

**EFFECT OF TRAINING BYSTANDERS ON RESPONSIVENESS OF PRE-
HOSPITAL EMERGENCY HEALTH CARE DELIVERY IN NAIROBI CITY
COUNTY, KENYA**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
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DOCTOR OF PHILOSOPHY IN HEALTH SYSTEM MANAGEMENT IN
THE SCHOOL OF MEDICINE AND HEALTH SCIENCES OF KENYA
METHODIST UNIVERSITY**

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DECLARATION

I declare that this research proposal is my original work and has not been presented in any other University.

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Approval and Recommendation

We confirm that the work reported in this research proposal was carried out by the candidate under our supervision.

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DEDICATION

This work is dedicated to my children, Kelvin Musyoka, Evans Mutua, and Elsie Muli for their patience in my absence during moments of intense concentration in my studies. I would also dedicate this work to all health systems managers in Kenya who are working tirelessly to strengthen the health systems and improve health outcomes.

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ABSTRACT

Emergency care systems are essential for delivering rapid critical care, and the bystander, as the initial system activator, is crucial to its responsiveness. This study investigated the impact of bystander training on the responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya. An unmatched case-control design using mixed methods was employed, drawing theoretical guidance from the Theory of Planned Behaviour, the Bystander Intervention Model, the Golden Hour Theory, and Queuing Theory. Data were collected from 752 households, the Emergency Operations Centre (EOC), and Accident & Emergency (A&E) departments using questionnaires, Focus Group Discussions (FGDs), Key Informant Interviews (KIIs), and checklists. Quantitative data were analysed with SPSS using descriptive statistics, a Difference-in-Differences (DiD) model to measure the intervention's causal effect, and correlation analysis. Qualitative data were thematically analysed using NVivo 12. The study demonstrated that bystander training had a positive impact on several emergency response metrics. The training increased participants' knowledge (adjusted $p=0.022$ DiD) and improved overall decision-making capabilities (adjusted $p=0.003$ model). Crucially, the intervention led to meaningful improvements in composite willingness-to-help scores ($p<0.001$), primarily by reducing psychological barriers such as fear of being judged ($p=0.001$), concerns about legal consequences ($p<0.001$), and bystander waiting tendencies ($p<0.001$). Operationally, the training significantly increased the number of emergency calls placed ($p=0.048$), the number of patients receiving care ($p=0.001$), and ambulance utilization rates ($p<0.0001$). Most importantly, training of bystanders significantly reduced emergency notification intervals ($P<0.001$) with a large unadjusted DiD effect of 38.4. The intervention group experienced a 76% reduction in delays exceeding 15 minutes (from 80.4% to 4.1%) and a notable increase in responses within 0–5 minutes, confirming the training's effectiveness in accelerating early emergency recognition and response. However, despite these numerous positive outcomes, the training did not improve the responsiveness times of pre-hospital emergency healthcare delivery in measured intervals: response ($p=0.136$), transportation ($p=0.354$), activation ($p=0.851$), and handover ($p=0.818$). The findings underscore the training's effectiveness in accelerating early response actions. It was recommended that the study results be used by the MOH, policymakers, and implementers to develop strategies for improving pre-hospital emergency healthcare delivery and increasing survival rates, including the incorporation of a bystander training component in the WHO Emergency Care System Framework (ECSF), thus overcoming some of the challenges faced by the health care systems in responding to emergencies.

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ABBREVIATIONS AND ACRONYMS

A&E	Accident and Emergency
CHVs	Community Health Volunteers
CPR	Cardiopulmonary resuscitation
DALYs	Disability Adjusted Life Years
ECS	Emergency Care Systems
ECSA	Emergency Care System Assessment
ECSF	Emergency Care System Framework
EMS	Emergency Medical Services
EOC	Emergency Operations Center
ERUs	Bystanders
ICT	Information Communication Technology
LMIC	Low-and-Medium Income Countries
MCRH	Mbagathi County Referral Hospital
MLKH	Mama Lucy Kibaki Hospital
NMS	Nairobi Metropolitan Services
SDG	Sustainable Development Goals
SOPs	Standard Operation Procedures
SPSS	Statistical Package for Social Sciences
TV	Television
UHC	Universal Health Coverage
UK	United Kingdom
USA	United States of America
WHA	World Health Assembly
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background Information

The World Health Organization (WHO) defines a health system as a synergy of organizations, individuals, and activities focused on advancing, restoring, or maintaining health. This system is structured around six interconnected building blocks: service delivery, health workforce, health financing, health information systems, governance and leadership, and medical products, vaccines, and technologies as cited by Ferrinho et al.(2023). The effective interaction of these blocks is crucial for improving pre-hospital emergency response and overall health outcomes (Rechel et al., 2020). While pre-hospital emergency response serves as a key performance indicator for health service delivery, the supplementary support from the other building blocks is of vital importance (Myers, 2019).

Health systems aim to ensure the highest attainable standard of well-being, necessitating their constant preparedness to guarantee quality and safe care, including pre-hospital emergency response (Demisse et al., 2022). Delays in emergency response and sub-optimal care contribute significantly to increased morbidity and mortality worldwide (Al Amiry & Maguire, 2021). Integrating emergency care services with other healthcare services is an effective strategy to improve timely access to care for priority populations with acute injuries and illnesses (Moresky et al., 2019). Therefore, enhancing acute and emergency care systems is fundamental for overall health system strengthening and optimal performance (Nakahara et al., 2019).

Globally, the success of pre-hospital care is often linked to teamwork among care delivery teams, as highlighted in the USA (Herzberg et al., 2019). In Australia, monitoring the incidence and success of critical pre-hospital interventions for children

with major injuries has been challenging (Curtis et al., 2020). Delivery of pre-hospital care in settings like Iran faces barriers related to public cooperation, involvement at the scene, and system factors such as facility location, ambulance type, and manpower (Khorasani-Zavareh et al., 2018).

Regionally, challenges in pre-hospital care delivery, such as those faced during the COVID-19 pandemic in Ethiopia, emphasized the need for equipped ambulances, trained manpower, and public awareness creation (Baru et al., 2022). Rwanda's Ministry of Health has been working toward approving and standardizing national pre-hospital care (Wojick et al., 2020). Integrated pre-hospital and emergency health care systems are critical, as emergency care contributes to addressing ten Sustainable Development Goals (SDG) targets (Reynolds et al., 2021). Emergency care is vital for overseeing a wide range of acute illnesses and injuries that contribute significantly to mortality and disability, especially in LMICs (Burkholder et al., 2019). Sound emergency services are estimated to reduce mortality by 54%–90% and disability-adjusted life years (DALYs) by 900 million to 2.5 billion in LMICs (Chang et al., 2016). Traumatic injuries disproportionately affect individuals in LMICs, which report approximately 90% of the burden of deaths and disability from injuries (Shaw, 2022; World Health Organization, [WHO], 2018). Compelling, prioritized, and opportune emergency care in LMICs could potentially mitigate approximately 45% of deaths and 36% of disability (Bieler et al., 2017; Whitaker et al., 2021).

In Kenya, the importance of an Emergency Care System (ECS) to lessen avoidable morbidities and mortalities is underscored by the Constitution of 2010 and detailed in the Health Act (2017). The current high demand for Emergency Medical Services (EMS) in Kenya driven by road traffic accidents, COVID-19, collapsing buildings, mass casualty events, and acute medical events, highlights the need for a

robust system to replace the existing underdeveloped, under-equipped, and inexperienced one (Mutua et al., 2024). Currently, there is a gap in national coordination of the emergency health care system and a lack of defined administration for ambulances (Lee et al., 2022).

Frequent occurrence of natural as well as man-made disasters besides mass casualty incidents in Nairobi City County has increased the demand for a responsive, safe, and effective prehospital emergency health care system. A survey conducted in Nairobi City County by Musyoka and Kioko (2021) indicates low utilization of pre hospital emergency services due to low knowledge of emergency numbers and the ability to take action at the emergency scene. This study analyses the emergency health care system using the WHO Emergency Care System Framework (ECSF), which is designed to help policymakers assess and reinforce national emergency care systems by identifying essential functions and system gaps (Reynolds et al., 2021). The ECSF guides the understanding of fundamental pre-hospital emergency care tasks executed at the scene, during transport, and at the emergency unit.

Pre-hospital emergency care providers include bystanders, health care providers, and dispatchers (World Health Organization,[WHO] 2018). Bystander is the emergency care system's 'activator' who must be willing to help, have the contact, access, and gadget to reach the dispatcher, and receives instructions from them (Vuorinen et al., 2021). A dispatcher, needs a clear directory of healthcare services for effective coordination and must be guided by time-sensitive and time-saving protocols (Morand et al., 2022). Healthcare Provider, requires a basic kit, and for patient transport (e.g., in an ambulance), they need skills in patient positioning, intervention, and monitoring. Protocols, especially triage protocols, must be in place at the destination facility, along with effective communication (Baru et al., 2022; Blodgett

et al., 2021). This study is keen to establish how training of bystanders impacts on responsiveness of the pre-hospital emergency care system, by assessing emergency response times, as well as bystanders' knowledge, decision making, willing to help and performance. The study will utilize an unmatched case-control study approach that will adopt both qualitative and quantitative research methods.

1.2 Statement of Problem

The majority of emergencies occur outside of healthcare facilities worldwide, significantly adding to the global burden of disease. This issue is particularly pronounced in Nairobi City County, Kenya, due to a weak and underutilized pre-hospital emergency healthcare system. The high frequency of natural and man-made disasters and mass casualty incidents has amplified the demand for a responsive, effective system. However, emergency data from the Nairobi City County Emergency Operations Center (EOC) from 2019–2020 revealed a critical gap: of over 60,000 emergency patients seen at MLKH, only 10% utilized pre-hospital emergency services, with only 2,520 of those having contacted the EOC for assistance, indicating severe underutilization.

The system's weakness stems from multiple factors, including the public's lack of knowledge of toll-free emergency numbers, inadequate training of response teams, and the absence of standard operating procedures (SOPs) and protocols (Musyoka & Kioko, 2021). A survey in Nairobi County further documented a low ambulance service use (37%) and a severe response time delay of approximately 40 minutes to one hour, nearly three times the WHO-recommended 15–20 minutes (Musyoka & Kioko, 2021). These systemic deficiencies deprive patients of timely access to pre-hospital care, escalating their risk of mortality and morbidity.

To address these gaps, training of bystanders on emergency notification and response is proposed to enhance their knowledge of emergency numbers and communication with the EOC, improve their decision-making, and increase their competency and willingness to act. Therefore, this study aims to evaluate the effect of training bystanders on the responsiveness of Pre-hospital Emergency Health Care delivery in Nairobi City County, Kenya

1.3 Study Purpose

The purpose of this study is to evaluate the impact of bystander training on the effectiveness of Pre-hospital Emergency Health Care Delivery in Kenyan urban settlements. This evaluation aims to quantify the improvement in bystander communication for reporting and responding to emergencies, ultimately seeking to reduce emergency response times and increase the survival rate for victims.

1.4 Study Objectives

1.4.1 Broad Objective

The broad objective is to establish the effect of training bystanders on responsiveness of pre-hospital Emergency Health Care delivery in Nairobi City County, Kenya.

1.4.2 Specific Objectives

- i. To establish the influence of bystander knowledge on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.
- ii. To assess the influence of bystander decision-making on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.
- iii. To establish the influence of bystander willingness to help on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.

- iv. To assess the influence of bystander's performance on responsiveness of pre-hospital emergency health care delivery
- v. To evaluate the effect of training bystanders on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.

1.5 Research Hypothesis

This study seeks to answer the following research Hypothesis:

- i. H₀₁: Bystander knowledge has no significant influence on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya
H₁₁: Bystander knowledge has a significant influence on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya
- ii. H₀₂: Bystander decision-making has no significant influence on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.
H₁₂: Bystander decision-making has a significant influence on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.
- iii. H₀₃: Bystander willingness to help has no significant influence on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.
H₁₃: Bystander willingness to help has a significant influence on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.
- iv. H₀₄: Bystander performance has no significant influence on responsiveness of pre-hospital emergency health care delivery
H₁₄: Bystander performance has a significant influence on responsiveness of pre-hospital emergency health care delivery

iv. H₀₅: Training of Bystanders has no significant effect on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.

H₁₅: Training of Bystanders has a significant effect on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.

1.6 Study Justification

The Constitution of Kenya offers an assurance of the right to the highest achievable standard of health to each individual. Article 43(2) of the Kenyan Constitution 2010 clearly articulates that no individual will be deprived of emergency medical treatment. Notably, every person's access to excellence emergency services features as an indispensable element of the human right to health, irrespective of extant obstacles to emergency care in Kenya, Africa, as well as universally (Burkholder et al., 2020).

Continued long-standing flaws extant in pre-hospital emergency care systems often lengthen emergency response time frequently leading to loss of lives especially in low-income environments (Barth, 2023). In the presence of broad variety of medical emergencies, Kenyans often (89%) depend on fellow Kenyans for transport to hospitals as well as provision of primary care at the emergency scene due to conventional barriers (Burkholder et al., 2019).

Study done in Kenya indicated the majority of EMS-related deaths were as result of delay in response coupled with deficiency of skills necessary in identification as well as handling of patients in life-threatening conditions (Nicholson et al., 2017). A different study in Kenya reported that 76.5% of casualties in road traffic accidents had been evacuated to health facilities by other road users as well as general public who lacked skills in provision of first aid (Makwaga et al., 2024) .

Importantly, majority of emergencies occur outside hospital settings which call for public participation in helping manage the situation. Emergency care contributes in addressing ten (10) Sustainable Development Goals (SDG) targets (Gelband et al., 2017). Bystander interventions have been identified to significantly reduce prehospital emergency response times and increase survival rate and Prehospital emergency care and its attributable outcomes are either understudied or under published in Africa. Bystander empowerment through education for immediate notification of emergency services is one of the least explored areas in previous studies (Musyoka et al., 2023)

Lack of prehospital emergency care infrastructure and monitoring system in countries developing emergency medical services system like in Africa, could inhibit success of studies. In a study, 42% of the respondents indicated that key factors that heighten their chances of helping in the event of an emergency included impacting them with necessary skills and knowledge, as well as protective apparatus (Broccoli et al., 2015).

The need to impact the public with skills on initial emergency management such as contact to call for an ambulance as well as relevant information to convey is emphasized in Kenya (Musyoka & Kioko, 2021). Additionally, thorough research on health systems to advise health systems strengthening initiatives in LMICs is frequently recommended in scholarly works (Barth, 2023). The training intervention encompassed in this study is aimed at strengthening the pre-hospital emergency health care system in Nairobi City County through providing bystanders with toll-free formal contacts to access emergency services, training on messages to convey, strengthening EOC and ambulance teams, implementing Standard Operating Procedures (SOPs) and

protocols for timely emergency response services to save lives and minimize medical complications.

1.7 Limitations of the Study

Generalization of findings from this study to entirely represent the scenario in Nairobi City County as well as Kenya in general, forms the key limitation in the current study. This is so because the study will be carried out in Nairobi City County and will only include general County hospitals, that is, Mama Lucy Kibaki (MLK) Hospital as well as Mbagathi Hospital, and omit Pumwani Maternity Hospital in addition to other public, private, as well as faith-based hospitals in Nairobi who respond to emergencies.

In addition, the study will only engage the County emergency operations center (EOC), under Nairobi City County. Importantly, the selected County hospitals have a high volume of emergency referrals, thus giving a better picture of the intervention outcome. The County Emergency Operations Centre has a toll-free number accessible to the entire public and provides free emergency ambulance services. The study targets the public within the community units in the catchment area who will be fully reached through Community Health volunteers (CHVs) who interact with all households. Education was also done during community dialogue meeting

1.8 Delimitation of the Study

The geographical space of this research was restricted to Nairobi City County with specific focus on MLK and Mbagathi County Hospitals; as well as the EOC under the Nairobi City County. The study intervention will be training that will target the households within catchment area of MLK Hospital and emergency team.

Study populations will include the households within catchment area of MLK Hospital and Mbagathi County Hospital who will be stratified into sub-counties, wards, and community units that are easily accessed by community health promoters (CHPs). One adult person will be interviewed in every household.

The other population of interest in this study includes the emergency operation unit, that is; the EOC staff, ambulance staff, as well Accident and Emergency (A&E) section staff found in the study County Referral hospitals. Study outcomes will be assessed using information collected from the public, EOC, ambulance team, and A&E departments in study county hospitals. The intervention will be at the community level and the evaluation of the effect at the Emergency Operations Centre and Accident and Emergency department in the hospitals.

1.9 Significance of the Study

Findings from this study will allow policymakers to identify gaps in the pre-hospital emergency health care system. Identified gaps will inform strategies for integrating emergency care systems that are at the moment unmet by the extant public health system to limit direct mortality and avoid secondary mortality by improving emergency response time.

The study will aid in the implementation of SOPs and increase the efficiency of operations at the EOC through capacity development. Study findings will further be used in the creation of context-relevant priority action plans for enhancing emergency care structures and increasing the utilization of pre-hospital emergency health care systems. For instance, more people in the public will be made aware of how to immediately activate emergency care services by calling and conveying the most appropriate message to the EOC. Moreover, over the study will establish a

teaching aid for pre-hospital emergency response activation. Information from this study will be available for reference and further studies.

1.10 Inclusion Criteria

The study used the following criteria for inclusion, that anyone who was 18 years and above and a resident of Embakasi west for more than 6 months were eligible for the study, all the households in Embakasi West were included in the study, CHPs whose reporting performance was 80% and above in their previous month before study, CHPs working in Embakasi West and were willing to participate in the study.

1.11 Exclusion Criteria

The exclusion criteria were that anyone who was a visitor in the household at the time of data collection was not being interviewed.

1.12 Assumptions of the Study

The study assumes that the EOC team, emergency response team and Accident and Emergency team will operate efficiently in line with the training offered during the study period. The intervention will be effective in reaching out to all targeted populations. The study outcomes will be independent of other activities outside the study. That the respondents will genuinely respond to research tools.

1.13 Definition of Operational Terms

Pre-hospital emergency health care system: -this refers to a process of care given outside the hospital setting by trained health care providers at the illness or injury scene of, amid transport to health facility, as well as at the emergency section within a health facility.

Responsive pre-hospital emergency health care delivery: This the ability of the health care system to provide timely, effective and appropriate medical care to patients in critical condition before they reach the hospital

Bystander: – refers to the individual who witnesses an emergency/casualty and can activate emergency care services.

Bystander knowledge of emergency services: - this refers to an individual's awareness to immediately call for emergency services in case of a casualty; awareness of the emergency numbers to call; and clarity of message to convey to the Emergency Operation Center (EOC).

Bystander decision-making: is the ability to observe a casualty, process and understand their condition, and make judgments on the appropriate means of transport to use to transport the casualty to the health facility.

Bystander willingness to help in emergencies: - refers to an individual's inclination to immediately call for help in emergency medical services after an emergency occurs.

Bystander: refers to the emergency operations Centre, Accident and Emergency department, and ambulance emergency response team.

Bystander performance: actions performed by the bystanders at the prehospital setting that improves emergency response times.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This section encompasses appraisal of literature on information guided by the study objectives. Additionally, the section covers the theoretical outline as well as the conceptual framework that defines existing relationship between variables in this study.

2.2. Pre-hospital Emergency Health Care Delivery

Universal Health Coverage (UHC), a foundational global health initiative spearheaded and passionately championed by the World Health Organization (WHO), represents an overarching vision for equitable healthcare access for all individuals, ensuring they can obtain essential health services without facing financial hardship. A cornerstone of this comprehensive framework unequivocally advocates for the fundamental inclusion of all health care services necessitating immediate and critical emergency medical treatment within the core provisions of any established national or regional system of medicine, irrespective of its specific organizational structure or funding model. This means that access to life-saving interventions for acute conditions, injuries, and sudden illnesses should be an intrinsic and non-negotiable component available to every citizen.

Moreover, UHC's expansive vision extends beyond current service provision to actively promote and integrate the development of robust and sustained programs for medical research cited by Chauhan et al. (2023) recognizing that continuous scientific inquiry and innovation are absolutely essential for advancing diagnostic capabilities, therapeutic interventions, and preventative strategies, thereby ensuring

the ongoing improvement and future resilience of healthcare delivery systems worldwide.

Emergency medical treatment is a dynamic and critical process that initiates its crucial interventions directly at the scene of the emergency, extending seamlessly through transit, and culminating only upon the patient's arrival and handover at appropriate health facilities. This integrated approach ensures continuous care from the immediate aftermath of an incident through to definitive hospital management. For a significant portion of the population facing sudden crises or life-threatening injuries, emergency medical treatment frequently serves as their fundamental and often sole initial point of contact with broader healthcare services. This accessibility is paramount, providing immediate professional attention during moments of acute vulnerability when rapid response can dramatically alter outcomes.

Ultimately, robust and well-functioning Emergency Medical Services (EMS) play an absolutely central and indispensable role in the entire healthcare ecosystem by profoundly decreasing preventable morbidity and significantly lowering the chances of mortality. Their capacity to deliver timely, skilled interventions before hospital arrival directly impacts patient survival and reduces the long-term consequences of severe health events. Emergency medical services are central in decreasing avertable morbidity as well as the chances of mortality (Matinrad & Reuter-Oppermann, 2022).

There is high demand for Emergency Medical Services (EMS) in Kenya, occasioned by the intense prevalence of both natural as well as man-made catastrophes, including road traffic accidents, the COVID-19 pandemic, collapsing buildings, mass as well as fire casualty occurrences in addition to acute medical events.

This increasing need for EMS highlights the challenges faced by healthcare systems in responding effectively to diverse emergencies, necessitating improvements in resources, training, and infrastructure to ensure timely and efficient medical responses (Mutua et al., 2024). This calls for a robust EMS to replace the extant, underdeveloped, under-equipped, and inexperienced system. Noteworthy, the formulated EMS policy 2020 has not yet been disseminated, which implies that there is minimal implementation countrywide. This gap in policy execution highlights the urgent need for improvements in EMS infrastructure and training to enhance emergency response capabilities nationwide. (Musyoka & Kioko, 2021).

According to the WHO, the pre-hospital emergency health care system entails pre-hospital health care services that are offered at the point of illness or injury, during patient transportation to a health facility, as well as within the emergency unit in the facility. Pre-hospital emergency health care services incorporate assessment of the patient's state of well-being, provision of possible health intervention at the scene of injury, as well as additional services during transportation and follow-up care at a health facility where necessary (Margus et al., 2020).

Pre-hospital emergency care providers mainly include bystanders, health care providers, as well as dispatchers (Fritzen, 2023). The crucial pre-hospital emergency healthcare system is primarily brought into action and set in motion by the initial involvement of a bystander, who plays a pivotal role by communicating vital information to the emergency dispatcher, most commonly through direct phone calls. This immediate contact serves as the critical first link in the chain of survival, initiating the entire response process.

Upon the rapid receipt of this incoming information, the highly trained dispatcher undertakes a multifaceted and instantaneous evaluation of the situation. They not only provide essential, immediate instructions to the caller, guiding crucial initial actions, but also meticulously assess the precise nature and severity of the emergency to determine the exact type of specialized emergency services required. Following this critical assessment, the dispatcher efficiently activates and deploys the most fitting emergency resources, ensuring that the dispatched team and equipment are perfectly aligned with the circumstances at hand to effectively address the crisis.

Upon arrival at the scene, pre-hospital emergency care team re-evaluates the circumstance afresh and consequently offer appropriate emergency treatment with possibility of patient transportation to the foremost fitting health care facility if necessary (WHO, 2018). This on-site reassessment is crucial for confirming initial details and adapting the strategy based on real-time observations. Consequently, they then provide the most appropriate and tailored emergency medical treatment directly where it's needed most, at the point of injury or illness. This intervention often includes the possibility of safe and expedited patient transportation to the foremost and most fitting healthcare facility, such as a hospital's emergency department, if the patient's condition necessitates advanced medical care or further diagnostic evaluation.

Noteworthy, not all circumstances of pre-hospital emergency health care continuously make it essential for patient transport to a health unit (Farhat et al., 2023). Circumstance evaluation, as well as examinations carried out by emergency health care experts at the scene, often inform the most appropriate plan of action to help and save the patient, including the use of alternative means of transport such as

a taxi. Strict use of ambulances is in cases where the patient's state needs close and consistent monitoring, or additionally needs medical treatment, or immediate admission to a health facility (Blodgett et al., 2021).

Evaluation of significant functions incorporates the estimation of the level of consciousness, blood pressure, pulse rate, cardiac function, level of blood glucose, as well as the content of alcohol, where necessary. Extensive capabilities within management in the field as well as the unit staffed with physicians, can facilitate additional tests on patients at the scene, with appropriate support for vital functions accorded. Some key support mechanisms include the use of technical aids for breathing, treatment of blood circulation using fluid/ medicinal therapy. Importantly, pain management is a significant aspect in the provision of pre-hospital emergency health care (Rabang & Nonan, 2021).

Ordinarily, service in pre-hospital emergency health care is more needed in events associated with breathing difficulties, chest pain, cerebrovascular disorders, as well as traffic accidents, in addition to slipping and falling accidents. It's evident that pre-hospital emergency services face significant deficiencies across most African states and numerous other developing nations worldwide. This widespread challenge means that many communities lack the immediate, on-scene medical care crucial for improving outcomes in critical situations. These gaps often manifest as limited infrastructure, insufficient trained personnel, and inadequate resource allocation for emergency response prior to hospital arrival.

Review of scholarly works as well as grey literature observed that the African continent bears approximately 90% of the global burden of trauma. For instance, mortality from post-traumatic ranges from 13% reported in Ghana to high levels of

40% reported in Nigeria. Notably, post-traumatic mortality is preventable, with South Africa reporting high rates of preventable mortality of 70%, while Ghana reported 60%, and Nigeria reported 40% (Koome et al., 2020).

Emergency care cuts across conventional disciplines that are focused on disease to oversee a wide range of intense ailments as well as injuries, which contribute considerably to mortality as well as disability, especially in LMICs. This implies that emergency care requires many different fields collaborating as opposed to being restricted to a single area of medicine. For instance, nurses, paramedics, and trauma surgeons are all essential in emergency management. Improving emergency care can drastically lower avoidable deaths and disability in low- and middle-income countries (LMICs), where resources may be scarce. To improve these services, it is imperative to train healthcare professionals and upgrade infrastructure (Burkholder et al., 2019). Sound emergency services are believed to lessen mortality by 54%-90% as well as disability-adjusted life years (DALYs) ranging between 900 million and 2.5 billion in LMICs. Furthermore, the burden of emergency conditions and the usage of emergency care across 40 countries indicate a pressing need for improved emergency services. Effective emergency care not only addresses acute health crises but also plays a crucial role in reducing the long-term impacts of these conditions on individuals and communities (Chang et al., 2016).

Focus on susceptible sections of populations that lack adequate access to emergency care, as well as consequent destitute health outcomes, has numerous similarities to emergency care delivery. Emergency circumstances, for instance, traumatic injuries, excessively impact individuals in LMICs. These vulnerable populations frequently experience difficulties because of structural hurdles that hinder prompt and efficient medical intervention, which can have serious health

repercussions, such as higher mortality and permanent disability. For example, insufficient resources and healthcare facilities in LMICs make it more difficult to receive emergency assistance, which in turn exacerbates severe injuries. This condition necessitates all-encompassing approaches to improve emergency care systems, such as enhancing access to necessary services and training healthcare professionals. It can greatly reduce the health risks related to traumatic injuries and enhance the general health of at-risk groups by addressing these gaps, which will ultimately promote a fairer healthcare environment (Shaw, 2022).

LMICs report approximately 90% of the burden of deaths as well as disability emanating from injuries. This alarming statistic indicates the substantial influence that injuries have on public health in these areas, where healthcare systems frequently find it difficult to supply sufficient funding for both prevention and treatment. This high burden is caused by a number of causes, including as poor infrastructure, restricted access to emergency medical services, and a lack of knowledge about safety precautions. Injuries can also result in permanent impairments, which put additional pressure on healthcare systems and lower people's and families' quality of life. To address this problem, comprehensive approaches are needed, such as expanding access to healthcare, strengthening safety education, and funding injury prevention initiatives to lower the frequency and effects of injuries in LMICs (World Health Organization Regional Office for South-East, 2019).

The positive impact of emergency care on the well-being of populations, in addition to the commitment to respect, advance, and preserve human rights to receive the highest feasible standard of health, justifies the call for nations to create and progress emergency care systems. Investing in emergency care systems allows different countries to safeguard their citizens' rights while simultaneously enhancing

health outcomes. One essential component of healthcare is having access to emergency services, which guarantees that everyone can get help right away when they need it. By supporting these systems, countries may show their dedication to social justice and health fairness, enabling everyone, regardless of background, to get high-quality care during emergencies (Burkholder et al., 2019).

In most instances, heightened morbidity and mortality are outcomes of delayed treatment of injury as well as acute illness. Delaying the required medical care might result in complications that increase the patient's condition and raise the risk of serious health problems and death. This case emphasizes how crucial prompt response is in medical settings, especially for trauma and acute illnesses, where every second can have a big impact on patient outcomes. In order to reduce these negative consequences and increase survival rates, it is crucial to improve access to emergency care and streamline treatment procedures (Bieler et al., 2017). Importantly, execution of compelling, prioritized, opportune emergency care in LMICs can potentially mitigate approximately 45% of deaths as well as 36% of disability. This demonstrates how important efficient emergency medical services are to enhancing health outcomes in environments with limited resources.

Healthcare systems can drastically lower the death and disability rates linked to acute illnesses and injuries by giving priority to emergency care treatments. These tactics not only increase patient survival but also improve the general quality of life for those impacted, highlighting the need for funding emergency medical facilities in LMICs (Whitaker et al., 2021). The current expanding predominance of non-communicable illnesses and injury in sub-Saharan Africa overwhelms the health systems that have been customarily mainly used to manage contagious diseases. The healthcare infrastructure, which is sometimes insufficiently prepared to address the

complex needs associated with trauma and chronic illnesses, faces major problems as a result of this shift in disease load. The region's health systems must adjust and strengthen their capacities to effectively handle these new health risks as non-communicable diseases like diabetes, heart disease, and cancer increase in frequency. This will guarantee comprehensive care and better population health outcomes (Kalkwarf et al., 2020).

Kenya, while making strides, is not entirely exempt from these broader challenges. While significant progress has been made, the nation's pre-hospital emergency care system is still relatively nascent in its comprehensive development. Currently, the landscape of these vital services is largely characterized by relatively novel initiatives, primarily driven by domestically trained Emergency Medical Services (EMS) staff. These dedicated professionals predominantly operate within private ambulance agencies, which often fill the void where public services may be less robust or widespread. This emerging private sector effort, while commendable, highlights the ongoing need for broader, more integrated, and universally accessible pre-hospital emergency care solutions across the country. Kenya is not totally exempted, considering the current relatively novel services that are offered by are provided by domestically trained EMS staff primarily working in private ambulance agencies (Musyoka & Kioko, 2021).

Currently, there is a crevice within the national coordination of the emergency health care system, in addition to undefined administration of ambulances providing emergency care services, which results in inefficiencies and delays in response times because the absence of a cohesive framework causes fragmented services that are unable to effectively communicate or collaborate, making it difficult to provide timely care; additionally, the lack of standardized training for emergency personnel makes

these problems worse by causing disparities in the quality of care across different regions, and the inconsistent implementation of current policies leaves many areas underserved and unable to meet the increasing demand for emergency services. These issues underscore the urgent need for better public awareness regarding the proper use of emergency care, improved data management systems to track and optimize resource allocation, and a unified approach to policy that guarantees equitable access to care for all citizens (Lee et al., 2022). This has caused ambulance agencies to work autonomously without any medical regulatory body that would decide as well as implement necessities for quality assurance in service delivery. Numerous emergency episodes in Kenya have escalated to major episodes due to the absence of coordinated provision of emergency services as well as inadequate resources.

