then

results would be placed into context by describing the alignment or not with the conceptual framework and the literature that was discussed in chapter 2 of the study.

Finally, recommendations for application would be deliberated in supporting the findings of the research and finished by placing the results into context with the study problem and showing contribution or practice to existing literature.

Implications

The research results implications are managed by the research questions, objectives and or hypothesis to make deductions. In this section of the chapter each of the research question would be appraised, beginning with the limitations, addressing the response to the research problem, conceptual framework, results and finally the contribution to literature as well as addressing how the study builds on existing research in the topic discussed.

To recap, the following variables were themed from the study objectives and hypothesis which is described in detail within chapter 2 of this study. The 32 variables derived were grouped into 5 areas which are demographics, satisfaction with the MIR training format and confidence earned after participation in the training, satisfaction with the level of MIR concepts, understanding post MIR training and MIR training program suggested new content.

Research Question/Objective/Hypothesis One

The investigation into addressing the objective and hypothesis 1, was answering the research question, what are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance service?

The variables used in the study were themed into satisfaction with the level of understanding, satisfaction with the confidence and satisfaction with MIR training received. The theme level of understanding was tested using the Q-Q plots (See Figures 34-37), this

was found to be statistically significant as the p value was < 0.05 for this theme. This led to the null hypothesis being rejected and the alternate being accepted that managers and frontline paramedics within HMCAS are subjected to factors that inhibit the acquisition and retention of major incident knowledge when it comes to working and managing a mass casualty incident which does affect their ability to work and manage a mass casualty incident as per HMCAS policies and procedures.

The findings are assessed under the following implications:

Results Interpretation under Limitations

The limitation on the generality of results from the sample size to the scope of the entire ambulance services in determining the understanding of responding to and working at major incidents related to barriers that inhibit acquisition and retention, might have some form of deviation from reality but challenges would always exist. The study on challenges when managing casualty situations highlighted that there was indeed a challenge on identifying a mass casualty situation and dealing with uncertainties, there is a mismatch between reality and contingency planning, establishing a functional command and control, adapting the response by medical personnel to the actual situation and ensuring a resilient response (Hugelius, Becker, & Adolfsson, 2020).

The limitation identified as a gap under the heading of communications was the area of terminology. Terminology was described in detail in chapter 1 of the study as a barrier due to being specific in major incidents and majority of staff working as frontline paramedics within the organization are not first language English speakers.

However, the results retained consistency and was evaluated for validity, as it did not impact on the findings neither on the ability to answer the research question as the

communication aspect and information related to absences of specific terminology were addressed in general.

Future research can delve deeper into the understanding of specific terminology that is used in emergency management. This can be included as questions in the data collection tool. Terminology is an important area that would require additional research to be conducted in emergency response, training of it is required as there is still emphasis placed on communication in response to an incident (Palmu, 2022).

Results Response to Research Problem and Purpose

The research was aimed at resolving the research problem of evaluating the current MIR guide, to highlight gaps that hinder frontline staff from fully engaging and responding too or working in major incidents. Literature has highlighted that there are indeed fundamental gaps that do exist that prevent frontline EMS staff in completely understanding major incident response. The results highlighted that there are indeed barriers that exist which inhibit the retention and acquisition of the understanding as well as the satisfaction in the confidence amongst HMCAS frontline paramedics.

The retention of skills to acquire acquisition and retention in general according to Kim, Ritter, & Koubek (2013) can only be ensured if there is regular procedures or repetition in place, this repetition allows for factual and task orientated knowledge to be acquired and retained. In addition, cognitive theory as discussed in chapter by Szulewski et al. (2021) is successful in all fields especially crisis resource management, this theory allows for the transfer of information to be acquired as well as resources associated in the field that the learning is being conducted in to be better understood, adapted, stored, and used when required.

Results Alignment with Conceptual Framework and Significance

The findings derived from this study fits in with the variables described in the conceptual framework which is ultimately derived from the literature. The gaps experienced by frontline paramedics as discussed has an influence on research question one and hypothesis one. The results have therefore supported the need for frontline paramedics to be fill in the gaps in the training requirements identified to better equip them to respond to and manage major incidents be it in mass gathering events or others. The significance revealed from the findings of this study related to research question one, hypothesis one can introduce the conceptual framework into theory as points or factors to consider in closing the gaps identified.

Results Expectations and Contribution to Literature

The results derived from in this study against the research question, objective and hypothesis one, is in line with the framework as advocated in the literature. The results will therefore contribute to the existing body of literature, and gaps identified can be assessed and worked on as it is a significant area to consider when ensuring frontline staff are able to retain core knowledge when working at major incidents.

Various factors have been identified in the literature, which was discussed earlier in chapter two, these factors included teamwork, problem solving, critical thinking, accurate information use and the further development in education and training within the context of major incident response (Fitzgerald et al., 2017).

Fitzgerald et al. (2017) included the framework for teaching and understanding disaster management that requires specific skills that is related to specific tasks related to roles and responsibilities. Barriers that further cemented the link between data collected in this study and barriers identified by Hugelius, Becker, and Adolfsson (2020) namely, resilient response to and management of the incident, adaptation of response to meet the reality of the

mass casualty incident faced, effective functioning in a crisis and dealing with uncertainty at the incident itself.

Results Implications to Practice, existing Body of Research and Doctoral Degree

The outcome of the results affiliated with research question, objective, and hypothesis one as outline and discussed in the previous sections highlight that there is indeed an implication in the outcome within HMCAS in the field of mass casualty response when it comes to gaps identified. There must be further training in bridging the gaps identified within HMCAS, this body of evidence has allowed for more research to fully understand these gaps and to robustly execute a plan and training sessions to overcome issues highlighted for both current and future frontline paramedics in the ambulance service.

The outcome of data produced because of the questions themed in question 1, is congruent with literature reviewed for this study, one can therefore conclude that there is value added in both a meaningful and significant way as existing paradigms were challenged, new insights were uncovered, and the connection of the theoretical framework being connected to existing knowledge in major incident response and management.

The research objective and hypothesis has assisted the study to meet the requirements that are needed/set out by the university to fulfil the objectives of the doctoral degree program.

Research Question/Objective/Hypothesis Two

Research question two in the study addressed what are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?

Nine of the variables were themed into common topics which according to the theme was satisfaction. Emphasis being placed on knowledge and skills amongst the paramedic profession is vital, possibly the most efficient form of teaching is the involvement of

paramedics in strategies that has them engaged, human-centred skills is best evaluated with the use of evaluation tools that one can self-report on (Ross, 2012).

Results Interpretation under Limitations

The target population for this study was 274 from a population of ($n = 871$). Of the population there was a return rate of ($n=307$) which was significant. However, the use of frontline paramedics only has been observed to be a limitation in the collection of the data. This study concentrated on frontline staff, there exists the opportunity to include non-frontline staff in future research in this chosen field of research, as they too have an important and significant contribution to make in the non-medical aspect of managing and responding to major incidents. Aspects that could have been tested is the ability and understanding of non-frontline staff as they too would need to aspects of response as outlined in the emergency response or disaster management cycle. Themes on mitigation and recovery are potential areas as future research for non-frontline staff as they are generally involved in human resource management, finance, infrastructure management or the actual set up of the resources (trucks, equipment, tents, command units, provision of sustenance) when it comes to major incidents or emergency management of disasters/mass casualty incidents.

Results Response to Research Problem and Purpose

The results were effective in addressing the research problem by highlighting the factors affecting the acquisition and retention of areas within the area of MIR and mass casualty response for both natural and man-made disasters that affects frontline staff within HMCAS. The factors identified (nine) from the variables responded well to the needs required by the organization in addressing education and training specifically.

Results Alignment with Conceptual Framework and Significance

The findings outlined in the study corresponded with the variables agreed on within the context of the conceptual the framework as well as the significance of the study which

was explained in previous chapters of the write up. The literature discussed in chapter 2 supported the findings from the data collected. Teamwork, communications, the ability to be able to think critically, be able to problem solve, ensure use of information, and possess professional competence and personal values are factors highlighted in the conceptual framework of chapter 2. These factors were aligned with the variables as determined by the research question and hypothesis of this study. The reaction of the training participants, the learning (as an outcome) by the participants in relation to training, behaviour of the participants due to the training received and the impact it had on the organization as a result were discussed in detail within chapter 2.

These elements discussed in chapter 2 were tested as outlined in chapter 3 and were deemed to be significant and therefore replication and verification can be done in other similar contexts under the same methodology outlined in this study. There were significant profound factors to be considered, such as those highlighted by Gregory (2010) were the importance of EMS frontline staff having embedded knowledge in response to and managing major incidents. In addition, having the background knowledge of Hazmat, mass gathering and understanding major incident concepts, terminology and basic knowledge deepens the concept of effectiveness in the area of MIR (Gregory, 2010).

Results Expectations and Contribution to Literature

Results highlighted in the study agreed with what was made probable in the framework as suggested by literature reviewed. The literature identified and used in chapter 2 has been significantly augmented with the factors considered in aiding the organization to improve on the acquisition and retention of major incident concepts that are required by frontline staff when responding to and managing major incidents. The literature has shown the importance on various aspects required by frontline staff, whilst there is traction in the field by developing the MIR guide, having an awareness program and involving staff in exercises and drills, there

is more that needs to be done as highlighted by evaluating the MIR guide and applying it to knowledge, understanding, perception and satisfaction. Contribution to literature as indicated by results in the study indicated command and control, terminology (communications), HAZMAT and use of action cards are fundamental areas that needs to be concentrated on.

Results Implications to Practice, existing Body of Research and Doctoral Degree

The results have astounding implication in the support of reviewing the current training practices in major incidents within HMCAS, the factors that were highlighted are directly involved in aspects that require change as outlined in literature on training and education as well as aspects or factors that organizations need to concentrate on to ensure frontline workers response to major incidents is understood.

In being able to fully understand issues pertaining to acquisition and retention, cognitive states need prediction, this “cognitive state” can only be achieved by having an understanding of cognitive theory based on skill retention and acquisition in any field of study (Kim, Ritter, & Koubek, 2011).

The results here highlight that the organization would need to consider the areas that would require better understanding, in doing so aspects such as command and control, communications which includes terminology, triage, action cards and Hazmat would be better prepared for and validated by outcomes of this study. There would be a need to research specific areas within each theme, example under communications which aspect is problematic i.e., radio use, channels to choose, specific terminology used in HMCAS when it comes to major incidents, to further validate the study. The outcome of data produced because of the questions themed for research in question 2 is congruent with literature reviewed for this study, one can therefore conclude that there is value added in both a meaningful and significant way as existing paradigms were challenged, new insights were uncovered, and the

connection of the theoretical framework being connected to existing knowledge in the area of major incident response and management.

The research objective has met the requirement of the doctoral degree program as outlined by the university.

Research Question/Objective/Hypothesis Three

One of the main objectives of this study was to understand expectations of major incident response around mass gatherings by frontline paramedics and managers in the use of response aids or action cards to boost confidence when working at mass casualty incidents. The HMCAS MIR guide uses various aids to assist frontline staff, however it is not being used effectively or not being used at all as highlighted by data collected. There needs to a scenario whereby frontline staff bridge the gap and make use of these aids to better assist them in making correct decisions and prevent them being led by emotions e.g., triaging children.

Fitzgerald et al. (2017) highlighted that in addition to standardizing training within the EMS sector, specific tasks (e.g., triage) must be specific to function. There were 6 variables used to theme the satisfaction with confidence post participation in MIR training, these variables included aspects of using the METHANE, undertaking of triage, undertaking the silver commander role, establishing of command and control, communications and HAZMAT. The results of the data obtained was found to be statistically significant in the specific areas mentioned above, which meant that the null hypothesis was rejected and the alternate accepted.

This then led to the conclusion that aids are required by frontline staff to increase their confidence levels, address concerns faced with, gives them clear definition of roles and responsibilities and improvement of patient care in certain areas e.g., accurate triage (Waltrich, Sheen, & Ling, 2021).

Results Interpretation under Limitations

In asking the respondents questions in the data collection tool, post results indicated that there is room for research within specific areas mentioned in the previous paragraph that would need to be probed further to fully understand and define aspects of the use of aids. An example of this would have been to probe deeper into the type of primary and secondary triage used in HMCAS and their understanding of it, as there are different types of triages used in various pre-hospital and in-hospital settings around the world. HMCAS being an organization that employs from around the world (discussed in chapter 1) would be best suited to delve into this area.

This did not influence the result interpretation as the sample size was deemed to be sufficient to define the areas described above.

Results Response to Research Problem and Purpose

The findings of the research responded to the research problem and purpose by directly identifying the areas that would need to be reviewed in the guide by ensuring use of the aids which are clearly defined for use within the guide. These areas are discussed in detail within chapter 2 of this study and highlights the aids being advised for use by frontline paramedics in responding to and working at major incidents. The results showed that a vast majority of the respondents do agree that making use of aids, action cards to indeed increase their confidence at a mass casualty scene.

Benefits do include improvement when it comes to confidence, a deeper understanding of one's own roles, organization policy knowledge and emergency plans being better understood (Waring, Skryabina, Goodwin, Lino, & Amlot, 2021).

Results Alignment with Conceptual Framework and Significance

The findings and or results aligned with the conceptual framework of this study. The findings outlined in the study corresponded with the variables agreed on within the context of the conceptual framework as well as the significance of the study which was explained in chapter 1 of the write up. The literature discussed in chapter 2 supported the findings from the data collected. The applicability of the results shown offers the organization that the study was undertaken in, for additional investigators to validate the conceptual framework in this study into a recognized theory.

Results Expectations and Contribution to Literature

Results highlighted in the study agreed with what was made probable in the framework as suggested by literature reviewed. The literature identified and used in chapter two has been significantly augmented with the factors considered in aiding the organization to improve on the acquisition and retention of major incident concepts that are required by frontline staff when responding to and managing major incidents by ensuring that use of cognitive aids such as action cards be used at all times.

Conflict with literature was not observed as the researcher validated variables used in this study by other studies such as five key challenges when responding to major incidents (Hugelius, Becker, & Adolfsson, 2020), teaching emergency and disaster management in Australia: Standards for higher education providers according to Fitzgerald et al. (2017) and the type of components of emergency preparedness exercises improve healthcare practitioner's emergency response learning. Waring et al. (2021) highlighted some of the literature highlight the use of aids in mass casualty incidents which are discussed further in this study.

Results Implications to Practice, existing Body of Research and Doctoral Degree

The result implication to practice highlights the significance that cognitive aids play in practice amongst EMS personnel. This validates the organizations need to ensure that action cards and or reference cards/aids are used at all times.