Given that there has been no oversight, emergency response protocols have not been standardized, which results in disparate degrees of care in different areas. Critical interventions may be delayed since many ambulances lack skilled people and necessary medical supplies. Furthermore, it is challenging to monitor patient outcomes and collect information to enhance services in the absence of a unified system. By creating a regulatory framework, all ambulance services might be held to a set of standards, enhancing care and possibly saving lives (Muke et al., 2022).

2.2.1. Responsiveness of Pre-Hospital Emergency Health Care delivery

The concept of prehospital emergency care, often delivered by Emergency Medical Services (EMS), represents a crucial frontier in modern healthcare. Far from merely transporting patients, it encompasses a complex system of rapid response, on-scene medical intervention, and safe conveyance to definitive care. This, explores the multifaceted nature of prehospital emergency care, highlighting its historical

evolution, core components, challenges, and its indispensable role in improving patient outcomes and public health.

Globally, Herzberg et al. (2019) argued that in the USA, the success in the delivery of pre-hospital care was strongly linked to teamwork. They argued that the overall teamwork among care delivery teams was strongly associated with delivery, with their observational study showing that teams with better coordination reduced medication errors by 68%, while each small improvement in teamwork performance (as measured on a 5-point scale) was associated with a 19% decrease in procedural errors. Importantly, communication problems during low-teamwork scenarios were directly responsible for 41% of all clinical errors, highlighting the importance of synchronized team dynamics as a safety mechanism in high-stakes prehospital environments. For the Australian case, Curtis et al. (2020) argued that critical interventions are performed infrequently in children with major injuries in the pre-hospital environment.

The monitoring of the incidence and success rates for staff performing these interventions is not readily available from all pre-hospital emergency medical services, largely because paramedics in New South Wales encounter pediatric major trauma so rarely with limited opportunities to maintain proficiency in life-saving procedures and because vital signs often fail to signal severe injury (as fewer than 12% of children with Injury Severity Scores >12 showed abnormal physiology per ambulance protocols), creating significant gaps in performance tracking despite injury being Australia's leading cause of childhood mortality.

Historically, prehospital care was rudimentary, often limited to basic first aid and transport. The exigencies of war, particularly the American Civil War and World War I, spurred innovations in battlefield evacuation and early medical interventions.

However, the true genesis of contemporary prehospital emergency care systems can be traced to the 1960s, with the recognition of the "golden hour" for trauma patients and the development of specialized training for paramedics. This shift marked a paradigm change from simply "scoop and run" to providing advanced life support at the scene.

At its core, a robust prehospital emergency care system is built upon several interconnected pillars. Firstly, public access and communication are paramount. A universally recognized emergency number serves as the entry point, allowing individuals to quickly summon help. This is complemented by trained dispatchers who provide crucial pre-arrival instructions, guiding bystanders in critical interventions like cardiopulmonary resuscitation (CPR) or bleeding control. Secondly, trained personnel form the backbone of the system. These range from basic first responders and Emergency Medical Technicians (EMTs) who provide foundational life support, to paramedics and increasingly, prehospital physicians, who offer advanced critical care interventions on scene, including intubation, medication administration, and fluid resuscitation.

Thirdly, appropriate equipment and vehicles are essential. Ambulances, whether ground or air, are equipped with a spectrum of medical devices, from defibrillators and oxygen delivery systems to sophisticated monitoring equipment and medications. The design of these vehicles is optimized for patient safety, comfort, and the ability to deliver care enroute. Fourthly, medical direction and oversight are critical for quality assurance and continuous improvement. Physicians provide online and offline medical control, establishing protocols, reviewing cases, and ensuring that prehospital providers operate within defined medical guidelines. Finally, seamless integration with the broader healthcare system is vital. This involves effective

communication with receiving hospitals, pre-notification of incoming critical patients, and established pathways for specialized care, such as emergency operation centers, stroke centers, and cardiac catheterization labs.

Despite its undeniable benefits, prehospital emergency care systems face numerous challenges, particularly in diverse global contexts. In many low- and middle-income countries (LMICs), the lack of formalized systems, inadequate funding, limited trained personnel, and geographical barriers significantly impede access to timely and effective prehospital care. Even in high-income countries, challenges persist regarding workforce shortages, burnout among providers, the increasing complexity of patient presentations, and the need for ongoing technological advancements. Furthermore, addressing the social determinants of health and ensuring equitable access to care across different socioeconomic groups remains a critical objective.

The role of prehospital emergency care extends beyond individual patient encounters. It plays a vital role in public health by acting as the first line of response during mass casualty incidents, natural disasters, and public health emergencies like pandemics. Prehospital providers are often the first healthcare professionals to identify and report emerging health threats, contributing to surveillance and early intervention strategies. Moreover, the data collected by EMS agencies can provide invaluable insights into community health needs, injury patterns, and disease prevalence, informing public health initiatives and prevention programs.

For any effective bystander, analyzing their operational efficiency critically hinges on understanding a series of distinct yet interconnected time intervals, each representing a crucial phase of their intervention; these time intervals, include, notification interval, activation interval, response time, on-scene time interval,

transportation interval and delivery interval (Alruwaili & Alanazy, 2022). These precise time measurements collectively define the unit's overall performance and capacity to deliver timely aid. Specifically, the initial phase involves the notification interval, which tracks the duration from the moment an emergency occurs or is identified until the emergency dispatch center is successfully alerted. Following this is the activation interval, measuring the time it takes for the dispatch center to process the incoming information and officially dispatch the appropriate emergency team. Once dispatched, the response time quantifies the period from the team's activation until their physical arrival at the incident scene.

Upon arrival, the on-scene time interval becomes critical; this measures how long the emergency personnel spend at the location, assessing the situation, stabilizing the patient, and preparing for transport. The on-scene time interval refers to the duration between arrival of emergency team at the scene and their departure from the site and comprises of access interval to the victim, victim's initial assessment interval, treatment interval at the scene and removal interval of the victim from the scene (Khorasani-Zavareh et al., 2018). Transportation interval refers to the duration taken from departure of the emergency team from the emergency scene to arrival at the health facility while delivery interval refers to the duration between emergency team's arrival at the health facility and victim's delivery to the emergency ward.

Compelling administration of time-sensitive circumstances moreover needs specific guidelines as well as procedures priority availed to ensure that care is timely provided in an organized way (Kannan et al., 2020). Thus, Emergency Care Systems (ECS) can be characterized as organizations relegated the duties of coordinating the functions of basic emergency care services at injury or illness scenes — requiring to be systematically assessed in the following five categories as defined by the WHO: (1)

emergency care data systems, (2) governance/finance structures, (3) scene care coordination protocols, (4) facility-based care standards, and (5) disaster preparedness frameworks to ensure efficient responses in African contexts (Kannan et al., 2020), during transportation to health facilities — a phase where systematic coordination of prehospital services significantly impacts survival rates, particularly in low-resource settings where transportation delays account for up to 54% of emergency care fatalities (Reynolds et al., 2017), as well as at the hospital in the emergency section and initial inpatient care — phases where Ugandan facilities face critical system failures: only 17% of hospitals meet minimum emergency equipment standards, and just 23% have trained emergency physicians available for initial resuscitation (Ningwa et al., 2020)

Multiple scholarly investigations have broadened their scope beyond the traditional confines of the emergency department itself, delving into the critical influence of the pre-hospital time interval as a pivotal metric in assessing the overall efficacy and operational success of emergency medical services. These studies posit that the duration spanning from the initial emergency event or call for assistance to the patient's eventual arrival at the hospital is not merely an isolated preceding phase, but rather an integral and foundational element that directly contributes to, and profoundly impacts, the comprehensive performance evaluation of the emergency department. This viewpoint underscores the interconnectedness of the entire emergency care continuum, suggesting that the efficiency and timeliness of care provided before a patient even crosses the hospital threshold are significant indicators of the emergency department's ability to effectively manage and deliver acute medical attention, thereby extending the perceived boundaries of its operational assessment to encompass the journey leading up to hospital admission. The pre-hospital time interval is the duration between call receipt by the emergency department and arrival at the health facility by

the emergency team (Khorasani-Zavareh et al., 2018). Further, Bhattarai et al. (2023b) consider recovery time interval as a key performance component and define it as the duration between when the emergency team leaves the hospital and arrives back at the health facility.

Increased morbidity as well as mortality among numerous populations have been attributed to delays in emergency response, in which the "triple threat" caused by COVID-19 dangerously increased bottlenecks: Social factors (public panic resulting in unnecessary calls), patient factors (delaying help-seeking until critical stages), and EMS-related factors (such as staff/equipment shortages) collectively overwhelmed dispatch centers across the world, with call levels increasing by up to 300% in many areas (Al Amiry & Maguire, 2021). Simultaneously, sub-optimal care comprising delayed as well as inadequate care due to numerous variables was made worse when health systems, particularly India's, divert resources to pandemic response, closing non-COVID services, and contributing to cascading failures. Manageable illnesses ended up being emergencies, putting additional strain on already-compromised emergency systems, as patients with chronic conditions lost access to routine care and medications (Chauhan et al., 2023).

Even though access to skilled care at times of need for emergency care is a challenge, integrating emergency care services with other health care services could effectively improve timely response to priority seeking populations, such as acute injuries as well as illness. Although there are still significant research gaps in optimizing these delivery systems for maximum lifesaving impact in resource-constrained settings, recent research shows that emergency care systems (ECS) could address up to 54% of annual deaths through coordinated prehospital-to-facility care. This integration is particularly significant in LMICs, where ECS could address acute

conditions that vary from transmissible diseases and pregnancy complications to injuries and non-communicable diseases (Moresky et al., 2019). In this way, progressing intense as well as emergency care systems is basic for general health system reinforcement and by large ideal performance, demonstrating the manner in which adding emergency capabilities to primary healthcare (PHC) framework, for example, through training community health workers to be first responders and coordinating care between villages and hospitals—makes emergency networks more affordable and accessible than standalone systems, particularly for those rural areas where professional ambulance services frequently don't reach (Nakahara et al., 2019).

Response time, within the critical domain of pre-hospital emergency care, is a multifaceted and crucial metric that encapsulates the entire duration from the moment an emergency is reported until a casualty begins to receive the recommended medical services from professional emergency service providers. It's far more than a simple stopwatch measurement; it represents the total elapsed time for the entire system to react and mobilize, bridging the gap between the onset of a medical crisis and the commencement of skilled, on-scene medical intervention. This vital interval encompasses every step of the emergency response chain, from the initial notification and dispatch to the rapid transit of emergency personnel to the incident location, ensuring that a person in need doesn't just receive attention, but rather, receives the specific, recommended medical attention that their condition demands. Response time in the context of pre-hospital emergency care refers to reaction time or total time taken before a casualty can receive recommended medical services from emergency service providers (Alotaibi et al., 2023). Minimal response time is associated with a speedy and precise accident notification system as well as available emergency medical

services, which helps in diminishing the chances of deaths occurring (Bhatti et al., 2019).

Achieving a minimal response time in emergency situations is intrinsically linked to the presence of both a rapid and highly accurate accident notification system, alongside readily available and efficient emergency medical services. This crucial synergy means that when an incident occurs, the alarm is raised without delay and with precise details, simultaneously activating a robust network of medical assistance that is prepared to mobilize instantly. This combined efficiency in notification and immediate access to care plays a pivotal role in significantly diminishing the chances of fatalities. In essence, the faster trained medical personnel can reach a scene, assess the situation, and initiate life-saving interventions, the greater the likelihood of positive patient outcomes and the reduction of preventable deaths. It underscores how every second saved through streamlined communication and rapid deployment directly translates into improved survival rates for those in critical need.

The effectiveness of the pre-hospital emergency healthcare system, along with the proficiency of its dedicated staff, is routinely and critically evaluated primarily through the lens of response time. This means that the swiftness with which emergency services reach a scene and begin patient care stands as the foremost metric for gauging overall operational efficiency and individual performance. It's a constant benchmark used to ensure that the system is not only robust but also consistently delivering timely interventions, directly impacting patient outcomes. This ongoing assessment based on rapid response ensures accountability and drives continuous improvement in the critical moments before a patient reaches definitive hospital care.

Regularly, the performance of the pre-hospital emergency health care system, as well as its staff, is assessed based on response time (Alanazy et al., 2020).

In the event of serious injuries, the individual's chances of survival diminish with an increase in the response time (Rossaint et al., 2023). As such it is vital that the individual is put under restorative care to heighten chances of full recovery in a hospital before the 'golden hour' ends (Babu, 2021). Historically, the assessment of pre-hospital emergency care (PEC) performance predominantly revolved around a singular, easily quantifiable metric: response times. This meant that the speed at which emergency medical services (EMS) arrived at a scene was considered the key indicator of their effectiveness. The quicker the ambulance or first responders reached a patient, the better the service was deemed to be.

However, extensive analysis and evolving understanding in emergency medicine have revealed significant limitations with this traditional approach. While rapid arrival might intuitively seem beneficial, numerous studies have demonstrated that simply measuring how fast help arrives is a poor predictor of the actual quality of care delivered to the patient or, more importantly, the ultimate patient outcomes. A quick response doesn't automatically equate to effective treatment, appropriate interventions, or a positive impact on recovery. In South Africa, a study identified 104 relevant QIs, including both clinical and non-clinical measures, which could potentially improve PEC assessment in LMICs (Howard et al., 2019).

In a study by Alruwaili and Alanazy, (2022), the performance of bystanders was assessed in Saudi Arabia. The study focused on illnesses that were time-sensitive and compared key time-interval measures for bystanders. The study was cross-sectional and assessed measures such as response time, transportation interval, on-

scene interval, and survival rates. Emergency response time in rural Saudi Arabia was significantly higher than the urban areas, with a median of 22 minutes versus 15 minutes (p-value < 0.00001). Further, duration time in rural Saudi Arabia was also significantly higher than the urban areas with rural median duration being 62 minutes in rural areas versus 43 minutes in urban areas (p-value < 0.0001).

Sabbaghi et al. (2023) evaluated the performance of emergency medical services units before and during COVID-19 in Iran. The study was a cross-sectional study and sampled 17, 860 emergency calls for the duration 2018-2021. Overall, the study established significant differences in different time intervals such as response time, on-scene duration, transfer interval, total run duration, and total trip duration before and during the COVID-19 pandemic (all p-values < 0.0001).

Regionally, Baru et al. (2022) cited adverse challenges in the delivery of pre-hospital care among COVID-19 patients in Ethiopia, but most of them were preventable. Based on the report, the need for equipping the ambulances with essential and properly functioning equipment and trained manpower was emphasized. Awareness creation and training of transport staff in identifying potential hazards, at-risk patients, adequate documentation, and patient handling during transport were also emphasized, with their study revealing that 34.2% of COVID-19 patient transports experienced adverse events—primarily oxygen supply failures (28%), clinical deterioration (22%), and patient handling errors (18%)— which were significantly more likely when ambulances lacked pulse oximeters (OR=3.1), stretchers (OR=2.7), or trained paramedics (OR=4.3), demonstrating how systemic gaps directly endangered patients during Africa's pandemic surge. In Rwanda, Wojick et al., (2020) the Rwanda Ministry of Health (MOH) was in the process of approving and

standardizing the national standard for pre-hospital care. Implementation was in its initial stages, with their research revealing that Kigali's new protocols reduced average ambulance response times from 28 to 12 minutes and increased correct triage decisions by 67% within the first 6 months of rollout, demonstrating how standardization directly improved outcomes for trauma patients in urban settings.

Emergency care systems ought to typically comprise of public as well as private organizations, according to WHO guidelines, which emphasize that these systems must meet four fundamental human rights principles under international law: facilities availability, nondiscriminatory accessibility, acceptable culturally competent care, and clinically acceptable quality; requirements that are equally applicable to public and private providers (Burkholder et al., 2019), emergency transport networks with integrated communication bolstered by emergency technicians must conform to WHO's human rights framework for emergency care, which stipulates non-discriminatory service delivery, financial affordability ($\leq 1\%$ household income per emergency), and geographic accessibility within 60 minutes for 90% of populations as ethical duties under international law (Jazairi et al., 2021) hospitals that are responsive to emergencies, as well as trauma-specialized health facilities that comprise skillful healthcare professionals must give equitable geographic distribution a priority in order to adhere to human rights standards; research demonstrate that mortality rates double when emergency facilities are more than 50 kilometers away from people, and that rural areas have three times fewer medical professionals per capita than urban areas (Rocha et al., 2017).

Facilities for rehabilitation, as well as a public able to comprehend restorative needs in emergency settings must work together, the study shows that when communities understand recovery steps and facilities coordinate care, patients get 68%

faster rehabilitation access, but currently only 1 in 5 emergency centers connect patients to rehab services, while 85% of people can't identify basic recovery needs after emergencies, causing preventable long-term health problems (Musyoka & Kioko, 2021). Thus, enhancing sufficient as well as prompt response in emergencies, which is enshrined in the Kenyan Constitution of 2010 and expounded within the Health Act (2017) of Parliament, is paramount to lessen avertable morbidities as well as mortalities amid the Kenyan population (Government of Kenya [GO.K], 2010).

The emergency care system in the current study is anchored on the World Health Organization (WHO) Emergency Care System Assessment (ECSA) outline that permits nations to assess their ECS and set needs for enhancement. ECSA subdivides ECS into five main classifications for assessment, entailing financing as well as governance; quality enhancement along with emergency care data; care at the scene, transportation, besides transfer; care at the health facility; in addition to readiness for emergency (Kannan et al., 2020).

Prehospital emergency care system is a dynamic and indispensable component of modern healthcare infrastructure. Its evolution from basic transport to sophisticated on-scene medical intervention has dramatically improved outcomes for countless patients suffering from acute illness and injury. While significant challenges remain, particularly in resource-constrained environments, the continued investment in training, technology, and systemic integration will further enhance its capacity to save lives, mitigate suffering, and contribute significantly to the overall well-being of communities worldwide and Kenya is not an exception. This study achieved a remarkable improvement on prehospital emergency care by a change in notification time interval in the intervention area as compared to control area associated with educated bystanders.

2.2.2 Influence of Bystander Knowledge on Responsiveness of Pre-Hospital Emergency Health Care Delivery

The most fundamental influence of bystander knowledge lies in their ability to recognize an emergency and promptly activate EMS. In many time-sensitive conditions, such as out-of-hospital cardiac arrest (OHCA), stroke, or severe trauma, every minute counts. A knowledgeable bystander can quickly identify the signs and symptoms of a medical emergency, leading to a faster call to the emergency services. Conversely, a lack of knowledge can lead to delayed recognition, hesitation, or even misidentification of the emergency, causing precious minutes to tick by before professional help is summoned. This delay directly impacts the notification interval and activation interval within the overall EMS response time.

Research indicates that pre-hospital care in low- and medium-income countries (LMIC) is seriously missing. In cases where there are traces of pre-hospital care, only a number of nations have been found to have a fully operational pre-hospital care framework that can match the standards of Western nations. As a result, the WHO has highlighted the need to develop bystanders' knowledge in the case of LMIC. With an aim of improving bystanders' knowledge, WHO has proposed bystander programs for knowledge and skills improvement as the foremost fundamental step within the improvement of a working pre-hospital framework (Tran et al., 2019).

Beyond simply calling for help, bystander knowledge can directly influence the delivery of life-saving interventions prior to the arrival of professional EMS. This is particularly evident in cases of OHCA, where bystander cardiopulmonary resuscitation (CPR) and the use of Automated External Defibrillators (AEDs) are crucial. Studies consistently demonstrate that early bystander CPR significantly

improves survival rates and neurological outcomes for OHCA patients. A knowledgeable bystander, trained in CPR, can initiate chest compressions and rescue breaths, maintaining vital blood flow to the brain and other organs until paramedics arrive. Similarly, public access defibrillation programs empower trained bystanders to use AEDs, delivering a life-saving shock that can restore a normal heart rhythm. Without this knowledge and willingness to act, the patient's condition can rapidly deteriorate, making resuscitation by EMS more challenging and less successful.

Bystander knowledge on how to respond in the event of an emergency is central to the improvement and activation of pre-hospital health emergency care services. Bystanders need to have relevant information on how to reach the EOC and notify them to dispatch an ambulance (Ollis et al., 2023). Bystanders should be empowered with contact information of the EOC and the ability to immediately reach them perhaps by the use of toll-free numbers (Munot, 2023).

The information relayed by bystanders to emergency dispatchers is vital for effective pre-hospital care delivery. A knowledgeable bystander can provide clear, concise, and accurate details about the incident, including the patient's condition, the nature of the emergency, the exact location, and any immediate interventions being performed. This detailed information allows dispatchers to; prioritize calls thus, dispatchers can accurately assess the severity of the situation and allocate resources appropriately. Provide effective pre-arrival instructions, based on the information received, dispatchers can guide bystanders through critical steps like bleeding control, positioning the patient, or even hands-on CPR instructions, known as "dispatcher-assisted CPR. Prepare EMS crews; as accurate information allows responding paramedics to anticipate the scene and the patient's needs, enabling them to bring the

necessary equipment and formulate an initial plan of action, thus reducing on-scene time.

Bystander information on how to reply when an emergency occurs is central to the activation of pre-hospital emergency care administrations (Musyoka et al., 2023). Bystanders ought to have significant knowledge on how to reach the EOC and inform them on the nature of the emergency and the need for the EOC to dispatch an emergency vehicle (Saadatmand et al., 2023). Bystanders ought to be enriched with contact data of the EOC and the capacity to instantly reach them quickly may be by the use of toll-free numbers (Nord, 2017).

In addition, Fagel et al. (2021) Noted that bystanders ought to be able to describe the status of the emergency occurrence in terms of the general nature of the emergency, location, and condition of the casualties to the EOC. This helps the EOC in making a preliminary decision on the nature of the reaction to undertake first in order to tone down its effect on the casualties, and if possible, respond in time to save lives. Therefore, bystanders' training is vital towards improving their knowledge and skills in pre-hospital emergency care.

Bystander knowledge can also contribute to the efficiency of EMS arrival and scene management. A bystander who knows the correct address, can provide clear landmarks, or even go out to guide the ambulance can significantly reduce "response time." Once EMS arrives, a knowledgeable bystander can quickly convey crucial information, helping the crew understand the situation faster and initiate care more effectively. They can also assist in securing the scene, ensuring the safety of both the patient and the responders, or even retrieving necessary patient information.

Gutierrez et al. (2020) conducted a study in rural America to assess mini training sessions using a compression-only CPR training method on bystanders. The aim was to assess the influence of training on different aspects of bystanders in providing CPR. The study involved a pre- and post-test study on one group of students at a select rural college. Data was collected using a pre-survey questionnaire containing 14 items after which training was administered by trained paramedics. Post-test data was collected using a post-survey questionnaire containing 13 items. On a change in knowledge due to the compression-only CPR training method, the study utilizes analysis of variance (ANOVA) to assess the significance of the change. Training led to positive change in knowledge from the pre- to the post-survey group.

In a cross-sectional study conducted among university students in China, Mao et al. (2021a) evaluated the effect of training on bystanders' knowledge to perform cardiopulmonary resuscitation (CPR). The study evaluated their knowledge on CPR and their willingness to participate in training. Through an online questionnaire data was collected. Overall, the study established that the average knowledge for students who received CPR training was 2.43, which was significantly different and higher as compared to the average knowledge of those who did not receive any CPR training (mean =1.90).

Tatebe et al. (2019) Conducted a study in Chicago to assess the impact of a general public course on first aid in a traumatic scene with subtopics in management of the scene, control of hemorrhage, and minimizing trauma's physical impact. Participants in the study filled knowledge-based assessment questionnaires pre-training, post-training, and 6-month follow-up. From the statistical analysis, knowledge score was found to significantly improve from a mean of 6.2 to a mean of 7.2 post-training and 7.7 after 6 months follow-up ($p\text{-value} < 0.0001$).

In a Pakistan study, Khan et al. (2022) evaluated how a designed training program on out-of-hospital cardiac arrest CP influenced skills and knowledge of participants in backgrounds that were non-health related. The study tested participants' knowledge and skills pre (prior to training), post (immediately after training) and 6 months after training was completed (retest). Training was video administered and also through demonstrations that were scenario-based via manikins. Skills and knowledge were evaluated through a checklist that was pre-defined. For the pre and post study, 652 participants completed while the retest was completed by 322 respondents. The results indicated that scores for knowledge significantly improved ($p < 0.0001$) from pre-test to post-test. However, the CPR knowledge score slightly reduced (though not statistically significant) for the retest.

In a Tanzanian study, Ndile et al. (2020) assessed the impact of a training program for bystanders on first aid for post-crash victims. The study involved interviews with stakeholders at a traffic department and a collection of bus drivers in a select city. Under the theme of benefits of first aid training on post-crash care, the study established that training had an effect on skills and knowledge for non-healthcare workers in providing appropriate care for crash victims.

Bystander knowledge on how to respond in the event of an emergency is central to the improvement and activation of pre-hospital health emergency care services (Albargi, 2023). Bystanders need to have relevant information on how to reach the EOC and notify them to dispatch an ambulance. Bystanders should be empowered with contact information of the EOC and the ability to immediately reach them perhaps by the use of toll-free numbers (Munot, 2023).

Bystanders ought to have significant knowledge on how to reach the EOC and inform them on the nature of the emergency and the need for the EOC to dispatch an emergency vehicle (Kirby, 2022). Bystanders ought to be enriched with contact data of the EOC and the capacity to instantly reach them quickly by the use of toll-free numbers so as to reduce activation and response intervals (Nord, 2017).

In addition, Fagel et al. (2021) Noted that bystanders ought to be able to describe the status of the emergency occurrence in terms of the general nature of the emergency, location, and condition of the casualties to the EOC. This helps the EOC in making a preliminary decision on the nature of the reaction to undertake first in order to tone down its effect on the casualties, and if possible, respond in time to save lives. Therefore, bystanders' training is vital towards improving their knowledge and skills on pre-hospital emergency care so to improve emergency response times.

This study conducted a training of the household on the emergency number for Nairobi so that they call immediately there is a crisis. They were also be trained on the message to convey to EOC during a crisis. The aim of the training was to equip bystanders with relevant knowledge on pre-hospital emergency care to respond to emergencies during crisis. The result post intervention indicated marked improvement in bystander of emergency number and quality emergency calls

2.2.3 Bystander Decision-Making on Responsiveness of Pre-Hospital Emergency Health Care Delivery

Bystander decision making, highlights a crucial and often underestimated aspect of the emergency care continuum. It points to the pivotal role that ordinary citizen, present at the scene of an emergency, play in determining how quickly and effectively professional pre-hospital emergency medical services (EMS) can respond

and deliver care. This influence stems not just from what bystanders know, but from the complex psychological and situational factors that govern their choices to intervene or not.

Bystander decision-making refers to the ability of bystanders to identify emergency cases in which casualties need pre-hospital emergency care (Bednarz et al., 2023). The ability of bystanders to identify cases that require emergency ambulance services is likely to trigger their immediate decision to call EOC, thereby reducing emergency services response time (Taylor et al., 2024). In its heart, bystander decision-making is intricately linked to a bystander's inherent skill in recognizing and evaluating emergency incidents to determine if the individuals involved, referred to as casualties, are in dire need of immediate medical attention before they can reach a hospital or before paramedics arrive. This involves a quick assessment of the situation to ascertain the severity of the crisis and to understand that prompt action, often in the form of initial first aid or calling for help, is imperative to mitigate harm and potentially save lives.

Bystander decision-making relates to the capacity of bystanders to recognize crisis cases in which casualties require pre-hospital emergency care (Satchell et al., 2023). The timeliness and correctness of a bystander's emergency recognition, coupled with their efficiency in summoning professional help, are crucial factors that markedly shape the ultimate success of any response. In essence, the sooner and more precisely an emergency is identified and reported by those present, the better the chances for a positive outcome. The capacity of bystanders to recognize cases that require emergency assistance is likely to trigger their choice to call EOC, leading to decreased reaction time for emergency attendance (Render, 2024).

In case of health emergencies, bystanders encounter traumatic scenes and faced with the decision dilemma on whether they should intervene to offer assistance (Andersson & Sundin, 2021). Equipping bystanders with pre-hospital emergency healthcare training is vital for improving their response to unexpected emergencies. This specialized knowledge empowers them to conduct a rapid yet comprehensive assessment and analysis of the unfolding situation, which then guides their critical decision-making process on whether to provide direct aid or seek professional help. Essentially, it gives them the framework to understand their role and capabilities in a high-stress environment. Kuntz and Searle, (2023) established that training helps bystanders notice the need for help from an emergency victim by making them recognize the seriousness of the emergency situation and the potential dangers of not acting in time. Kuntz and Searle, (2023) further noted that training equips bystanders with skills to know whether they should act if the action benefits outweigh the inaction costs.

According to Charlton et al. (2023), training can empower bystanders to act confidently and appropriately, ultimately saving lives and improving patient outcomes. Confidence is a critical factor influencing whether a bystander decides to intervene during an emergency (Riccò et al., 2020). Training programs are incredibly effective because they don't just teach you practical skills; they also build your confidence. They do this by giving you opportunities for repeated practice and immersing you in simulations of real-life scenarios. This hands-on approach helps you feel more prepared and capable when facing actual situations. Training programs not only teach practical skills but also build confidence through repeated practice and simulation of real-life scenarios (Abelsson et al., 2020).

A study by Jensen et al. (2023) found that trained bystanders reported higher confidence levels in performing CPR compared to those without training, which directly correlated with a higher likelihood of intervention. Emergency situations naturally bring on stress and anxiety, which can seriously hinder a person's ability to make sound decisions. Thankfully, training plays a crucial role in helping individuals manage these intense psychological reactions. It does this by making them thoroughly familiar with emergency procedures and decision-making processes, allowing them to act more effectively even under pressure. According to a study by Geyer, (2022), trained bystanders demonstrate faster reaction times and better decision-making under pressure compared to untrained individuals.

In the USA, Leary et al. (2019) assessed how virtual training mobile application and a standard training mobile application influenced bystanders' decision making in cases of emergency. Random bystanders were either categorized in the virtual training and standard training mobile applications. Before and after training, data is collected from the bystanders on the likelihood to call 911, conduct CPR and ask for automated external defibrillator (AED). The study conducted statistical testing through Wilcoxon rank sum tests. Generally, the study found that use of virtual training mobile application led to a significant increase on the decision to call 911 and ask for an AED. Significant differences in decision making on whether to call 911 and ask for an AED was also found to be significantly different between the virtually trained group and group trained using the standard mobile application with the former having the higher likelihood of calling 911 and asking for an AED.

In a Norwegian study by Gerwing et al. (2021) evaluated the influence of training intervention through a course for enhancing communication skills in case of

emergencies. Additionally, training the respondent in basic first aid along with establishing accessible emergency equipment is recommended (Okwiri et al., 2023).

Health systems are intended to ascertain the most noteworthy achievable standard of wellbeing for a community; hence underscoring being fortified always to guarantee quality as well as safe care, including pre-hospital emergency response plus care. Research carried out in Ethiopia, where 1 in 10 COVID-19 patients transferred by ambulance encountered an abrupt decline in health during transportation, effectively demonstrates the importance of continuous strengthening. Routine transfers became life-threatening circumstances due to a mixture of critical delays, such as waiting intervals before pickup, pre-existing diabetes, and unsteady breathing rates. These results demonstrate that, despite the availability of ambulances (one component), other system components, such as effective dispatch procedures and chronic illness care, must cooperate to stop patients from getting worse before they ever get at the hospital (Demisse et al., 2022).