The outcome of data produced because of the questions themed for research in question 3 is congruent with literature reviewed for this study. One can therefore deduce that there is value added in both a meaningful and significant way as existing paradigms were highlighted and the benefits thereof, existing insights were validated, and the connection of the theoretical framework being connected to existing knowledge in the area of major incident response and management.

The research objective has met the requirement of the doctoral degree program as outlined by the university.

Recommendations for application

Literature indicate that EMS must be involved in mass casualty and major incident response at all levels. The continuous education and training in the field is important as described by various authors in the field. The purpose of this study was to evaluate the current MIR training program to improve the acquisition and retention of frontline paramedic's knowledge in major incident response in Qatar within HMCAS.

In analysing the data, there were clear areas identified that needed attention, such as command and control, communications, triage, use of cognitive aids e.g., action cards and HAZMAT, that would benefit both frontline staff as well as the organization represented.

Training and education and the practical application of knowledge are areas that would need to be improved on, to better equip and manage expectations of staff working at mass casualty/major incidents.

Making use of prior knowledge, skills, experience, satisfaction with confidence in training and satisfaction with MIR concept understanding, it was evident from the analysis, and the literature discussed in chapter 2 that training and education would need to be at the forefront of MIR. Training would need to include both theory as well as practical aspects such as discussions, tabletop, and live exercises, and must be suited for specific staff in specific roles (areas of responsibility/qualifications) within the organization.

The MIR guide being used by the organization is current, with a review due in 2024. Being current and aligned with current international best practice, frontline paramedics would need to know and become more familiar with the various components of it which is indicated by the results of the study data.

In addition, recommendations for application would include observations as part of the national exercise carried out by the country once a year. Observations include evaluators review, whilst this can be seen as a simple mechanism of gaining first-hand impressions in the field, it does provide specific knowledge to the target group, however it should not be seen as accurate a representation of the survey used to collect data but it can be helpful for further research and application (Consultores, 2019). Prone to interference by observer attitudes, the observations highlighted in the following paragraphs should be interpreted with reservations (Consultores, 2019).

Recommended for application are the following which are based on the study objectives:

Objective 1 of the study is to identify barriers that influence acquisition and retention information in response to major incidents at mass gatherings. Identified as barriers having an influence on acquisition and retention of information are continued education and training, command and control and role identification which will be further explained below:

Continued Education and Training

Failure of frontline paramedics understanding various components within the MIR guide and not engaging in continuous practice as well as furthering one's knowledge in the area or major incident response negatively impacts frontline staff in the accurate management and response to major incidents in HMCAS.

The recommendations for education and training flows from the findings of this study as well as work done by other researchers of which was discussed in chapter 2. Areas that were highlighted as the outcome of the analysis of the data indicate that the current training awareness program is not sufficient and more needs to be done to better prepare and equip frontline staff to be able to work and respond to mass casualty incidents.

In line with reviewing the major incident guide to improve acquisition and retention of frontline paramedics in major incident response, it is apparent (based on outcomes from the data) that there is a need to develop and implement a formal training program with strategic aims, objectives, and outcomes.

With the establishment of the department of healthcare professions (DHP) within the Ministry of Public Health (MOPH), there is the requirement of continued professional development (CPD), therefor implementing such a training program and suggesting to the organization the importance of education and training in the field of major incidents will ensure benefit for both frontline staff as well as for the organization itself.

Command and Control

All levels of command i.e., gold, silver and bronze roles would need to be understood by all frontline staff, those that are in specific roles on the major incident rotor would need specific training in areas of roles and responsibilities in specific areas identified. These areas recognized is the need in establishing or identifying as a silver commander (first EMS person on scene), handing over of command to a more senior person on their arrival, being able to

establish additional roles identified which is specific to the major incident level declared. In addition to the identifying of roles, the responsibilities would need to be understood. These should follow the action cards that has been developed for use by the organization (example, appendix 1) in line with establishing and setting up of roles and responsibilities.

According to published studies, there is a requirement for improvement of healthcare workers in areas of command and control, safety, communications, and assessment (Sultan, Carlstrom, Sorenson, Alruwaili, & Manesh, 2023).

Role identification

The commander designated or appointed as being first on scene at the incident must be able to command (other roles) as well as control every aspect of the incident. These should include the establishment of communication lines being available to monitor all aspects of the scene, even if they are doing something else. To ensure team dynamics the commander must be able to keep the entire team calm and avoid panic. The commander needs to be composed and focused, be able to listen and arrive at appropriate decisions by making an assessment of the situation.

Making use of an appropriate approach in making an assessment, he or she would need to know what steps are next in the decision-making process or assessment of the major incident. Be able to assess safety aspects to self, the scene and survivors. In addition, communications is a fundamental aspect a commander would have to be well acquainted in. Being able to understand the infrastructure required and needed in setting up of effective communication lines is fundamental, these include knowing TETRA radio talk groups, dissemination of appropriate channels to corresponding roles within the talk group, understanding the links required to be set up between various control centres and the roles of the centres.

Additional assessments must include knowing the METHANE and being able to correspond, this would be the appropriate required pre-determined attendance of resources required, triage and the allocation of roles i.e., primary and secondary triage personnel, being able to set up the MIR scene (infrastructure layout), ensure the appropriate use of triage sieve and triage sort and the use of the cognitive aids in triaging, have an understanding of patient acuity and knowing the resources required in order to necessitate such treatment and finally understand what modes of transport are required (road or air), destination of patients in accordance with receiving hospitals.

Objective 2 of this study was to develop a custom-made major incident response training curriculum that can assist staff (frontline paramedics and managers) in the acquisition and retention of information when faced with mass casualty response at mass gatherings by assessing specific common topics that were identified or misunderstood, this will form part of a future improvement project. Identified as part of this objective included topics being misunderstood are triage, hazardous materials and communications which are further elaborated on below.

Triage

Based on existing literature and recommendations on prehospital triage there seems to be little evidence in support of one type of triage over another, however there is preference in some (Jetten, Seesink, & Klimek, 2022).

In reviewing 632 studies on prehospital triage there is enough evidence to support that over triage prehospitally is most common compared to under triage however there is room for accuracy improvement with making use of cognitive aids (Jetten, Seesink, & Klimek, 2022).

The first responders within the organization (HMCAS) uses the sieve and sort triage tool. In reviewing the triage tool, Jetten, Seesink, and Klimek (2022) highlighted that the triage sieve tool showed a significant correct response when used together with a cognitive

aid or decision card (see appendix 2), under triage was reduced and training in this tool vastly adds improvement in accuracy, so too for the use of triage sort for secondary triage of patients (see appendix 3) just an hour of training can improve triage and prevent both over and under triage of patients at mass casualty scenes, with the retention of what has been taught for at least 6 months irrespective of medical background, provided that the triage sort cognitive aid is used.

Hazardous Materials (HAZMAT)

Data collected has shown that frontline staff were not at all confident when response to questions on understanding of HAZMAT incidents, bioterrorism, donning and doffing of PPE in HAZMAT were reviewed and analysed. With Qatar being the one of the leaders in the production of natural gas, various communities within the State are exposed daily to the possibility of a major incident related to hazardous materials. In addition, one should not forget the novel Corona Virus (COVID-19), Ebola Virus Disease, or the Lebanon incident where ammonium nitrate exploded injuring almost 6000 people and leaving 204 dead.

The importance of having an understanding and knowledge in HAZMAT response within the ambulance services is due to it being the primary medical responding agency to any significant or mass casualty incident in the state.

In a similar review as part of an approved study in HMCAS (Ref: MRC-01-20-372) by Farhat et al. (2022) the knowledge and proficiency of frontline paramedics was tested in HAZMAT and chemical, biological, radiological, nuclear (CBRN) knowledge to determine safety and efficiency in the field by frontline staff to ensure success in the management and response of such incidents.

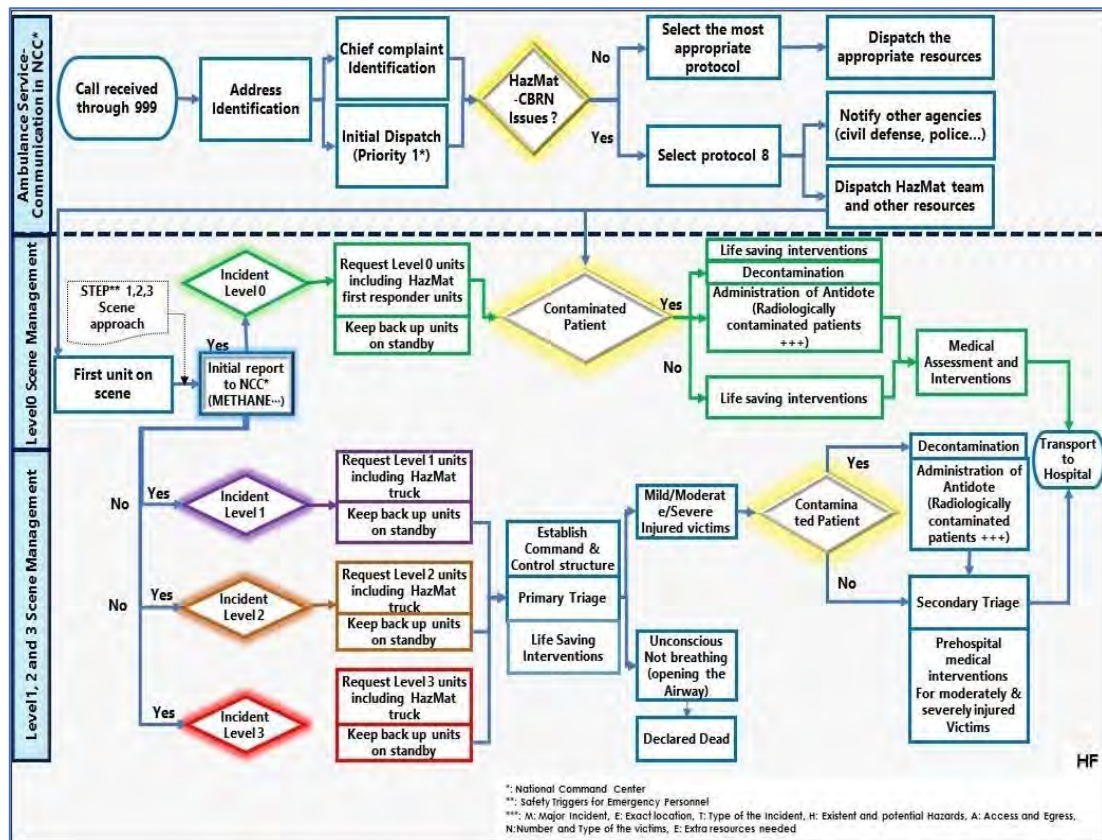
In identifying the root cause and categorizing factors (environmental, risk-based plan and training) the cause and effect “Fishbone diagram” was used, the following was indicated to be recommended as future training to HMCAS frontline staff:

- (a) Mass casualty incident decontamination.
- (b) Pre-Hospital response to emergencies regarding bioterrorism.
- (c) Pre-hospital response to and management of radiological emergencies.
- (d) Pre-hospital response to and management of disease outbreaks and epidemics

Hassan et al. (2022) further highlighted aspects on training in mass gathering type events and HAZMAT, by highlighting all HMCAS personnel undergo HAZMAT training including newly recruited personnel that are brought in for specific mass gathering sporting events being hosted by the country.

In another study done by Hassan et al. (2021) within HMCAS (Ref: MRC-01-20-372) on prehospital frontline workers readiness towards HAZMAT- CBRN incidents in a cross-sectional study, results indicated that there are indeed deficits in staff knowledge in the area of HAZMAT training, response and management.

In addition to the factors highlighted in this study and supported by the factors raised by Hassan et al. (2021) the process map of HAZMAT incident management would need reinforcing to all frontline workers.

Figure 50*HAZMAT Process Map*

Note. Reprinted with permission

Further recommendations for application in HAZMAT, the following would need to be considered:

- (e) Use of the primary response units deployed to HAZMAT incidents in anticipation for an actual incident.
- (f) Understanding of the HAZMAT component of the MIR plan as outlined in the MIR guide used by the organization.
- (g) Frontline workers ability to accurately identify HAZMAT-CBRN agents at a scene.
- (h) Further training on the clinical assessment and decontamination measures required for HAZMAT-CBRN patients on being exposed to incidents that are chemical in nature.

- (i) Frontline workers being familiar with lifesaving and safety measures when responding to and working at HAZMAT-CBRN incidents.

Farhat et al. (2021) further highlighted that communication, PPE as well as donning and doffing are additional areas that need attention for frontline staff to be familiar with to respond and manage HAZMAT incidents. The development and delivery of a HAZMAT awareness course for pre-hospital staff is fundamental to improve the knowledge level at a wider yet innovative level to ensure staff acquisition and retention of HAZMAT procedures at an incident, this can be done online, face to face or as part of a blended training package (Hassan et al., 2021).

Communications

According to Harmsen, Geeraedts, Giannakopoulos, Terra, Christiaans, Mookink, and Bloemers (2017) communication can be defined as the provision of ensuring an operational snapshot of an incident with the ability of creating a report that is credible. There is a clear need for effective understanding of communications and skills in this area for effective reporting and handover during a major incident (Harmsen et al., 2017).

Information gathered from the data, indicated that frontline staff were unclear on aspects of communications used in the organization. Various communications infrastructure has been used in all EMS systems around the world, however each system has a different approach, meaning there is no standardization. In addition, communication, and aspects thereof (terminology, radio use) is only as effective as the people that are trained to use and understand them. Communication requires frontline staff to be confident in knowing all aspects of communication well to be effective in the management and response to major incidents.