Khorasani-Zavareh et al. (2018) argued that delivery of pre-hospital care in Iran was affected by various factors. The most important barriers in relation to pre-hospital care delivery were related to the manner of cooperation by members of the public with the EMS and their involvement at the crash scene, as well as to pre-hospital system factors, including the number and location of EMS facilities, type and number of ambulances, and manpower, with their qualitative analysis showing that these challenges created critical delays across four key time intervals: 1) notification time (delayed crash reporting by bystanders), 2) response time (ambulance dispatch bottlenecks), 3) on-scene time (extended extrication due to public interference), and 4) transport time (rerouting due to inadequate facility distribution), compounding risks for road trauma victims where every minute lost reduces survival odds by 7-10%.

A study highlighted the call of member-states in collaboration with WHO to survey, set up as well as progressively monitor integrated pre-hospital on top of emergency health care systems within health facilities, since emergency care contributes in addressing ten (10) Sustainable Development Goals (SDGs) targets in southern Sri Lanka, only 1 in 5 injured patients reached hospitals by ambulance, showing how weak pre-hospital systems undermine SDG progress when communities lack access to organized emergency transport (L. M. Reynolds et al., 2021). This study analyzes the emergency health care system as visually represented using an infographic of the WHO Emergency Care System Framework (ECSF) that is outlined to bolster policymakers assess or reinforce national emergency care systems.

The WHO ECSF as well as the emergency care services complementary essential package, epitomize a way through which emergency care can be universally scaled up globally, quickening advancements toward universal health coverage as well as additional SDG targets. Further, ECSF provides consensus-based essential functions of emergency care systems, and that facilitates the identification of system gaps to aid in priority setting (Reynolds et al., 2021). Considerable need for proof to improve comprehension capacity, shortcomings, strengths, as well as improvement-precedence areas, especially in low-resource situations, the assessment tool found that emergency systems in poor regions have dangerous gaps: only 1 in 3 ambulances carry life-saving equipment, while community distrust causes 70% of families to avoid calling for help even during heart attacks (Mehmood et al., 2018).

The emergency care system in this study is guided by the ECSF, which entails fundamental pre-hospital emergency care tasks executed at the illness or injury scene, during transport, as well as at the emergency unit. Pre-hospital emergency care providers include bystanders, health care providers, and dispatchers, according to

(WHO, 2018). Pre-hospital emergency care is provided both at the scene as well as during patient transport; however, pandemic conditions present EMS teams with significant obstacles. 78% of responders express extreme fear about spreading diseases to their family members, and a lack of personal protective equipment (PPE) makes infection control in cramped ambulance settings extremely difficult. At the same time, during mass casualty incidents, equipment shortages such as oxygen and ventilators occur. Teams use mobile decontamination units for equipment safety, adhere to stringent double-gloving protocols during high-risk procedures, attend peer support groups run by the hospital to process trauma, and depend more and more on telemedicine consultations to prioritize critical transports in order to cope with these pressures.

These adjustments show that maintaining emergency treatment during medical emergencies necessitates giving responder safety and patient requirements equal consideration (Yilmaz et al., 2021). The bystander is the emergency care system ‘activator’ and receives instructions from the dispatcher, especially in stroke situations, where dispatchers now employ precise procedures to detect large vascular occlusion (LVO) when responding to emergency calls. Paramedics can confirm this crucial sign on the spot and start immediate triage to comprehensive stroke centers for time-sensitive interventions like thrombectomy by asking callers a binary question about whether the patient's head or gaze is deviated away from the side of weakness, a key sign of cortical ischemia. This allows dispatchers to screen for LVO strokes quickly and accurately. This expedited identification procedure shows how structured dispatch questioning in conjunction with bystander observation improves pre-hospital stroke care pathways by triggering specific stroke protocols during the initial emergency response phase, hence reducing treatment delays (Vuorinen et al., 2021).

The study specifically evaluated whether training delayed decision-making or not. Respondents who undertook the course were found to make decisions more quickly as compared to those in the control group.

2.2.4 Bystander Willingness to Help on Responsiveness of Pre-Hospital Emergency Health Care Delivery

While bystander knowledge refers to what a person knows about emergencies and first aid, and bystander decision-making encompasses the psychological processes of whether to act, bystander willingness to help delves into the motivation and readiness to overcome potential barriers and actively intervene. It's the intrinsic drive that translates knowledge and the decision to act into actual action.

Bystanders need to be positive and willing to help or call for help when an emergency happens (Aldridge et al., 2022). The existing body of academic work primarily investigates bystanders' inclination to act during an emergency, specifically examining their readiness to both directly assist the casualty and to contact emergency care services. Moreover, studies conducted in more developed nations have also shed light on the significant impact that specific training programs have on increasing bystanders' willingness to offer aid when faced with health-related emergencies. This indicates a dual focus in the literature: understanding the inherent willingness to help, and then exploring how education and preparation in pre-hospital care can enhance that willingness.

In a Chinese study, Mao et al. (2021a) evaluated bystanders' willingness to perform CPR and considered the role of training. The study found close to half of the respondents in the study (47.2%) to be willing to offer simple help such as checking whether the patient was breathing, conscious, and dialing. Only one-third of the

respondents were willing to perform CPR on bystanders. The study further established that willingness to help improved with knowledge increase after training. Therefore, an indirect significant effect of training on the willingness of bystanders to help was established.

Jaskiewicz et al. (2022) conducted a study in Poland to establish the impact of training on bystanders' willingness and self-confidence to conduct CPR in adults who were working. The study involved a post- and pre-test quasi-experimental research design. Training was on basic life support. There was statistically significant difference in willingness to perform CPR before and after training. Participants who had received training for a duration exceeding 2 years were found to significantly change their willingness to perform CPR on children and strangers, while those who had received training for less than 2 years indicated more willingness to perform CPR on strangers.

In a Canadian study, Muise et al., (2019) assessed whether there will be more willingness and confidence for learners to act in cases of emergencies after training on first aid. The study involved control and test groups, with questionnaires being utilized in collecting data. Data was collected before, instantly after, and later (6 months) after being trained. Post training, the study found that training had no significant effect on willingness and confidence to act in case of emergencies. Further, there were no significant differences in willingness and confidence to act between the test and control groups.

Park et al. (2020) conducted a study to assess whether basic life support training influenced laypeople's willingness to participate in CPR. The study was conducted using an intervention group that underwent training in the HEROS program

and a control group that did not undergo any form of training. After training, both groups demonstrated high willingness to engage in CPR. Further, significant differences in willingness to help between the two groups were found, with the intervention group recording higher levels of willingness to help ($p\text{-value} < 0.001$).

Pivač et al. (2020) conducted a study on training school children and their willingness to help in the performance of CPR. The study utilized a mixed-methods research design of mixed methods. With samples in the pre- and post-study being separate, the study was conducted in Slovenia's public elementary schools. The study found significant improvements in willingness to help others in CPR after training among the participants. Ross et al. (2018) conducted a study in the USA to assess the effect of training on hemorrhage control on bystanders' willingness to participate in medical and traumatic emergencies. Willingness was measured on a scale of 5. Before training, the willingness score was 2.5, while post-training, the score was 4.0. The differences in willingness score were statistically significant with a $p\text{-value} < 0.0001$.

The research showed that this training improved participants' sense of self-efficacy and willingness to act during such emergencies. Specifically, the training was found to boost participants' confidence in their ability to apply both direct pressure and tourniquets in bleeding emergencies. Therefore, the training not only increased knowledge and skills but also positively affected participants' attitudes, leading to increased willingness to respond to bleeding emergencies. Likewise, any training of bystanders increases the willingness to help.

In Taiwan, CHENG-YU et al. (2016) evaluated how training that was population-based affected bystanders' willingness to perform CPR. The study was a retrospective study that involved questionnaires before and after training. The results

established a significant increase in willingness to conduct CPR by bystanders (p-value = 0.0016). Further, training also resulted in improvement in willingness to conduct CPR on strangers after training (p-value < 0.0001).

Bystander willingness to help plays a critical role in emergency medical situations, significantly influencing emergency response time intervals such as activation, response, transportation, arrival, and handover times, all of which are pivotal in determining outcomes in patients (Goto et al., 2018). When bystanders are willing to help, it plays a crucial role in ensuring that rescue operations are well-coordinated. This willingness facilitates a quicker dispatch of emergency services and more efficient navigation to the scene. Ultimately, this leads to a potential reduction in the overall response time, improving outcomes in critical situations. Bystanders' willingness to help ensures there is coordination of rescue operations, which can facilitate quicker dispatch and navigation, leading to potential reduction of response times (Goto et al., 2018).

The willingness of bystanders to offer assistance in an emergency has consistently been shown to result in a significantly reduced transportation interval for casualties. By actively engaging in fundamental emergency support services, such as providing initial aid or relaying critical information, bystanders greatly enhance efficient scene management. This improved organization at the scene directly facilitates expedited transport decisions, ensuring that there are no unnecessary delays in moving the patient to the emergency department, thereby guaranteeing an optimal and swift transportation time. Delays are minimized in preparing the victim allowing the emergency response personnel initiate immediate evacuation of the victim to the hospital (Klein & Thielen, 2025).

Streamlined victim preparation significantly reduces delays, enabling emergency responders to expedite evacuation and transport to a medical facility. This study was relevant in reducing the emergency time through bystanders training. This is further reiterated by (Faul et al., 2016) who demonstrated that bystanders' willingness to help in basic life support offers initial stabilization which allows the EMS personnel to expedite on-scene management and transport decisions. This implies reduced response times especially in terms of handover intervals and transportation intervals.

It is imperative to have functioning as well as effectively interacting building blocks of the health systems that enhance pre-hospital emergency response, activities, as well as health outcomes, countywide, territorially, and universally, a connection that is eloquently illustrated in actual emergency situations where bystander training proves to be a vital lifeline. Training bus drivers in basic first aid created a life-saving community building block. These drivers learned how to stop bleeding and safely move injured people using locally available materials like cloth strips, demonstrating that simple, context-specific adaptations can transform regular citizens into essential emergency responders. Take Tanzania, where 50% of road crash victims died before hospital arrival. CPR training also increased students' knowledge scores by over 200% on average in Chinese universities, but only 34% of them were willing to help strangers. This shows that even when the "training building block" works, other important elements like legal protections and cultural attitudes must coincide to allow action (Alkhalidi et al., 2021).

One of the impacts of emergency care on disease burden is its capacity to help manage a broad assortment of severe injuries and ailments over the life expectancy of

all populations. Effective emergency care systems have become crucial for minimizing long-term health problems while also improving population health outcomes in addition to easing acute medical emergencies. For example, acute diseases like heart attacks and strokes, which are common in many populations, can have their mortality rates considerably reduced by prompt therapies. Additionally, by incorporating socioeconomic determinants of health into emergency care procedures, it becomes easier to address the root causes of health inequities, which maximizes resource allocation and improves access to care. By concentrating on these factors, emergency services can more effectively customize their responses to match the various demands of communities, which will ultimately result in a more robust healthcare system that can successfully manage both acute and chronic health conditions (Whitman et al., 2022).

Whereas essential avoidance endeavors are imperative to decrease the burden of intense illnesses, emergencies are prevalent in the developed and least developed nations. A number of things, including accidents, natural catastrophes, or unexpected health problems, can trigger emergencies. It is essential to have efficient emergency care systems in both wealthy and developing nations. By ensuring that patients receive care in a timely manner, these systems can prevent problems and save lives. Better planning and response tactics can result from an awareness of the particular difficulties that each region faces, which will eventually improve everyone's health (Burkholder et al., 2019).

Communities have started to progressively identify the importance of the presence and utilization of strong emergency care services in decreasing disease burden across the globe as these services play a critical role in enhancing access to timely medical intervention, which is essential for improving health outcomes,

especially in underserved and rural areas where treatment delays can result in higher rates of morbidity and mortality. Therefore, improving emergency medical systems not only makes it easier to respond quickly to acute medical emergencies but also promotes better coordination with nearby healthcare facilities, which eventually results in better patient care and lower healthcare costs overall (Su et al., 2019).

Huge numbers of lives are lost due to progressive enduring shortcomings in health systems that block execution, retention capacity, as well as harbor anticipated benefits in health outcomes and coverage, especially in low-income settings. These health systems' inadequacies are frequently brought about by a lack of resources, poor infrastructure, and inadequate training for medical personnel, all of which make it more difficult to provide high-quality care. These difficulties are made worse in low-income environments by restricted access to necessary medical equipment and supplies, which results in avoidable fatalities and long-term health problems. Resolving these issues is essential to enhancing health outcomes and guaranteeing that everyone has access to the healthcare services they require. Investing in infrastructure, training, and resource allocation can strengthen health systems and drastically lower mortality rates while improving population health overall, especially in communities that are already at risk (Burkholder et al., 2019).

Scholars and health stakeholders recommend thorough health policy in addition to research in health systems that are designed to advise endeavors to fortify health systems within low and middle-income countries (LMICs). Much focus is emphasized on the application of concepts of systems thinking in planning and assessing the health system, reinforcing interventions. Additionally, it has been highlighted that incorporating Health Technology Assessment (HTA) is an essential part of this process since it offers a methodical way to assess the effects of health

technologies, which helps make well-informed decisions that support the Sustainable Development Goals (SDGs). The importance of HTA in improving health systems has been emphasized by the World Health Organization (WHO), especially in LMICs where resources are scarce and the need for efficient interventions is critical. By employing HTA, policymakers can better understand the medical, economic, and ethical impacts of health initiatives, ensuring that strategies are not only effective but also equitable and sustainable in addressing the unique challenges faced by these regions (Alkhaldi et al., 2021).

It is crucial that the bystander is willing to help in case of an emergency and has the contact, access, and gadget to reach the dispatcher. The dispatcher needs to have a clear directory of healthcare services for an effective dispatch process and coordination. Noteworthy, the dispatcher ought to be guided by protocols that are time-sensitive as well as time-saving, for instance, the SARA app allows for real-time video feedback during out-of-hospital cardiac arrest (OHCA) emergencies. This allows dispatchers to visually assess the scene and assist bystanders in performing critical interventions, such as using a defibrillator and proper cardiopulmonary resuscitation (CPR), while also coordinating the EMS response. This dual approach reduces communication errors and expedites the time to life-saving interventions by providing visual confirmation of patient conditions and bystander actions. In time-sensitive situations where prompt, properly administered CPR can double or triple survival chances, this integration of video technology with dispatch protocols greatly increases the accuracy of remote assistance. It also shows how digital tools improve traditional dispatch systems by establishing interactive support channels between medical professionals and bystanders (Morand et al., 2022).

The recommended health care provision requires that the service provider have a basic kit. Health care provision during patient transport, such as an ambulance, requires healthcare providers and drivers. However, ambulance crews can use other options, such as transporting patients straight to community health centers, setting up follow-up appointments with their regular doctors, or setting up home care visits, for non-urgent patients who don't require emergency department care but still can't be left alone. These strategies can cut down on needless ER visits while still providing patients with the care they need. These options function best when ambulance services have established relationships with nearby healthcare professionals and employ straightforward decision-making tools to securely select the appropriate course of treatment for each patient's circumstances. This increases system efficiency while maintaining patient safety as the first concern (Blodgett et al., 2021).

The healthcare providers ought to be skilled in the care needed by such patients, such as patient positioning, intervention, as well as monitoring skills. Additionally, protocols, especially triage protocols, ought to be at the destination in addition to communication to the destination facility. Particularly for COVID-19 patients, this calls for specific infection control measures during transportation, such as appropriate personal protective equipment (PPE) use, vehicle ventilation management, and oxygen therapy administration. These abilities were essential in Addis Ababa, where 28% of transported patients suffered from adverse events like oxygen desaturation due to inadequate training for providers. Standardized handover procedures between EMS teams and receiving facilities, especially when incorporating real-time patient vitals updates and prehospital interventions through coordinated communication systems, dramatically decreased the likelihood of clinical deterioration, the study further highlighted. During infectious disease outbreaks, these data demonstrate how safe

emergency medical transport is based on protocol-driven coordination and pathogen-specific clinical competencies (Baru et al., 2022).

Kirschenbaum and Rapaport, (2020) noted that bystanders' willingness to help in situations of emergencies has a significant impact on emergency response times. This crucial benefit arises because bystanders who are willing to help immediately initiate vital actions, such as promptly calling for professional assistance and providing basic first aid. These immediate interventions effectively bridge the critical time gap until trained medical personnel arrive, significantly reducing the overall duration it takes for the emergency victim to receive much-needed care. This is because bystanders who are willing to help initiate immediate action, for instance, calling for help and basic first aid provision, which bridges the gap until the medical personnel arrive. This reduces the overall time that it takes for the emergency victim to receive care.

Bystander willingness to help is improving outcomes in emergency, particularly in low- and middle-income countries (LMIC) with limited formal prehospital services (Duut et al., 2022). However, Kirschenbaum and Rapaport, (2020) added that this is often affected by the "bystander effect," where the presence of other people can result in responsibility diffusion, making individuals less likely to intervene, which ultimately delays response times.

Community networks, practical training, cultural norms, and policy frameworks are all components of the health system that must work together like gears in a watch. Tanzania's 92% participation rate in training related to license renewals demonstrates how these components can turn bystanders from defenseless witnesses into empowered first responders who fill critical care gaps in the crucial hour before professional help arrives (Rechel et al., 2020). In spite of the fact that the pre-hospital

emergency response is a predominant performance marker of the country's health service delivery, the corresponding contribution of the additional building blocks is of extraordinary significance to improve these markers, because without trained bystanders who are willing to help or inform experts who have the ability of carrying out so, even the most effective emergency protocols fall insufficient.

Considering Chinese universities, although the fact that CPR training doubled students' knowledge scores, only 34% of the respondents were willing to help strangers. This shows that for the training block to have a practical influence, the cultural attitudes building block must be supported. Additionally, research on air ambulance teams shows that clinician exhaustion affects life-saving decisions during crucial transfers, demonstrating that the workforce well-being block has an immediate effect on emergency performance.

The above examples demonstrate that emergency responsiveness is a chain in which all the links, from physician attentiveness to bystander confidence, must remain intact. It is not only about ambulances and equipment. Investment in all building blocks is important for protecting lives, as if one weakens (such as worn-out employees or reluctant bystanders), the entire system fails (Myers, 2019). This study looked at factors that may influence bystanders in do or not help in emergencies. The training reduced some fears from bystanders where they were afraid of legal consequences on handling emergency patients, among being judged by their superiors, as well lack of competence to act.

2.2.5 Influence of Bystander Performance on Responsiveness of Pre-Hospital Emergency Health Care Delivery

Bystander performance in this study was addressing the actions bystanders perform at prehospital setting amounting to swift emergency response and reducing the emergency response times. The bystanders were being rated by (calling EOC and notifying emergencies, on the quality of emergency calls made, on knowledge of emergency number as patients at (A & E), as patients in choosing means of transport). This was done before and after training in both control and intervention area. Bystanders are emergency care systems activator (Vuorinen et al., 2021), and they are link the health care professionals with community emergency services.

Trained bystanders possess more efficient emergency knowledge and skills, like recognizing emergency numbers and knowing what to do in a crisis, which facilitates a smoother flow of necessary information to professional responders. This enhanced communication creates a foundation of common understanding, ultimately improving overall response effectiveness and cooperation during emergencies, as well as improving their performance in reporting to the EOC and A & E. An emergency operations center (EOC) is the central area for planning operational data and assets for vital administration of open wellbeing crises and occasions (Davis, 2022). Emergency operation centers provide communication and data apparatuses and an administration framework amid a reaction to open wellbeing crises and occasions. They moreover give other basic capacities to bolster decision-making and execution, coordination, and collaboration (Uyimleshi, 2021).

The bystander in a hospital acts in a way that prevents possible hazards through a timely response based on emergency incidents taking place in an area, training and increasing bystander knowledge about emergency numbers and procedures

significantly enhance their ability to provide this effective, timely response, thus saving lives (Musyoka et al., 2023). Based on a discussion by Feng and Cui (2021) bystander also acts in a way that prevents the health deterioration of victims. This follows the fact that immediately an emergency occurs, the victim's health deteriorates, thus calling for an immediate response to enhance survival.

Training of bystanders has been proven in research to improve the efficiency of operations in the bystander. For instance, after training, bystanders are aware of the message to convey to the emergency response team, thus minimizing disagreements between the two sections (Riou, 2024). The proactive training of bystanders has been consistently demonstrated to significantly accelerate the initial phase of emergency response. When individuals at the scene possess fundamental knowledge and skills, they are empowered to provide critical information more accurately and concisely during emergency calls. This enhanced communication directly enables emergency dispatchers and the response team to make faster, more informed decisions regarding resource allocation and immediate interventions. Consequently, the time required for emergency services to understand the situation, prepare, and deliver essential care is dramatically reduced, leading to more efficient and effective management of critical incidents compared to scenarios involving untrained individuals.

Training of bystanders has also been found to reduce the time required for emergency calls since the emergency response team is able to deliver required decisions more quickly when dealing with a trained bystander as compared to when dealing with a non-trained one. This has been found in scholarly literature to lead to an increase in the number of calls and referrals to hospitals' emergency units (Linderoth et al., 2021).

The systematic training of bystanders has been consistently and unequivocally found to profoundly reduce the critical time interval required for initiating emergency calls. This efficiency gain is attributed to the enhanced capacity of the emergency response team to formulate and deliver required decisions with significantly greater speed and accuracy when interacting with a trained bystander, as opposed to situations involving an untrained or unprepared individual. This demonstrable improvement in the initial response phase has been extensively corroborated in scholarly literature, leading to a notable and beneficial increase in both the overall volume of emergency calls received and the subsequent referrals of patients to hospitals' critical emergency units, thereby optimizing the continuum of care.

According to Perera et al. (2023), calls by bystanders to emergency units are essential in the survival chain. In such calls, the bystander is reliant on the information they elicit from bystanders to have a picture of the situation. With such information and the professional guidelines and resources available, they are able to make critical lifesaving decisions.

The timely and informed calls initiated by bystanders to emergency units are not merely beneficial but are absolutely fundamental and profoundly essential components within the intricate survival chain of critical incidents. In these crucial communications, the entire operational effectiveness of the bystander is heavily and critically reliant upon the comprehensive and accurate information they are able to elicit from the on-scene bystanders to construct a clear, immediate, and actionable picture of the unfolding situation. It is precisely with the synthesis of this vital real-time intelligence, combined with their extensive professional guidelines, established protocols, and the diverse array of specialized resources at their disposal, that emergency personnel are empowered to swiftly and confidently formulate and execute

critical, often instantaneous, lifesaving decisions that directly influence patient outcomes and the overall success of the intervention.

In emergency cases, the response team should achieve high accuracy levels; however, this can falter when the information conveyed is ambiguous or vague. Therefore, when dealing with a trained bystander, there is smooth information flow, which is a prerequisite for enhancing common ground, thus ensuring cooperation between the bystander and the emergency team (Munot, 2023). Research by Craig, (2020) also reveals that bystander training aligns expectations, emergency system knowledge and medical information between the bystander and the emergency response team. This makes the emergency response team recognize emergency cases such as cardiac arrest on time since they pursue a line of questioning that the bystander understands and one that he/she is able to provide diagnostic information rather than describing symptoms.

In a study conducted in Norway, Gerwing et al. (2021) evaluated the impact of training towards aligning callers and emergency response team in information delivery. Training intervention comprised of a course designed to improve communication skills of the callers and operators. The study analyzed 3034 calls from the intervention area and 1659 calls from the control area pre and post training. The study established that the training course reduced interaction time thus enabling the emergency response team receive other calls. This led to a significant increase in number of calls and patients referred to the emergency unit of the select hospital in the intervention area ($p\text{-value} < 0.0001$).

Derkenne et al. (2020) conducted a study in Paris, France, to assess how the detection of emergency calls could be improved for cardiac arrest patients. To improve the call detection rate, the Paris Fire Brigade trained the public on basic life support

and the “Hand on Belly” technique in 2012. The study adopted a cross-sectional research design that collected samples of calls from 2012-2018. The study targeted calls that led to the detection of out-of-hospital cardiac arrest by the emergency response team. During the 6 years of the study period, the research established a 5% increase in emergency calls per year for the same number of calls’ recipients at the emergency department. Further, the study established that more calls identifying cardiac arrest patients was increasing over time.

Kenya has been creating numerous vital components of a pre-hospital crisis therapeutic administration (EMS) framework. This is often due to the ever-increasing request for crisis restorative care across the nation. An appraisal of Kenyan EMS preparing educate in 2016 built up that there was no national or state-level approach existed that builds up levels of EMS suppliers or anticipated support of information and abilities; preparing teach had autonomously made their preparing measures; preparing materials were not adjusted for the nearby setting; the establishment of fundamental life structures and physiology instruction was powerless.

Preparing did not center on the indication- or syndrome-based complaints; understudies had trouble applying foundational classroom information in recreations and clinical experiences, and there was a restricted accentuation on complex basic considering. The Study prescribed that standardizations of preparing were required in Kenya, counting clearly characterized levels of suppliers, and anticipated learning results since preparing graduates ought to be EMS suppliers who approach understanding care with high-order side effect- or syndrome-based basic considering (Nicholson, et al., 2017).

Furthermore, the expeditious and efficient response time of Emergency Medical Services (EMS) stands as an absolutely paramount and inherently crucial factor within the entire spectrum of pre-hospital emergency care. This critical metric does not merely represent a logistical measurement; instead, it directly and profoundly influences the trajectory of patient outcomes and, indeed, significantly impacts overall survival rates for individuals experiencing acute medical emergencies or traumatic injuries. The swift arrival of trained personnel and specialized equipment can be the definitive determinant between life and death, or between minor and severe long-term disability.

However, it is important to acknowledge that a multitude of complex and often unpredictable factors collectively exert a substantial influence on the actualization of these vital EMS response times. These significant determinants include, but are not limited to, challenging geographical obstacles such as remote locations, mountainous terrain, or sprawling urban areas with intricate street layouts. Additionally, adverse weather conditions, ranging from heavy snow and ice to torrential rains, dense fog, or even extreme heat, can severely impede travel and operational efficiency. Congested traffic patterns, particularly during peak hours or due to unforeseen accidents, present a constant and formidable hurdle to rapid transit.

Moreover, patient-specific considerations, such as the exact location within a building, the type of emergency, the presence of hazards at the scene, or even the clarity of initial information provided by callers, can all contribute to delays in reaching the individual in need. Several factors affect EMS response times, including geographical obstacles, weather conditions, traffic, and patient-specific considerations (Alshammari et al., 2024). Internal factors such as facilities, human resources, and

service protocols, as well as external factors like environmental conditions and patient clinical status, contribute to variations in pre-hospital time intervals (Setyarini & Windarwati, 2020).

This study was looking at the bystander in three areas, including the EOC coordination, looking at the coordination of emergency calls from the public as well as the health care facilities. All the calls were being recorded, the type of emergency and location. The EOC coordinated the dispatch of ambulances to the emergency scene. The health care providers were able to stabilize the patient at the scene and refer appropriately to the respective health care facility. The emergency care team, (were the health care providers working with ambulances and responding to the emergencies, working at the EOC receiving emergency calls and also working at the A& E department receiving and treating emergency patients).

At the A & E department the study was looking at triage and hand over process and how long it takes, mode of means transports in use, number of emergency patients being seen at A& E and their knowledge on emergency numbers, before and after intervention. All this will be working toward improving pre-hospital emergency care delivery, since EOC is the link between the community and emergency care system.

2.2.6 Effect of Training of bystanders on Responsiveness of Pre-Hospital Emergency Health Care Delivery

Literacy in emergency health care is regarded as essential in life saving of the victims. As a result, policymakers in health have adopted different strategies and targets to improve emergency health care literacy and preparedness. To achieve high-quality emergency health care, literature has proposed education campaigns for different stakeholders, with bystanders considered key among them. The education

campaigns have also targeted geographic locations considered as high-risk so as to improve intervention by bystanders. Moreover, literature also suggests that non-targeted education campaigns and training of bystanders to be successful in improving intervention by bystanders (Kawai et al., 2024). Further, training on emergency pre-hospital care has been shown to improve performance in aspects such as CPR performance, survival of cardiac arrest patients, and response rate by the bystanders (Ho et al., 2020).

Furthermore, extensive evidence robustly indicates that dedicated educational interventions focused on emergency pre-hospital care demonstrably enhance the overall operational capabilities and clinical effectiveness of responders. This specialized training has been conclusively shown to significantly elevate performance across multiple critical dimensions. For instance, it leads to a marked improvement in the quality and execution of cardiopulmonary resuscitation (CPR) procedures, ensuring higher compression rates, appropriate depth, and minimized interruptions, which are all vital for maintaining cerebral and coronary perfusion.

Consequently, this heightened proficiency directly translates into a substantial increase in the survival rates for individuals experiencing out-of-hospital cardiac arrest, as effective early resuscitation is paramount to restoring spontaneous circulation and preventing anoxic brain injury. Moreover, such comprehensive training programs empower bystanders to not only act more swiftly but also to enhance their overall response efficiency and preparedness, leading to a more rapid and effective deployment of resources when every second counts. This cumulative effect underscores the transformative impact of continuous professional development in the realm of emergency medical services (Ho et al., 2020).

Furthermore, well-structured educational initiatives and practical training programs play an indispensable role in empowering lay individuals to become vital first responders at the scene of an emergency. Such instruction meticulously hones bystanders' ability to critically assess their surroundings, enabling them to swiftly and accurately identify potential dangers and unforeseen hazards that could compromise safety for themselves, the victim, or even arriving professional rescuers. This proactive hazard recognition is crucial for preventing further injury and securing the immediate environment. Beyond mere observation, this specialized training thoroughly prepares these individuals to confidently execute critical on-site lifesaving interventions, including the crucial techniques of cardiopulmonary resuscitation (CPR) and providing effective assisted breathing, thereby bridging the vital time gap before professional medical help arrives and significantly increasing the chances of patient survival.

Moreover, when circumstances necessitate, the training equips bystanders with the knowledge and confidence to safely and methodically assist in the careful evacuation of individuals from an immediate danger zone, ensuring that movement is conducted in a manner that minimizes additional harm or exacerbation of injuries, thus contributing fundamentally to effective emergency scene management

Further, training helps sensitize bystanders identify possible hazards, perform on-site lifesaving activities such as resuscitation and assisted breathing and if necessary assist in evacuation from the emergency scene in a safe way (WHO, 2022).

In an emergency case, trained bystanders can make a decisive difference in the medical emergency outcome (Leemeyer et al., 2020). With most deaths from emergency cases such as heart attack, trauma, stroke or any other illness that is time sensitive occurring within the golden hour (first hour) and in most cases outside the hospital (Bhattarai et

al., 2023b), training of bystanders on pre-hospital care therefore becomes a crucial section of emergency care and can affect outcomes in health in the emergency department (Varghese, 2020).

Consequently, the systematic education and empowerment of bystanders in essential pre-hospital care techniques emerges as an absolutely indispensable and profoundly crucial component within the entire continuum of emergency medical services. This pivotal segment of care is far from peripheral; instead, it forms a foundational pillar, directly influencing the trajectory of patient well-being even before specialized medical teams arrive at the scene.

The knowledge and skills imparted to ordinary citizens through such training programs have a tangible and significant impact on the subsequent health outcomes observed within the controlled environment of the emergency department. Patients who receive timely and appropriate first aid from trained bystanders often arrive at the hospital in a more stable physiological state, with critical functions supported and initial injuries or conditions potentially mitigated. This early intervention can dramatically reduce the severity of complications, enhance the effectiveness of definitive treatments initiated by hospital staff, and ultimately contribute to improved morbidity and mortality rates, thereby optimizing the overall prognosis for individuals presenting to emergency units.