The organization has the responsibility to ensure that preparedness in communication, as it is the basis of being effective in mass casualty response. These communication and

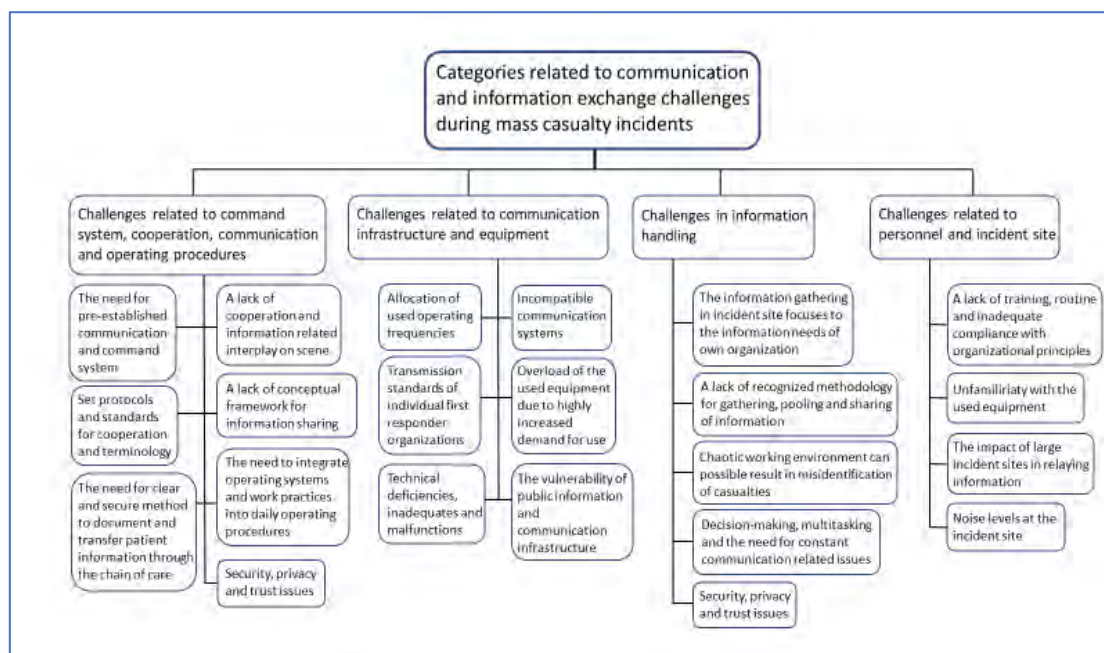
exchange of information at mass casualty incidents should include skill, knowledge and communication strategies to ensure information coordination and closed loop communication (Chungong, Choupe, Ho, Nuzzo, Brown, & Kandel, 2021).

Communication in any mass casualty incident has been shown to be deficient, insufficient, and problematic amongst first responders at the site of an incident due to poor planning and gaps in current systems (Chungong et al., 2021).

Based on the outcome of data analysis around communication strategies, the specific areas for review and recommendations are communication set up in the command system and operations, terminology review and common understanding, use of TETRA radio infrastructure and the implementation of cognitive aids explaining the communication process from beginning to closure of the incident.

The areas for review and recommendations are aligned with work done by Palmu (2022) where the author identified the following communication challenges by reviewing work done by 9 authors between the years 2012 and 2021 in communications at mass casualty incidents, identified were, command systems, communication operating procedures and cooperation, equipment infrastructure use related to communications, the handling of information and understanding and emergency responders at the incident site communications.

The following areas would be recommended for implementation based on literature and outcomes of this study:

Figure 51*Areas for recommendation**Note.* Adapted with permission

Objective 3: Understand expectations of major incident response around mass gatherings by frontline paramedics and managers in the use of response aids or action cards to boost confidence when working at mass casualty incidents.

Action Cards/Reference Cards

Objective 3 of recommending the above for application is due to frontline staff needing to understand and be completely familiar with the following, being able to recognize a major incident, being able to declare a major incident (METHANE) and to the appropriate Level of response required, being able to set up an immediate command structure and understand the requirements for handover to a more senior staff when they arrive, be familiar with talk groups and being able to set up/delegate appropriate radio channels to corresponding commanders, being very familiar with primary triage and secondary triage, including use of the triage cards

and processes (recording and updating), Understand pre-determined attendance and resources (logistics) and the use of reference or action cards as cognitive aids.

A meta- analysis study conducted by Greig, Zolger, Onwochei, Thurley, Highamn, and Desai (2023) indicated that the use of cognitive aids has demonstrated completeness of a task correctly and thus reducing errors, this included the use of aids when demonstrating its use in skills that are deemed to be non-technical. Making use of aids have shown to standardise management due to variances in content development, understanding and presentation.

Working in complex and environments that are dynamic in nature has shown to put pressure on systems which directly influence risk, memory, outcomes, and decision making (Greig et al., 2023).

Incorporating cognitive aids (action/reference cards) into use by organizations has benefits as they offer compliance in tasks being required to be completed with definable actions.

Summary of Recommendations

The recommendation for implementation is aligned to chapter 2 of this study as well as the data that was produced as part of the study. In order of the objectives used the following are recommended as discussed in the preceding paragraphs:

Objective 1: continued education and training, command and control and role identification.

Objective 2: triage, hazardous materials and communications.

Objective 3: use of action cards

Recommendations for future research

The findings of this study have indicated factors that can be further researched to provide both the acquisition and retention of managing and responding to major incidents within HMCAS. The variables being assessed because of the objectives and hypothesis have

been looked at from various satisfaction and understanding perspectives however the factors were limited to frontline staff within HMCAS in the State of Qatar only.

These, as well as other limiting factors, has afforded the opportunity for further research in this field against the variables tested as well as in other additional areas that would benefit both the organization and the EMS professional as a whole in the area of major incident response. It would be further required that future researchers be able to identify and fill in the gaps that was not thought off in this research and hence add to the recommendations so that organizations such as HMCAS and other EMS can consider in assisting their teams to be able to respond and work at major incidents.

The recommendations for future research are, training and education, incident command systems, interoperability and the disaster management continuum within EMS are discussed under the respective headings in the following paragraphs.

Training and Education

Mass casualty incident training and education has been highlighted by various authors (see chapter 2), these studies have incorporated both pre-hospital and in hospital reviews of major incident training and recommendations as per observations done in either training or real incidents that has occurred over the years.

Future research in education and training in major incident response within the organization would include the following areas as highlighted chapter 2, as well as by Usoro et al. (2023) who had done a scoping review on the essentials components that first responders would need training in, to better equip them in responding to mass casualty incidents.

These components were divided into themes and subthemes and are aligned with results of this study. Certain themes and subthemes, under training and education are also highlighted in other areas for “future research”, in later paragraphs.

The themes and subthemes according to Usoro et al. (2023) which can be recommended for future research under training and education within the organization are:

- (a) Planning, Procedures and Policy: frontline staff would need to have an appropriate knowledge of the MIR plan/guide being used by the organization, know the activation procedures used, understand the policies and procedures used and standard operating procedures.
- (b) Incident Command: know the command-and-control arrangements being used by the organization, an understanding of the operation centres/command centres within the organization, be able to set up command and control at the scene according to the guide of the organization and understand interoperability, interoperability components within the organization and mutual interoperability policies, SOP's and policies in place.
- (c) Treatment and Transport: understand triage and type used within the organization, understand patient distribution in line with arrangements in place between EMS and hospitals and mass decontamination or HAZMAT.

In addition to the recommendations made by the Usoro et al. (2023) a study done by Wexler, Schultz, Biddinger, Ciottone, Cornelius, Fuller, Lefort, Milsten, Philips, and Nemeth (2023) indicated essential components in disaster medicine that one would need to know and understand to be effective and competent. The study by Wexler et al. (2023) set out to define a curriculum for disaster medicine. The authors had described 14 areas that would need to be included in a training and education curriculum.

The curriculum recommended by Wexler et al. (2023) is aligned to the outcomes highlighted by Usoro et al. (2023) and the results of this study which were highlighted and discussed in chapter 2. For the purpose of this study, and in line with future recommendations,

based on outcomes, 13 areas would be included for future research within the organization as well as for possible other EMS systems.

The factors related to prehospital disaster management components and the core competencies related to patient care, medical knowledge, practice-based learning, and skills related to each of the 14 areas described by Wexler et al. (2023) under the following areas are opportunities for research.

Area 1: Principles of disaster medicine; triage and its components as well as allocation of resources, investigate the various triage systems used, and as the outcome of the research, adopt the most appropriate for the organization.

Area 2: Emergency Management Systems and Medical Oversight; understanding of the disaster management continuum, local and national disaster management response, basic knowledge of incident command systems, designing of exercises and effective execution of the exercises.

Area 3: Disaster Medicine and Public Health Systems; understand roles and responsibilities in areas of disaster medicine that is related to public health and the effects of climate change on disaster medicine.

Area 4: Disaster Preparedness and Health Care; understanding of incident command systems, understand the command centre roles and responsibilities, communications, surge capacity and overall mass casualty management.

Area 5: Disaster Resilience and Preparedness; understanding of organizational and national preparedness, preparedness for oneself and business continuity for senior managers and or commanders.

Area 6: Field Logistics and Operations; understand triage, treatment and transport protocols, decontamination, mortuary and surge mortuary protocols and requirements, mass casualty incident operations, and operations continuity.

Area 7: Disaster Management and Psychological Support; effects of dealing with mass casualty/disasters on mental health and organizational support.

Area 8: Legal and Ethics; dealing with ethics and legal issues in disasters and mass casualty response.

Area 9: Prehospital Disaster Medicine; there are several factors that an organization can consider for inclusion for training and education in this aspect highlighted by Wexler et al. (2023) however, to keep in line with chapter 2 and the outcome of the data of the study, EMS operations which incorporates command and control, communications (call sign use for commanders, establishing of talk groups and interoperability, back up in communication procedures and IT, chain of command and support) would need further research in line with education and training. Scene assessment and being able to identify the scenario faced with (METHANE, further information that is available, scale of the scene faced, mutual aid requirements and type of casualties e.g. adults, paediatrics, burns, trauma or medical) are all aspects that contribute to scene assessment. Tactical EMS response to active threats such as marauding shooters, stabbing incidents and explosions are areas that would need further development to both research and train staff to be complaint in.

Area 10: Chemical, Biological, Radiological, Nuclear and Explosive (CBRN) & Environmental type disasters; further research is required in this area of disaster medicine, factors that would need to be included in research as well as inclusion in training and education are being able to recognize the incident, know how to assess safety and response to it, treatment of patients, decontamination of patients, types of chemical agents used in these types of attacks, understanding of biological disasters, categories of bioterrorism agents, countermeasures, pandemics and their countermeasures, HAZMAT, personal protective wear and being able to use the correct type as well as donning and doffing of such, triage of patients,

blast, crush, and burn injuries, stampede, and adverse weather condition response are areas that need to be further investigated.

Area 11: Mass Gatherings; understanding mass gathering medicine is an area that would need to be included in education and training and further research would be needed in this area within organizations. Consideration would need to be given to mass gathering planning, crowd control and dynamics.

Area 12: Communications; areas within communication that responders would need to understand are in communication informatics and systems, use of social media and disasters (internet of things i.e. IOT), crisis and emergency risks in communication. Knowing the channels of communication being used in the organization, having a pre-determined list of staff contacts and their information, ensuring redundant systems are in place, knowing the devices that are being used and understand information that would need to be shared.

Area 13: Technology; there are various potential areas for inclusion in technology related to mass casualty or disasters. Some of the areas that have the potential for future research is telemedicine, patient tracking, crisis mapping and modelling of disasters for simulation purposes using artificial intelligence. There are various factors within the areas of education and training that overlap in other aspects of mass casualty response and management which has similar and common threads that would need to be better understood. With the two (2) articles being released in late 2023 by Wexler et al. (2023) & Usoro et al. (2023) solidifies areas for education and training within mass casualty response as well as highlighted potential areas for future research within the organization being studied as well as other EMS systems worldwide.

Incident Command Systems

Further research would need to be conducted in incident command systems (ICS) to ensure a common understanding and standardization system is adopted for the management and response at major incidents. Whilst results from the study has indicated that the MIR training/awareness course duration is not sufficient to fully grasp all areas major incidents, 55% of respondents agreed that the course did not offer them the skills and 59% agreed that the knowledge gained from the course was not sufficient.

On arrival of the first EMS unit on scene, the responsibility would be to set up command and control and take charge of the scene. Results further indicated that 44% either agreed to understanding the principles of command and control whilst 56% disagreed on knowing the principles.

Future research in command and control as part of ICS, would need to concentrate on specific aspects such as roles (e.g., Silver Commander, Bronze Commander) however there is more to just command and control. FEMA (2018) indicated that organizations generally have a simplistic incident command and control structure.

An understanding of ICS by frontline staff, including senior management that are on call for major incidents would need to be further researched within the organization. The incident command system (ICS) is the most adopted approach that has been used worldwide since the inception of emergency services management at major incidents, as this approach oversee both coordination and continued evaluation of the scene between all sectors (Nistor, Pham, Pickl, Gaidric, & Cococar, 2020).

In any response to major incidents that are deemed as high risk with high frequency, not making use of an ICS response heightens the risk of non-accountability, failure of integration of first responders at the scene, ineffective use of resources, lack in coordination

(command and control) and making use of a major incident response plan in a non-systematic method (FEMA, 2018).

FEMA (2018) describes ICS as a tool that can be considered as both effective and efficient that commanders would need to consider to be able to ensure that they have an organized response to mass casualty type events. The recommendation by FEMA (2018) is that ICS be used for all types of incidents, small, large, simple or complex. The reasoning behind this according to Perry (2006) and FEMA (2018) is accountability, maintain span of control, ensure that effectiveness is achieved in the command-and-control system set up and appropriate deployment of resources.

Areas for future research within the organization in line with the ICS and areas identified under command and control in this study are:

Terminology

It is imperative that responders speak the same language. Making use of common terminology eliminates miscommunication (FEMA, 2018).

Command that is Unified

In response to a major incident, multiple agencies would respond i.e. fire, medical and police. Multiple agencies would need to function as one whilst at the same time maintaining their own command and control structure. A unified command would ensure accountability, authority, and coordination (FEMA, 2018).

Chain and Unity of Command

Chain of command is the organization's structure that falls within the ICS and chain of command is seen as the individuals (Bronze, Silver roles) direct supervisor at the incident site i.e. bronze roles reporting to the silver roles and silver roles reporting to the incident commander. Chain and unity of command achieves an organization's objective at an incident and maintenance of personnel (FEMA, 2018).

Management by objectives

Span of control, procedures and protocols would be better understood and carried out if the scene is managed according to set objectives by commanders (FEMA, 2018).

Communications being integrated

Multiple agencies working together would need to ensure proper use of communications, this would need to be an understanding of types of communications infrastructure being used, all agencies having a robust channel of communication ensuring effective means of communication (FEMA, 2018).

Span of Control

An ideal span of control would need to have between 3 to 7 people to ensure agency effectiveness (HMCAS, 2021).

Transfer of Command

Prolonged scene/incident requires an effective take over and handover mechanism, this would need to include briefings, situational awareness and an understanding of various phases of the incident i.e. response or recovery (FEMA, 2018).

Recommending future research in ICS within the organization is to ensure acquisition and retention in key areas highlighted above in order to perform in roles and responsibilities allocated in responding to and working at in mass casualty/major incidents. Future research would identify perceptions, understanding and initiate learning practices in areas that would need to be better understood. Future research that would identify key areas would allow for ICS principles to be followed (Lindell & Litz, 2008).

Interoperability

In the event of a major incident or mass casualty type event, the need for fire, police and EMS to work together and share information or data is needed for successful management at levels in an emergency. The assumption is that interoperability exists in and between

services however studies have demonstrated that this does not exist (Gastaldi & Horlait, 2022).

Future research would need to be done to ascertain the level of understanding of the “interoperability” aspects used in emergency management within the organization and then expanded to other emergency services to further develop understanding, use and benefits within emergency services organizations and between emergency service organizations in the country.

With expanding the study to include other agencies, interoperability would enhance teamwork as this would ensure not only cooperation but understanding in a multi-agency response as measure to be able to ensure improvement in healthcare as well as mass casualty incident management and response (Bendowska & Baum, 2023).

Future research in the realm of interdisciplinary cooperation with focus on an interdisciplinary, multidisciplinary and transdisciplinary teams. According to Bendowska and Baum (2023) these terms (although used interchangeably) do differ in a semantically and etymologically manner. This area advocated for future research under the heading of interoperability would encompass multidisciplinary teamwork, were each professional from an agency work within their scope i.e. silver commanders commanding their respective agencies at a major incident.

Interdisciplinary would concentrate on roles and responsibilities being overlapped i.e. search and rescue of patients, where civil defence provide the search and rescue aspect and EMS provide the medical expertise by ensuring that aspects of communication, teamwork, professional roles as well as joint problem solving or objectives are highlighted and executed. WHO (2010) highlighted that any interprofessional education and training has the ability for collaboration, remove stereotypes, encourage interaction and a multi skill approach.

Bendowska and Baum (2023) further highlighted that there is a difference in professional culture, this difference brings about difference in beliefs, behaviour, customs, training and education. Future research amongst these medical professionals within the corporate would allow for an understanding of each other's culture, work behaviour and customs whilst identifying areas for future collaboration.

The five areas for future research under the heading of interoperability would be communications, training and exercises, use of technology, standard operating procedures (SOP) and governance (which are discussed under previous headings).

For clarification, the same topics as part of future areas for within the organization, applies for between organizations, as this would enable various emergency services to work together from a set of rules that has been developed together for being able to work together as one team in addressing objectives that has been set for responding to and managing a major incident.

Future Research in Governance

The establishment of a governing structure that is common will assist in improving processes, policies, and procedures by improving on cooperation, coordination and communication. Structures used in governance frameworks allows for clear decision making, and this allows for set objectives to be met.

Future Research in Standard Operating Procedures

Making use of SOP's assist first responders to effectively manage an incident across all areas at a mass casualty incident, these SOPs should have technical and operational components to be successful in implementation for use. They should be effective and unambiguous when being developed for use. Future research in SOP creation and use would need to be done in two phases, phase one is for within the organization itself (not shared) for use by first responders and then phase two would be SOP creation for between first responder

organizations in order for agencies to work together to be able to plan a coordinated, compatible platform for sharing of data, promote an effective multi-disciplinary response, work from a set of communication and terminology that is understood by all.

Examples of future research in SOP development for major incident response between organizations would be MIR first unit on scene, MIR scene set up, response to HAZMAT incidents and roles and responsibilities in MIR.

Future Research in Technology

Understanding current technology infrastructure is critical in being effective at major incidents, however it should be able to meet the needs of frontline staff i.e. simple to use and operate, effective, safe, secure and scalable to support small- or large-scale mass casualty incidents. There should be a combination of technology use i.e. radios, direct mode radios, safe intrinsic radios, application use that is specific to the organization. The organization that the study was conducted, makes use of various technology in the daily management of response to incidents. Future research in use of technology includes making use of internet of things (IOT), drone surveillance of the mass casualty incident site for effective mapping and planning for deployment of commanders at forward points, weather consideration for HAZMAT incidents, common applications that can be used to make response and feedback/updates easier and use of radios/talk groups.

Future Research in Training and Exercises

Various aspects of communication were highlighted in the study that lacks both satisfaction with confidence and satisfaction with the level of understanding. Further training and exercise development related to communications interoperability would need to be researched to fully understand aspects tested that first responders lack in the this area. These communications aspects were covered under training and education at the beginning of this section.

Aspects that would need further research are understanding the equipment and applications used by the organization. The equipment used in major incident response varies from technical equipment (weather stations, tents, ventilators, lighting, radios, electronic patient care record capturing devices, mobile data terminals) so that the end user would be able to trouble shoot in the event that they are called on to use any of the said equipment and applications in a major incident.

An additional aspect of interoperability is having regular structured table top exercises addressing various incident scenarios. This would address planning too and identify areas that would require further research and training. Whilst single agency table top exercises do not address or promote interoperability it would benefit promote mechanisms used in interoperability to promote management and frontline paramedic in critical aspects of major incident management.

Communications

Communications is said to be key in all aspects of mass casualty incidents, however it is also the key area for failure in prehospital incidents. Areas highlighted in a 2023 study indicated that prehospital responders being overwhelmed with communication equipment, infrastructure, outdated equipment and a lack in training were areas of concern (Causer, Barten, Willems, Mieren, & Saville, 2023). Future research would include frontline staff understanding of equipment, IT infrastructure and use of them within the service.

Disaster Management Continuum within EMS

The outcomes of this study highlighted several areas that first responders had indicated that they would like further understanding and training in. Areas indicated were related to the disaster management continuum which was discussed in chapter 2 of this study. Of interest, EMS systems traditionally concentrated on the response phase of disasters and not necessarily

on the rest. Areas highlighted by the respondents within the organization being studied showed that preparedness, response, recovery mitigation and mass gatherings are wanted by frontliners to be included in the major incident response guide and in future training being offered by the organization. The response on topics for further education and training is congruent with the response on frontline staff wishing to further increase their knowledge, which is over and above the training awareness package currently being offered by HMCAS.

A Saudi Arabian study highlighted similar findings as highlighted by this study, were an effective response in disasters would require being prepared in all of the areas as part of the disaster management continuum (Alrazeeni, 2015). Whilst both man-made and natural disasters are on the increase worldwide, there are no EMS organizations that would be exempt, this therefore requires that EMS are on top of understanding and being prepared in the field of disaster management (Alrazeeni, 2015).

Future research in this area would need to be done within the organization in line with the disaster management continuum, these include, how will HMCAS perceive their readiness in disaster management (non-frontline staff involved in current roles within the organization)?, what exact skills would be required by non-frontline staff to better understand disaster management?, and what is the current knowledge level that non-frontline staff have?

Whilst this study had addressed areas from the MIR guide with knowledge and skills in major incident response within HMCAS amongst frontline paramedics, more research would need to be undertaken to validate this in line with the disaster management framework used by the WHO and EMS to ensure all staff are prepared within the service.

Singh, Lamine, Sapkota, Bahattab, and Eriksson (2023) investigated themes in disaster management, and within the theme's enablers were highlighted for recommending effective response to and working at a mass casualty incident in the future. Of interest was the involvement of non-frontline critical roles such as procurement of items needed at a major

incident, supply of items/logistics from stores to scene, involvement of human resources and the involvement of a production team to physically set up infrastructure or drive vehicles and cleaning or restocking of vehicles/items during the response and recovery phase of the disaster management cycle (Singh et al., 2023).

Whilst various models, frameworks and procedures exist to be able to assist organizations such as HMCAS, the disaster management cycle discussed in chapter 2, is the most familiar. The WHO in 2021, with publishing the classification and minimum standards for emergency medical teams strengthens various aspects that fall within the disaster management continuum which was discussed in detail because of the data analysis outcomes of this study.

Conclusion

Over the past few years, there has been a significant increase in major incidents worldwide; examples of these, according to the Journal of Emergency Medical Services (JEMS), are the Chicago train collision, the drive-by shooting in Cincinnati, exposure to chemicals in Illinois, the COVID -19 pandemic and the current war. Major incident response has become one of the most researched and concentrated topics amongst emergency response agencies and countries worldwide. While there are some descriptive studies on preparedness and response, first responder agencies must assess their staff and organization preparedness in both skills and knowledge.

This study has been conducted at a time of necessity; the topic has been explored not only due to the recent COVID-19 pandemic, effects of global warming, wars and threats of it, and terrorist attacks but also due to the various mass gathering events that are being hosted by the country such as the recently completed FIFA World Cup Qatar 2022, but additional upcoming international events such as the World Aquatic Championships Doha 2023 and the Asian Cup Qatar 2023, to name a few.

The acquisition and retention of mass casualty response from man-made or natural disasters is the foundation for being prepared for, responding to, and managing these types of incidents by EMS. First responders, as seen by other studies highlighted in this study, as well as outcomes by the data shown in this study, show that EMS responders need to be adequately trained in specific areas. To fully understand this, a study was conducted among HMCAS first responders in the context of responding to and working at mass gathering-type events during a major/mass casualty incident.

This study aimed to understand the requirement of frontline staff in the context of major incident response to be fully prepared for such an incident, whether in daily responses or at a mass gathering event. First responders need to have an increased sense of realism when training for mass casualty response (Schulz et al., 2023).

The purpose of the study was to address major incident response amongst the first responders in HMCAS by evaluating the current major incident response guide and training used to develop the program to improve the acquisition and retention of paramedics when working at this type of mass casualty incidents. While the significance was aimed at observations and attitudes towards mass gathering-type events, the study looked into mass casualty response as a whole in order to highlight areas that would need improvement, as suggested by the data collected.

This descriptive cross-sectional study used a validated questionnaire that addressed the frontline staff within HMCAS. The questionnaire was approved by the university ethics committee and the organization's research and ethics committee. The knowledge, as well as the proficiency of frontline staff in the management and response to mass casualty incidents, was addressed in this study. Therefore, understanding the extent and addressing the risk factors can vastly improve the organization's readiness for such incidents in a successful and safe response.

Making use of the cognitive theory and the Kirkpatrick evaluation mode/theory, as discussed in chapter two under the conceptual framework, a meaningful impact would need to be made in major incident response within the organization, and this was achieved by focusing on skills disposition, knowledge, lifelong learning, teamwork, problem-solving, and critical thinking as well as personal values and competence.

Several causes of process variation were looked into to improve these processes; such variations identified were human resources, the environment, training and education, understanding, and the systems themselves. The questionnaire concentrated on the essentials of EMS response to mass casualty incidents. It was categorized into three main themes: environmental factors, risk-based preparedness, and education and training. The intrinsic factors (also known as factors that the organization controls) highlighted a risk-based preparedness plan that uncovered areas of improvement, i.e., policies, command and control, triage, technology use, interoperability, education and training, and topics from the disaster management continuum being mitigation, preparedness, response as well as recovery.

With regards to training and education, there was emphasis placed on frontline paramedics acquiring knowledge and skills to respond to and work in mass casualty-type scenarios, which must also be able to fulfil the training and educational needs of individuals as well as the needs of the organization.

Compared with previous studies such as the ones done by Usoro et al. (2023) who found that EMS staff has to have specific core essential knowledge and components such as knowledge and skills to be in the position to respond to a mass casualty incident. However, this core knowledge needed was best described by Wexler et al. (2023) with the development of the core model content needed by medical personnel to effectively manage and respond to mass casualty/major incidents for both man-made and natural disasters.

Moreover, other authors (discussed in chapter two) indicated that first responders needed training and education development in mass casualty incidents, as it would enhance confidence and ensure that first responders are mentally prepared to respond to such incidents. The results of this study indicated that knowledge acquisition and retention according to the major incident response plan/guide is present amongst frontline staff due to self-acquired learning or previous exposure learning from mass casualty response in their home country.

However, the results can be explained as frontline staff need to have awareness, knowledge, and skill upliftment to improve their acquisition and retention through education and training, workshops, and exposure to incidents via mock drills. Areas that were identified by this study and in line with other authors which would need to be known and understood by frontline paramedics within HMCAS are the understanding of disaster medicine and public health systems, emergency management systems, disaster preparedness, resilience, field operations, and logistics, legal and ethics, HAZMAT and CBRNe exposure, mass gathering events, communications, and technology use and interoperability.

This research has provided evidence using results that have met the study objectives, provided an answer to the study questions, and responded to the suppositions of the hypothesis.

The listed variables of the study were placed into 5 themes to address the research questions better; the themes identified were demographics, satisfaction with the MIR training format, satisfaction with the confidence earned after participation in the training, satisfaction with the level of MIR concepts understanding after participation in the MIR awareness training and future suggested topics that frontline staff would want included in future MIR training. The link identified between the study objectives and questions is in line with the purpose of the study, which was to review the current major incident training plan to improve

the acquisition and retention of paramedics when working at major incidents or mass gatherings so that all work from the same background and knowledge base.

The following paragraphs will conclude the study, using the findings as per the study questions related to the study goals.

The study's first research question was to be familiar with the expectations of major incident response by frontline paramedics within HMCAS, especially knowing what barriers inhibit the acquisition and retention of the components of responding to and working at major incidents. The findings have shown that there are indeed barriers that significantly impact frontline staff's understanding of major incident response. Such barriers identified were previous exposure to major incidents, the training format, skills acquired, and the organization's current guidebook, all of which were statistically significant.

The findings further revealed that the barriers highlighted are similar to other studies where it was shown that training and skills are essential and that a lack of these places an additional stressor on those working at major incidents (Reily et al., 2022).

A major contributing factor to the barriers identified was that 69.8% of the respondents had no prior in-hospital MIR exposure, while 48.1% had no exposure to prehospital major incident response. This effectively meant that those employed within the service rely entirely on the training and awareness package available when new staff join.

Training themes were subsequently identified for both in-hospital and prehospital exposure to major incidents, where skills, training format, and the understanding of the current MIR guidebook all yielded a significant association with gaps identified in the current practice.

According to Sadat, Khodayarian, and Vafaeenasah (2022) the additional competence of staff working at such incidents was vastly improved when specific topics were addressed in an organization's training programs. Within the organization being studied, the barriers

would need to be addressed to equip frontline staff better to respond to mass casualty incidents. The barriers identified, therefore, rejected hypothesis one of the study and accepted the null hypothesis.

The limitation of the study was the exclusion of non-frontline staff; however, other researchers have shown that non-frontline staff have an essential role to play in the overall management of major incidents (Greig et al., 2023). Although seen as a limitation, it opened the possibility for future research within the organization.

In addressing the study's second research question, common topics were identified within the overarching topic of major incident response that frontline paramedics often misunderstand within the ambulance service studied. Common topics identified from reviewing the literature highlighted communication difficulties, triage, debriefing post-incident, lack of training and preparedness, ineffective protocols and guidelines in place by the organization, interoperability, limited experience, and non-implementation or proper use of modern technology (Skryabina et al., 2021). The study literature contributed to this objective as the literature discussed in chapter two showed that these topics are, in fact, standard and would need attention.