In Paris, France, Derkenne et al. (2020) found that training reduced time required by an emergency unit call center to answer calls and the duration to sending an emergency team to durations less than those recommended by international guidelines. Pebriani et al. (2021) conducted a study in Indonesia to assess the impact of training and development in a continuous manner towards improving intervention time for the rapid response unit. The study was conducted pre-training (2015-2016)

and post-training (2017-2020). The study established continuous training to lead to a reduction in intervention time by the rapid response unit for all types of emergencies such as accidents and illnesses. The study attributed the reduction to the continuous training equipping the community and the rapid response team with the required hard and soft skills for emergency response. Participants were trained on the required intervention times for different health emergencies and how to detect them thus enabling the community to be familiar on necessary steps to be taken to intervene.

Training can also have an effect on other aspects of performance in the emergency department. In a UK study, Waring et al. (2021a) evaluated the effect of training on preparedness of the emergency healthcare staff. Training was done through Emergo Train System regarding emergency response. The study used mixed methods questions with pre- and post-training questionnaires collecting data on 83 respondents. Interviews were also utilized in data collection from 10 key informants. Through paired t-test, training was found to significantly improve preparedness of emergency response team at different levels such as the individual level, team level, agency level and multi-agency level thus improving response rate in case of emergencies.

Xu et al. (2022) evaluated the preparedness of the emergency team in China as a result of CPR education for bystanders. Preparedness was measured using a standardized scale referred to as the Team Emergency Assessment Measure (TEAM), containing 11 items assessing behaviors of health personnel dealing with emergencies. Differences in scores between pre- and post-training were assessed through the Wilcoxon test. Overall, the study found that response times for emergencies were significantly shortened after training. For instance, identification of cardiac arrest was reduced from 10 minutes to 7 minutes ($p\text{-value} = 0.0001$) and time for airway opening significantly reduced from 45 minutes to 35 minutes ($p\text{-value} = 0.01$). In Cameroon,

non-medical bystander intervention was associated with reduced early mortality among injury victims, despite the lack of a formal prehospital care system. However, research in Kenya revealed inadequate knowledge of trauma care among bystanders and a lack of essential emergency care equipment (Okwiri et al., 2023).

2.3 Theoretical Framework

This study is based on four theories; the theory of Planned Behavior; the bystander intervention model, the Golden hour theory, and Queuing Theory.

2.3.1 Theory of Planned Behavior

Ajzen, (1991) developed the theory of planned behavior (TPB) and proposed three-dimensional theoretical frameworks that can be utilized in human behavior understanding and prediction. According to Ajzen, (1991) The likelihood of executing an action is connected to the intent of undertaking it. Intent is determined by three dimensions comprising of attitude, subjective normative beliefs, and control beliefs. Attitude defines the beliefs of the person undertaking an action, and in this case beliefs of the bystanders.

Regarding bystander intervention in pre-hospital emergency health care, a positive attitude would imply thinking that intervening would help save life. Subjective normative beliefs relate to how the person perceives the judgment of the people close to him/her regarding the actions undertaken. In the context of bystanders' intervention, it would imply thinking that people closer will approve and be proud for intervening. Control beliefs relate to being confident in one's own capacity to intervene in pre-hospital emergency health care.

An attitude towards a certain action, for instance, bystander intervention in this context, is developed, either positively or negatively, from the beliefs held by the

person towards the action in addition to other factors related to the action. Actions that people believe to have positive outcomes, for instance, willingness to intervene, are favored, while actions that people believe have negative outcomes are unfavored (Ajzen, 1991). Therefore, it is vital to implant the view that intervention in pre-hospital emergency care is of great importance.

For subjective normative beliefs, human beings are naturally social creatures with high regard on what the society and people around perceive his or her actions (Ajzen, 1991). The element of social interaction should therefore be considered when training bystanders on pre-hospital emergency health care (Myall et al., 2020). This helps dispel the peculiarity of bystander intervention in public. Based on TPB, if the community is in favor of certain behaviors, that is, the societal norm is to initiate bystander intervention promptly, then laypersons will have a positive intent to intervene should an emergency arise (Ajzen, 1991).

Control beliefs on the other hand, relate to community empowerment to actually perform an action, depending on the available resources and opportunities at a specific time (Ajzen, 1991). A bystander who feels empowered and feels that he or she possesses the capacity to undertake a particular action has a higher likelihood to act when needed. Based on this, bystanders should be given sufficient training on pre-hospital emergency health care. This ensures that they have a sense of control. It is also important to train bystanders so as to instill confidence in them while engaging in pre-hospital emergency health care (Lukacena et al., 2019). For training to instill confidence in bystanders, it should focus on the three dimensions of TPB which include positive attitude installation, promotion of positive societal expectation and promotion of an empowerment sense (Liaw et al., 2020a).

The theory has been applied in explaining bystander intervention in different emergency cases, such as cardiac arrest. For instance, (Liaw et al., 2020a) Conducted a study and applied TPB to explain how training helps to improve the perception and confidence of bystanders in CPR and accessing AED programs. Based on TPB, training was found to improve willingness to conduct CPR and AED and also reduce fears and concerns in CPR performance. Zhou et al. (2021) conducted a study in China and adopted TPB variables to assess knowledge, status of training, and willingness to conduct CPR among students in a medical university. Students with high CPR training have high knowledge, a high positive attitude, a high subjective norm, and high perceived behavioral control towards performing CPR.

In an Indian study, TPB was adopted to predict the intention of the youth to help road accident victims. The study found TPB to provide a framework that was valid and reliable in predicting college students' intention to help victims of road accidents, with perceived confidence, social norm, and attitude being significant determinants of intention to help. The theory is fit for the study since the pre-hospital emergency health care training is developed to sensitize as well as educate the public on how to immediately respond in the event of an emergency. The theory further elaborates on bystander willingness to help in the event of an emergency (Rustagi et al., 2023).

2.3.2 Bystander Intervention Model

Latané and Darley, (1970) created the bystander intervention model, also known as the situational model. The model is a five-step model suggesting that intervention decision is complex and bystanders should notice the event first, interpret it as an emergency, take accountability for acting, make a decision on how to act, and

make a choice to act. Latané and Darley (1970) further note that possible barriers at any point of the five steps are likely to hinder intervention by bystanders.

The theory has further been applied by Burn, (2009) in explaining bystanders' intervention in sexual assaults. According to Burn (2009) the first step in the model involves noticing an event, with the barrier in this step being failure to notice due to the distraction of the bystander. The second step of identify the situation as appropriate for bystander intervention. In other words, the situation should be interpreted as high risk. The main barrier in this step is ignorance, which may lead to failure in identifying the situation as highly risky.

The third step is to take responsibility for the intervention. In this step, bystanders identify a victim at a risk of being assaulted sexually or sexually assaulting, but fail to intervene if they do not perceive it as their responsibility. Failure to take responsibility is influenced by other bystanders being present, bystanders' relationship with the probable perpetrator or victim and beliefs related to the likely worthiness of the victim. According to Latane and Darley (1970) increase in the number of bystanders diffuses his/her responsibility with each bystander feeling a responsibility sense that is decreased. This responsibility diffusion is highly likely in cases when there is no cohesion among bystanders and intervention is not supported by social norms. Bystanders are more likely to intervene when a relationship exists between him/her and the bystander or when the victim is a member of their circle (Levine et al., 2002).

The fourth step towards bystander intervention is the decision on how to help, with the main barrier being failing to intervene due to a deficit in skills (Burn, 2009). Uncertainty on what to do or say when another faces assault risk or is being assaulted may result to intervention failure due to inadequacy in skills. The fifth step involves

making a choice to act or intervene, which can be hindered by the bystander having the fear of being embarrassed, social concerns, and awkwardness, which results to the barrier of audience inhibition (Latané & Darley, 1970). Nickerson et al. (2014) applied the bystander intervention model in assessing bullying and sexual harassment in the USA. Through structural equation modeling, it was evident that all steps were affected by the previous phase in the model as proposed in the model.

Bystander intervention model was therefore created to clarify why bystanders in crises sometimes do and other times do not help. Noteworthy, the helping responses may be inhibited at any stage of the process. In this study, the bystander intervention model defines bystander knowledge and bystander decision-making. Bystander knowledge is covered under ‘know how to help’ which implies knowledge of emergency numbers and messages to convey to emergency service providers. Bystander decision-making is covered under ‘interpret the situation as an emergency’.

2.3.3 Golden Hour Theory

The theory is credited to Cowley (1976) and characterizes the duration immediately an injury occurs when emergency intervention is most effective for the victim. Cowley (1976) noted that the use of standardized emergency management protocols in the first hour after a traumatic event significantly improved health outcomes and reduced mortality. Therefore, the theory of golden hour emerged to emphasize how speed is important in emergency procedures. If a victim is critically injured, there are less than 60 minutes for survival. Though death might not occur immediately after 60 minutes elapse, but may occur days or weeks later, something has occurred in the victim’s body that is not reparable.

A study by Sampalis et al. (1993) found a significant application of the golden hour theory by studying the importance of reduced times in out-of hospital care in

reducing mortality rates. Further, Sampalis et al. (1999) established the importance of the golden hour theory by establishing that reduced time in pre-hospital care led to dying odds declining. The theory has also been useful in explaining how reduced pre-hospital time benefits specific population of patients including those with head injuries (Dinh et al., 2012), excessive bleeding (Clarke et al., 2002), severe injuries in the chest (Clevenger et al., 1988) and patients of trauma in rural areas whose transportation interval is very long (Grossman et al., 1997).

An interdisciplinary study by Tachon (2018) established that time sensitive care is applicable in diverse health care areas and departments such as emergency medical services, intensive care unit and trauma operating room. Neczypor and Holley (2017) entrenched the theory in evidence-based care provision in mothers and their newborn babies. The study found the golden hour to comprise of practices that lead to stabilizing of the mothers and the newborn such as delayed clamping of the cord, assessment of newborns on the maternal abdomen, non-urgent tasks delay for time exceeding 60 minutes and early breastfeeding initiation. The study found the golden hour to lead to thermoregulation of the neonates, reduced stress levels in the mothers and the neonates and improved bonding of the mother and the baby.

The theory of the Golden Hour fits this study that focuses on reducing emergency response time to save lives through the provision of medical services at the earliest time and while on transport. Emergency response time is dependent on notification interval and activation interval. Notification interval is the time taken by a bystander to call the EOC, while activation time is the time taken by EOC to dispatch an ambulance to the emergency scene.

2.3.4 Queuing Theory

Queuing theory was first established by (Erlang, 1909) while studying telephone traffic. In general, queuing theory mathematically studies waiting lines. Under the theory, models are constructed to study lengths of queues and the waiting time. Queuing theory has been shown by researchers to be applicable in health care management. For instance, (Fomundam & Herrmann, 2007) utilize the theory in summarizing various results in analysis of waiting and utilization times and design of health systems. For Sessaiah and Thiagaraj (2011) queuing theory can be adopted to analyze the distribution of patients in queue and determine parameters such as the probability of chasing away patients and distribution of waiting time.

For Mayhew and Smith (2008) queuing theory represents flow of patients and emergency calls in an accident and emergency department. An application by (McQuarrie, 1983) while applying queuing theory established that waiting time can be reduced by prioritizing patients requiring shorter time for services. (Vass & Szabo, 2015) conducted a study in Romania and utilized queuing theory in characterizing flow of patients in an emergency department so as to ensure optimal allocation of resources based on a number of expected patients from the emergency operations center. For Elalouf and Wachtel (2022) Queuing theory assessed how patients are directed in an emergency department and how their flow is managed. In Jordan, Qandeel et al.(2023) assessed queuing theory at a select cancer center emergency department to establish the distribution of patients. The study established the average number of patients in the queue as not exceeding 3 with the waiting time being a minimum of 1 minute and maximum of 4 minutes.

In this study, Queuing theory scrutinizes the entire system of waiting in line, including elements like the rate of emergencies, number of ambulances, number of

casualties, the capacity of the EOC, average ambulance service time, and queuing discipline. Queuing discipline refers to the rules of the queue, for example, whether it behaves based on a principle of first-in-first-out, last-in-first-out, prioritized, or serve-in-random-order. Queuing theory in this study is applied with measures that seek to reduce emergency response time.

2.3.5 WHO Emergency Care Systems Framework

In as how much this study is guided by the theory of planned behavior, the Bystander intervention model, the golden hour model and queuing theory model; the WHO emergency care systems frame work crowns it all, it aligns all the key actors together in coordination and monitoring response times. The WHO framework addresses the entire emergency care pathway, from the scene of the emergency to transport and hospital care (WHO, 2018). It highlights the importance of integrating various sectors to ensure a seamless response. The WHO stresses that effective coordination is essential for optimizing emergency care outcomes. This involves; information sharing between different care providers, Smooth handovers of patients between different stages of care and establishing clear communication channels. Emergency response times is of key essence in WHO emergency systems frame work. The framework implicitly prioritizes minimizing emergency response times and effective coordination contributes directly to faster response times by; enabling rapid dispatch of emergency services, streamlining patient transport and ensuring that hospitals are prepared to receive emergency patients.

The WHO framework aims to create well-coordinated emergency care systems that can deliver timely and effective responses. This involves strong coordination between all actors in the system, from first responders to hospital staff, and the use of tools and strategies to minimize response times. This study capitalized on

strengthening the WHO framework by building capacity on bystander knowledge on emergency numbers, message to convey in an emergency and what to do in an emergency. Figure 2.1 and Figure 2.2 shows the WHO emergency care systems farmwork

Figure 2.1:

WHO Emergency Care Systems Frame Work

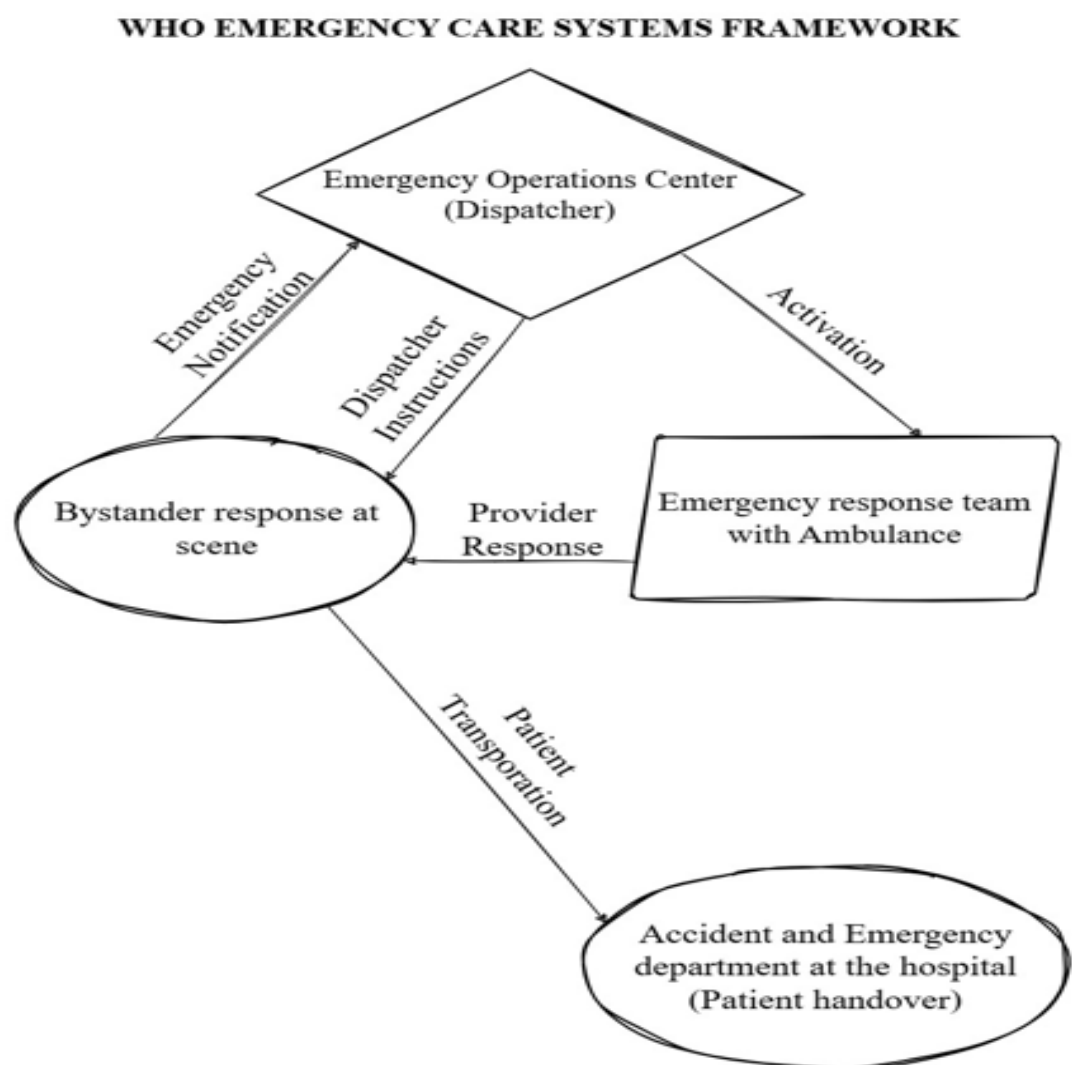
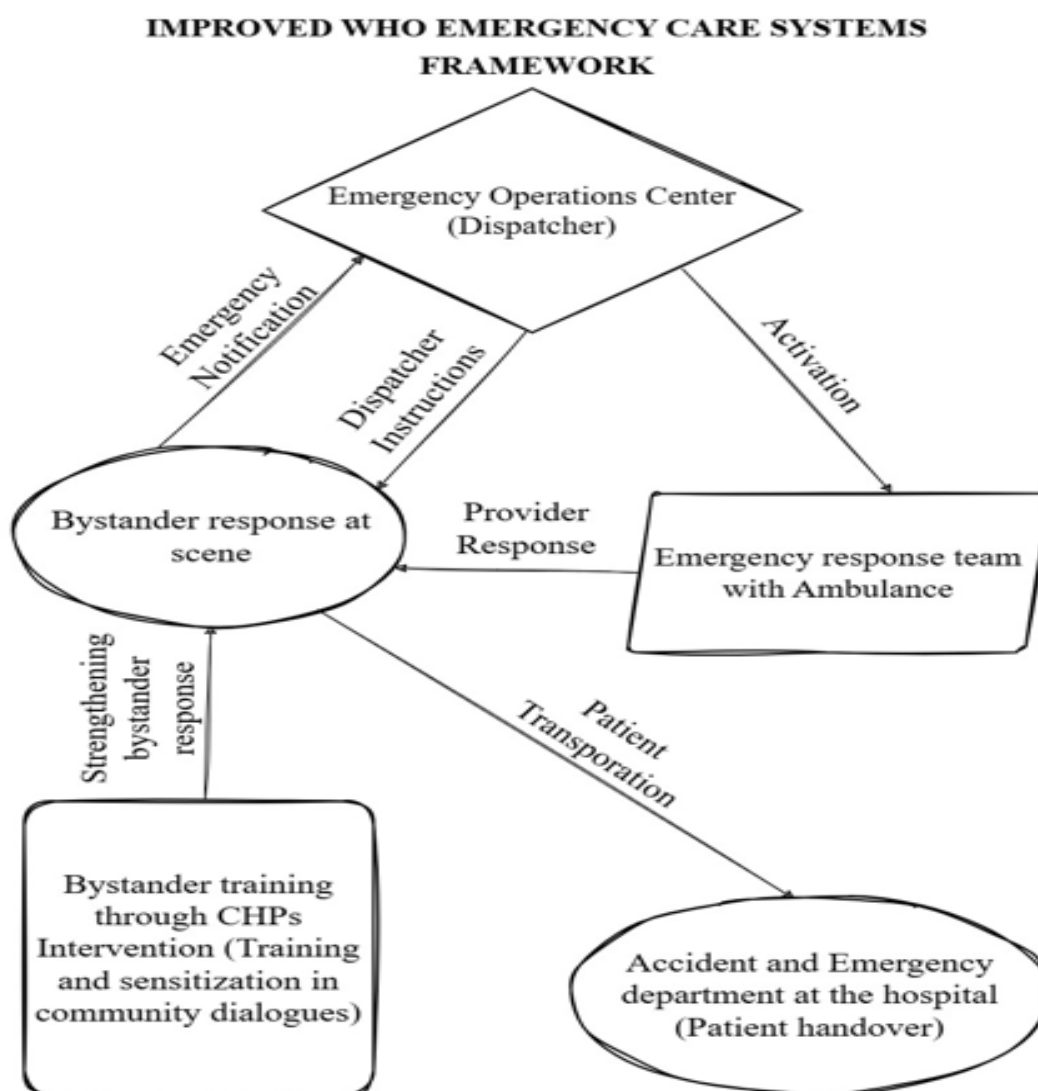


Figure 2.2:

Improved WHO Emergency Care Systems Frame Work

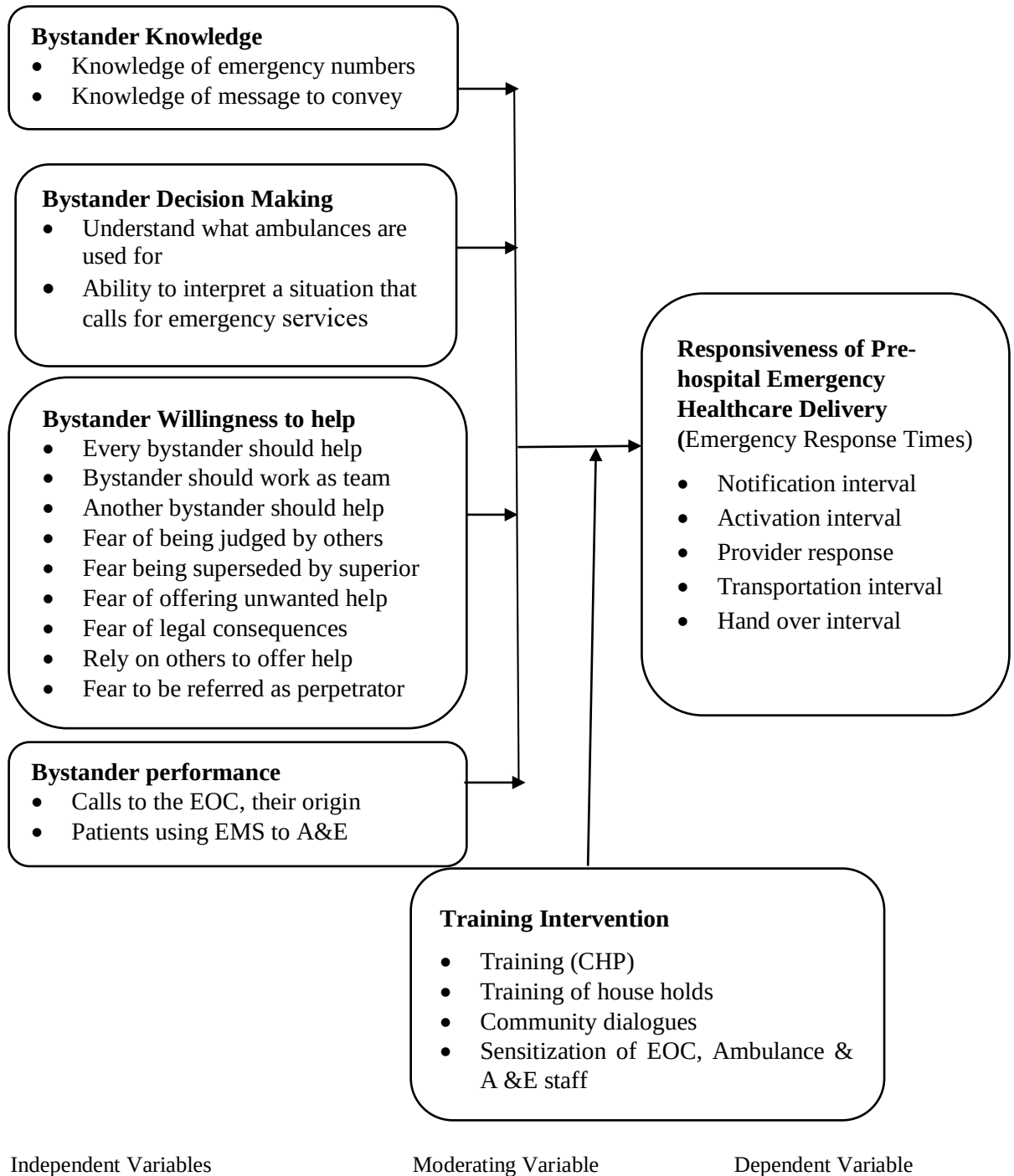


2.4. Conceptual Framework

A conceptual framework refers to a diagrammatic presentation outlining the expected relationship between the variables in a study. For each variable, the conceptual framework clearly outlines its measurable indicators (Varpio et al., 2020). For this study, the conceptual framework is as outlined in Figure 2.3.

Figure 2.3:

Conceptual Framework



CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

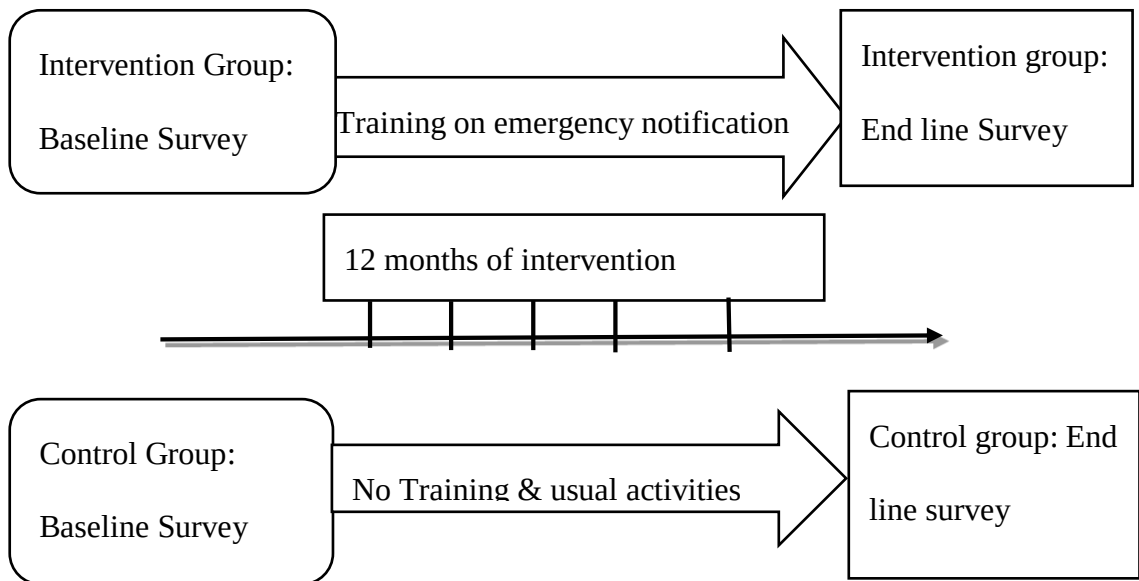
The chapter describes the research procedure that was used in carrying out the study. It comprises the study design, study population, study sample size and sample determination, study intervention, and data collection instruments. Further, the chapter elaborates on issues of validity and reliability of data-gathering tools, explanation of information-gathering procedures, data quality, analysis, presentation, and ethical considerations.

3.2 Study Design

This was an unmatched case-control study that adopted both qualitative and quantitative research methods. The study used an intervention and control group to evaluate the effect of training intervention on emergency response time, calls to EOC, and the number of casualties using emergency services before and after the training. Pretesting was done to make sure the two groups were comparable before intervention, and post-intervention allowed the researcher to evaluate the immediate effects of the intervention on the outcome variable. Additionally, the researcher was able to measure between group differences before the intervention by using a baseline data. See Figure 3.1 on the study procedure.

Figure 3.1:

The Study Procedure



3.2.1 Mixed Methods

This study employed a mixed-methods approach, which has gained popularity for its comprehensive methodology, incorporating multiple methods to address research questions effectively (Dawadi et al., 2021). This approach involves the systematic collection, analysis, interpretation, and reporting of both qualitative and quantitative data.

The chosen mixed-methods modality influences how data is interpreted, conveyed, and integrated. In this study, data were collected using a convergent parallel mixed-method design. This design merges qualitative and quantitative data to provide a meaningful explanation of research issues by integrating philosophical frameworks from both post-positivism and interpretivism (Fetters & Molina-Azorin, 2020). This approach offers several advantages, including logical grounding, methodological flexibility, and an in-depth understanding of smaller cases (Maxwell, 2022).

Mixed-methods research enhances the generalizability and implications of findings for the entire population. The quantitative approach allows researchers to gather data from a large number of participants, thereby increasing the potential to generalize findings. Conversely, the qualitative approach offers a deeper understanding of the investigated issue, honoring the participants' perspectives. In essence, quantitative data provides breadth to the study, while qualitative data adds depth (Tashakkori et al., 2021).

3.3 Study Area

The research was carried out in Nairobi City County. The Nairobi City County hosts the Capital City of Kenya, and with the highest population of 4.397 million as per the census conducted by the Kenya National Bureau of Statistics in 2019 for urban and peri-urban persons (Kenya National Bureau of Statistics [KNBS], 2019). The County covers an area of 703.9 square kilometers and approximately 60% of the inhabitants of Nairobi live in informal settlements in congested and poor environmental sanitation, exposing the population to high risk of emergencies and disasters, disease outbreaks like cholera, fires etc. The nature of activities and emergencies emanating within the county warrants an effective and efficient pre-hospital emergency care system.

The county has two general county referral hospitals namely Mama Lucy Kibaki Hospital (MLKH) and Mbagathi County Referral Hospital (MCRH) that mainly receive general emergency patients. The study included households within the sub-counties hosting the two county hospitals. The Sub County hosting MLKH includes Embakasi West, while MCRH is hosted at Kibra Sub-County. The Sub-County hosting MLKH formed an intervention while the sub county hosting MCRH became the control group.

The choice of catchment area of MLKH to become an intervention was based on the high population of residents and low network of hospitals compared to catchment area of MCR. Nairobi City County has an Emergency Operations Center that coordinates the evacuation of patients in the region at no cost. The county has a total of 83 ambulances that are government and privately owned according to a study conducted by (Musyoka & Kioko, 2021).

3.4 Study Population

The study populations included households within the Sub-County hosting Mama Lucy Kibaki County Hospital as cases and households within the sub county hosting Mbagathi County Hospital as controls. Nairobi City County emergency operation center (EOC), and Accident and Emergency (A&E) departments in study hospitals. The study training intervention targeted the households within the sub county hosting Mama Lucy Kibaki Hospital and emergency team at the EOC, ambulances and A & E of MLKH.

The households were stratified into 1 subcounty, Embakasi west subcounty, and 64 community units within Embakasi West that surrounds MLKH, while stratification in Mbagathi County Referral Hospital catchment area was 1 sub county, that is Kibra Sub-County with 64 community units. Each community unit has 1,000 households allocated to 10 Community Health Promoters (CHPs) who provides basic health information to all households in their community units. The study sampling frame was households in all community units within catchment area of MLKH and that of MCRH. Study outcomes were assessed using information collected from households, EOC, and A&E departments in County referral Hospitals.

3.5. Sampling Procedure

The study utilized stratified and purposive sampling techniques. The households were stratified into one sub-county and 64 community units within the sub county hosting Mama Lucy Kibaki Hospital; while stratification in Mbagathi County referral Hospital area included one sub-county and 64 community units. Households in each community unit were listed to form a sampling frame. Proportionate and representative samples of households was randomly selected using simple random sampling from each community stratum until desired sample size was achieved as shown in Table 3.1.