In identifying MIR training topics that were weakly perceived in aiming to reduce the knowledge gaps concerning these topics, the following were identified as an outcome of the data analysis: HAZMAT, bioterrorism, and types of suits that are worn by frontline paramedics, which includes the donning and doffing, command and control and radio communications. While the topics identified are areas that are specific within the organization being studied, the need for further training and development, ICS, interoperability, technology debriefing, use of memory aids, and protocols or policies that assist frontline staff in the decision-making process when responding to and managing mass casualty incidents were identified.

The study results indicate areas needing attention within HMCAS major incident preparedness. The areas identified are in agreement with the conceptual framework i.e. the reaction to the training by the participants by evaluating the reaction to questions, which establishes thought processes, the learning (as an outcome) by the participants in relation to the training, which gauges the techniques or mindset by answering of the questionnaire to gauge the frontline EMS understanding, behaviour of the participants due to the training received which would evaluate the differences in behaviour, i.e., teaching of a new proposed curriculum that would need to be developed to incorporate skills and knowledge that are receptive and beneficial in the workplace. Moreover, the impact it has had on the organization as a result of the participant's behaviour.

All questions raised tested significance to tests that were conducted which led to the conclusion that there are indeed many noteworthy elements that influence frontline EMS staff; these factors identified are in line with Skryabina et al. (2021) Trzos et al. (2019) Hugelius et al. (2020) and Palmu (2022).

The second hypothesis, pertinent core essential topics do not need to be known, discussed, or taught within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers was therefore rejected. The null hypothesis was accepted, as the p-value (< 0.05) for the tables revealed that communications, command and control, HAZMAT, bioterrorism, and type of suits (Donning and Doffing), as discussed in the previous paragraph, showed statistical significance. This is consistent with other studies discussed in each of the headings mentioned.

The findings of this research, which addressed objective two not only addressed the conceptual framework but also tied in with literature and contributed to specific topics within a broader topic that frontline staff within EMS would need a better understanding of.

The study contributed to further research within objective two of this study and highlighted areas for implementation within the organization; limitations were also identified. However, again, as highlighted under the conclusion of objective one, the study's limitations were the exclusion of non-frontline staff. However, other researchers have shown this to have an important role to play in the overall management of major incidents (Greig et al., 2023). Although seen as a limitation, it opened the possibility of future research within the organization.

The third objective of this study was to understand expectations of major incident response around mass gatherings by frontline paramedics and managers in the use of response aids or action cards to boost confidence when working at mass casualty incidents.

Although results here indicated satisfaction with the training, the continuous variables indicated that data was not normally distributed. Interestingly, when the data was quantified, four areas were identified that contributed to answering question three, i.e., use of action cards, triaging, levels of response, and role-specific training. The findings were congruent with studies performed by Porthouse, Clancy, and Thurgood (2022) which indicated that clear objectives validated a system as it performs consistently. However, Verheul, Visser, Beerens, Duckers, and Bierens (2018) looked into exercises in preparing hospitals for mass casualty-type incidents; they similarly highlighted that consistency validated the use of tools used in mass casualty incidents.

As this was the first study of the acquisition and retention of major incident response within the ambulance services in Qatar, more research would need to be undertaken to validate results as an accurate reflection of actual preparedness. In the recommendation of future research, several factors have been identified and recommended, i.e., training and education, which would need to incorporate aspects of planning and policy development, incident

command, and familiarization with the organization's treatment and transport protocols and standard operating procedures.

Moreover, this study has identified specific gaps in the training and awareness that the organization is undertaking. The gaps identified and that would need to be included in future major incident response are education and training, understanding of the organization's major incident response plan, uniform integration of the disaster management continuum into current awareness and training, and use of technology and incident command systems. Using a unified and accepted major incident response course by the organization being studied would enable frontline paramedics to develop as individuals, as the need to learn more and do more can only be achieved by allowing them to contribute to all the identified phases of major incident response.

While the study investigated the acquisition and retention of frontline paramedics and mass casualty incidents as the primary targets of the survey, the limitation (as discussed in previous paragraphs) is in line with other studies that other personnel are involved in preparing for, responding to, and recovering from an incident. While major events are being planned for the country, there would be the need to hire staff for short-term contracts to provide medical cover at the various sites simultaneously; this would increase the frontline staff capacity, which would require additional critical training. This limitation has offered ideas for new research opportunities within the organization to be done in conjunction with this study.

Frontline paramedics are involved in prehospital emergency care of patients. Therefore, strong emphasis is placed on education, training, skills, and continued assessment in various prehospital emergency care response disciplines and transportation of sick and injured patients. Moreover, the development of methods used in teaching has, over the years, evolved from didactic to involvement of learners through various mechanisms such as

workshops, scenario-based methods, and, most recently, making use of technology (Aminizadeh et al., 2019).

What must be remembered, according to Curtis, Trang, and Chason (2018) is being able to recognize knowledge proficiency in a subject does not equate to being competent in the execution of skills into actual practice. This was further confirmed by Horrocks, Hobbs, HlthMan, Tippet, and Aiteken (2018) where a scoping review was conducted. Core competencies were outlined with core technical as well as specialist competencies needed by frontline staff in order to be better prepared to respond to and work at mass casualty incidents; it was highlighted that the training and educating of frontline paramedical staff in disaster and mass casualty response should be an essential component of training within an organization as well as about the disaster management continuum, as it would prepare staff in their ability as well as their competence to respond in such incidents efficiently.

The study has identified areas for future research that can be done to ensure further the acquisition and retention of staff working within the organization as well as external emergency services involvement and possible areas within the corporation involving other healthcare workers. Highlighted within the study for future research are incident command systems, training and education, interoperability, and the disaster management continuum.

In summary, this study delves into the critical domain of major incident response, focusing on the specific context of the Hamad Medical Corporation Ambulance Service (HMCAS). The escalating frequency and severity of major incidents globally, ranging from the Chicago train collision to the ongoing COVID-19 pandemic, underscore the imperative for robust emergency response mechanisms. This research is particularly timely considering the recent and upcoming major events hosted by Qatar, including the FIFA World Cup Qatar 2022, the World Aquatic Championships Doha 2023, and the Asian Cup Qatar 2023.

The essence of preparedness, response, and management in the face of mass casualty incidents, whether stemming from natural disasters or human-made crises, forms the bedrock of emergency medical services (EMS). The study recognizes the pivotal role of well-trained first responders and emphasizes the need for a realistic approach in their training, as highlighted by Schulz et al. (2023). To this end, the research conducted within HMCAS focuses on understanding the specific requirements of frontline staff in major incident response, considering both their day-to-day responsibilities and their roles during mass gathering events.

A comprehensive review of the existing major incident response guide and training programs within HMCAS serves as the basis for program enhancement. The study, approved by both the university ethics committee and the organization's research and ethics committee, investigates the knowledge and proficiency of frontline staff in managing mass casualty incidents. The findings underscore the importance of addressing risk factors and improving organizational readiness through targeted interventions.

Applying the Kirkpatrick evaluation model, the study achieves a meaningful impact on major incident response within HMCAS. By emphasizing skills disposition, knowledge, lifelong learning, teamwork, problem-solving, critical thinking, and personal values and competence, the research identifies areas of process variation. These variations, including human resources, environmental factors, training and education, understanding, and systemic elements, are explored to enhance major incident response.

The study employs a descriptive cross-sectional approach, utilizing a validated questionnaire to capture the perspectives of frontline staff. Themes such as environmental factors, risk-based preparedness, and education and training emerge from the questionnaire, shedding light on intrinsic factors controlled by the organization. This risk-based preparedness plan reveals opportunities for improvement in policies, command and control, triage,

technology use, interoperability, education and training, and various stages of the disaster management continuum.

Training and education take centre stage, with an emphasis on arming frontline paramedics with the necessary knowledge and skills for effective responses to mass casualty incidents. Drawing on insights from Usoro et al. (2023) and Wexler et al. (2023) the study highlights the core essential knowledge needed by EMS staff, extending this to a model content that encompasses both man-made and natural disasters. It aligns with existing literature emphasizing the importance of ongoing training and education to boost confidence and mental preparedness among first responders.

Despite indications of knowledge acquisition and retention in the major incident response plan/guide, the study emphasizes the necessity for continual awareness, knowledge enhancement, and skill upliftment. Recommendations include education and training programs, workshops, and exposure to incidents through mock drills. Areas requiring attention within HMCAS align with global standards, encompassing disaster medicine, public health systems, emergency management systems, disaster preparedness, resilience, field operations, logistics, legal and ethical considerations, HAZMAT and CBRNe exposure, mass gathering events, communications, and technology use.

Addressing the research questions and objectives, the study reveals significant barriers impacting frontline staff's understanding of major incident response. Noteworthy factors include previous exposure, training format, skills acquisition, and the organization's guidebook. The study identifies a need for addressing these barriers, emphasizing the importance of in-hospital and prehospital exposure to major incidents.

Furthermore, common topics misunderstood by frontline paramedics within the ambulance service are identified, aligning with literature on communication difficulties, triage, post-incident debriefing, lack of training, ineffective protocols, interoperability

challenges, limited experience, and underutilization of modern technology. The study contributes to future research by highlighting weakly perceived MIR training topics, including HAZMAT, bioterrorism, types of suits worn by paramedics, command and control, and radio communications.

Results reject the first hypothesis while supporting the null hypothesis, emphasizing the importance of addressing identified barriers and weaknesses in training topics. Limitations, such as the exclusion of non-frontline staff, open avenues for future research within the organization. The study acknowledges the first of its kind within the ambulance services in Qatar and recommends further research to validate results and enhance preparedness.

In conclusion, the study not only offers insights into the major incident response landscape within HMCAS but also contributes to the broader discourse on EMS preparedness. By identifying gaps, proposing improvements, and emphasizing the ongoing evolution of training methodologies, the research provides a roadmap for enhancing major incident response capabilities. Future endeavours should build upon these findings, exploring incident command systems, training and education strategies, interoperability measures, and the broader disaster management continuum to fortify frontline paramedics and ensure optimal responses to major incidents.

The following table summarizes the study's findings on the research questions.

Table 137*Summary of Findings on Research Questions*

Research Study Topic	Research Questions	Study Method	Findings of Questions	Interpretation of Limitations	Reaction to Purpose	Alignment with Conceptual Framework	Contribution to Literature	Implications to Practice	Recommendations for Application	Future Research
Reviewing the major incident training program to improve the acquisition and retention of frontline paramedic's knowledge in major incident response in	What are the barriers that inhibit the acquisition and retention of major incident response in mass gatherings by frontline paramedics and managers within the ambulance	A descriptive cross- sectional study	Managers and frontline staff are subjected to factors that inhibit the acquisition and retention of MIT knowledge affecting their ability to work and manage a mass casualty incident	Sample size related to the scope of the service, terminology as a barrier	There are gaps that exist as well as barriers. Skill Retention as well as education and training needs to be better understood	In agreement with the studies conceptual framework which is backed by literature and no conflict noted	Teamwork, problem solving, critical thinking and further development in education and training.	Further training is required to bridge the identified gaps	Command and control roles and responsibilities training with the use of action cards. Role Identification and aspects that would need commanding. Triage and regular	Inclusion of non- frontline staff in future studies under similar circumstances Training and education Incident Command

Qatar	service?						training with the use	Systems
							of current tools used	
What are the common topics within the area of major incident response for emergency services that are often misunderstood by frontline paramedics and managers?	Common topics	Exclusion of	Results	In	Augmentation	Supports the	by the organization.	Interoperability
	identified are	non-frontline	highlighted	agreement	of current	review of the		
	HAZMAT,	staff	were effective	with the	literature	current	HAZMAT	Collaboration of
	Bioterrorism,	participating in	in addressing	studies	identified and	training		an
	confidence with	the study as	the research	conceptual	used within the	practices	Communications	interdisciplinary
	donning and		problem. Nine	framework	study.	within	and its associated	approach to
	doffing		variables	which is		HMCAS in	infrastructure	Major Incidents
	procedures, ICS,		identified	backed by		MIR	Use of Action Cards	
	Radio		responded well	literature				
	communications		to the	and no			Training and	
	and	organizational	conflict			Education		
	interoperability		needs.	noted				
What current	Use of action	Exclusion of	Aids are	In	Augmentation	Cognitive		
major incident	cards, triage	non-frontline	required to	agreement	of current	aids have a		
response aids	confidence, levels	staff	increase	with the	literature	significant		

need to be	of response, role	participating in	confidence,	studies	identified and	influence
revised to better	specific training	the study as	address	conceptual	used within the	amongst
assist	and inclusion of	well as the	concerns, and	framework	study, on use of	EMS
ambulance and	disaster	limited sample	give clear role	which is	action cards in	frontline
critical care	management	size due to	and	backed by	high stress	paramedic
paramedics to	continuum in	exclusion of	responsibility	literature	situations.	use.
work	future training	non-frontline	to frontline	and no		
confidently at a		staff	staff.	conflict		
major incident?				noted		