Table 3.1:

Sample Scope for Unmatched Case-Control Study

Sub-County	Community Units (Each with 1,000 households allocated to 10 CHPs)	No of households	Sample households	CHPs
Embakasi West Sub-County: Mama Lucy Kibaki Hospital	64	64,000	376	640
Kibra Sub-County: Mbagathi County Referral Hospital	64	64,000	376	640
Total			752	

The study collected data from one adult respondent in sampled households; this means that anyone who was 18 years and above found in the household was interviewed. The bystander (EOC, Ambulance team and A&E in the two hospitals) were purposively selected. The CHPs who conducted training to the household and in community dialogue days were also purposively selected.

3.5.1 Sample Size Determination

The study sample size was 752 households, including a 10% attrition rate, determined using the OpenEpi Version 3 open-source calculator. The sample was

calculated with a 5% precision level, a 95% two-sided confidence level (1-alpha), an 80% power (chance of detecting), a 1:1 ratio of controls to cases, an assumed 50% exposure rate among controls, a hypothetical 37% exposure rate among cases, and a minimal detectable odds ratio of 0.64, as shown in Table 3.2.

Table 3.2:

Sample Scope for Unmatched Case-Control Study

Sample Size for Matchless Case-Control Study			
	- Two-sided confidence level(1-alpha)		95
	- Power (% chance of noticing)		80
	- Ratio of Controls to Cases		1
	- Hypothetical percentage of controls with exposure		37
	- Hypothetical ratios of cases with exposure:		50
	- Least extreme Odds Ratio to be detected:		1.56
	Kelsey	Fleiss	Fleiss with CC
Sample Size – Cases	325	324	342
Sample Size – Controls	325	324	342
Total sample size:	650	648	684

References

Kelsey et al., Methods in Observational Epidemiology 2nd Edition, Table 12-15

Fleiss, Statistical Methods for Rates and Proportions, formulas 3.18 & 3.19

A precision level of 5% implies that the researcher intends to make an error of 5% maximum. The power of 80% implies that the study expects (80%) to get the difference between the cases and controls. Hypothetical proportion of controls with exposure is unknown and thus presumed to be of 50% while the hypothetical proportion of cases with exposure of 37% is bench marked on a study conducted in Nairobi Metropolitan Services (Musyoka & Kioko, 2021).

3.6 Study Intervention

The intervention in this study was training and it used CHPs. Healthcare promoters provide services to the household, and community. They are expected to

establish the link between the community and the health facility care system (MOH, 2020). In Kenya, the CHPs are selected by the community members and are attached to a link health facility. Their purpose is to encourage communication and feedback mechanisms between the health system and health clients. The training targeted the households within catchment area surrounding MLKH. To reach the households, the researcher used CHPs. A training intervention was conducted to 128 Community Health Promoters (CHP) and were provided with training guidelines preparing them for training of households in the intervention area on emergency notification. This was a two-day activity, and on the completion of the training all the trained CHP were assigned regions in Embakasi west to begin training households on emergency toll numbers (1508) the emergency number for Nairobi, on how to make emergency notification, a message to convey to the EOC and what to do at an emergency scene. This training continued for one year from March, 2023 to February, 2024. During the intervention period, changes in number of emergency calls to the EOC and their origin, changes in number of patients using emergency services (ambulances) and their origin, emergency response time was being monitored closely.

Precisely, the posters and stickers provided contained the toll-free numbers to call the Nairobi City County emergency operation center in case of an emergency and a message to convey. Precise information was on self-identification, location of the emergency, type of emergency, number of casualties and safety of the scene. Information on the posters and stickers was in English and Kiswahili. The stickers were distributed to the households to stick them into the houses and be able to remember the information provided. The intervention was implemented within 12 months.

The end-line data collection was done at the end of 12 months from both the control and intervention area, using structured researcher administered questionnaire. The rationale for choosing 12 months was that, this was ample time for change of behavior to individuals at the community on learning the emergency toll number, saving in their phones, and calling it with a positive perspective.

3.7 Data Collection Instruments

This study collected both qualitative and quantitative data. Quantitative data was gathered using questionnaires while qualitative data was gathered using focus group discussions (FGDs), key informant interviews guide and observation checklist.

3.7.1 Questionnaires

Questionnaires were used to gather data from the households. Questionnaires are considered appropriate for data collection when dealing with a large sample size. Further, they are advantageous since they can be quickly administered and ensure uniformity in terms of the questions presented to the respondents. In this study, questionnaires contained four sections. Section A enquired on demographic information, section B enquired on bystander knowledge, section C enquired about bystander's decision making and section D enquired about bystander's willingness to help during emergencies.

3.7.2 Focus Group Discussion

Data was also gathered through focus group discussions. The focus group discussions involved organizing the households into groups of 10-12 people. The focus group discussions deliberated on bystander operations, bystander knowledge, bystander decision making and bystander willingness to help during emergencies and how this affected responsiveness of pre-hospital emergency healthcare delivery. The

study conducted 2 focus group discussions during the baseline survey (1 for the control group and 1 for the intervention group).

3.7.3 Observation Checklist

Emergency operation center observation checklist was used to collect data on the bystander, emergency care providers trained, numbers of calls made to EOC, time interval of emergency response. A hospital checklist was used to collect information on the means of transport used by emergency patients coming to the A&E. The data was then triangulated to elucidate and establish areas of improvement.

3.7.4 Key Informant Interview

Key informant interview was done to the in charge of accident and emergency department, and in charge of EOC, barely to understand their knowledge on pre-hospital emergency health care system, their expectation on the study and what help they would require. The interviews were conducted during the baseline and post-intervention surveys. Therefore, a total of four interviews were conducted.

Table 3.1:*Summary of Research Instrument Used*

Research Objectives	Data required	Methods
To establish the influence of bystander knowledge on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.	collect information from bystanders on face-to-face communication	use of researcher administered structured questionnaire, FGD
To assess the influence of bystander decision-making on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.	collect information from bystanders on face-to-face communication	use of researcher administered structured questionnaire, FGD,
To establish the influence of bystander willingness to help on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.	collect information from bystanders on face-to-face communication	use of researcher administered structured questionnaire, FGD
To evaluate the performance of the bystander on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.	Collect information from health care providers, observation by researcher	Researcher administered structured questionnaire, observation check list, KII
To evaluate the effect of bystander training on responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya.	CHP trained on emergency notification, Household reached on emergency notification information on patients using emergency services, emergency calls to the EOC, emergency response times	Researcher administered questionnaire, FGD guide & KII, field narrative (endline).

3.8 Pretest Study

A pilot study was conducted in Dagoretti Sub-County. The sample size for the pilot study was 35 respondents. This was guided by Hajjar (2018) who asserted that 10% of the desired sample size is an appropriate number for piloting. The aim for piloting was to ascertain reliability and validity of the research instruments. Through piloting, the researcher assessed the applicability of the research instruments and identified any mistakes that were unforeseen and would affect the results. This helped dependability and usefulness of the tools.

3.9 Reliability and Validity of the Research Instruments

3.9.1 Validity of the Research Instruments

Validity governs to check whether a study truly measures that which it was planned to measure or how honest are the explore results (Kaman & Othman, 2016). Validity is the correctness and relevance of interpretations that are founded on the study outcomes (Mohajan, 2017). A tool is thought to be effective if it measures what its dues to measure. Validity in this study was ensured by pre-testing the study tools to resolve issues of ambiguity that might be a threat to validity.

Moreover, by conducting intense literature review and adopting the pretested questionnaires that were designed to answer the intended study questions assisted the researcher to assure external validity. Triangulation of study tools enhanced validity. Validity was also ensured through the involvement of supervisors who are experts in this area of study. Further, experts on emergency care services were also involved in enhancing the validity of the research instruments.

3.9.2 Reliability of the Research Instruments

Reliability refers to the degree to which actions are repeatable over time in diverse situations (Kaman & Othman, 2016). Consistency is grouped into external consistency (which is the level to which a research results can be imitated in diverse places) or internal consistency (which is the level to which associates of the study team will reach agreement with their observations during the data gathering exercise) (Bell et al., 2022). The reliability of the study tools was ascertained by conducting a pretest, and results from the pretest indicated a reliability of Cronbach's alpha coefficient of 0.860. This was deemed acceptable according to Taber (2017) who

demonstrated that Cronbach Alpha coefficient of 0.7 and above deems the instruments as reliable

3.10 Data Collection Procedure

Before embarking on data collection, the researcher sought relevant permits. First, an introductory letter was sought from the post-graduate School, Kenya Methodist University. After obtaining an introductory letter, the researcher then sought a research permit from the National Commission for Science Technology and Innovation. The researcher also obtained authority to collect data from Nairobi City County Directorate Health Services Research and Ethics Committee. Data collection was achieved with the help of 12 research assistants with prior experience on data collection and with a bachelor's degree. The research assistants were trained on sampling and administration of questionnaires for a period of one week before the baseline survey. Each research assistant practiced participants' sampling and distribution of questionnaires on at least 15 participants a setting that was realistic during training. This drill and mock fieldwork were executed by one field expert and the researcher.

The study employed both qualitative and quantitative methods of study during data collection, particularly structured researcher administered questionnaires were administered to the households and collected data from attributes of bystander knowledge, decision making, willingness to help, and Hospitals accident and emergency department to collect information on bystander performance to include, patients knowledge on emergency number, means transport used and the reason for choosing the means of transport. Checklists were also used at the EOC to collect distribution of emergency calls and their origin, quality of emergency calls and emergency response times.

A researcher's structured questionnaire was used among the sample to collect data for baseline and end-line study. Clients were approached on arrival to accident and emergency department during triage and asked to willingly participate in the study. The informed consent was read out to them in a language they understood and asked to sign if ready and willing to participate. After signing the consent form, the clients were asked to participate in the baseline survey by being taken through the questionnaire by the researcher. If the patient was unable to talk the relative or the person accompanying the patient was being interviewed on giving consent.

For the household questionnaire, on visiting the sampled household, the researcher and the research assistants would introduce self and the reason as to why he/she was there. If there was an adult person at the time of the visit and have accepted to participate in the study would be taken through the questionnaire by the researcher/research assistant. The baseline data collection was done every day for one month until the desired sample size was attained. Baseline data was also collected from the KII from the EOC and A & E as well. Two focused group discussions were conducted, one at the control area and the other at the intervention area as the baselines data. Upon completion of baseline data collection, an analysis of the baseline data was done according to the/ procedure stated in the data analysis section.

Key Informant Interview Guide was used among the EOC Manager and the in charge of A&E of MLKH (the intervention Hospital). Researcher administered questionnaire was also used to collect end line data at the EOC and A& E at the hospitals under study. Interviews were conducted at their work places during their convenient time but within the study's timeframe. Four FGDs were also conducted at Embakasi West Sub-County (intervention) and Kibra Sub-County (control) at the end of the intervention. For each region, intervention and control area, two FGDs were

conducted, one pre-training and one post-training for the two regions. The interviews and the FGDs were recorded with the help of one research assistant using an audio recorder.

3.11 Data Analysis Procedures and Method

3.11.1 Data Analysis Procedures

For both the baseline and end-line survey, the study obtained quantitative and qualitative data. Quantitative data gathered was entered, coded, cleaned off any discrepancies and outliers, and analyzed using SPSS version 26.0 software. Data analysis involved generating descriptive statistics such as frequencies, percentages, measures of central tendency such as the mean and median and measures of dispersion such as the standard deviation for the individual attributes, calls at the EOC, utilization of emergency services at the A&E department, and Emergency response times. The descriptive statistics were conducted separately for the control and intervention areas, with results showing separate results for the baseline and end-line survey for each area.

3.11.2 Method of Data Analysis

Data analysis involved generating descriptive statistics such as frequencies, percentages, measures of central tendency such as the mean and median and measures of dispersion such as the standard deviation for attributes like emergency response times, overall bystanders' knowledge score, overall bystanders' decision-making score and overall bystanders' willingness to help. Chi square test was used to determine if there were significance differences in distribution of emergency calls and their quality at the EOC, change of emergency patients, their knowledge on emergency numbers, their choice on means of transport to A&E.

The study also utilized a quasi-experimental difference-in-difference approach to evaluate the impact of the intervention by comparing the changes in the bystanders' knowledge, decision-making, and willingness to help between the intervention and the control groups at baseline and the post-intervention period. First, the parallel trend in the outcome variables was examined to establish equivalence between the control and the intervention groups in the baseline. The core analysis employed regression and logistic models that included the study arm (location) and time (baseline and post-intervention) indicators with their interaction terms that showed the treatment effect for each outcome variable – bystanders' knowledge, decision-making and willingness to help in an emergency. The confounding covariates for the adjusted model were the respondents' age, gender, marital status, education level and employment status.

The unadjusted model for linear regression and logistic regression:

$$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \beta_3 (\text{Treat}_i \times \text{Post}_t) + \epsilon_{it}$$

$$\text{Logit}(P(Y_{it}=1)) = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \beta_3 (\text{Treat}_i \times \text{Post}_t)$$

The adjusted model for linear regression and logistic regression:

$$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \beta_3 (\text{Treat}_i \times \text{Post}_t) + \gamma_1 \text{Age}_i + \gamma_2 \text{Gender}_i + \gamma_3 \text{Educi} + \gamma_4 \text{Marital}_i + \gamma_5 \text{Employ}_i + \epsilon_{it}$$

$$\text{Logit}(P(Y_{it}=1)) = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \beta_3 (\text{Treat}_i \times \text{Post}_t) + \gamma_1 \text{Age}_i + \gamma_2 \text{Gender}_i + \gamma_3 \text{Educi} + \gamma_4 \text{Marital}_i + \gamma_5 \text{Employ}_i + \epsilon_{it}$$

Symbols:

Y_{it} – the outcome variable for the respondent i at time t .

β_1 -the DiD estimator

$Treat_i = 1$ if in the intervention group, $= 0$ if in the control group.

$Post_t = 1$ if post-intervention group, $= 0$ if in the basekine

Age_i – age categories of the respondent.

$Gender_i$ – gender of the respondent, binary for male and female

Edu_i – respondents' level of education

$Marital_i$ – respondents' marital status

$Employ_i$ – respondents' employment levels

The DiD estimator would show the impact of the intervention compared to the control group. This DiD was used for both unadjusted and adjusted models with confounding factors (age, gender, education level, marital status and employment). These confounders were used to strengthen the confidence in the results. Using the coefficients, the p-values and conducting robustness checks ensured the findings reflected genuine effects of the intervention.

3.11.3 Assumptions of the Difference in Difference Model

- **Parallel Trends Assumption:** Both treatment and control groups would have followed the same trend over time in the absence of the intervention.
- **No Simultaneous Interventions:** No other interventions are affecting the treatment or control group during the study period.

- **Stable Unit Treatment Value Assumption (SUTVA):** The treatment of one unit does not affect the outcome of another unit.

3.11.4 Limitations of Difference in Difference Model

- **Violation of Parallel Trends:** If the trends diverge before the treatment, the results may be biased.
- **Unobserved Confounders:** If there are unmeasured variables that affect the outcome differently between the groups, this can lead to biased estimates.
- **Generalizability:** The findings may not be applicable to other settings or populations beyond the studied groups.
- **Measurement Error:** Any inaccuracies in measuring the outcome variable can lead to biased results.

Qualitative data collected using interviews and FGDs was exported to Nvivo 12 software for thematic analysis. The study utilized inductive thematic analysis which involved interviews and FGDs' transcription, coding and themes development. Inductive thematic analysis in qualitative data entails identifying, analyzing and reporting themes or patterns. Six phases of thematic analysis as outlined in (Braun & Clarke, 2006), were utilized. Phase one involve familiarization with the data during transcription which was done after the interviews. This enabled the researcher understand the interviews' output and assess whether data was responding to the questions of the study. The researcher listened to the recordings several times and made a verbatim of all the utterances. The audio recordings were transcribed, printed and read three times so as to search for meanings and patterns. The researcher made notes on the transcripts to generate coding ideas which could be useful in later phases.

During phase two, initial codes were generated. According to (Braun & Clarke, 2006) a code is the most basic segment of raw data that can be meaningfully assessed to identify a feature of the data that appears interesting to the analyst. Coding can be manually done or through the help of a computer programme (Varpio et al., 2020). For this study, manual coding was done through writing notes on the transcripts and through highlighter pens to identify data segments and potential patterns. During phase three, themes were searched for. This differs from phase two in the sense that, phase two involves broader level focus while this phase involves a more objective-oriented sorting of different codes into probable themes and collating all the relevant data extracts that have been coded within themes that have been identified. Codes not fitting into any of the identified themes were set aside and discarded later.

During phase four, themes were reviewed at two levels. The first level involved re-reading the extracts from each theme including the basic theme rather than of the coherent patterns. The second level involved individual themes' consideration in relation to the research objectives. Additional data within themes that had been missed in earlier stages of coding was included. Extracts not fitting within the themes identified were discarded. Phase five involved themes defining and naming. This was done in accordance with the data aspects they displayed and their purposes for inclusion. In phase six, a report was produced. This involved a write-up of the narrative so as to produce a concise, logical, and coherent account of the story across and within themes. Extracts originating from the transcripts, including quotations that were direct were embedded in the narrative so as to substantiate basic themes and provide an argument in responding to the objectives of the study.

Table 3.4:*Steps of analyzing qualitative data*

Phase 1: Data familiarization	Careful reading of transcribed data by being critical and analytical of the informants' words. Note taking of important words.
Phase 2: Generate initial codes	Generate relevant codes or phrases with respect to the research questions.
Phase 3: Search for themes	Group codes into themes according to their unifying features.
Phase 4: Review potential themes	Determine whether the generated themes reflect the entirety of the data.
Phase 5: Define and name the themes	Name each theme that reflects the research questions.
Phase 6: write report	Write clear and analytical report of the findings by making arguments based on the research questions

3.12 Ethical Considerations

Approval of the research proposal and instruments was sought from the Research and Ethics Committee of Kenya Methodist University (Approval Number: KeMU/ISERC/HSM/01/2023). Authorization by the National Commission for Science, Technology and Innovation (License No: NACOSTI/P/23/23640) was obtained. Authorization was also sought from the Nairobi City County Directorate Health Services Research and Ethics Committee (REF NO: NCCG/HWN/REC/318). Again, the researcher obtained permission from the respective hospital management and the EOC before the commencement of data collection.

The researcher provided respondents with the information on the research and its intended purpose and informed consent was obtained from them. Responses obtained from respondents were handled with a lot of confidentiality. The study was flexible and any respondent who wished to withdraw from the interviews was free to step out.

The interviews were grounded on voluntary contribution and only respondents ready to reply to questions justly were engaged. There was no payment or compensation to the participants, the information provided by the respondents was analyzed and applied into improving health outcomes.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study and the discussions. The baseline and end-line findings are presented together in the line of the research objectives. Findings from the qualitative data synergize with those from quantitative data. The end-line findings were achieved after implementing a health systems intervention for 12 months. Both the baseline and post-intervention studies evaluated bystanders' knowledge, decision making and willingness to help during emergencies. The baseline and post-intervention also assessed responsiveness of pre-hospital emergency healthcare delivery. This was an unmatched case control study that adopted both qualitative and quantitative research methods. It had a control group, Kibra Sub-County and Mbagathi County Referral Hospital, and an intervention group Embakasi West Sub-County and MLKH in Nairobi City County.

4.2 Response Rate

In total, 376 questionnaires were distributed during the baseline survey both for the control and intervention areas. Out of these questionnaires, 359 and 353 questionnaires were considered adequately filled for final analysis for the intervention and control areas respectively. This represented a response rate of 95.5% and 93.9% for the intervention and control areas respectively. For the post-intervention, a total of 376 questionnaires were distributed both in the control and intervention areas respectively. Out of these 372 and 361 questionnaires were adequately filled for the intervention and control areas respectively. This represented a response rate of 98.9% and 96.0% for the intervention and control areas respectively. For both the baseline

and post-intervention, the response rates were adequate for final analysis and making inferences.

4.3 Reliability Results

A pilot study was conducted before actual survey with 35 respondents from Dagoret subcounty to assess the instrument reliability and how the questions are asked practically in field. Results and field experiences helped refine the questions and how to ask them during the survey. Results from the pilot study indicated a high reliability as indicated by the Cronbach's alpha coefficient of 0.860 (see Table 4.1). This was deemed acceptable according to (Taber, 2017) who demonstrated that Cronbach Alpha coefficient of 0.7 and above deems the instruments as reliable

Table 4.1:

Cronbach Alpha Reliability Statistics for the Household Survey Tool

	Number items	of	Cronbach's Alpha	Remark
Bystander knowledge	9		0.88	Adequate
Bystander Decision Making	10		0.79	Adequate
Bystander Willingness to Help	16		0.74	Adequate
Overall Reliability Test (All questions)	35		0.86	Adequate

Source: Pilot data (2023)

We also conducted preliminary analysis for the questions asked in the pre-test to check whether the tools are captured as required. For this pilot, we only did descriptive statistics because the intention is to check the questions and make necessary adjustments before the baseline survey.

4.4.1 Demographic Profile of the Study Respondents

The demographic profile of the study respondents is as shown in Table 4.2.

Table 4.2:

Distribution of the Respondents by Demographic Characteristics

	Control		Intervention	
	Baseline n (%)	Post-Intervention n (%)	Baseline n (%)	Post-Intervention n (%)
gender				
Male	123 (31.3)	163 (42.9)	135 (37.6)	159 (42.7)
Female	270 (68.7)	217 (57.1)	224 (62.4)	213 (57.3)
Age of Respondents in Years				
20 years and below	30 (7.6)	26 (6.8)	19 (5.3)	7 (1.9)
21-30 years	158 (40.2)	197 (51.8)	138 (38.4)	127 (34.1)
31-40 years	97 (24.7)	93 (24.5)	121 (33.7)	141 (37.9)
41-50 years	65 (16.5)	36 (9.5)	46 (12.8)	73 (19.6)
51 years and above	43 (10.9)	28 (7.4)	35 (9.8)	24 (6.5)
Marital status				
Married	217 (55.2)	192 (50.5)	218 (60.7)	245 (65.9)
Single	139 (35.4)	158 (41.6)	114 (31.8)	114 (30.6)
Separated/Divorced	37 (9.4)	30 (7.9)	27 (7.5)	13 (3.5)
Level of Education				
Primary/Less	168 (42.8)	97 (25.5)	44 (12.3)	39 (10.5)
Secondary	167 (42.5)	179 (47.1)	181 (50.4)	160 (43.0)
Post- Secondary	58 (14.8)	104 (27.4)	134 (37.3)	173 (46.5)
Residence				
Along major highway/road	137 (34.9)	140 (36.8)	144 (40.1)	227 (61.0)
Interior	256 (65.1)	240 (63.2)	215 (59.9)	145 (39.0)
Employment Status				
Full employed	13 (3.3)	26 (6.8)	59 (16.4)	58 (15.6)
Casual laborers	90 (22.9)	79 (20.8)	14 (3.9)	11 (3.0)
Unemployed	154 (39.2)	134 (35.3)	153 (42.6)	135 (36.3)
Self-employed	136 (34.6)	141 (37.1)	133 (37.0)	168 (45.2)

The gender of the respondents selected from the households during the baseline survey indicates that there were 68.7% (270) and 62.4% (224) of females in the control and intervention areas respectively. Similarly, 57.1% (217) and 57.3% (213) of the respondents during post-intervention were also female (see Table 4.2). In the control and intervention areas, respectively, 31.3 (123) and 37.5 (135) of the respondents were men during the baseline survey, while 42.9 (163) and 42.7 (159) of the respondents were males during the post-intervention survey. Though there are disparities in gender for the baseline and post-intervention surveys, both genders were well presented during the baseline survey.

Age was then recoded into categories 20 years and below, 21-30 years, 31-40 years, 41-50 years, 51 and above. For the control area, majority of the respondents, 158 (40.2 %) were in the age bracket 21-50 years; for the intervention group, majority of the respondents, 138 (38.4%), were in the age bracket 21-40 years during the baseline survey. In terms of the age categories as reported in Table 4.2, 197 (51.8%) of the respondents in the control area were aged 21-40 years. On the other hand, individuals aged 20 years and below made up the least number of respondents in the baseline survey 30 (7.6%) and 19 (5.3%), respectively, in the control and intervention areas. In the post-intervention survey, 26 (6.8%) and 7 (1.9%) of the respondents were individuals aged 20 years and below, respectively. This representative of typical Kenyan household dynamics and the nation's most economically active adult population (KNBS, 2024; Kouladoun, 2022).

Respondents also indicated their marital status as shown in Table 4.2. The three categories of marital status, separated, divorced and widowed, were recoded into one category. From the results, majority of the respondents during the baseline survey as

shown by 217 (55.2%) and 218 (60.7%) were married for the control and intervention area respectively, while in the post-intervention survey 192 (50.5%) and 245 (65.9%) were married for the control and intervention area respectively. A small subset of the respondents in the baseline survey was the combined group comprising the separated, divorced and widowed, representing 37 (9.4%) and 27 (7.5%) respectively, in the control and intervention areas. In the post-intervention survey, representing 30 (7.9%) and 13 (3.5%), respectively in the control and intervention areas.

For ease of interpretation and analysis, the level of education variable was restructured. The none and primary categories were combined to create a primary/less group. Additionally, higher education levels, including certificate, diploma, degree, master's, and PhD, were consolidated into a post-secondary category. Evident from the results is that most of the respondents during the baseline survey as indicated by 168 (42.8%) for the control area, had primary/less education and 181 (50.4%) for the intervention area had secondary education. Further, the majority of the respondents during the post-intervention survey indicated by 179 (47.1%) in the control areas had secondary education and 173 (46.5%) had post-secondary education in the intervention areas.

Conversely, based on the baseline survey, only a handful of the respondents, representing 58 (14.8%) had post-secondary education in the control areas and 44 (12.3%) had primary education and less in the intervention areas, respectively. Similarly, in the post-intervention survey, 97 (25.5%) and 39 (10.55%) of the respondents had primary education and less in the control and intervention areas, respectively. While the percentage of respondents with primary and less education declined in the post-intervention group following the intervention, the intervention

area demonstrated a significant increase in post-secondary education (46.5%) in comparison to the control area (14.8% at baseline and 25.5% post-intervention) as shown in Table 4.2. Most participants having secondary education and beyond, mirrors findings in comparable studies (Silva & Santos, 2021), a more educated population in readiness for PEC.

Respondents were also required to indicate whether they resided along a major highway/road or interior (far away from a major highway/road). During the baseline survey, majority of the respondents, 256 (65.1%) and 215 (59.9%) indicated that they resided in an interior residence for the control and intervention areas respectively. interior residents demonstrated high baseline knowledge (87.4%), which remarkably improved to 100%. This suggests prior training, strong community preparedness, or higher education levels within these communities. Despite being further from major roads, their superior knowledge equips them well to respond to emergencies within their communities, particularly where formal Emergency Medical Services (EMS) response times might be longer (Amro et al., 2024).

Post-intervention, 240 (63.2%) of the respondents in the control area living in an interior location while 227 (61.0%) of the respondents in the intervention area lived along major highway/road. (see Table 4.2). Most from interior indicating community's readiness to for PEC

Respondents also indicated their employment status. Based on the responses during the baseline survey, 154 (39.2%) and 153 (42.6%) of the respondents in the control and intervention areas respectively were unemployed. On the other hand, during the post-intervention survey, 141 (37.1%) and 168 (45.2%) of the respondents in the control and intervention areas respectively were self-employed. The employment status results show that a small minority of the respondents who

participated in the post-intervention survey were full-employed, 26 (6.8%) in the control areas, and casual laborer, 11 (3.0%) in the intervention areas. In the intervention area, most of the respondents were self-employed, 168 (45.2%) and unemployed, 153 (42.6%). This is an indication of employment status that showed shifts between baseline and post-intervention surveys. The intervention area experienced a notable increase in self-employment (45.2%) after the intervention, with unemployment remaining a significant factor (42.6%). Full-time employment and casual labor were reported by a small minority in both areas. This increases the likelihood of the respondents being bystanders and their likelihood to have a significant role in case of emergencies. The significant improvement among casual laborers, in particular, highlights the potential for such interventions to empower individuals who may be at higher risk of witnessing emergencies and previously lacked critical life-saving skills (Duut et al., 2022; Ndile et al., 2020a) (see Table 4.2).

4.4.2 Influence of Bystander Knowledge on Responsiveness of Pre-Hospital Emergency Healthcare Delivery in Nairobi City County, Kenya

The study also evaluated the bystanders' knowledge on the responsiveness of pre-hospital emergency healthcare delivery before any training. Knowledge was first assessed in terms of whether the respondents knew the toll-free numbers they would call in case of emergencies and the findings tabulated in Table 4.3.

Table 4.3:*Toll-Free Number Knowledge*

Control		Intervention		DID				
Baseline n (%)	Post- Intervention n (%)	Baseline n (%)	Post- Intervention n (%)	Unadjusted	P-value	Adjusted	P- value	
Do you know the toll-free number to call in case of health emergencies? (toll-free)								
No	277 (70.5)	185 (48.7)	162(45.1)	64 (17.2)	1.57	0.049	1.72	0.022
Yes	116 (29.5)	195 (51.3)	197(54.9)	308 (82.8)				
Knowledge of toll-free number (1508)								
No	393(100)	319(83.9)	346(96.4)	194(52.2)	21.8	<0.001	-	-
Yes	0 (0)	61(16.1)	13(3.6)	178(47.9)				

Note: DID from adjusted model controls for age, education level, sex, marital status and employment.

According to Table 4.3, during the baseline survey in the control area, majority of the respondents, 277 (70.5%), indicated not knowing the toll-free number they would call in case of health emergencies. This matches with a response from a participant in the control group FGD before training responded by indicating not knowing any emergency number as noted in the following comment:

DID Analysis

The Difference -in-difference estimates the causal effect of the bystander knowledge on the responsiveness of pre-hospital visits by comparing the changes over time between the control and the intervention group. According to Table 4.3, the unadjusted DiD coefficient of 1.57 and p-value of 0.049 suggested that the intervention increased the likelihood of knowing the toll-free number by 1.57 times compared to the intervention group, and the effect was statistically significant with a p-value slightly less than 0.05. There was a statistically significant effect of the bystander training intervention on the knowledge of the toll-free number 1508. The unadjusted

DiD coefficient of 21.8 [(47.85 - 3.62) - (16.05 - 0.00)] percentage points and $p < 0.001$ indicated that the intervention increased the likelihood of knowing the toll-free number by 21.8 percentage points. The adjusted DiD estimates could not be generated due to a complete lack of variability in the control group at baseline (0%) which created a statistical singularity. After adjusting for potential confounder which were age, gender, marital status, education level and employment status the effect size slightly increased to 1.72 times, remaining statistically significant with a p-value less than 0.05. This indicated that the intervention significantly improved the knowledge of the toll-free emergency number and the adjusted model showed a stronger effect indicating that the intervention was successful, this mirrors a study by (Bhattarai et al., 2023a; Delaney et al., 2024).