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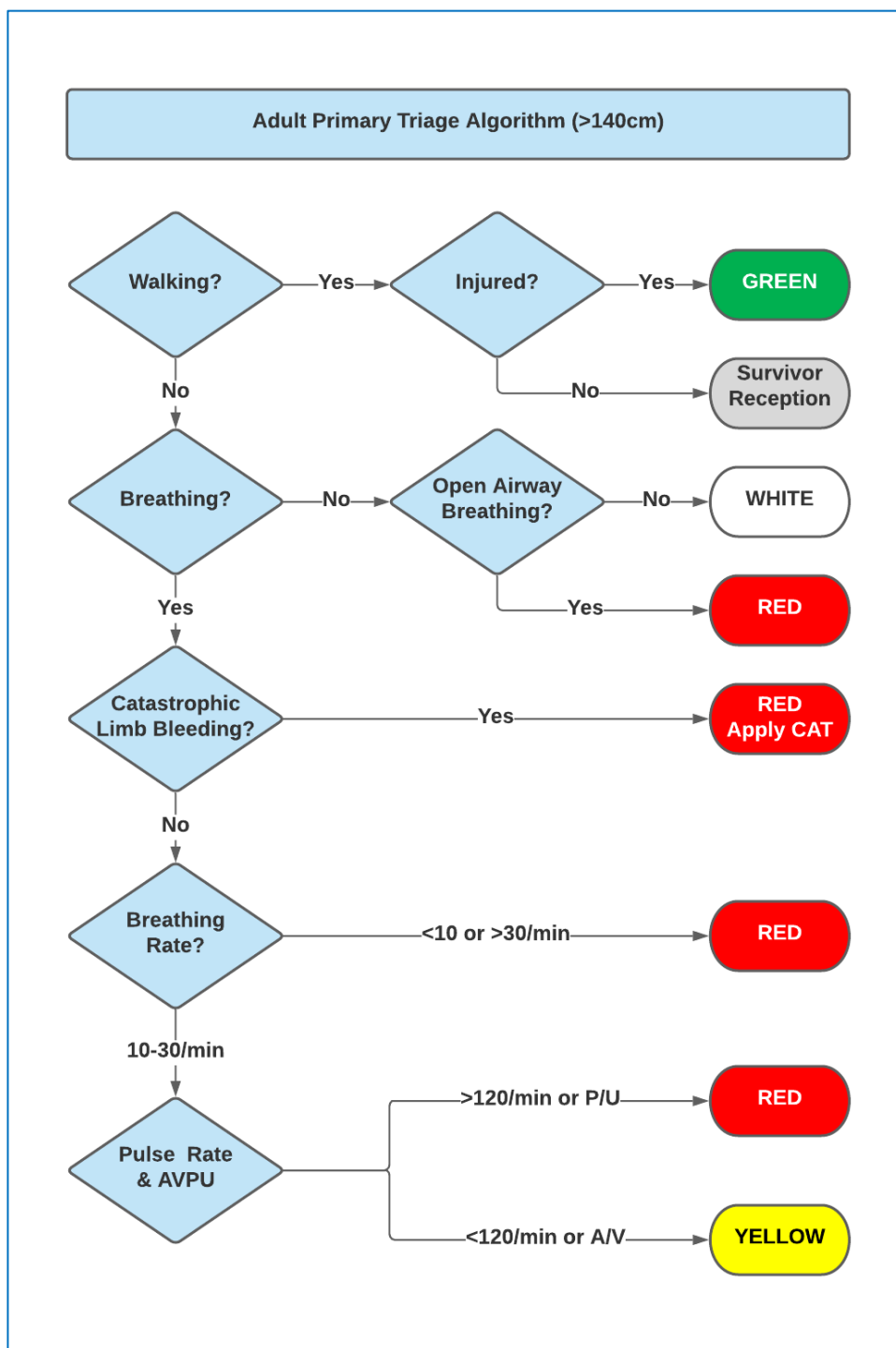
Appendix C: First unit on scene

 مؤسسة حمد الطبية Hamad Medical Corporation HEALTH • EDUCATION • RESEARCH صحة • تعليم • بحوث	 خدمة الإسعاف Ambulance Service	
HMCAS Major Incident Response Guide		MIR Ref: 003
FIRST UNIT ON SCENE		RADIO CALL SIGN SILVER COMMAND
KEY ROLE	First arriving Unit either as an Ambulance or First Responder assuming initial Incident Control (Driver) & Incident Command (Attendant) responsibilities until relieved by more senior commanders	
REPORTS TO:	RESPONSE LEVEL	COMMANDER
	LEVEL 0 or 1	Gold Command
	LEVEL 2 or 3	Gold Command
		RADIO CHANNEL
		Gold Major
		Gold Major
NO.	TASK	COMPLETED
	FIRST AMBULANCE OR RESPONSE DRIVER	✓ ✕
1	Book 'On Scene' with NCC on designated channel	
2	Park as near to the scene as safety permits; do not leave the vehicle	
3	Don high visibility clothing, safety boots, and safety helmet	
4	Assume role of Silver Control (Call Sign: SILVER CONTROL)	
5	Leave flashing emergency lights and hazard warning lights 'ON'	
6	Maintain comms link between attendant and NCC	
7	Provide initial METHANE Report to NCC from vehicle base radio	
8	Request additional resources as required	
9	Hold all staff at your vehicle until briefed by SILVER COMMAND	
10	Ensure all arriving staff wear PPE and bring triage packs	
	If first ambulance attendant on scene is alone (single crewed), then he/she will be responsible for carrying out the ATTENDANT duties described below:	
	Continued on MIR 003(2)	
NOTES/COMMENTS:		

MIR 003(1)

Appendix D: Silver Command

 مؤسسة حمد الطبية Hamad Medical Corporation HEALTH • EDUCATION • RESEARCH صحة • تعليم • بحوث		 خدمة الإسعاف Ambulance Service	
HMCAS Major Incident Response Guide			MIR Ref: 009
SILVER COMMANDER			RADIO CALL SIGN
			SILVER COMMAND
KEY ROLE	Overall responsibility for Command & Control for HMCAS at the scene of an incident – TACTICAL role to direct all ambulance service resources as required.		
REPORTS TO:	RESPONSE LEVEL	COMMANDER	RADIO CHANNEL
	LEVEL 0 LEVEL 1,2 or 3	N/A – Incident Control Gold Command	Control Major Gold Major
NO.	TASK	COMPLETED ✓ ✗	
1	Don tabard marked 'SILVER COMMAND' and PPE including safety boots and safety helmet		
2	Collect TETRA radios (x2) from Command unit and switch to designated channels; conduct a radio test		
3	Confirm declaration of 'Major Incident' has been passed on to NCC		
4	Start your own INCIDENT LOG – request a Silver Loggist to assist (initially from Forward Control Team)		
5	Start your own DECISION LOG – request a Silver Loggist to assist		
6	Ensure that a Specialized Emergency Management Officer acts as SILVER TACTICAL advisor and deputy Silver Commander		
7	Ensure that appropriate resources have been deployed specific to the incident LEVEL		
8	Assume command of all HMCAS / Medical Operations on site		
9	Confirm Bronze Parking: Job Action Card MIR 010 allocated		
10	Confirm Bronze Primary Triage: Job Action Card MIR 011 allocated		
11	Ensure Primary Triage has commenced		
12	Allocate SILVER roles (Medical, Operations, Support; Specialized for LEVEL 2 and 3 incidents)		
	Continued on MIR 009(2)		
NOTES/COMMENTS:			
PUBLIC SAFETY SENSITIVE MIR 009(1)			

Appendix E: Triage Sieve

Appendix F: Triage Sort

Physiological Variable	Measured Value	Score	Measured Value	Score	Insert Score	
	ADULT		PAEDS			
Respiratory Rate	10 – 29	4	10 – 24	4	A	
	> 29	3	25 – 35	3		
	6 – 9	2	> 35	2		
	1 – 5	1	< 10	1		
	None	0	None	0		
Systolic Blood Pressure	≥ 90	4	> 90	4	B	
	76 – 89	3	70 - 90	3		
	50 – 75	2	50 - 69	2		
	1 – 49	1	< 50	1		
	No BP	0	No BP	0		
Glasgow Coma Scale	13 – 15	4	14 – 15	5	C	
	9 – 12	3	11 – 13	4		
	6 – 8	2	8 – 10	3		
	4 – 5	1	5 – 7	2		
	3	0	3 - 4	1		
Triage Revised Trauma Score					A+B+C	
Revised Trauma Score	PRIORITY		PRIORITY		ADULT	PAEDS
	Priority 1		Immediate		1 - 10	2 - 11
	Priority 2		Priority 2		11	12
	Priority 3		Priority 3		12	13
	Priority 0		Priority 0		0	1

Appendix G: Official Approvals



UREC Decision, Version 2.0

Unicaf University Research Ethics Committee Decision

Student's Name: Naven Kasenthiren Pullian

Student's ID #: R1905D8514507

Supervisor's Name: Dr Evangelia Siachou

Program of Study: UUZ: DBA Doctoral of Business Administration

Offer ID /Group ID: O21416G21406

Dissertation Stage: 3

Research Project Title: Developing a Major Incident Training Plan Curriculum to Improve the Acquisition and Retention of Frontline Paramedics in Preparation for Mass Gathering Events in Qatar

Comments: No comments

Decision*: A. Provisionally approved without revision or comments

Date: 31-Mar-2021

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.



UREC Decision, Version 2.0

**Unicaf University Research Ethics Committee
Decision**

Student's Name: Naven Kasenthiren Pullian

Student's ID #: R1905D8514507

Supervisor's Name: Dr Evangelia Siachou

Program of Study: UU-DBA-900-3-ZM

Offer ID /Group ID: O55866G62484

Dissertation Stage: DS3

Research Project Title:

Reviewing the Major Incident training program to improve the acquisition and retention of front-line Paramedics knowledge in preparation for mass gathering events in Qatar

Comments: No comments.

Decision*: A. Approved without revision or comments

Date: 20 Apr 2023

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix H: Consent Forms



UU_IC - Version 2.1



Informed Consent Form

Part 1: Debriefing of Participants

Student's Name: Naven Kasenthiren Pullian

Student's E-mail Address: navenp@yahoo.com

Student ID #: R1905D8514507

Supervisor's Name: Evangelia Siachou

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUM: DBA - Doctorate of Business Administration

Research Project Title: Reviewing the Major Incident training program to improve the acquisition and retention of front-line Paramedics knowledge in preparation for mass gathering events in Qatar

Date: 30-March-2023

Provide a short description (purpose, aim and significance) of the research project, and explain why and how you have chosen this person to participate in this research (maximum 150 words).

High-profile mass gathering events taking place in Qatar has become apparent that whilst triage, treatment and transportation is important, other factors such as command and control, communications and inter-operability needs to be further investigated. The need to improve acquisition and retention of the major incident response guide with the development of a structured curriculum as well as identifying barriers that inhibit retention and acquisition of mass casualty response. The study would also highlight significant roles and responsibilities so that frontline staff understand what is expected of them as emergency workers if there is a need to respond or work in a mass casualty type incident at mass gathering type events. All managers and executives on the weekly on call roster would be chosen to participate as well as all dedicated major incident response staff and frontline ambulance paramedics.

The above named Student is committed in ensuring participant's voluntarily participation in the research project and guaranteeing there are no potential risks and/or harms to the participants.

Participants have the right to withdraw at any stage (prior or post the completion) of the research without any consequences and without providing any explanation. In these cases, data collected will be deleted.

All data and information collected will be coded and will not be accessible to anyone outside this research. Data described and included in dissemination activities will only refer to coded information ensuring beyond the bounds of possibility participant identification.

I, Naven Kasenthiren Pullian, ensure that all information stated above is true and that all conditions have been met.

Student's Signature: Naven Pullian



UU_IC - Version 2.1

Informed Consent Form

Part 2: Certificate of Consent

This section is mandatory and should to be signed by the participant(s)

Student's Name: Naven Kasenthiren Pullian

Student's E-mail Address: navenp@yahoo.com

Student ID #: R1905D8514507

Supervisor's Name: Evangelia Siachou

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUM: DBA - Doctorate of Business Administration

Research Project Title: Reviewing the Major Incident training program to improve the acquisition and retention of front-line Paramedics knowledge in preparation for mass gathering events in Qatar

I have read the foregoing information about this study, or it has been read to me. I have had the opportunity to ask questions and discuss about it. I have received satisfactory answers to all my questions and I have received enough information about this study. I understand that I am free to withdraw from this study at any time without giving a reason for withdrawing and without negative consequences. I consent to the use of multimedia (e.g. audio recordings, video recordings) for the purposes of my participation to this study. I understand that my data will remain anonymous and confidential, unless stated otherwise. I consent voluntarily to be a participant in this study.

Participant's Print name:

Participant's Signature:

Date:

If the Participant is illiterate:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had an opportunity to ask questions. I confirm that the aforementioned individual has given consent freely.

Witness's Print name:

Witness's Signature:

Date:



Gatekeeper letter

Address: 27 Mogul Crescent

Date: 30-Mar-2023

Subject: Research Undertaking

Dear Ambulance Service Group Research Committee (GROC)

I am a **doctoral** student at Unicaf University **Zambia**.

As part of my degree I am carrying out a study on reviewing the major incident training program to improve the acquisition and retention of front-line paramedics knowledge in preparation for mass gathering events in Qatar.

I am writing to enquire whether you would be interested in/willing to participate in this research.

Subject to approval by Unicaf Research Ethics Committee (UREC) this study will be using a **questionnaire to gather information**.

My supervisor is Dr. Evangelia Siachou, briefly described the study would ascertain the acquisition and retention of frontline paramedics in Qatar with responding to, working in and managing major incidents due to mass gathering type events that the country would be hosting with the aim of highlighting significant roles and responsibilities associated with major incidents.

Thank you in advance for your time and for your consideration of this project. Kindly please let me know if you require any further information or need any further clarifications.

Yours Sincerely,

Naven Pullian

Student's Name: Naven Pullian

Student's E-mail: navenp@yahoo.com

Student's Address and Telephone: 97466255682

Supervisor's Title and Name: Dr. Evangelia Siachou

Supervisor's Position: Tutor

Supervisor's E-mail: e.siachou@unicaf.org



REAF_DS - Version 3.1



**UNICAF UNIVERSITY
RESEARCH ETHICS APPLICATION FORM
DOCTORAL STUDIES**

UREC USE ONLY:

Application No:

Date Received:

Student's Name: Naven Kasenthiren Pullian

Student's E-mail Address: navenp@yahoo.com

Student's ID #: R1905D8514507

Supervisor's Name: Evangelia Siachou

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUM: DBA - Doctorate of Business Administration

Research Project Title: Reviewing the Major Incident training program to improve the acquisition and retention of front-line Paramedics knowledge in preparation for mass gathering events in Qatar

1. Please state the timelines involved in the proposed research project:

Estimated Start Date: 01-Dec-2019

Estimated End Date: 31-Jan-2024

2. External Research Funding (if applicable):

2.a. Do you have any external funding for your research?

☐

YES

☒

NO

If YES, please answer questions 2b and 2c.

2.b. List any external (third party) sources of funding you plan to utilise for your project. You need to include full details on the source of funds (e.g. state, private or individual sponsor), any prior / existing or future relationships between the funding body / sponsor and any of the principal investigator(s) or co-investigator(s) or student researcher(s), status and timeline of the application and any conditions attached.

NA

2.c. If there are any perceived ethical issues or potential conflicts of interest arising from applying or and receiving external funding for the proposed research then these need to be fully disclosed below and also further elaborated on, in the relevant sections on ethical considerations later on in this form.

NA

3. The research project

3.a. Project Summary:

In this section fully describe the purpose and underlying rationale for the proposed research project. Ensure that you pose the research questions to be examined, state the hypotheses, and discuss the expected results of your research and their potential.

It is important in your description to use plain language so it can be understood by all members of the UREC, especially those who are not necessarily experts in the particular discipline. To that effect ensure that you fully explain / define any technical terms or discipline-specific terminology (use the space provided in the box).

Hamad Medical Corporation ambulance services is the service provider for all prehospital emergency medical care in the State of Qatar. The national ambulance service is the only pre-hospital service provider in the Qatar and is responsible for emergency care (Morris, 2014).

High-profile mass gathering events taking place in Qatar has become apparent that whilst triage, treatment and transportation is important, other factors such as command and control, communications and interoperability needs to be further investigated and understood by front-line ambulance paramedics (AP) and critical care paramedics (CCP). The need to improve acquisition and retention of the major incident response guide with the development of a structured curriculum as well as identifying barriers that inhibit retention and acquisition of mass casualty response. The study would also highlight significant roles and responsibilities so that front-line staff understand what is expected of them as emergency workers if there is a need to respond or work in a mass casualty type incident at mass gathering type events. The questions that would be addressed are the following:

1. Explore the barriers that inhibit the acquisition and retention of major incident response (MIR) in mass gatherings by front-line licensed paramedics within the ambulance services.
2. Explore the common areas/topics within MIR that are misunderstood and needs to be re-evaluated in the current MIR guide and teaching curriculum used in HMCAS.
3. Determine if front-line staff possessed MIR knowledge, skills and experience prior to the current training program offered by HMCAS.
4. Determine if frontline staff possessed MIR knowledge, skills and experience post the current training program offered by HMCAS.
5. Evaluate the MIR training program current course content in order to further develop it in line with current best practice.

3.b. Significance of the Proposed Research Study and Potential Benefits:

Outline the potential significance and/or benefits of the research (use the space provided in the box).

There are various disasters that occur through out the world be it natural or man made. Countries have variations in training emergency staff in MIR, Qatar being no different, have over the years invested heavily in (MIR) capacity however being the national ambulance service and the only pre-hospital care provider in the State the reviewing of the current MIR guide in order to acquire and retain MIR knowledge, the understanding of these plans should firstly be understood in order to be able to respond to and work at major incidents both safely for those affected in the incident and staff respectively. The significance of the study would be developing a common understanding towards major incident response, adopting and potentially embracing a standardized training curriculum in relation to the current major incident response guide. The objective is to review the current program in order to expand and develop a major incident training plan curriculum to improve the acquisition and retention of front-line paramedics knowledge in preparation for mass gathering events in the State of Qatar.

4. Project execution:

4.a. The following study is an:

- ☒ experimental study (primary research)
- ☐ desktop study (secondary research)
- ☐ desktop study using existing databases involving information of human/animal subjects
- ☐ Other

If you have chosen 'Other' please Explain:

4.b. Methods. The following study will involve the use of:

Method

Materials / Tools

Qualitative:

- ☐ Face to Face Interviews
- ☐ Phone Interviews
- ☐ Face to Face Focus Groups
- ☐ Online Focus Groups
- ☐ Other *

Quantitative:

- ☐ Face to Face Questionnaires
- ☒ Online Questionnaires
- ☐ Experiments
- ☐ Tests
- ☐ Other *

*If you have chosen 'Other' please Explain:

5. Participants:

5 a. Does the Project involve the recruitment and participation of additional persons other than the researcher(s) themselves?

- ☒ YES If YES, please complete all following sections.
- ☐ NO If NO, please directly proceed to Question [7](#).

5 b. Relevant Details of the Participants of the Proposed Research

State the number of participants you plan to recruit, and explain in the box below how the total number was calculated.

Number of participants

Slovan's formula was used to establish the number of required participants for the sample size in order to complete the assessment. The population target is $N = 871$, the lowest number of responses required is 274, for an error tolerance of $\alpha = 0.05$. With a 95% confidence interval (CI) for this subset of the chosen population a minimum sample size of 89 would be acceptable.

Describe important characteristics such as: demographics (e.g. age, gender, location, affiliation, level of fitness, intellectual ability etc). It is also important that you specify any inclusion and exclusion criteria that will be applied (e.g. eligibility criteria for participants).

Age range From To

Gender ☒ Female
☒ Male

Eligibility Criteria:

- Inclusion criteria
- Exclusion criteria

Disabilities

Other relevant information (use the space provided in the box):

5 c. Participation & Research setting:

Clearly describe which group of participants is completing/participating in the material(s)/ tool(s) described in 5b above (use the space provided in the box).

All front-line paramedics (both critical care and ambulance paramedics) will be included in this study. All managers who rotate on the "ambulance services on call" rota will be included in the study (managers within HMCAS are either ambulance paramedic or critical care paramedic qualified).
All participants will be expected to complete the questionnaire since it is the only data collection tool for the study.

5 d. Recruitment Process for Human Research Participants:

Clearly describe how the potential participants will be identified, approached and recruited (use the space provided in the box).

The data tool itself would be created using MS forms and sent out via email to the various email groups i.e. CCS - Management Mail Group (CCS-Management@hamad.qa) ; CCS Management Team Mail Group (CCSManagementTeam@hamad.qa) ; EMS Critical Care Paramedics Email Group (EMSCriticalCareParamedics@hamad.qa) ; AS-Retrieval Service Staff Mail Group (AS-RetrievalServiceStaff@hamad.qa); EAS-Supervisors Mail Group (EAS-Supervisors@hamad.qa); Ambulance Service Operations Mail Group (AmbulanceServiceOperationsMailGroup@hamad.qa); and WhatsApp on the various teams group that staff are in on Team A, B, C, D respectively.
The ambulance services has the Group Research Oversight Committee (GROC) who will give permission for data to be collected. With this letter the ambulance services workforce planning department would give access to their data base contact of potential participants

5 e. Research Participants Informed Consent.

Select below which categories of participants will participate in the study. Complete the relevant Informed Consent form and submit it along with the REAF form.

Yes	No	Categories of participants	Form to be completed
☒	☐	Typically Developing population(s) above the maturity age *	Informed Consent Form
☐	☒	Typically Developing population(s) under the maturity age *	Guardian Informed Consent Form

* Maturity age is defined by national regulations in laws of the country in which the research is being conducted.



5 f. Relationship between the principal investigator and participants.

Is there any relationship between the principal investigator (student), co-investigators(s), (supervisor) and participant(s)? For example, if you are conducting research in a school environment on students in your classroom (e.g. instructor-student).

☒ YES

☐ NO

If YES, specify (use the space provided in the box).

The researcher is a senior operations manager at HMCAS, where the chosen population would be recruited from. The proposed recruited population DO NOT report to the principle investigator. Although the researcher and potential participants are professionally related, all participants are at the same level or superior to the research. The researcher therefore has no direct or indirect control or influence over potential participants.

6. Potential Risks of the Proposed Research Study.

6 a. i. Are there any potential risks, psychological harm and/or ethical issues associated with the proposed research study, other than risks pertaining to everyday life events (such as the risk of an accident when travelling to a remote location for data collection)?

☐ YES

☒ NO

If YES, specify below and answer the question 6 a.ii.

6 a.ii Provide information on what measures will be taken in order to exclude or minimise risks described in 6.a.i.

6 b. Choose the appropriate option

	Yes	No
i. Will you obtain written informed consent form from all participants?	☒	☐
ii. Does the research involve as participants, people whose ability to give free and informed consent is in question?	☐	☒
iii. Does this research involve participants who are children under maturity age? If you answered YES to question iii, complete all following questions. If you answered NO to question iii, do not answer Questions iv, v, vi and proceed to Questions vii, viii, ix and x.	☐	☒
iv. Will the research tools be implemented in a professional educational setting in the presence of other adults (i.e. classroom in the presence of a teacher)?	☐	☒
v. Will informed consent be obtained from the legal guardians (i.e. parents) of children?	☐	☒
vi. Will verbal assent be obtained from children?	☐	☒
vii. Will all data be treated as confidential? If NO, explain why confidentiality of the collected data is not appropriate for this proposed research project, providing details of how all participants will be informed of the fact that any data which they will provide will not be confidential.	☒	☐
viii. Will all participants /data collected be anonymous? If NO, explain why and describe the procedures to be used to ensure the anonymity of participants and/or confidentiality of the collected data both during the conduct of the research and in the subsequent release of its findings.	☒	☐

6 b. Choose the appropriate option

	Yes	No
i. Will you obtain written informed consent form from all participants?	☒	☐
ii. Does the research involve as participants, people whose ability to give free and informed consent is in question?	☐	☒
iii. Does this research involve participants who are children under maturity age? If you answered YES to question iii, complete all following questions. If you answered NO to question iii, do not answer Questions iv, v, vi and proceed to Questions vii, viii, ix and x.	☐	☒
iv. Will the research tools be implemented in a professional educational setting in the presence of other adults (i.e. classroom in the presence of a teacher)?	☐	☒
v. Will informed consent be obtained from the legal guardians (i.e. parents) of children?	☐	☒
vi. Will verbal assent be obtained from children?	☐	☒
vii. Will all data be treated as confidential? If NO, explain why confidentiality of the collected data is not appropriate for this proposed research project, providing details of how all participants will be informed of the fact that any data which they will provide will not be confidential.	☒	☐
viii. Will all participants /data collected be anonymous? If NO, explain why and describe the procedures to be used to ensure the anonymity of participants and/or confidentiality of the collected data both during the conduct of the research and in the subsequent release of its findings.	☒	☐

	Yes	No
ix. Have you ensured that personal data and research data collected from participants will be securely stored for five years?	☒	☐
x. Does this research involve the deception of participants? If YES, describe the nature and extent of the deception involved. Explain how and when the deception will be revealed, and who will administer this debrief to the participants:	☐	☒

6 c. i. Are there any other ethical issues associated with the proposed research study that are not already adequately covered in the preceding sections?

☐ Yes ☒ No

If YES, specify (maximum 150 words).

6.c.ii Provide information on what measures will be taken in order to exclude or minimise ethical issues described in 6.c.i.

6 d. Indicate the Risk Rating.

☐ High ☒ Low

7. Further Approvals

Are there any other approvals required (in addition to ethics clearance from UREC) in order to carry out the proposed research study?

☒ YES ☐ NO

If YES, specify (maximum 100 words).

Permission would be needed from the Employer.

8. Application Checklist

Mark ☒ if the study involves any of the following:

- ☐ Children and young people under 18 years of age, vulnerable population such as children with special educational needs (SEN), racial or ethnic minorities, socioeconomically disadvantaged, pregnant women, elderly, malnourished people, and ill people.
- ☐ Research that foresees risks and disadvantages that would affect any participant of the study such as anxiety, stress, pain or physical discomfort, harm risk (which is more than is expected from everyday life) or any other act that participants might believe is detrimental to their wellbeing and / or has the potential to / will infringe on their human rights / fundamental rights.
- ☐ Risk to the well-being and personal safety of the researcher.
- ☐ Administration of any substance (food / drink / chemicals / pharmaceuticals / supplements / chemical agent or vaccines or other substances (including vitamins or food substances) to human participants.
- ☐ Results that may have an adverse impact on the natural or built environment.

9. Further documents

Check that the following documents are attached to your application:

		ATTACHED	NOT APPLICABLE
1	Recruitment advertisement (if any)	☐	☒
2	Informed Consent Form / Guardian Informed Consent Form	☒	☐
3	Research Tool(s)	☒	☐
4	Gatekeeper Letter	☒	☐
5	Any other approvals required in order to carry out the proposed research study, e.g., institutional permission (e.g. school principal or company director) or approval from a local ethics or professional regulatory body.	☒	☐

10. Final Declaration by Applicants:

- (a) I declare that this application is submitted on the basis that the information it contains is confidential and will only be used by Unicaf University for the explicit purpose of ethical review and monitoring of the conduct of the research proposed project as described in the preceding pages.
- (b) I understand that this information will not be used for any other purpose without my prior consent, excluding use intended to satisfy reporting requirements to relevant regulatory bodies.
- (c) The information in this form, together with any accompanying information, is complete and correct to the best of my knowledge and belief and I take full responsibility for it.
- (d) I undertake to abide by the highest possible international ethical standards governing the Code of Practice for Research Involving Human Participants, as published by the UN WHO Research Ethics Review Committee (ERC) on <http://www.who.int/ethics/research/en/> and to which Unicaf University aspires to.
- (e) In addition to respect any and all relevant professional bodies' codes of conduct and/or ethical guidelines, where applicable, while in pursuit of this research project.



I agree with all points listed under Question 10

Student's Name:

Supervisor's Name:

Date of Application:

Important Note:

Save your completed form (we suggest you also print a copy for your records) and then submit it to your UU Dissertation/project supervisor (tutor). **In the case of student projects, the responsibility lies with the Faculty Dissertation/Project Supervisor.** If this is a student application, then it should be submitted via the relevant link in the VLE. Please submit only electronically filled in copies; **do not** hand fill and submit scanned paper copies of this application.



Memo

TO	Mr Naven Pullian Operations Manager, Events, HMCAS	DATE	09 April 2023
FROM	Dr Loua Assad Hanna Al Shaikh Medical Director Chairman, HMCAS Group Research Oversight Committee	REFERENCE NO.	AS 2022- 180
SUBJECT	APPROVAL FOR RESEARCH STUDY: "Reviewing the Major Incident training program to improve the acquisition and retention of front-line Paramedics' knowledge in preparation for mass gathering events in Qatar"		
CC	Prof. Guillaume Allier Director of Research, HMCAS Mr Saleh Al-Meqareh Assistant Executive Director, Events, HMCAS		
☐ URGENT ☐ CONFIDENTIAL ☐ PLEASE PROCESS ☒ FYI			

Please be informed that the Ambulance Service Group Research Oversight Committee (GROC) has reviewed and approved the project proposal entitled "Reviewing the Major Incident training program to improve the acquisition and retention of front-line Paramedics' knowledge in preparation for mass gathering events in Qatar" to be conducted by Mr Naven Pullian. This is subject to you sharing your study findings with the GROC and eventually trying to submit your work for publication in a scientific journal within 6 months of completing the study.

You may now proceed with the submission of your proposal through Abhath so it can also be evaluated by the Medical Research Centre's (MRC) team and the Institutional Review Board, taking into consideration the feedback from our reviewer(s).

If it is intended that parts of the findings be submitted for publication or presented at a conference, this will be subject to prior review and approval by the GROC and MRC. Please keep us informed of this or any changes you may make to this study as it could affect this approval decision.

Please note that this study approval will only be effective once you have returned a signed copy of this letter.

Best Wishes,


Dr Loua Assad Hanna Al Shaikh

Medical Director, Hamad Medical Corporation-Ambulance Service

Dr. Loua Al Shaikh
Medical Director
HMC Ambulance Service
028375

I acknowledge receipt of this letter and will comply with the instructions stipulated.