Figure 4.1:

Trends of the Knowledge of Toll-Free Number

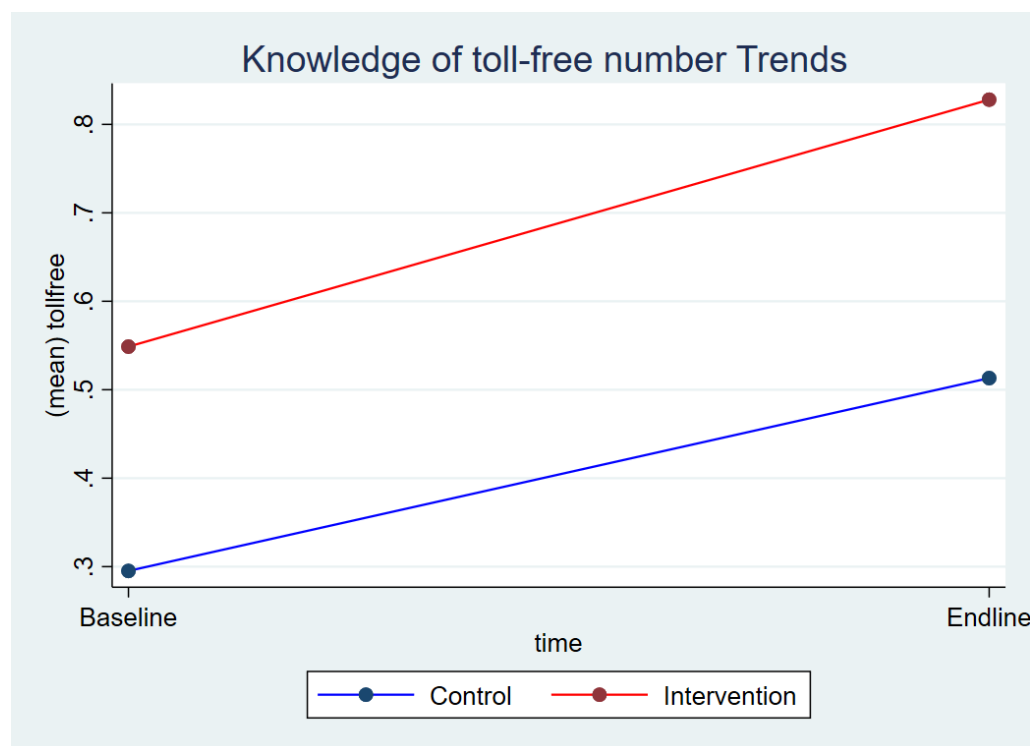


Fig 4.1 above depicts a line graph showing the trends in knowledge of a toll-free emergency number over time, comparing the control group and the intervention

group at baseline and post-intervention. The control started at a mean score of 3.0 where the intervention started at 5.5. Both have an upward trend but the intervention group (red line) showed a steeper upward trend compared to the control group (blue line), suggesting the intervention had a positive impact and therefore may have improved knowledge. The control group improved as well but to a lesser extent.

“I really do not know what number to call. In case of an emergency, I would probably panic and call a close family member or neighbors for help” (FGD, participant 1, control group before training)

In the intervention area, during the baseline survey 197(54.9%) indicated knowing the toll-free number they would call in case of a health emergency. However, one participant in the intervention group seemed to know the preferred emergency number before training, and this was based on past experience of an emergency as shown by the following claim:

“I experienced an emergency last year when my father had a stroke attack. Initially I dialed 999 and the recipient advised me to dial 1508 for medical emergencies in the county. I received help after dialing 1508. If they have not changed it, I believe it is the correct one” (FGD, participant 5, intervention group before training).

During the post-intervention survey, for the control area, 195 (51.3%) of the respondents indicated that they know the toll-free number to call in case of health emergency; even though the numbers seemed to have increased among the ones who know the emergency number to call, this was contraindicated by a response from FGD, example a participant indicated,

"If I needed help in case of an emergency, I guess I would just ask someone nearby like my neighbor. I am not sure if there is a special number that I would call" **(FGD, participant 10, post training)**.

This is also supported by the interviews from the in-charge EOC and in-charge A&E. before training, the interviewees demonstrate that there is low knowledge on the preferred emergency number to call. For example, the following response by the in-charge EOC illustrates this:

"From what we have observed, the community's knowledge of toll-free emergency numbers, including 1508, is quite low. Many people either do not know which number to call in case of a medical emergency or mistakenly dial other general emergency numbers like 999. We receive numerous calls on incorrect lines, which delays response times. For instance, some call the police or fire department instead of dialing 1508 for medical emergencies. This gap in awareness often leads to critical delays in emergency response" **(KI, EOC, before training)**

The following response by in-charge A&E also demonstrates this:

"A significant number of people in the community do not know the official toll-free number, 1508. Most emergency cases reach to us indirectly through the police hotlines. In other cases, staff and the bystander are contacted by well-wishers who then give out the official 1508 number. The community needs more sensitization on how to access emergency medical services promptly." **(KI, A & E, before training)**

On the other hand, 308 (82.8%) of the respondents in the intervention area indicated they know the toll-free number to call in case of an emergency. The findings demonstrate an increase in the proportion of respondents who indicated they know the toll-free number to call in case of a health emergency in both the intervention and control areas in all surveys. This corresponds with the focused group responses. After

training, FGD responses from the intervention area noted a significant increment on knowledge of the emergency toll number to call. The following response by one of the participants in the FGD post-intervention confirms this claim:

“There has been a lot of sensitization campaign on the emergency number. Now I know that 1508 is the number to call if there is an emergency” (FGD, participant 7, intervention post training)

Another participant also supports this claim:

“Some few months ago, I would have just called 999 because that is what I have thought is the emergency number. But now I know that 1508 is actually the correct number” (FGD, participant 3, intervention post training).

After training, it was evident that there was a noticeable improvement in awareness on the preferred emergency number to dial. The in-charge EOC cited the following:

"There has been a noticeable improvement in the community's awareness of emergency contact numbers, particularly 1508 over the last one year. We have seen an increase in correctly placed emergency calls, which means people are beginning to understand where to seek help. Many callers now confidently request medical assistance through the right channel, which enhances efficiency in dispatching emergency services. While there's still room for further sensitization, the progress is encouraging" (KI, EOC, after training)

The in-charge A&E also supports this from the following comment:

"More patients and their relatives now mention that they called 1508 when seeking emergency assistance. Some even report advising others to use the number in case of medical emergencies. This improvement in knowledge directly translates to better

response times and timely medical intervention. However, continued reinforcement through community awareness programs will be crucial to ensuring that this knowledge becomes widespread and second nature to everyone" **(KI, A & E, after training)**

During the baseline survey, out of those who indicated that they know the toll-free number in the control area, 78.8% (78) stated that they have not saved the number in their phones while 83.8% (165) indicated having not saved it in their phones in the intervention area, this was also represented in the FGD both in control and intervention groups before training, a participant in an intervention group indicated having known the number through a poster from a healthcare facility that she had visited as evident from the following response:

"I once saved the telephone number in my phone when I visited the local dispensary for my child's vaccination. The number that I saved is 1508 (reads it from her phone). I have never called it but I thought it would be helpful to know an official number for health emergencies only" **(FGD, participant 8, intervention before training).**

Post-intervention, on whether respondents had saved the number, 70.7% (104) in the control group and 81.5% (247) in the intervention group had saved it representing an increment on the number of respondents who had saved the toll-free number,

"I have saved the emergency number and I have called it severally. We were also provided with posters during training" **(FGD, participant 6, intervention after training).**

These findings are illustrated in Table 4.3.

Different numbers were cited as toll free numbers; however, 911, 999 and 1508 were the most cited. Further, some respondents also cited more than one number as

toll free. It should also be noted that the number of emphasis as toll free number was 1508. During the baseline survey, among the most cited toll-free numbers in the control area included 911 (16.2%) and 999 (61.6%); among the most cited toll-free numbers in the intervention area included 911 (53.8%), 999 (19.3%) and 1508 (6.6%) as shown in Table 4.4. During post-intervention survey, differences are noted on what exactly is the number respondents would call, between the control and the intervention group. For the control group, 28.0% of those who knew the toll-free number to call cited 911, 76.9% cited 999 while 26.4% cited 1508 as the toll-free number to call in case of health emergency. For the intervention group, the toll-free numbers included 1508 (57.5%), 911 (33.1%) and 999 (6.8%). Based on the training administered, it should be noted that the toll-free number preferred for health emergency was 1508 which is evident in the majority of the respondents in the intervention group after training (see Table 4.4).

To also measure knowledge, respondents were also presented with self-rating questions on the action they would take if they were the first to witness an emergency. Being Likert Scale items, the extent of agreement or disagreement was as shown in Table 4.4.

Table 4.4:*Bystander Knowledge scores*

	Control		Intervention		DID			
	Baseline n (%)	Post- Intervention n (%)	Baseline n (%)	Post- Interventions n (%)	Unadjusted	P- value	Adjusted	P- value
You know what to do at an emergency scene								
Disagree	68 (17.3)	27 (7.11)	37 (10.3)	14 (3.8)	1.352	0.340	1.341	0.364
Undecided	71 (18.1)	49 (12.9)	17 (4.7)	7 (1.9)				
Agree	254 (64.6)	304 (80.0)	305 (85.0)	351 (94.4)				
You know the emergency number to call								
Disagree	190 (48.4)	59 (15.5)	129 (35.9)	56 (15.1)	1.102	0.678	1.219	0.415
Undecided	62 (15.8)	72 (19.0)	16 (4.5)	1 (0.3)				
Agree	141 (35.9)	249 (65.5)	214 (59.6)	315 (84.7)				
You know who to call first in an emergency								
Disagree	130 (33.1)	33 (8.7)	45 (12.5)	27 (7.3)	0.843	0.524	0.840	0.526
Undecided	60 (15.3)	65 (17.1)	27 (7.5)	10 (2.7)				
Agree	203 (51.7)	282 (74.2)	287 (79.9)	335 (90.1)				
You know the message to convey								
Disagree	121 (30.8)	30 (7.9)	33 (9.2)	19 (5.1)	0.741	0.289	0.753	0.328
Undecided	79 (20.1)	60 (15.8)	31 (8.6)	11 (3.0)				
Agree	193 (49.1)	290 (76.3)	295 (82.2)	342 (91.9)				

Note: The potential confounders for the adjusted DiD model were age, gender, marital status, education level and employment status. The composite knowledge score's unadjusted DiD estimate is -0.94 (p -value <0.001). The p -value is less than 0.001 and the adjusted DiD is for the composite knowledge score of -0.840. Disagree and Undecided were coded into one category and measured against Agree in the DiD analysis.

During the baseline survey, 64.6% (254) of the respondents agreed that they know what to do at an emergency scene; 48.4% (190) disagreed they know the emergency number to call; 51.7% (203) agreed they know who to call first in an emergency and 49.1% (193) agreed they know the message to convey in the control

area. In the intervention area, 85.0% (305) agreed that they know what to do at an emergency scene; 59.6% (214) agreed that they know the emergency number to call; 79.9% (287) agreed that they know who to call first in an emergency and 82.2% (295) agreed that they know the message to convey.

DiD Analysis

The Difference-in-Difference measures the change in the intervention group compared to the control group. For the question “You know what to do at an emergency scene” the DiD estimates were 1.35 (p-value = 0.340) for the unadjusted model and 1.34 (p-value = 0.364) for the adjusted model. This indicated that the intervention increased the likelihood of knowing what to do at an emergency scene by 1.35 times compared to the control group. After adjusting for potential confounders, the effect size slightly reduced to 1.34 times; the effect was not statistically significant in either model. The intervention did not significantly improve knowledge of what to do at an emergency scene (P-values > 0.05). The estimates for the question “You know the emergency number to call” were 1.102 (p-value = 0.678) for the unadjusted model and 1.219 (p-value = 0.415) for the adjusted model. The positive coefficients suggest that the intervention group increased the likelihood of knowing the emergency number to call by 1.1 times compared to the control group.

For the adjusted model, the effect size slightly increased by 1.22, a small positive effect of the intervention. The p-values > 0.05 indicated no statistically significant impact. The intervention did not significantly improve the knowledge of the emergency number to call. The estimates for the question “You know who to call first in an emergency” were 0.843 (p-value = 0.524) for the unadjusted model and 0.840 (p-value = 0.526). There was no significant difference in the coefficients after the model was adjusted for potential confounders, meaning the confounding variables

had minimal impact on the estimate. The coefficients of ~0.84 suggested that the intervention group had a small, non-significant (p-values > 0.05) increase in knowledge of who to call first in an emergency compared to the control group. This suggested that the intervention did not meaningfully improve the knowledge of who to call first.

The DiD estimates of the question "You know the message to convey" were 0.741 (p-value = 0.289) for the unadjusted model and 0.753 (p-value = 0.328) for the adjusted DiD model. The coefficients increased slightly (0.741 to 0.753). These coefficients indicated that the intervention group slightly increased the knowledge of the message to convey by 0.74 times compared to the control group for the unadjusted model and 0.75 times compared to the control group for the adjusted model with covariates. This implied that adjusting for covariates made the effect less reliable, and hence the intervention did not statistically enhance the knowledge of what message to convey.

From the FGDs, it is evident that there was a larger portion of participants in the control group and intervention group lacking a clear action plan and showing uncertainty and hesitation on what to do in case of an emergency. Indicated by a participant in the control group;

"I would try to comfort the victim as I try to call 999 for emergency help. Since I lack first aid training, I would not have specific help that I would offer" **(FGD, Participant 7, Control group before training).**

However, it was also notable that there were participants in the control group and intervention group having a clear action plan before training; and after training for

the control group. Before training a participant in the FGD from the control area indicated the following showing knowledge on what to do in case of an emergency:

“If I saw an emergency victim such as an accident victim, I would check if the victim is breathing. If they are, I would call for emergency help such as police or an ambulance” **(FGD, Participant 9, Control group before training)**

Post-intervention, majority of the respondents in the control group as shown by 80.5% (304), 65.5% (249), 74.2% (282) and 76.3% (290) agreed that they know what to do at an emergency scene, know the emergency number to call, know who to call first in an emergency and know the message to convey respectively. Further, majority of the respondents in the intervention group as shown by 94.4% (351), 84.7% (315), 90.1% (335) and 91.9% (342) agreed that they know what to do at an emergency scene, know the emergency number to call, know who to call first in an emergency and know the message to convey respectively. This is also supported by the FGD having one of the respondents indicating that;

“I am aware that moving an injured person is dangerous; so, I will keep the person still and try to stop or minimize any bleeding. I will do this while trying to seek for emergency help, also inquire of emergency supplies like gloves of which without it becomes difficult to handle patient who is bleeding for fear of infection” **(FGD, Participant 4, intervention group before training)**

This was also the same case with the control group post-intervention.

Other participants in the FGD in the control area lacked a clear action plan after the training as noted from the following response from one of the participants:

“I know it is good to help during an emergency and I would want to. I am however

afraid that I would do something wrong. Maybe I would probably call close friends or family members for assistance” (FGD, Participant 6, Control group after training)

Another participant in the control lacking a clear action plan reiterated the following:
After training, some FGD participants in the control area had a clear action plan as noted from the following response by one of the participants:

“I will check whether the victim is conscious and then call an emergency number. The most common one that I know is 911” (FGD, Participant 5, Control group after training)

Before training, it was also evident that some participants in the FGD from the intervention area showed a clear action plan while others showed lack of a clear action plan. One participant in the intervention area claimed the following while showing a clear action plan on what to do in case of an emergency:

“I would help stabilize the victim and then find a way to call for help; probably, I would ask another bystander to help call for emergency help” (FGD, Participant 3, intervention group before training)

Another participant showing a clear action plan indicated the following:
“If it involves an accident or other injurious emergencies such as fire, I will make sure that the area is safe. I will also check the status of the victim, for example, pulse rate and if the victim is stable. If there are other persons, I would ask them to help by calling for emergency. However, I want to learn how to perform Cardio pulmonary resuscitation (CPR) especially when the pulse rate is very low and irregular” (FGD, Participant 1, intervention group before training)

After training, most participants in the FGD from the intervention group demonstrated a clear action plan. However, there were traces of participants lacking a

clear action plan. From the following response by one participant a clear action plan is evident:

"I now know that I should call 1508, identify myself, provide details about my location and clearly describe what I witnessed and the status of the victim" **(FGD, Participant 2, intervention group after training)**

The interviews with in-charge EOC and A&E also reinforce these findings. Before training, it was evident that bystanders' conduct was not supportive in an emergency scene. The in-charge EOC supports this through the following response:

"The general conduct of bystanders at an emergency scene is often uncoordinated and, at times, counterproductive. Many people panic or crowd the scene without knowing how to assist effectively. We frequently receive reports of individuals mishandling victims, such as moving injured persons without stabilizing them, which can worsen their condition. Additionally, some bystanders focus more on recording videos than offering meaningful assistance. There is a clear need for structured training to help the community understand their role in an emergency situation" **(KI, EOC before training)**

This was also supported by the in-charge A&E based on the following response:

"From what we see in the hospital, many patients arrive with complications that could have been minimized if bystanders had better knowledge of emergency care. For example, we often admit accident victims who were moved improperly, leading to spinal injuries. Others arrive in critical condition because no one at the scene provided basic first aid, such as stopping bleeding. The lack of proper response at the scene means that valuable time is lost before medical professionals take over. The

community needs training on how to act appropriately during emergencies." **(KI, A & E before training)**

After training, a shift was noted in the interview responses with the interviewees acknowledging that knowledge on how bystanders handle emergencies had improved. The in-charge EOC conforms this by claiming the following:

"We have observed a shift in how bystanders handle emergency situations. When callers report incidents, we have clear descriptions of the situations; we now hear more cases where basic first aid has been administered before emergency responders arrive. For example, we receive reports of bleeding being controlled, victims being reassured, and unnecessary movements being avoided. While not everyone has fully grasped the best practices, the level of awareness and responsible action at emergency scenes has improved significantly" **(KI, EOC, after training)**

This is further reinforced by the following response from in-charge A&E:

"We are beginning to notice positive changes in how patients arrive at the hospital after an emergency. More individuals are receiving initial care at the scene, whether it's proper positioning, bleeding control, or CPR when needed. Patients and their families now mention that bystanders tried to help in an informed way instead of just watching or acting impulsively. There is still work to be done especially in CPR, but there is a real difference as compared to several years ago" **(KI, A & E before training)**

Knowledge was also assessed in terms of how likely the respondents were likely to call any toll-free number in case of an emergency whether the number was known or not. They were also assessed how the knowledge of health care staff presence in an ambulance was likely to influence their decision to call for an ambulance. The results are as illustrated in Fig 4.2 and 4.3 below.

Table 4.5:

Likelihood of Calling Toll Numbers in Emergencies Based on Toll Number Familiarity and Decision to Call an Ambulance: The Role of Healthcare Staff Presence

	Control		Intervention	
	Baseline n(%)	Post- Intervention n(%)	Baseline n(%)	Post- Intervention n (%)
Whether the toll number is known or unknown, how likely are you to call any toll number in case of an emergency?				
I can't call	6 (1.5)	11 (3.1)	0 (0.0)	12 (3.2)
Am unlikely to call	38 (9.7)	6 (1.7)	19 (5.0%)	15 (4.0)
Am somehow likely to call	63 (16.0)	39 (10.9)	53 (14.0)	11 (3.0)
Am likely to call	68 (17.3)	51 (14.2)	92 (24.2)	33 (8.9)
I will automatically call	218 (55.5)	252 (70.2)	216 (56.8)	301 (80.9)
How likely does knowing about presence of health care staff in an ambulance influence your decision to call for an ambulance?				
Very unlikely	13 (3.3)	16 (4.5)	4 (1.1)	15 (4.0)
Somehow likely	88 (22.4)	80 (22.3)	101 (26.6)	177 (47.6)
Very likely	292 (74.3)	263 (73.3)	275 (72.4)	180 (48.4)

Figure 4.2:

Likelihood of Calling Toll Numbers in Emergencies Based on Toll Number Familiarity

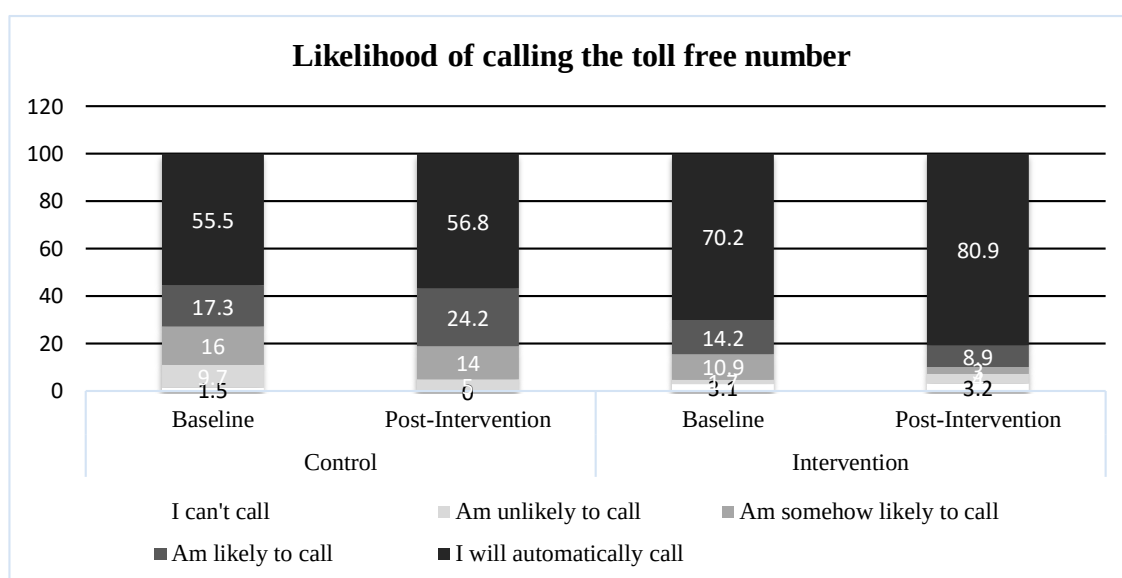
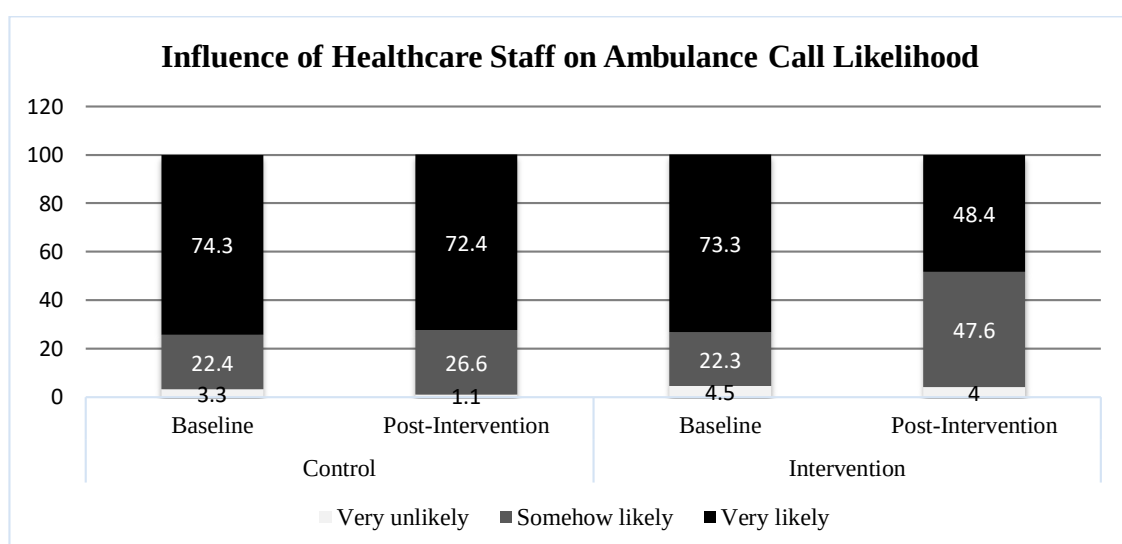


Figure 4.3:

Decision to Call an Ambulance: The Role of Healthcare Staff Presence



In the baseline survey, 55.5% (218) of the respondents in the control area indicated that they would automatically call any toll number, whether the number is known or unknown to them; 70.2% (252) of respondents in the intervention area indicated they would automatically call any toll number. Similarly, 74.3% (292) and 73.3% (263) of the respondents in the control and intervention areas, respectively,

would be very likely to call for an ambulance because of the knowledge of the healthcare staff's presence in the ambulance. In the post-intervention survey, the results indicate that 56.8% (216) and 80.9% (301) of the respondents in the control and intervention areas, respectively, would automatically call any toll number. Further, 72.4% (275) of the respondents in the control group were very likely to be influenced to call for an ambulance due to the likelihood of knowing about the presence of healthcare staff.

On the other hand, 48.4% (180) of the respondents in the intervention areas are very likely to call for an ambulance because of the knowledge of healthcare staff presence in the ambulance as illustrated in Fig 4.2 and 4.3. Additionally, Fig 4.2 illustrates that the intervention group showed a clear increase in willingness to call any toll number while the control group remained stagnant, suggesting the intervention had positive effects/ increased the trust in toll numbers. Fig 4.3 depicts the intervention likelihood to call for an ambulance dropped drastically, while the control group stayed stable, suggesting the intervention reduced the likelihood to call for an ambulance.

These findings are supported by the FGD responses. The responses from the FGD from the control area show no significant improvement in knowledge on whether bystanders should call a toll number for emergency help and who to call specifically. Responses in the control group further show a major portion of the participants having no clear idea on whether to call any toll number and who to call before and after training. Nevertheless, there is another portion in the same groups with a clear idea on whether to call any toll number and who to call before and after training.

The response below by one of the participants indicates a participant with a clear idea on the toll number to call (though wrong) and who to call:

“I will definitely try to call for emergency services, though I am not sure of the right number; may be 911. I will even try to call the police through 999, they can offer further guidelines” (FGD, Participant 3, before training Control area)

Another participant with an idea on the toll number to call and who to call indicated the following:

“I will call the nearby hospital because I believe I can find their number; but right now, I do not have any idea of any toll-free number” (FGD, Participant 6, before training Control area)

Other participants in the control area indicated being unlikely to call any toll-free number and having no clear idea on the right person to call in case of an emergency. This is shown by the following response from one of the participants:

“I will probably call a family member first; if unavailable, I will call a friend or a neighbor. I have no idea of any emergency number to call” (FGD, Participant 10, before training Control area)

The following response also shows lack of an idea on who to call and unlikeliness to call a toll-free number:

“I would rely on other bystanders to exchange ideas on what to do in an emergency. I will try to wake the victim up or evacuate them from the scene” (FGD, Participant 10, before training Control area)

After training, some participants were likely to call an emergency number and had an idea of the right person to call. This is shown by the following response from one participant from the control area after training:

“I will try calling a hospital for emergency help. Though I do not have the correct number to call dedicated for emergencies, I will try and get from the internet such as

social media pages of the hospitals” (FGD, Participant 7, after training Control area)

In the FGD from the control area, there were also participants who indicated that they were unlikely to call any emergency number and had no idea on the best person to call in case of an emergency. This is demonstrated by the following comment by one participant from the FGD:

“I do not have any specific toll-free number. I am therefore unlikely to call any. I am also not sure on the best person to call since I have heard of cases where those called, either the police or from the hospital emergency unit ask one to fuel the car; any obligation from the police or the hospital would lie on me and I am therefore not sure who would be the best” (FGD, Participant 7, after training Control area)

Before training, responses from participants in the FGD from the intervention area demonstrate mixed responses: some participants with an idea on who to call and secondly, some participants with no idea on the toll-free number to call and who to call in case of an emergency. One of the participants while indicating knowledge of the toll-free number to call and who to call indicated the following:

“I think I will call an ambulance. I know the right number for the county ambulance services” (FGD, participant 11, intervention before training)

Another participant indicating knowledge of the toll-free emergency number to call, but not sure on who to call reiterated the following:

“I will call 911; however, I am not sure if it works in this case. If that fails, I will call the police and see if they can send help” (FGD, participant 10, control before training)

After training, it is evident that most of the participants in the FGD from the intervention area know the toll-free emergency number to call and who to call. This is evident from the following one participant:

“I know exactly the toll-free number to call in case of emergency. I would call 1508 immediately and report to the emergency department” **(FGD, participant 7, intervention before training)**

Another participant in the FGD from the intervention area cited the following post-intervention:

“I understand that calling 1508 offers the fastest response for emergency cases. I will not hesitate calling the number and report to the emergency department for assistance” **(FGD, participant 8, intervention before training)**

The interviews further confirm these results. Before training, the interviewees indicated low likelihood of bystanders calling the emergency toll-free number and cited several reasons such as not being aware of the number among other reasons. Before training, the in-charge EOC stated the following:

“From my experience, the likelihood of community members calling the emergency number, especially 1508, is quite low. Many people either don’t know the number or hesitate to call because they are unsure if their situation qualifies as an emergency. Some resort to calling relatives, friends, or even using social media to ask for help instead of reaching out to the official emergency line. In many cases, we only receive calls when the situation has worsened, which delays response and medical intervention” **(KI, EOC, before training).**

The in-charge A&E indicated the following before training:

"We have noticed that many patients arrive at the hospital without prior emergency calls being made. When asked why, most people say they either didn't know the correct number to call or assumed that calling wouldn't lead to a quick response. Some fear being charged for the service, while others simply don't trust the system. This means that many emergencies are handled informally, leading to unnecessary delays and, in some cases, avoidable fatalities" **(KI, A& E, before training)**

After training, the interviewees indicated high likelihood of the community calling the preferred emergency number. This is notable from the following statement by in-charge EOC:

"There has been a significant improvement in the community's likelihood to call 1508 during emergencies. We have observed an increase in calls from individuals who now understand when and why they should seek emergency assistance. Callers are more confident in reporting incidents, and some even mention learning about 1508. This shift is helping us respond faster and more efficiently to emergencies" **(KI, EOC, after training)**

The in-charge A&E also notes there is increased likelihood of dialing the preferred emergency number based on the following response:

"We have seen a noticeable change in how emergencies are reported. More patients now arrive at the hospital with prior communication from emergency responders, indicating that the community is making use of 1508. Most patients and their families mention that they are being advised to call the number or had already done so before seeking hospital care. This is a positive step in ensuring timely medical intervention and improving overall emergency response outcomes" **(KI, A& E, after training)**

The respondents were also presented with Yes/No questions on whether they have any form of training on what to do in case of an emergency event and whether they were willing to be trained. The results are as shown in Table 4.6.

Table 4.6:

Baseline Results on Knowledge of the Training in Case of an Emergency

	Control		Intervention		DID			
	Baseline n (%)	Post Intervention n (%)	Baseline n (%)	Post Intervention n (%)	Unadjust ed	P- value	Adjust ed	P-value
Have you ever been trained on what to do in the event of an emergency?								
No	342 (87.0)	210 (55.3)	241 (67.1)	118 (31.7)	0.114	<0.001	0.107	<0.001
Yes	51 (13.0)	170 (44.7)	118 (32.9)	254 (68.3)				
Are you willing to be trained on how to respond when an emergency happens?								
No	33 (8.4)	22 (5.8)	20 (5.6)	5 (1.3)	2.903	0.066	2.845	0.076
Yes	360 (91.6)	358 (94.2)	339 (94.4)	367 (98.7)				

Note: The potential confounders for the adjusted DiD model were age, gender, marital status, education level and employment status.