Name: Naven Pullian

Signature: 

Date: 11-04-2023

Tel: (+974) 4397504-06
Fax: (+974) 4393526

P.O. Box 3050
Doha, Qatar
www.hamad.qa

Appendix I: Tool Developed

06/10/2022, 10:33

Μαθηρ1νχδεντΓρεπορεδνεσσανδ Ρεσπονε ιν Γρεπορμιν φορΜασσΓαμερνγ Επεινις-ΗΜΧΑΣ

Major Incident Preparedness and Response in Preparation for Mass Gathering Events - HMCAS

* Required

1. What is your gender? *

☐ Male

☐ Female

☐ Prefer not to say

2. What is your current age? *

☐ 18 - 29

☐ 30 - 39

☐ 40 - 49

☐ >50

ηττα//φορμ αοφφχε.χομ /παρεσδεσγ νπαρεπλ.απτεζ?αση_περ=Ω ινδοοσλσε1δ&αση_υπν=ββαλτορι %40γμ αλχομ &λαγ=εν-ZA&οργιν=ΟφφχεΔσχομ &ρουτ

1/10

06/10/2022, 10:33

Major Incident Preparedness and Response in Preparation for Mass Gathering Events - HMCAS

3. How long have you been working in Hamad Medical Corporation Ambulance Services ? *

- ☐ < 1 to 3 years
- ☐ less than 5 years
- ☐ Between 5 - 10 years
- ☐ Between 10 - 15 years
- ☐ More than 15 years

4. Do you have previous major incident response training? *

- ☐ Yes
- ☐ No

5. What is your current area of responsibility? *

- ☐ Ambulance Paramedic
- ☐ Critical Care Paramedic
- ☐ Management
- ☐ Ambulance Paramedic & Role on the Major Incident Roster
- ☐ Critical Care Paramedic and Role on the Major Incident Roster
- ☐ Not Clinical & Role on the Major Incident Roster

6. Do you have a role on the weekly on call major incident roster ? *

- ☐ Yes
- ☐ No

06/10/2022, 10:33

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7. I have participated in major incident training within HMCAS *

- ☐ Yes
- ☐ No

8. I am involved in major incident educational training activities (e.g. CPD, conferences, seminars)? *

- ☐ As a student
- ☐ As an instructor/facilitator/lecturer
- ☐ I am not involved in any training or lecturing activities

9. I am aware of major incident response training that is carried out within HMCAS ? *

- ☐ Yes
- ☐ No

10. I find that major incident response preparedness and response is understandable within HMCAS ? *

- ☐ Yes
- ☐ No

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11. How confident are you in where to find information on major incidence response to fill the gaps in knowledge on the subject? *

- ☐ Extremely confident
- ☐ Somewhat confident
- ☐ Neutral
- ☐ Somewhat not confident
- ☐ Extremely not confident

12. I would be interested in furthering my knowledge in major incident response knowledge ? *

- ☐ Yes
- ☐ No

13. As a first responder and or manager i read journal articles related to ambulance services and major incident response to keep current of trends in the field? *

- ☐ Yes
- ☐ No

14. Finding information on major incident response is an obstacle to me being prepared for responding to and managing a major incident? *

- ☐ Yes
- ☐ No

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15. I receive adequate training and support in my designated role at a major incident *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

16. I would be interested in undertaking major incident response training classes that is specific to my expected role at an incident? *

- ☐ Yes
- ☐ No

17. I need training in the following areas of major incident response in support of my role *

- ☐ Gold Command Roles & Responsibilities
- ☐ Silver Command Roles & Responsibilities
- ☐ Bronze Command Roles & Responsibilities
- ☐ Communication Procedures
- ☐ HAZMAT
- ☐ Major Incident Response Terminology Mass gatherings
- ☐ Triage
- ☐ Mass gatherings

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18. I am familiar with the types of triage used by HMCAS in major incidents? *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

19. I am familiar with the use of a METHANE Report *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

20. I am familiar with Radio Communication Procedures at a major incident ? *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

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21. I am familiar with Major Incident Response Terminology used by HMCAS ? *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

22. Having "ACTION CARDS" and "REFERENCE CARDS" (e.g. METHANE) improves my confidence and is valuable in assisting me in my assigned role at a major incident? *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

23. In the event of a HAZMAT related major incident, i am aware of the organisations standard operating procedure ? *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

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24. How confident are you in the role that you are expected to undertake (e.g. triage) *

- ☐ Extremely confident
- ☐ Somewhat confident
- ☐ Neutral
- ☐ Somewhat not confident
- ☐ Extremely not confident

25. How confident are you in undertaking more than 1 role if expected at a major incident (e.g. silver command if first on scene as an ambulance paramedic)? *

- ☐ Extremely confident
- ☐ Somewhat confident
- ☐ Neutral
- ☐ Somewhat not confident
- ☐ Extremely not confident

26. In the event of a bioterrorism/biological attack at a mass gathering event, i am familiar with procedures that limits exposure to myself and the community? *

- ☐ Not at all familiar
- ☐ Not so familiar
- ☐ Somewhat familiar
- ☐ Very familiar
- ☐ Extremely familiar

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27. I am familiar with the major incident response guidebook and its content that is used by HMCAS ? *

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly agree

28. I require additional support and training in the field of major incident response incorporating HAZMAT/mass gathering in preparation for big events ? *

- ☐ Yes
- ☐ No

29. I am aware of the potential vulnerabilities faced by ME in the response and management of major incidents (e.g. limited recognition of risks and preparedness measures) *

- ☐ Never
- ☐ Occasionally
- ☐ Sometimes
- ☐ Often
- ☐ Always

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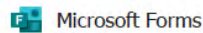
Major Incident Preparedness and Response in Preparation for Mass Gathering Events - HMCAS

30. I believe i am valuable and a key figure in my role & responsibility at a major/mass casualty incident within HMCAS.

*

- ☐ Never
- ☐ Occasionally
- ☐ Sometimes
- ☐ Often
- ☐ Always

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Appendix J: List of Variables, Testing Method and Reference

	Variables	Categories	Testing Method of the variables & Reason	Reference to objectives & Reference to variables
1	Gender	1. Male 2. Female	Distribution in gender Chi Square	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348. King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548- e554
2	Age	1. 18-29 years old 2. 30-39 years old 3. 40-49 years old 4. 50-59 years old 5. > years old	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness

			hoc (example: Tukey/Benforonni...)	evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348. King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554
3	HMCAS medical qualification	1. Ambulance paramedic 2. Critical Care Paramedic	The dependent variable would be the ambulance paramedic and the critical care paramedic	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348. King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster

				management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554
4	HMCAS employment	1. < 1 year 2. 1-5 years 3. 6-10 years 4. 10-15 years 5. > 15 years	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-hoc (example: Tukey/Benforonni...)	Objective 1 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
5	Prior ambulance service	1. Yes 2. No	Chi Square	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the

	experience/ exposure			disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
6	Prior MIR training	1. Yes 2. No	Chi Square	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
7	How many MIR in Qatar did you attend prior to attending the training programme?	1. <5 2. 6-10 3. 11-15 4. 16-20 5. > 21	Kruskall Wallis Confidence distribution with regard to MIR training If p is significant, post- hoc (example: Tukey/Benforonni...)	Objective 1 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548- e554 Han, S. J., & Chun, J. (2021). Validation of the

				disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
8	Confidence level in dealing with MIR prior to attending the MIR training programme.	1. Not confident at all 2. Slightly confident 3. Somewhat confident 4. Fairly confident 5. Completely confident	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-hoc (example: Tukey/Bonferroni...)	Objective 1 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348
9	Prior MIR exposure in	1. Yes 2. No	Chi Square	Objective 1 Han, S. J., & Chun, J.

	ambulance service			(2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
10	Prior exposure in hospital	MIR 1. Yes 2. No	Chi Square	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
11	Did you attend the training programme in Qatar?	MIR 1. Yes 2. No	Chi Square	Objective 1 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
12	When did	1. <1 year ago 2. 1-2 years ago	Kruskall Wallis	Objective 1

	you attend the MIR training Programme?	3. 3-4 years ago 4. 5-6 years ago 5. > 6 years ago	Confidence distribution with regard to MIR training If p is significant, post-hoc (example: Tukey/Benforonni...)	Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348.
13	Did the MIR training programme equip you with the appropriate knowledge?	1. Yes 2. No	1. Chi Square 2. Backward Binary Logistic regression: will help to determine the predictors affecting the staff knowledge	Objective 2 Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i> , 23(1), 29-36.
14	Did you learn the necessary skills to deal with MIR?	1. Yes 2. No	Chi Square	Objective 2 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International</i>

				<i>Journal of Environmental Research and Public Health</i>, 18(3), 1348. Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i>, 23(1), 29-36.
15	How many MIR incidents did you attend post attending the MIR training programme?	1. <5 2. 6-10 3. 11-15 4. 16-20 5. > 20	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-hoc (example: Tukey/Benforonni...)	Objective 2 Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i> , 23(1), 29-36.

16	How confident do you feel about attending MIR after attending the training programme?	1. Yes 2. No	Chi Square	Objective 2 Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i> , 23(1), 29-36.
17	Has the MIR training programme improved your on-scene communication skills?	1. Yes 2. No	Chi Square	Objective 2 Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i> , 23(1), 29-36.
18	Has the MIR training	1. Yes 2. No	Chi Square	Objective 2 Han, S. J., & Chun, J.

	improved your knowledge of when to identify an MIR is required?			(2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i>, 18(3), 1348. Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i>, 23(1), 29-36.
19	Has the MIR training improved your on-scene teamwork when dealing with a MIR incident?	1. Yes 2. No	Chi Square	Objective 2 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public</i>

				<i>Health, 18(3), 1348.</i> Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment of knowledge, skills and preparation for disaster management. <i>Australasian emergency care, 23(1), 29-36.</i>
20	Are you familiar with the command and control functionalities on a MIR incident?	1. Yes 2. No	Chi Square	Objective 2 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine, 184(9-10), e548-e554</i> Tillekaratne, H. I., Werellagama, D. R. I. B., & Prasanna, R. (2021). Command and Control Mechanism for Effective Disaster Incident

				Response Operations in Sri Lanka. In <i>Multi-Hazard Early Warning and Disaster Risks</i> (pp. 615-631). Springer International Publishing. Escudeiro, A., Escudeiro, E., Silva, L. O., Bandeira, R. A. de M., Souza, L. P., Leiras, A., & Oliveira, R. T.. (2022). Command and control system management: a perspective of disaster response actors in Brazil. <i>Production</i>, 32(Prod., 2022 32). https://doi.org/10.1590/0103-6513.20210106
21	All MIR terminology is clearly defined?	1. Strongly agree 2. Disagree 3. Neither agree nor disagree 4. Agree 5. Strongly Agree	Cronbach alpha	Tillekaratne, H. I., Werellagama, D. R. I. B., & Prasanna, R. (2021). Command and Control Mechanism for Effective Disaster Incident Response Operations in Sri Lanka. In <i>Multi-Hazard Early Warning and Disaster</i>

				<i>Risks</i> (pp. 615-631). Springer International Publishing.
22	How confident are you with radio communication?	1. Not confident at all 2. Slightly confident 3. Somewhat confident 4. Fairly confident 5. Completely confident	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-hoc (example: Tukey/Bonferroni...)	Objective 2 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554 Tillekaratne, H. I., Werellagama, D. R. I. B., & Prasanna, R. (2021). Command and Control Mechanism for Effective Disaster Incident Response Operations in Sri Lanka. In <i>Multi-Hazard Early Warning and Disaster Risks</i> (pp. 615-631). Springer International Publishing. Escudeiro, A., Escudeiro, E., Silva, L. O., Bandeira, R. A. de M., Souza, L. P., Leiras, A., & Oliveira, R. T.. (2022). Command and control

				system management: a perspective of disaster response actors in Brazil. <i>Production</i>, 32(Prod., 2022 32). https://doi.org/10.1590/0103-6513.20210106
23	How confident are you with patient triage after attending the MIR training programme?	1. Not confident at all 2. Slightly confident 3. Somewhat confident 4. Fairly confident 5. Completely confident	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-hoc (example:Tukey/Benforonni...)	Objective 2 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i>, 184(9-10), e548-e554
24	How confident are you with identifying and dealing with bioterrorism related MIR incidents?	1. Not confident at all 2. Slightly confident 3. Somewhat confident 4. Fairly confident 5. Completely confident	Kruskal Wallis Confidence distribution with regard to MIR training If p is significant, post-hoc (example:Tukey/Benforonni...)	Objective 2 Brewer, C. A., Hutton, A., Hammad, K. S., & Geale, S. K. (2020). A feasibility study on disaster preparedness in regional and rural emergency departments in New South Wales: Nurses self-assessment

				of knowledge, skills and preparation for disaster management. <i>Australasian emergency care</i>, 23(1), 29-36. King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i>, 184(9-10), e548-e554 Farhat, H., Laughton, J., Ganagaram, P., El Aifa, K., Khenissi, M.C., Zaghouani, O., & Alinier, G. (2022). Hazardous materials and chemical, biological, radiological, and nuclear incident among prehospital care professionals in the State of Qatar. <i>Global Security: Health, Science and Policy</i>, 71(1), 24-36.
25	Were you made familiar of the MIR training programme	1. Yes 2. No	Chi Square	Objective 3 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills,

	outcomes prior to the programme commencing?			and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554
26	Do you think that the format of the MIR training programme is appropriate?	1. Yes 2. No	Chi Square	Objective 3 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554
27	Did you find the online reading material (MIR Guidebook) relevant prior to attending the programme?	1. Yes 2. No	Chi Square	Objective 3 Farhat, H., Laughton, J., Ganagaram, P., El Aifa, K., Khenissi, M.C., Zaghouani, O., & Alinier, G. (2022). Hazardous materials and chemical, biological, radiological, and nuclear incident among prehospital care professionals in the State of Qatar. <i>Global Security: Health, Science and Policy</i> , 71(1), 24-36.

28	Were you offered adequate practice time during the MIR training programme?	1. Yes 2. No	Chi Square	Objective 3 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i>, 184(9-10), e548-e554 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i>, 184(9-10), e548-e554
29	Do you think the time allocated to the MIR training programme is appropriate to meet the outcomes?	1. Yes 2. No	Chi Square	Objective 3 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i>, 184(9-10), e548-e554

30	Do you think that further MIR related material should be added to the content of the programme?	1. Yes 2. No	Chi Square	Objective 3 King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10), e548-e554
31	What further MIR topics should be included in the programme?	1. Yes 2. No	Chi Square	Objective 3 Han, S. J., & Chun, J. (2021). Validation of the disaster preparedness evaluation tool for nurses—the Korean version. <i>International Journal of Environmental Research and Public Health</i> , 18(3), 1348. King, H. C., Spritzer, N., & Al-Azzeh, N. (2019). Perceived knowledge, skills, and preparedness for disaster management among military health care personnel. <i>Military medicine</i> , 184(9-10).

END!