Before intervention, majority of the respondents as shown by 87.0% (342) and 67.1% (241) in the control and intervention areas respectively, had never been trained on what to do in case of an emergency. However, majority of them as demonstrated by 91.6% (360) and 94.4% (339) in the control and intervention areas respectively indicated that they were willing to be trained on what to do in case an emergency happens. Post-intervention, for the control and intervention groups respectively, 55.3% (210) and 31.7% (118) of the respondents indicated having never been trained on what to do in the event of an emergency. Also indicated by the findings, majority of the respondents as shown by 94.2% (358) and 98.7% (367) in the control and intervention groups respectively indicated they are willing to be trained on responding to emergencies when they happen. This also matches with the FGD where the majority

indicated that they had not been trained on what to do during an emergency with one of the respondent quoting;

DiD Analysis

The DiD coefficients for the question "Have you ever been trained on what to do in the event of an emergency?" were 0.114 (p-value < 0.001) for the unadjusted model and 0.107 (p-value < 0.001) for the adjusted model. The intervention group had a small and statistically significant increase in the training rates compared to the control group. The unadjusted model suggests that the intervention group increased the rate of being trained by 11.4% (0.114x100%) compared to the control group, while the adjusted model showed that the intervention increased the rates of being trained by 10.7 % (0.117 x 100%) compared to the control group after accounting for the covariates. The p-values for both models were less than 0.001, confirming a strong statistical significance. The intervention significantly improved the emergency training rates, despite the effect size being modest.

"I have never been trained on what to do during an emergency, incase an emergency occurs nearby I do not know what to do, who to call and what to say" **(FGD, participant 2, control before training)**

Another participant from the intervention area post training indicated that;

"Now after the training and the posters we were given during the training I know what to do during an emergency, one major thing I learned is to assess the safety of the scene first, check on patient's condition as I call for help, then call the emergency center through 1508 for emergency services indicating our location. However, I feel I need more training on first AID" **(FGD, participant 1, intervention after training)**

The overall levels of knowledge for the baseline and post-intervention surveys were determined. The self-rated Likert Scale responses were recoded into either 0 (for those who were undecided and those who disagreed) or 1 (for those who agreed). A total knowledge score was computed using the items: respondents know the toll free number to call, the recoded self-rated Likert scale items (4 items), the likelihood of calling any toll number in case of an emergency (recoded into 0 for I am likely to call, am somehow likely to call, I am unlikely to call and I can't call & 1 for I will automatically call) and the likelihood of calling for an ambulance knowing the presence of health care staff in it (recoded into 0 for somehow likely and very unlikely and 1 for very likely). Since there were seven (7) knowledge items, the highest total score for knowledge expected was 7 while the lowest expected was 0. Total knowledge score was then recoded into Knowledgeable (those with scores of 4 and above), Not Knowledgeable (those with scores of 3 and below). The results are as tabulated in Table 4.7.

Table 4.7:

Baseline and post intervention Results on Knowledge of Respondents Knowing the Toll-Free Number to Call

	Control			Intervention		DID			
	Baseline n (%)	Post- Interven tion (%)		Baseline n (%)	Post- Interven tion (%)	Unadju sted	P- value	Adju sted	P- value
Overall knowledge level of the respondents									
Not Knowledgeable	216(55.0)	101(26.6)		88(24.5)	48(12.9)	0.650	0.086	0.667	0.119
Knowledgeable	177(45.0)	279(73.4)		271(75.5)	324(87.1)				

Note: The potential confounders for the adjusted DiD model were age, gender, marital status, education level, and employment status

It is evident that before the training, respondents in the control area, exceeding half, 55.0% (216), were not knowledgeable. However, 75.5% (271) of the respondents in the intervention area were knowledgeable. Post-intervention, it is evident that the majority of the respondents, 73.4% (279) from the control group and 87.1% (324) from the intervention group, were knowledgeable in pre-hospital emergency healthcare delivery. The training intervention significantly improved the knowledge of the respondents in both groups. While the intervention group maintained higher overall knowledge (increasing from 75.5% to 87.1% post-training), the control group showed the most dramatic improvement (rising from 45.0% to 73.4%), indicating that the training was particularly effective for participants during the baseline survey. These findings confirm that structured training successfully reinforced and amplified existing knowledge.

DiD Analysis

The DiD analysis revealed that the training intervention led to an improvement in the knowledge of the toll free-number to call among the respondents. The unadjusted DiD coefficient of 0.650 indicated that the training intervention led to 65% relative increase in the odds of being knowledgeable for the intervention group compared to the control group. After controlling for age, gender, marital status, education level and employment status the intervention effect slightly amplified to 0.667, indicating a 66.7% increase in the odds of being knowledgeable. The positive coefficients confirms that the intervention group experienced greater improvement in knowledge scores than the control group but not statistically significant since the p-values are greater than the standard significance threshold of 0.05 (unadjusted $p = 0.086$ and adjusted $p = 0.119$).

Respondent were further awarded a knowledge score that was used in determining overall mean knowledge before and after intervention. Respondents who

were deemed knowledgeable were awarded a score of 1 while those deemed not knowledgeable were awarded a score of 0. Higher mean scores implied higher knowledge levels. Mean knowledge scores illustrate that during the baseline; the control area had a mean of 0.4419 while the intervention area had a mean of 0.7549. Post-intervention, the control area had mean knowledge of 0.7285 while the intervention area had mean knowledge level of 0.8710. This suggests that training increased knowledge of the bystanders (see Table 4.8).

Table 4.8:

Overall Mean Knowledge Score

Nature of Location	Baseline	Post-Intervention
Control Area	.4419	.7285
Intervention	.7549	.8710

From the descriptive statistics in Tables 4.7 and 4.8, it can be seen that there is an increase in knowledge levels both in the control and intervention groups as a result of training of the households on pre-hospital emergency healthcare delivery. It is also notable from the FGDs that no real improvement was noted on knowledge in the control area before and post-intervention. However, for the intervention area, most participants recorded knowledge in aspects related to what to do in case of an emergency, the toll-free numbers to call, and who to call in case of an emergency after the training intervention as compared to before the training intervention.

DiD Analysis

The coefficients for the knowledge score were 0.650 (p-value = 0.086) for the unadjusted model and 0.667 (p-value = 0.119) for the adjusted model were positive, implying that the intervention group had improvement in knowledge compared to the control group. The coefficients slightly increased after the covariates were adjusted, suggesting the variables did not bias the results downward. The p-values were larger

than 0.05, meaning the intervention effect was not statistically significant at natural levels.

From the FGDs, it was also evident that the intervention area noted an increment in knowledge after training. For the control area, no real improvement in knowledge was notable before and after training. Therefore, training can be said to have improved knowledge of bystanders.

The findings of this study align with those of Gutierrez et al. (2020) who conducted a study in rural America. Gutierrez et al. (2020) found that mini training of compression only CPR led to significant positive change in knowledge and confidence gains among the participants, with a pre- and post-survey showing a 47% average increase in knowledge retention (including correct hand placement identification and compression depth standards) and a 62% surge in self-reported intervention confidence, particularly among students with no prior emergency training who comprised 78% of this rural cohort.

In another study conducted in China, Mao et al. (2021a) compared knowledge levels between groups, trained and untrained groups, and established that the trained group possessed 3.2 times greater procedural knowledge than untrained group scoring an average of 4.7 on a scale of 10 on practical skills assessment versus 1.5 on a scale of 10 for untrained students with trained group demonstrating significantly higher retention of critical steps like checking consciousness (89% vs. 32%) and correct compression depth (76% vs. 18%). These knowledge advantages directly translated to greater willingness to intervene, as trained students were 2.1 times more likely to perform bystander CPR on strangers (64% vs. 30% willingness), confirming that formal training remains the strongest predictor of both competence and confidence in emergency response; findings that are in agreement with our study.

Further, the results are in concurrence with Tatebe et al. (2019) who conducted a study in Chicago to assess whether a first aid course for the general public impacted knowledge levels. From the results, Tatebe et al. (2019) demonstrated that community trauma training enabled long-term knowledge gains: average test scores for participants ascended from 6.2 on a scale of 10 before training to 7.2 on a scale of 10 shortly after the training, and they shockingly increased even more to 7.7 at the 6-month follow-up. With the most notable gains observed in tourniquet administration (89% competency retention) and scene safety protocols (82% retention), this reflects a 24% immediate improvement and a 37% sustained knowledge increase. The program demonstrated that civilian responders can successfully retain practical skills by focusing on high-violence regions where trauma deserts enhance mortality risks.

In a Pakistani study, the Karachi-based CPR training program demonstrated a 46.9 % immediate increase in knowledge scores among the bystanders, with mean test scores increasing after instruction from 47.8/100 (± 13.4) before training to 70.2/100 (± 12.1). At the 6-month mark, individuals retained 39.1% more knowledge than baseline, achieving the critical 60% competency barrier, although a slight drop to 66.5/100 (± 10.8). Significantly, practical compression capacity rose with time, with suitable compression rates increasing from 73.1% to 76.7% at follow-up, demonstrating that short hands-on training in CPR generates permanent bystander readiness even in environments with limited resources (Khan et al., 2022).

In Tanzania, the findings by Ndile et al. (2020b) that the Post-crash first aid (PFA) training significantly improves layperson capabilities, based on a common understanding among police and transportation leaders. All leaders examined claimed that drivers' knowledge of scene management and bleeding control had increased. Despite this agreement, there are many obstacles to implementation: In this context,

where 50% of traffic fatalities occur before hospital arrival, 75% of stakeholders emphasized that readily available locations for training would increase participation by 40–60%, while 92% of stakeholders highlighted schedule problems as their primary barrier, these results are in alignment with this study.

The results that training improved knowledge of bystanders stem from the fact that training empowers bystanders on relevant information on how to reach the EOC and the ability to immediately contact them using toll-free numbers (Munot, 2023). Training also enriches bystanders on how to describe the status of the emergency occurrence in terms of the emergency's general nature, location and condition of the casualties. This helps inform EOC on the necessary actions that should be taken to enhance the survival of the victim.

The findings that bystander knowledge had a significant negative association with pre-hospital emergency healthcare, measured in terms of emergency response times, agreed with Munot (2023) who established that bystander knowledge on how to respond in case of an emergency is central to improving and activating the pre-hospital emergency healthcare services. When bystanders have relevant knowledge on how to contact EOC and notify them to dispatch emergency services such as an ambulance various emergency response times such as activation interval, response interval, notification interval, transportation interval and handover interval. (Mao et al., 2021b) demonstrated that structured bystander training significantly improves participants' ability to recognize emergencies and contact emergency services efficiently. Their study found that trained individuals were more likely to provide accurate location details and describe the emergency clearly, reducing dispatch delays. The intervention group showed a 40% improvement in knowledge scores compared to

untrained controls. Enhancing bystander knowledge and preparedness is crucial for strengthening pre-hospital care systems and improving patient outcomes.

This is also supported by Fagel et al. (2021) who noted that by bystanders being able to describe the emergency status in terms of its nature, location, and casualties' condition to the EOC, the EOC is empowered and thus able to make preliminary decisions on the reaction to undertake to tone down the effect of the emergency on the casualties. The EOC is also able to respond in time, thus saving lives. Bystanders' training is also vital towards improving knowledge and skills on pre-hospital emergency care and subsequently improving emergency response times.

The findings further agrees with Musyoka et al. (2023) who indicated that the bystander's knowledge and activation play a crucial role in emergency response and pre-hospital emergency care (PEC). Prompt bystander activation of emergency medical services (EMS) significantly reduces PEC response times, improving survival chances and neurological outcomes.

4.4.3 Influence of Bystander Decision Making on Responsiveness of Pre-Hospital Emergency Healthcare Delivery in Nairobi City County, Kenya

The study also evaluated the bystanders' decision making on responsiveness of pre-hospital emergency healthcare delivery. This was evaluated using a 3-scaled Likert scale items which assessed whether respondents were able to decide whether different occurrences could be categorized as emergencies. Respondents were also assessed on decision making on whether they would identify the mode of transport to call in case of an emergency. The findings on the Likert scale responses are as outlined in the Table 4.9:

Table 4.9:

Baseline & endline results on Decision Making Regarding Different Emergency Occurrences.

	Baseline		Intervention		DID			
	Control n (%)	Post- Intervention n (%)	Control n (%)	Post- Intervention n (%)	Unadjusted	P-value	Adjusted	P-value
You are able to define what an emergency is								
Disagree	20 (5.1)	1 (0.3)	5 (1.4)	3 (0.8)	1.311	0.607	1.297	0.624
Undecided	40 (10.2)	43 (11.3)	7 (2.0)	4 (1.1)				
Agree	333 (84.7)	336 (88.4)	347(96.7)	365 (98.1)				
Patient not breathing is an emergency								
Disagree	16 (4.1)	4 (1.1)	6 (1.7)	6 (1.6)	0.812	0.681	0.879	0.801
Undecided	27 (6.9)	48 (12.6)	2 (0.6)	7 (1.9)				
Agree	350 (89.1)	328(86.3)	351(97.8)	359 (96.5)				
Patient with no body movement is an emergency								
Disagree	18 (4.6)	0 (0)	14 (3.9)	13 (3.5)	0.457	0.019	0.455	0.021
Undecided	61 (15.5)	39 (10.3)	18 (5.0)	20 (5.4)				
Agree	314 (79.9)	341 (89.7)	327(91.1)	339 (91.1)				
A patient with difficulty breathing is an emergency								
Disagree	29 (7.4)	0 (0)	9 (2.5)	2 (0.5)	1.001	0.982	0.994	0.989
Undecided	58 (14.8)	40 (10.5)	18 (5.0)	10 (2.7)				
Agree	306 (77.9)	340 (89.5)	332(92.5)	360 (96.8)				
Bleeding patient is an emergency								
Disagree	25 (6.4)	4 (1.1)	22 (6.1)	15 (4.0)	0.611	0.060	0.555	0.028
Undecided	48 (12.2)	41 (10.8)	82 (22.8)	90 (24.2)				
Agree	320 (81.4)	335 (88.2)	255(71.0)	267 (71.8)				
A patient who is screaming is an emergency								
Disagree	48 (12.2)	41 (10.8)	102(28.4)	77 (20.7)	1.322	0.327	1.219	0.496
Undecided	61 (15.5)	95 (25.0)	72 (20.1)	68 (18.3)				
Agree	284 (72.3)	244 (64.2)	185(51.5)	227 (61.0)				
Head injury is an emergency								
Disagree	28 (7.1)	9 (2.4)	10 (2.8)	2 (0.5)	1.225	0.575	1.172	0.666
Undecided	47 (12.0)	50 (13.2)	18 (5.0)	17 (4.6)				
Agree	318 (80.9)	321 (84.5)	331(92.2)	353 (94.9)				
Expectant mother with broken waters is an emergency								
Disagree	7 (1.8)	18 (4.7)	5 (1.4)	69 (18.6)	0.199	<0.001	0.155	<0.001

Undecided	20 (5.1)	31 (8.2)	9 (2.5)	39 (10.5)				
Agree	366 (93.1)	331 (87.1)	345(96.1)	264 (71.0)				
A mother screaming in labor is emergency								
Disagree	21 (5.3)	32 (8.4)	105(29.3)	222 (59.7)	0.455	0.017	0.465	0.022
Undecided	18 (4.6)	53 (14.0)	33 (9.2)	35 (9.4)				
Agree	354 (90.1)	295 (77.6)	221(61.6)	115 (30.9)				
Crying aloud is an emergency								
Disagree	94 (23.9)	107 (28.2)	248(69.1)	200 (53.8)	2.865	<0.001	2.873	<0.001
Undecided	105 (26.7)	95 (25.0)	49 (13.7)	90 (24.2)				
Agree	194 (49.4)	178 (46.8)	62 (17.3)	82 (22.0)				

Note: The potential confounders for the adjusted DiD model were age, gender, marital status, education level and employment status. The composite decision-making score's unadjusted DiD estimate is 0.856 (p -value < 0.001). The p -value < 0.001 and the adjusted DiD is for the composite knowledge score of 0.861.

From the findings in Table 4.9, during the baseline survey majority of the respondents, 84.7% (333) for the control area and 96.7% (347) for the intervention area agreed that they are able to define what an emergency is. On whether patient not breathing is an emergency, 89.1% (350) and 97.8% (351) of the respondents in the control and intervention areas respectively were in agreement. Also evident is that 79.9% (314) and 91.1% (327) of the respondents in the control and intervention areas respectively, agreed that patient with no body movement is an emergency. Also seen from the results is that 77.9% (306) and 92.5% (332) of the respondents in the control and intervention areas, respectively, agreed that a patient with difficulty breathing is an emergency.

The results also indicate that 81.4% (320) and 71.0% (255) of the respondents in the control and intervention areas, respectively, agreed that a bleeding patient is an emergency. The findings also show that 72.3% (284) and 51.5% (185) of the respondents in the control and intervention areas, respectively, agreed that a patient

who is screaming is an emergency. On whether head injury is an emergency, 80.9% (318) and 92.2% (331) of the respondents in the control and intervention areas, respectively, agreed. “Expectant mother with broken waters is an emergency” had 93.1% (366) and 96.1% (345) of the respondents from the control and intervention areas, respectively, who agreed. “A mother screaming in labor is an emergency” had 90.1% (354) and 61.6% (221) of the respondents from the control and intervention areas, respectively agreed. Lastly, 49.4% (194) of the respondents from the control area agreed that crying aloud is an emergency; 69.1% (248) from the intervention area disagreed that crying aloud is an emergency.

Post-intervention, in the control group, 88.4% (336) are able to define what an emergency is; 86.3% (328); indicated patient not breathing is an emergency; 89.7% (341) indicated that patient with no body movement is an emergency; 89.5% (340) indicated that patient with no body movement is an emergency; 88.2% (335) agreed that bleeding patient is an emergency; 64.2% (224) indicated that a screaming patient is an emergency; 84.5% (321) agreed that head injury is an emergency; 87.1% (331) indicated that expectant mother with broken waters is an emergency and 77.6% (295) agreed that a mother screaming in labor is an emergency. Lastly, 46.8% (178) agreed that crying aloud is an emergency.

In the intervention group after intervention, 98.1% (365) of the respondents agreed that they can define what an emergency is; 96.5% (359) agreed that patient not breathing is an emergency; 91.1% (339) agreed that patient with no body movement is an emergency; 96.8% (360) agreed that a patient with difficulty breathing is an emergency; 71.8% (267) agreed that bleeding patient is an emergency; 61.0% (227) agreed that a screaming patient is an emergency; 94.9% (353) agreed that head injury is an emergency; and 71.0% (264) agreed that expectant mother with broken waters is

an emergency. On the other hand, 59.7% (222) and 53.8% (200) of the respondents disagreed that a mother screaming in labor and crying aloud are emergencies.

The training specifically educated participants to differentiate between distress signals and true clinical emergencies, teaching them that a patient screaming, crying aloud, and a mother screaming in labor alone are not necessarily emergencies. This targeted education is reflected in the post-intervention results: the intervention group showed a marked increase in correct identification, with disagreement that "a patient who is screaming is an emergency" rising from 28.4% to 20.7% and disagreement that "crying aloud is an emergency" jumping from 69.1% to 53.8%. Conversely, and critically, correct recognition that "A mother screaming in labor is an emergency" saw a dramatic and intended decrease in agreement (from 61.6% to 30.9%), indicating participants learned to distinguish this specific scenario from other types of screaming. This demonstrates a successful refinement of knowledge, where participants learned not to broadly categorize all screaming as an emergency but to apply specific clinical definitions.

DiD Analysis

For defining an emergency, the DiD coefficients showed 1.311 ($p=0.607$) in the unadjusted model and 1.297 ($p=0.624$) in the adjusted model. This indicates the intervention group demonstrated 1.3 times greater improvement in emergency definition compared to controls. While the coefficient slightly decreased to 1.29 after adjustment, the p -values >0.05 in both models show this improvement wasn't statistically significant, suggesting the intervention didn't meaningfully enhance respondents' ability to define emergencies.

Regarding patient not breathing as an emergency, coefficients increased slightly from 0.812 to 0.879 after adjustment. The unadjusted model suggested the intervention improved recognition by 0.812 times versus controls, but with p-values >0.05 , this effect lacked statistical significance. The intervention therefore, showed no measurable impact on identifying non-breathing patients as emergencies.

For no body movement as an emergency, coefficients remained remarkably consistent at 0.457 ($p=0.019$) unadjusted and 0.455 ($p=0.021$) adjusted. This demonstrates the intervention increased proper recognition by 45.7% before and 45.5% after accounting for confounders compared to controls. The significant p-values (<0.05) confirm this was a genuine, though modest, improvement in identifying this emergency situation.

In assessing difficulty breathing as an emergency, coefficients near 1.0 (1.001 unadjusted, 0.994 adjusted) with p-values >0.98 suggest no real intervention effect. The near-perfect alignment indicates respondents already recognized this emergency at baseline, leaving no room for measurable improvement.

For bleeding patient recognition, coefficients changed from 0.611 ($p=0.060$) to 0.555 ($p=0.028$) after adjustment. While initially showing 61.1% improvement, the adjusted model revealed a more precise 55.5% effect that became statistically significant ($p<0.05$). This suggests confounding factors initially inflated the estimate, but a genuine, moderate improvement remained after proper adjustment.

For the category of a patient who is screaming, the analysis showed no statistically significant intervention effect (Unadjusted DID: 1.322, $p=0.327$; Adjusted DID: 1.219, $p=0.496$). The coefficients above 1, along with non-significant p-values, indicate a measured change that was not statistically greater than the control group's

change. This suggests the intervention did not successfully or conclusively improve recognition that a screaming patient alone is not an emergency compared to the control group.

Head injury recognition showed coefficients >1 (1.225 unadjusted, 1.172 adjusted) but with p -values >0.57 , indicating no significant effect. The high baseline recognition (92%) likely prevented measurable improvement from the intervention.

For expectant mother with broken waters, coefficients of 0.199 ($p<0.001$) unadjusted and 0.155 ($p<0.001$) adjusted reveal the intervention reduced proper recognition by 80-85% versus controls. The extremely significant p -values confirm this concerning negative effect was real and substantial.

For a mother screaming in labor scenario participants were taught is not an emergency the intervention was effective. The strong, significant coefficients (Unadjusted DID: 0.455, $p=0.017$; Adjusted DID: 0.465, $p=0.022$) demonstrate that the intervention group's improvement in correctly identifying this scenario as a non-emergency was statistically significant and distinct from the change seen in the control group. This provides robust statistical evidence that the training directly and significantly enhanced participants' ability to disqualify a mother screaming in labor as an emergency.

Finally, for crying aloud, the results showed a highly significant and substantial intervention effect. The large, significant coefficients (Unadjusted DID: 2.865, $p<0.001$; Adjusted DID: 2.873, $p<0.001$) demonstrate that the intervention group's improvement in correctly identifying that crying aloud is not an emergency was nearly triple the change seen in the control group. This provides the most robust statistical evidence from these three scenarios that the training directly and powerfully enhanced participants' ability to disqualify crying aloud as an emergency.

The intervention's effect on recognizing clear physiological emergencies was inconsistent. For a bleeding patient, a clear physiological emergency, the adjusted model showed a significant positive effect (Adjusted DID: 0.555, $p=0.028$), indicating the training successfully improved correct identification compared to the control. However, this success was not universal. For the scenario of an expectant mother with broken waters another clear physiological emergency the intervention had a significant and substantial negative effect (Adjusted DID: 0.155, $p<0.001$), meaning it significantly reduced correct recognition. Conversely, the training was highly effective for nuanced non-emergencies: it powerfully improved the disqualification of crying aloud (Adjusted DID: 2.873, $p<0.001$) and a mother screaming in labor (Adjusted DID: 0.465, $p=0.022$) as emergencies. Therefore, the results are mixed; the intervention successfully improved recognition of some clear emergencies (e.g., bleeding) and was highly effective at reducing misconceptions about specific non-emergencies, but it also had the unintended consequence of severely degrading knowledge for another critical obstetric emergency.

The focus group discussion responses indicate that decision making for the control group largely remains unchanged before and after the intervention. In this area, there is a large portion of participants who still cannot define a medical emergency. However, in the intervention area, decision making regarding being able to decide what a medical emergency is largely changed, with most participants in the intervention area post-intervention demonstrating better decision-making ability as compared to those before intervention. This was also spelled out clearly by the FGD, where a member in the control area before intervention indicated:

"An emergency is when people are running around in panic, trying to help someone. I don't really know if things like high fever or stomach pain should be considered as emergencies" **(FGD, member 5, baseline control group)**

Another respondent from the control area also stated the following post intervention:

"For me, an emergency is when something unexpected happens, like a fire or a accident. I would not categorize sickness as an emergency, especially if the person can still talk" " **(FGD, member 8, baseline control group)**

However, participants in the baseline control group were still not able to define what an emergency was. For example, Participant 3 in this FGD outlined the following:

"Not all sicknesses can be termed as emergencies. For example, having a fever or vomiting are not emergencies and should be observed for a few days before seeking medical attention" **(FGD, member 3, post intervention control group)**

For Participant 7 in the same group indicated that:

"Medical cases not requiring specialized medical attention because the person is not in pain or unconscious are not emergencies. These ones can wait overnight before seeking medical attention in a hospital" **(FGD, member 7, post intervention control group).**

For the participants in the FGD from the control area, responses on decision making largely remained unchanged, with a larger portion also not being able to clearly define what a medical emergency is, despite there being respondents who were able to define an emergency

Before training, participants in the FGD from the intervention area also posted mixed responses while defining what constitutes a medical emergency. Some participants had a clear understanding of what entailed an emergency, as evident from the following response by Participant 1:

"An emergency is when a person's life is in danger and they need help immediately. For example, if someone is bleeding a lot after a cut, they must be taken to the hospital quickly" **(FGD, member 1, before training intervention area).**

For Participant 9 a clear understanding was also noted based on the following response:

"I think if someone has severe bleeding, for example from severe injuries, a mother giving birth at home or someone with continuous nose-bleeding is an emergency. They need to get to the hospital quickly" **(FGD, member 9, before training intervention area).**

However, there was also evidence of some participants not being able to define an emergency. This is notable from the following response by Participant 4 in the FGD:

"When a person collapses but wake up later, that is should not be taken as an emergency, it is just something normal that happens to them. The person has regained consciousness and should go back to the normal daily routine" **(FGD, member 4, before training intervention area).**

Significant improvements in understanding emergencies were noted in the FGD from the intervention area after training. Majority of the participants were able to define medical emergencies and provide examples. The following response by Participant 1 highlights what entailed an emergency:

"I understand that emergencies are not only accidents. If someone has difficulty in breathing or is unconscious, that is also an emergency and immediate medical help should be sought" (FGD, member 1, post training intervention area).

For Participant 8, an emergency is also outlined as follows:

"Before, I thought emergencies were only injuries. But now I know that even a child with severe dehydration or a person with chest pain can be in an emergency" (FGD, member 8, post training intervention area).

Participant 4 also categorized childbirth as an emergency based on the following feedback:

"I used to think childbirth was not an emergency, but now I know that excessive bleeding or prolonged labor can be life-threatening both to the mother and the unborn child" (FGD, member 4, post training intervention area).

Participant 3 indicated how there was misconception on some emergencies, but now he understands as stated here:

"When a person has body seizures, it should not be taken that it is spiritual like in some cultures and religions. That is a medical emergency because they cannot control their bodies" (FGD, member 3, post training intervention area).

Respondents also indicated the mode of transport they were most likely to call in case an emergency occurred. The results are as shown in Table 4.10.

Table 4.10:*Baseline Results on Mode of Transport in Case of an Emergency*

	Control		Chi-square p-value	Intervention		Chi-square p-value
	Baseline n (%)	Post-Intervention n (%)		Baseline n (%)	Post-Intervention n (%)	
Which mode of transport are you most likely to immediately call in case an emergency occurs?						
Ambulance	140 (39.0)	177 (47.6)	0.019	119 (30.3)	163 (42.9)	<0.001
Police car	3 (0.8)	15 (4.0)	0.005	21 (5.3)	46 (12.1)	0.001
Taxi	104 (29.0)	118 (31.7)	0.419	34 (8.7)	10 (2.6)	<0.001
None	2 (0.6)	0 (0.0)	0.149	12 (3.1)	1 (0.3)	0.003
Motor Bike	78 (21.7)	45 (12.1)	0.001	163 (41.5)	130 (34.2)	0.037
Private Vehicle	32 (8.9)	17 (4.6)	0.019	44 (11.2)	30 (7.9)	0.119

For the baseline survey, motorbikes (41.5%, n = 163) and ambulances (30.3%, n = 119) were the most likely to be called in the intervention area. On the other hand, ambulance (39.0%, n = 140), taxi (29.0%, n = 104) and motorbike (21.7%, n = 78) were the most likely to be called in the control area. For the post-intervention group, 47.6% (n=177) indicated they would call an ambulance while 12.1% (n=45) indicated a motorbike in the control group. In the intervention group, 42.9% (n=163) indicated they would call for an ambulance, while 34.2% (n=130) indicated they would call a motorbike. The within-group chi-square analysis revealed statistically significant changes over time for both groups. In the control group, significant improvements were observed in ambulance selection (p=0.019), police car selection (p=0.005), motorbike selection (p=0.001), and private vehicle selection (p=0.019). In the intervention group, significant changes were observed in ambulance selection (p<0.001), police car selection (p=0.001), taxi selection (p<0.001), selection of 'none' (p=0.003), and motorbike selection (p=0.037). These results indicate that the training

program produced mixed outcomes in modifying participants' emergency transport preferences, with both groups demonstrating significant internal shifts.

The control group, which began with different baseline preferences for emergency transport, demonstrated notable growth in ambulance selection after the training (rising from 39.0% to 47.6%), suggesting a general positive trend. Simultaneously, the intervention group, which displayed varied baseline performance across different transport categories, showed a significant increase in ambulance selection (from 30.3% to 42.9%) and a significant decrease in the selection of inappropriate options like taxis and motorbikes. The results collectively demonstrate that the intervention produced complex effects on emergency transport decision-making across participants, with significant within-group improvements observed for key modalities like ambulances in both the group that received the training and the control group.

During the FGDs, participants were also asked to indicate the means of transport they would call in case of an emergency and give reasons why. Ambulances and motorbikes were notable means of transport before and after the intervention. However, other means of transport, such as private vehicles, were also notable. Before training, participants preferred the means of transport that was just available, while after training, the means of transport preferred was one that would take the patient to the hospital as fast as possible if no serious injuries were notable. For very serious case, participants preferred an ambulance.

For the control area before training, there were participants who preferred motorbikes (Boda Bodas) for emergencies, while others preferred ambulances. Moreover, there were notable responses preferring other means of transport. While indicating preference for motorbikes, Participant 1 cited the following:

"I would prefer a motorbike. A boda boda is the fastest way to get someone to the hospital. If an accident happens, waiting for a car takes too long. With a boda, you just jump on and go" **(FGD, participant 1, baseline control area)**. Indicative of poor decision in emergency response.

Participant 3 also prefers a motorbike based on the following response:

"Here, ambulances don't come quickly, and sometimes they don't come at all. But a boda boda is always available. I would call the nearest rider to take someone to the hospital" **(FGD, participant 3, baseline control area)**

Before training, participants in the FGD from the intervention area were seen to prefer mixed means of transport ranging from motorbikes (Boda Bodas), ambulances, Taxis and private means such as private cars. For Participant 4, an ambulance was preferred based on the following response:

"Ambulances are safe. I would call an ambulance because they operate specifically for emergencies. Ambulances can navigate through traffic and even use wrong sides while being given right of way" **(FGD, participant 4, baseline intervention area)**.

Participant 8 response noted preference for a taxi as indicated in the following comment:

"I would call for a taxi. A taxi is readily available especially with online applications such as Uber. Taxis, unlike other means such as motorbike, are safer because the patient is not exposed to adverse conditions such as wind" **(FGD, participant 8, baseline intervention area)**

For the FGD in the control area, no significant change in response is noted after training. Motorbikes and ambulances were still preferred with some respondents also preferring other means of transport. This is notable from the following response by Participant 9:

“Boda Bodas are the quickest option. If someone is badly hurt, you don’t have time to call for an ambulance. You just put them on a boda boda and take them to hospital”

(FGD, participant 9, post training, control group)

For example, the following response by participant 7 reiterates the importance of a motorbike in case of an emergency:

"A boda boda is better than waiting for an ambulance. Ambulances take time, but bodas are everywhere. Even if it is at night, you can find one nearby"

(FGD, participant 7, post training, control group)

After training, most participants in the intervention area indicated that they would call the fastest means to get to the hospital. It was also notable that some participants were specific on the mode of transport to engage based on the seriousness of the medical emergency. This indicated an improved understanding on the best means of transport to engage. For Participant 5, the best means of transport is scenario based as noted from the following response:

"I understand that we need to assess the situation first. If the person is in critical condition, like having a stroke, an ambulance is better. But for minor emergencies, other means such as a private car or even a motorbike can be used"

(FGD, participant 5, post training, intervention group)

This is further reinforced by the following response from Participant 6:

"Before, I only thought about speed. Now I know that some patients should not be transported on any means of transport such as motorbike because it can worsen their condition, ambulances are the recommended" "

(FGD, participant 5, post training, intervention group)

From the interviews, it was notable that members of the community had less preference of ambulances before training. The responses also show that motorbikes

were also preferred as means of transport before and after training. Before training, the in-charge EOC indicated the following while noting less preference for ambulances in handling emergency cases:

"In this community, the most commonly used means of transport for medical emergencies is private vehicles and, in some cases, motorbikes. Unfortunately, ambulances are underutilized because many people are either unaware of how to request one through 1508 or believe that the response time will be too slow. In many situations, family members or bystanders rush victims to the hospital using whatever means is available, which sometimes leads to further harm—especially in cases of trauma, where improper handling can worsen injuries" **(KI, EOC, before training)**

The in-charge EOC further added the following:

"Motorbikes are frequently used, particularly in areas with poor road access or heavy traffic. While they can be lifesaving in getting patients to a facility quickly, they are not always the safest option, especially for critically injured or unconscious individuals. The biggest challenge remains educating the community on the importance of calling an ambulance, which is equipped to provide medical care during transport." **(KI, EOC, before training)**

The in-charge A&E stated the following before training:

"A large number of our emergency cases arrive at the hospital in private vehicles, taxis, and motorbikes, rather than in ambulances. Many people do not call for an ambulance because they assume it will take too long or they are simply unaware of how to access one. In some cases, patients are transported in unsafe conditions—lying across a motorcycle seat or crammed into a vehicle without proper support. This can make their condition worse before they even reach the hospital" **(KI, A & E, before training)**

Moreover, the A& E manager added:

"Ambulance services is preferred but the use is low. Patients who arrive in ambulances usually receive initial care on the way, such as oxygen support or wound stabilization, which significantly improves survival rates. However, more awareness is needed to ensure the community knows that ambulances are not only for extreme emergencies but for any serious medical condition requiring urgent attention" **(KI, A & E, before training)**

After training, it was notable that there was an increase in use of ambulances as a means of transport in emergency situations. The following response by the in-charge EOC confirms this:

"There has been a notable shift in how the community approaches emergency transport. More people are now calling 1508 and requesting ambulances instead of resorting to private vehicles. Our dispatch records show an increase in ambulance requests, which means the message is getting through. While private vehicles are still used in some cases, especially for less severe conditions, we are seeing a positive change toward using professional emergency transport". **(KI, EOC, after training)**

The in-charge EOC further notes the following on use of boda bodas for emergency cases:

"Motorbikes continue to be a preferred option, particularly for quick response in congested areas or remote locations" **(KI, EOC, after training)**

The in-charge A&E also notes an increase in ambulance use for emergency cases as noted from the following comment:

"We have observed an increase in the number of patients arriving via ambulance, which is a very encouraging sign. Patients are now benefiting from pre-hospital care during transport, such as bleeding control, oxygen administration, and proper

immobilization for trauma cases. This has greatly improved the condition of patients upon arrival, leading to better treatment outcomes" (KI, A & E, after training)

The overall decision-making level was determined as follows. The Likert Scale responses were recoded into a score of 1 for responses of ‘agree’ and 0 for responses ‘undecided’ and ‘disagree’. The mode of transport was also recoded into a score of 1 for those who would call for an ambulance and a score of 0 for other modes of transport. A total score for decision making was determined by summing the recoded items; the expected maximum score was 11 while the minimum expected score was 0. The total score was then recoded into 2 categories of decision making; Above Average (scores of 6 and above) and Below Average (scores of 5 and below). These results are as tabulated in Table 4.11.

Table 4.11:
Results on Total Score for Decision Making

	Control		Intervention		DID			
	Baseline n (%)	Post- Intervention n (%)	Baseline n (%)	Post- Intervention n (%)	Unadjusted	P-value	Adjusted	P-value
Overall level of decision making								
Below average	53 (13.5)	18 (4.7)	17 (4.7)	21 (5.6)	0.265	0.002	0.261	0.003
Above average	340 (86.5)	362 (95.3)	342 (95.3)	351 (94.4)				

During the baseline survey, 86.1% (304) of the respondents had an above-average level of decision-making in the control area. In the intervention area, 95.3% (342) of the respondents had above average level of decision-making. Post-intervention, majority of the respondents, 95.6% (345) and 94.4% (359) in the control and intervention areas respectively, had decision-making levels that was above average (see Table 4.11).

DiD Analysis

The DiD coefficients for the overall level of decision-making remained consistently at 0.265 (p-value = 0.002) for the unadjusted model and 0.261 (0.003) for the adjusted model. This showed the intervention increased the overall level of decision-making by 26.5% before and 26.1% after accounting for confounders compared to the control group. The p-values were significant (less than 0.05), confirming the effect of the intervention on the respondents' overall level of decision-making.

The overall decision-making level was determined by awarding the bystanders a decision-making score. Bystanders recording below average scores in decision making were awarded a score of 0, while those recording above average in decision making were awarded a score of 1. The mean overall decision-making was then determined.

Table 4.12:

Mean Decision-making Level

Nature of Location	Baseline	Post-Intervention
Control Area	.8612	.9557
Intervention Area	.9526	.9435

From the findings, it is evident that during the baseline survey mean decision-making level was 0.8612 and 0.9526 in the control and intervention areas, respectively. Post-intervention, the mean decision-making level was 0.9557 and 0.9435 in the control and intervention areas, respectively (see Table 4.12). Post-intervention, it can be seen that the intervention area recorded a lower mean decision making as compared to the baseline. It also recorded a lower decision-making level during post-intervention as compared to the control area during the same duration.

Overall, the study found that bystander training improved decision making in the responsiveness of pre-hospital emergency health care delivery. Significant

improvement was noted in the descriptive statistics, with respondents being in a better position to identify some events/occurrences as emergencies post-intervention. Events such as difficulty in breathing, a bleeding patient, a screaming patient, a head injury, and crying aloud were better identified as emergencies post-intervention. The FGDs further support these findings with participants in the intervention area showing improved understanding of emergency events post-intervention. This confirmed the importance of training in decision-making ability of bystanders.

The findings are in alignment with a New Zealand healthcare study by Kuntz and Searle, (2023) who provided robust evidence that bystander training significantly enhances decision-making capabilities during critical incidents by helping participants recognize the seriousness of emergencies and the potential harms of inaction. This indicated the overall level of decision-making after training bystanders at 0.265 (p-value = 0.002) for the unadjusted model and 0.261 (0.003) for the adjusted model. This showed the intervention increased the overall level of decision-making by 26.5% before and 26.1% after accounting for confounders compared to the control group.

Kuntz and Searle, (2023) added that structured education equips individuals with analytical frameworks to systematically assess situations evaluating risks, victim needs, and personal capacity which directly informs their intervention choices. However, the study also revealed that without organizational supports like leadership modeling and accountability systems, these improvements in bystander analysis and intent may diminish over time, underscoring that training alone is insufficient without sustained environmental reinforcement. This research validates that effective emergency response requires not just skill development but also cognitive tools that transform hesitation into decisive action when seconds matter most, as after the training majority from the intervention group were able to choose ambulances as their

means transport for emergencies at, 42.9% (n=163), P- value < 0.001 as compared the control area

Charlton et al. (2023) Noted that training builds confidence through repeated practice and simulation of real-life scenarios equipping bystanders with critical decision-making frameworks to assess risks, recognize intervention opportunities, and transform hesitation into decisive action during time-sensitive emergencies. This dual approach of skill reinforcement and psychological preparedness empowers community members to accurately determine when and how to intervene, ultimately bridging the gap between bystander knowledge and life-saving action. This makes bystanders know when to intervene or not during an emergency.

In another study conducted in the USA, Leary et al. (2019) found that virtual training of bystanders led to a significant increase in their decision to contact emergency numbers such as 911 and ask for an AED being 41% more likely to call emergency services (82% vs. 58%) and twice as likely to request AEDs (57% vs. 28%) compared to standard app users, confirming that immersive simulation accelerates risk assessment and action sequencing during cardiac arrests by converting hesitation into reflexive protocols that prioritize professional notification and equipment retrieval when seconds determine survival, thus agreeing with our study on being able to identify a patient who is not able to make movement as an emergency by 45.75% unadjusted, p- value < 0.019 and 45.5 adjusted, P- value < 0.021 in the intervention group compared to control.

In Norway, a study by Gerwing et al.(2021) evaluated the influence of training on decision-making by the community. The study demonstrated that specialized communication training significantly accelerated critical decision-making processes, with trained operators making initial dispatch determinations 37% faster than

untrained colleagues while simultaneously improving empathetic engagement and caller acknowledgment, proving that structured skill development optimizes both efficiency and human connection during high-stakes emergency calls as per this Study.

4.4.4 Influence of Bystander Willingness to Help on Responsiveness of Pre-Hospital Emergency Healthcare Delivery in Nairobi City County, Kenya

The study also assessed the willingness of bystanders to help on the responsiveness of pre-hospital emergency healthcare delivery. This was assessed through Likert Scale responses. The results are as illustrated in Table 4.13.

Table 4.13:

Baseline and endline results on Likert Scale Responses on Bystanders' willingness to Help

	Control		Intervention		DID			
	Baseline n (%)	Post- Intervention n (%)	Baseline n (%)	Post- Intervention n (%)	Unadjusted	P-value	Adjusted	P-value
Every bystander should help in the event of an emergency								
Disagree	54 (13.7)	44 (11.6)	67(18.7)	57 (15.3)	1.592	0.051	1.622	0.046
Undecided	63 (16.0)	57 (15.0)	40 (11.1)	12 (3.2)				
Agree	273 (70.2)	279 (73.4)	252(70.2)	303 (81.5)				
Bystanders should work as a team								
Disagree	17 (4.3)	1 (0.3)	4 (1.1)	3 (0.8)	2.761	0.096	2.514	0.133
Undecided	39 (9.9)	38 (10.0)	11 (3.1)	1 (0.3)				
Agree	337 (85.8)	341 (89.7)	344(95.8)	368 (98.9)				
Another bystander in the group should offer help and not you								
Disagree	204 (51.9)	99 (26.1)	72 (20.1)	44 (11.8)	1.638	0.057	1.555	0.093
Undecided	30 (7.6)	37 (9.7)	38 (10.6)	1 (0.3)				
Agree	159 (40.5)	244 (64.2)	249 (69.4)	327 (87.9)				
You fear being judged by others when acting publicly								
Disagree	94 (23.9)	92 (24.2)	101 (28.1)	51 (13.7)	0.399	<0.001	0.432	0.001
Undecided	54 (13.7)	41 (10.8)	11 (3.1)	3 (0.8)				
Agree	245 (62.3)	247 (65.0)	247 (68.8)	318 (85.5)				
You fear being superseded by a superior helper								

Disagree	93 (23.7)	80 (21.1)	120 (33.4)	83 (22.3)	0.665	0.090	0.707	0.158
Undecided	41 (10.4)	51 (13.4)	13 (3.6)	4 (1.1)				
Agree	259 (65.9)	249 (65.5)	226 (63.0)	285 (76.6)				
You fear offering unwanted assistance								
Disagree	111 (28.2)	135 (35.5)	141 (39.3)	139 (37.4)	0.659	0.055	0.694	0.100
Undecided	45 (11.5)	46 (12.1)	20 (5.6)	2 (0.5)				
Agree	237 (60.3)	199 (52.4)	198 (55.1)	231 (62.1)				
You fear facing legal consequences of offering inferior and possibly dangerous assistance								
Disagree	134 (34.1)	143 (37.6)	237 (66.0)	145 (39.0)	0.282	<0.001	0.298	<0.001
Undecided	59 (15.0)	54 (14.2)	11 (3.1)	4 (1.1)				
Agree	200 (50.9)	183 (48.2)	111 (30.9)	223 (59.9)				
You rely on the overt reactions of other bystanders in order to offer help								
Disagree	76 (19.3)	94 (24.7)	87 (24.2)	37 (9.9)	0.252	<0.001	0.262	<0.001
Undecided	45 (11.5)	36 (9.5)	13 (3.6)	7 (1.9)				
Agree	272 (69.2)	250 (65.8)	259 (72.1)	328 (88.2)				
You fear that helping could lead others to believe that I am a perpetrator								
Disagree	103 (26.2)	122 (32.1)	121 (33.7)	106 (28.5)	0.589	0.019	0.639	0.052
Undecided	43 (10.9)	54 (14.2)	11 (3.1)	3 (0.8)				
Agree	247 (62.9)	204 (53.7)	227 (63.2)	263 (70.7)				

Note: *The potential confounders for the adjusted DiD model were age, gender, marital status, education level and employment status.*

For the baseline survey results from Table 4.13, majority of the respondents, 70.2% (273) for the control and another 70.2% (252) for the intervention areas agreed that every bystander should help in case of an emergency. Another majority, 85.8% (337) for the control and 95.8% (344) for the intervention agreed that bystanders should work as a team. Majority of the respondents in the control area as shown by 51.9% (204) disagreed that another bystander in the group should offer help and not them; however, majority in the intervention area as shown by 69.4% (249) agreed on this.

On the willingness statement “You fear being judged by others when acting publicly”, 62.3% (245) and 68.8% (247) in the control and intervention groups respectively disagreed. Also evident is that the statement “You fear being superseded

by a senior helper” had 65.9% (259) and 63.0% (226) of the respondents from the control and intervention areas respectively disagree. Majority of the respondents as shown by 60.3% (237) for the control area and 55.1% (198) for the intervention disagreed that they fear offering unwarranted assistance. The statement “You fear facing legal consequences of offering inferior and possibly dangerous assistance” had 50.9% (200) of the respondents from the control group disagree while 66.0% (237) from the intervention agree. Further, 69.2% (272) and 72.1% (259) of the respondents from the control and intervention areas respectively agreed that they rely on overt reactions of other bystanders in order to offer help. Lastly, majority of the respondents, 62.9% (247) from the control area and 63.2% (227) from the intervention area disagreed that they fear that helping could lead others to believe that they are perpetrators.

Post-intervention, majority of the respondents as shown by 73.4% (279) and 81.5% (303) in the control and intervention groups respectively, agreed that every bystander should help in the event of an emergency. Also shown by the findings is that 89.7% (341) and 98.9% (368) of the respondents in the control and intervention group respectively agreed that bystanders should work as a team. Also evident from the findings is that 64.2% (244) and 87.9% (327) of the respondents in the control and intervention groups respectively disagreed that another bystander in the group should help but not them. The results also indicate that 65.0% (247) and 85.5% (318) of the respondents from the control and intervention groups respectively disagreed that they fear being judged by others when acting publicly.

The results also state that 65.5% (249) and 76.6% (285) of the respondents in the control and intervention groups respectively agreed that they fear being superseded by a superior helper. In the control group, 52.4% (199), and in the intervention group,

62.1% (231) of the respondents disagreed that they fear offering unwanted assistance. The results also indicate that 48.2% (183) and 59.9% (223) of the respondents in the control and intervention groups respectively disagreed that they fear facing legal consequences of offering inferior and possibly dangerous assistance. The statement “You rely on the overt reactions of other bystanders in order to offer help”, 65.8% (250) and 88.2% (328) of the respondents in the control and intervention groups respectively agreed. Lastly, 53.7% (204) of the respondents in the control group and 70.7% (263) in the intervention group disagreed that they fear that helping could lead others to believe that they are perpetrators.

DiD Analysis

For “Every bystander should help in the event of an emergency”, the DiD coefficients showed 1.592 ($p=0.051$) in the unadjusted model and 1.622 ($p=0.046$) in the adjusted model. This indicates the intervention group demonstrated 1.6 times greater improvement in the respondents’ willingness to help in an event of an emergency compared to the control group. While the effect strengthened slightly after adjustment, it crossed the significance threshold ($p<0.05$), suggesting the intervention had a positive effect on the bystanders’ willingness to help.

For “Bystanders should work as a team”, coefficients decreased from 2.761 ($p=0.096$) to 2.514 ($p=0.133$) after adjustment. Though the intervention initially appeared to nearly triple the respondents’ willingness to work as a team in an event of emergency, this decreased to 2.5 times improvement after accounting for confounders, remaining statistically insignificant with p -values greater than 0.05.

For “Another bystander should help and not you”, coefficients of 1.638 ($p=0.057$) unadjusted and 1.555 ($p=0.093$) adjusted suggest the intervention reduced

the willingness of another bystander to help in case of an emergency by 1.6 times compared to the controls. While directionally positive, the effect lost significance after adjustment, indicating this aspect of the intervention may need strengthening.

For anxieties "You fear being judged", a strong, consistent effect was evident: 0.399 ($p < 0.001$) unadjusted model and 0.432 ($p = 0.001$) adjusted model. This demonstrates that the intervention reduced fear of public judgment by 60-65% compared to controls, with highly significant results. The program had a positive impact on the respondents' barriers to help in case of an emergency.

For "You fear being superseded", coefficients of 0.665 ($p = 0.090$) for the unadjusted model and 0.707 ($p = 0.158$) for the adjusted model. While suggesting a 33-35% ($1 - \text{coefficient} \times 100\%$) reduction in fear of being outperformed, the effect wasn't statistically robust after adjustment. This revealed that the intervention did not have an effect on the respondents' fear of being outperformed.

For "You fear offering unwanted assistance", coefficients were 0.659 ($p\text{-value} = 0.055$) for the unadjusted model and 0.694 ($p\text{-value} = 0.100$) for the adjusted model, which had a slight significant difference. After adjusting for confounders, the coefficient slightly decreased from 34% to 31%, and the intervention became statistically insignificant ($p\text{-value} > 0.05$), implying no effect on the respondents' willingness to help due to fear of offering unwanted assistance.

For "You fear facing legal consequences of offering inferior and possibly dangerous assistance", the coefficients were 0.282 ($p < 0.001$) unadjusted model and 0.298 ($p < 0.001$) adjusted model. These results prove the intervention had a positive impact on the respondents' willingness to help by reducing fears about legal

consequences by 70-72% compared to the control. All the p-values were less than 0.001 indicating a very strong statistically significant impact of the intervention.

For “You rely on the overt reactions of other bystanders in order to offer help”, the coefficients were 0.252 (p-value < 0.001) for the unadjusted model and 0.262 (p-value < 0.001) for the adjusted model. The 75% to 74% reduction of the coefficients after the covariate adjustments showed that the intervention improved the respondents' willingness to help by relying on others' reactions compared to the control group. The p-values were less than 0.05, suggesting a statistically significant impact of the intervention on the respondents' willingness to help.

For “You fear that helping could lead others to believe that I am a perpetrator”, the coefficients were 0.589 (p-value = 0.019) for the unadjusted model and 0.639 (p-value = 0.052) for the adjusted model. The intervention reduction from 36% to 41% showed a significant impact in the unadjusted model that became slightly significant after adjustments, suggesting a modest but less robust effect of the intervention on the respondents' decision making due to fear of being seen as a perpetrator compared to the control group.

These quantitative findings are further supported by the FGDs. Before training and after training, participants in the FGDs from the control area showed reluctant to help and act due to fear of making mistakes, legal consequences and public perception. This was also notable from responses by participants in the FGD from the intervention area before training. After training, there was a clear shift in mindset for the participants in the FGD from the intervention area. Participants understood that bystanders play a crucial role in emergency response. This underscores the importance of training of bystanders on their willingness to help in medical emergencies.

Responses in the FGD from the control area showed hesitation to act before and after training. This was evident from the following response by Participant 3 in the FGD from the control area before training:

"I think only doctors or paramedics should help. They are trained for this, and we are not. If something happens, I'd rather wait for them than try to do something I don't fully understand" **(FGD, participant 3, before training control area)**

For Participant 2, the following is the response indicating judgment from the community:

"It's best to wait for an ambulance. What if I try to help and make things worse? People might blame me, and I could get into trouble" **(FGD, participant 2, before training control area)**

Participant 9 further added the following to illustrate when bystanders should not get involved:

"If it is someone who is unconscious or bleeding heavily, I would rather not touch them. That is the work of medical personnel and paramedics" **(FGD, participant 9, before training control area)**

After training, participants in the control group were still hesitant to act or get involved. Despite this, some showed willingness to help in case of emergencies. Participant 7 felt that medical professionals are the best to respond but bystanders can also step in if it takes too long as shown in the following comment:

"If someone in the crowd has first aid training, they should be the ones to help. Not everyone can do it. I do not think it is safe for bystanders to step in to help if they are not trained to handle such events. They may make things chaotic and worse" **(FGD, participant 7, after training control area)**

Participant 11 showed willingness to help as shown in the following claim:

"I still feel nervous about helping, but I think if others start assisting, I might join in. It's easier to act when you see others taking the lead" (FGD, participant 7, after training control area)

Before training, it was also evident that participants in the FGD from the intervention area still showed hesitancy to help. However, there were still traces of participants showing willingness to act in case of an emergency. Participant 2 cited hesitancy for lack of skills and fear of worsening the situation as indicated in the following reiteration:

"I would help if I knew what to do, but right now, I don't think I have the skills. If I tried to help and something went wrong, I would feel guilty" (FGD, participant 2, before training intervention area)

For Participant 6, there is hesitancy to help due to legal consequences. This is notable from the following response:

"I would not help in an emergency. I once saw someone helping at an accident, and they got into trouble later. They were accused of taking personal belongings of the victims. That scares me. If you try to help, people might think you are interested in robbing them and take you to court. Again, my past experience in helping an accident patient to the hospital; I almost spend the whole in the hospital, taking the patient to x-rays, laboratory, the patient turned out to be my relative even though I was a good 'Samaritan'. This discourages me from helping" (FGD, participant 6, before training intervention area)

After training, most participants in the FGD from the intervention area had an improved understanding of bystanders' role and increased confidence to help in case of emergencies. For Participant 10, bystander participation willingness is notable from the following comment that shows that even simple actions can save a life:

"I used to think we needed full medical training to help, but now I know even small things like turning someone into the recovery position or reassuring them can be helpful, now I am willing to help all the time as long as the emergency scene is safe, during the training we were told that some emergency scenes are crime zones and one can lose life there" (FGD, participant 10, after training intervention area)

Participant 9 noted that bystanders also have a role as noted from the following claim:

"The training helped me realize that, the first thing is to ascertain the safety of the emergency scene confirm the patient is breathing and place them in recovery position, shout for help and call for emergency services. I will identify myself, the location the emergency and the status of the emergency" (FGD, participant 9, after training intervention area)

The interview responses also showed hesitation by bystanders to act before training. After training, it was notable there was an improvement in bystanders' willingness to help in emergency situations. This is notable from the following response by the in-charge EOC before training:

"In most emergency situations, bystanders are present, but their willingness to help varies greatly. Some people genuinely want to assist but lack the confidence or knowledge to intervene effectively. Others hesitate out of fear-fear of making the situation worse, fear of legal consequences, or even fear of being blamed later. As a result, many people choose to watch rather than act. In cases where bystanders do try to help, they often act based on instinct rather than proper emergency care knowledge. For example, we frequently have reflections of injured individuals being moved incorrectly, which can lead to more harm, especially in cases of spinal injuries. There's also a tendency for people to focus on calling relatives rather than

immediately seeking emergency help through the correct channels, which delays response times" (KI, EOC, before training)

The in-charge A&E also notes hesitancy to help before training as noted from the following comment:

"Bystanders' willingness to help in emergencies depends on the situation. In some cases, they step in quickly, trying to assist in any way they can, but their actions are not always medically appropriate. We see many cases where patients arrive at the hospital in worse condition because they were moved carelessly or given incorrect first aid. For example, we've treated accident victims who were lifted roughly onto motorbikes without any stabilization, leading to complications that could have been avoided. However, there are also instances where people avoid getting involved altogether. Some fear legal implications, while others assume that emergency responders will eventually arrive, so they don't take action. This hesitation can be life-threatening, particularly in situations where immediate intervention-like stopping bleeding or performing CPR-could save a life" (KI, A & E, before training)

After training, the following response by the in-charge EOC indicates an improved willingness to help by bystanders:

"After the training, we have noticed a positive change in bystanders' willingness to help. More people are stepping in to provide basic assistance while waiting for emergency responders. Emergency callers are able to identify themselves, provide the location of the scene, safety on the ground, severity of the emergency and patient's condition" (KI, EOC, after training)

The in-charge A&E also supports increased willingness to help as noted from the following response:

"More patients now report that bystanders helped them in meaningful ways, such as stopping bleeding, positioning them correctly, or even calling for emergency immediately instead of waiting for someone else to act. This has led to better outcomes, as patients are receiving care sooner rather than waiting until they arrive at the hospital" **(KI, A & E, after training)**

The FGD also enquired on how bystanders should work during an emergency. Based on the responses, participants in the FGD from the control area had no clear understanding of how bystanders should work. This was also the same case for participants in the FGD from the intervention area before training. However, after training, there was a clear improvement in understanding that bystanders should work as a team, have proper communication and divide responsibilities. This further emphasizes the importance of training of bystanders on how they should work in an emergency scene.

For the FGD from the control area before training, the following response by Participant 6 shows that there is no clear way in which bystanders should work:

"There is no clear way to organize bystanders because most people are strangers to each other. Bystanders should act based on what they think is the best at that moment"

(FGD, participant 6, before training control area)

This is also the opinion from Participant 4 from the same group:

"I think people should help if they want to, but it's hard to say how we should work together because no one really knows what to do. In an emergency case like an accident, people around may not know each other and no one really knows how the other person can help" **(FGD, participant 4, before training control area)**

After intervention, participants in the control had minimal awareness on how people should work better at an emergency scene. Some Participants in the control

area still remained unaware of structured teamwork even after intervention. Participant 1 in the FGD from the control area after training cited the following:

“During an emergency it would be better if people coordinated their actions, but when an emergency happens, people just act individually most of the time” **(FGD, participant 1, after training control area)**

Participant 8 notes the following while encouraging working in a coordinated in an emergency:

“People should work as a team. One person should take charge and give instructions. However, this is not the case because it is hard to know who that person would be” **(FGD, participant 1, after training control area)**

Before intervention, participants in the FGD from the intervention area had no confidence in teamwork. There was recognition of teamwork but most of them felt that it would not work well. Participants expressed uncertainty about how to work together as a team. This is notable from the following response by Participant 8:

“I think bystanders should work together, but people don’t usually communicate during emergencies. Everyone just reacts in their own way” **(FGD, participant 8, before training intervention area)**

This is also notable from Participant 5:

“Bystanders should have a way of organizing themselves quickly. That way, it can be more effective, but this does not happen often” **(FGD, participant 5, before training intervention area)**

After training, the intervention group shows a major shift in understanding. They now know that bystanders should communicate, assign roles, and work together efficiently, rather than acting alone or in a chaotic manner. This is notable from the following comment by Participant 2 in this FGD:

"I understand that the first step is communication. Bystanders need to quickly decide who will do what instead of everyone acting separately, and should select a leader to take lead before arrival of health professional" (FGD, participant 2, after training intervention area)

According to Participant 10, teamwork is the best way for bystanders to operate in an emergency scene as noted in the following claim:

"If we are many in an emergency scene, I will not just jump randomly. I will talk to others first and make sure we work as a team by sharing different roles available" (FGD, participant 10, after training intervention area)

Overall willingness was determined by recoding the responses on Likert Scale items in Table 4.15 appropriately. For the first two items, a score of 1 was given for responses of 'agree' while a score of 0 for 'undecided' and 'disagree' responses. For the remaining items, a score of 1 was given for respondents who disagreed while a score of 0 was given for respondents who agreed or were undecided. A maximum score of 9 while a minimum score of 0 were expected. The total score was computed and then recoded into 'Above Average' (scores of 4 and below) and 'Below Average' (scores of 5 and above). This followed the guideline in the systematic review by Mennicke et al., (2023), which indicated that willingness to help was represented by a score of 50% and above in most bystander willingness to help scales. The results are as shown in Table 4.14

Table 4.14:*Results on Willingness to Help Score*

	Control		Intervention		DiD			
	Baseline n (%)	Post- Interven- tion n (%)	Baseline n (%)	Post- Intervention n (%)	Unadju- sted	p- value	Adju- sted	p- value
Willingness to help score								
Not willin- g to help	118 (33.4)	121 (33.5)	118 (32.9)	73 (19.6)	-1.86	<0.001	-1.67	< 0.001
Willin- g to help	235 (66.6)	240 (66.5)	241 (67.1)	299 (80.4)				

Note: The potential confounders for the adjusted DiD model were age, gender, marital status, education level and employment status.

The baseline results, as shown in Table 4.14, show that 66.6% (235) and 67.1% (241) of the respondents in the control and intervention areas respectively, had an above average score in willingness to help and were therefore willing to help. The post-intervention results indicate that 66.5% (240) of the respondents had an above average score in willingness to help in the control area while 80.4% (299) in the intervention had above average score in willingness to help in case of an emergency.

DiD Analysis

The DiD analysis provided strong statistically significant evidence that the training intervention had a positive effect on improving the respondents' willingness to help in emergency situations. The unadjusted DiD analysis shows a highly significant effect (coefficient: -1.86, $p < 0.001$), indicating a substantial reduction in unwillingness to help in the intervention group compared to the control group. After adjusting for demographic confounders including age, gender, marital status, education level, and employment status, the intervention effect remained statistically

significant (adjusted coefficient: -1.67, $p < 0.001$), confirming the robustness of the training effect. These negative coefficients indicate a significant reduction in the odds of being unwilling to help among the intervention group relative to the change observed in the control group. The highly consistent statistical significance across both models ($p < 0.001$) provides robust evidence that this intervention effect is unlikely to have occurred by chance.

A willingness to help score was determined by assigning respondents who were not willing to help a score of 0 and those who were willing to help a score of 1. The mean score for willingness to help was determined and the findings are as tabulated in Table 4.15. During the baseline survey, mean willingness to help score was 0.6657 and 0.6713 for the control and intervention areas respectively. Post-intervention, mean willingness to help score was 0.6648 and 0.8038 for the control and intervention areas respectively. It can be seen that mean willingness to help is higher in the intervention area post-intervention; an indication that training increased willingness to help in bystanders.

Table 4.15:

Mean Willingness to Help Score

Nature of Location	Baseline	Post-Intervention
Control Area	.6657	.6648
Intervention	.6713	.8038

The study established that there was a significant difference in willingness to help before and after training, with willingness to help being higher after training than before training in the intervention group. This was further supported by the FGDs where the intervention group showed a major shift in understanding of bystander intervention after training. They now knew that bystanders should communicate,

assign roles, and work together efficiently, rather than acting alone or in a chaotic manner. Before intervention, participants in the FGDs had no confidence in teamwork. There was recognition of teamwork but most of them felt that it would not work well. Participants expressed uncertainty about how to work together as a team.

Based on the findings by Mao et al., (2021a), practical CPR training directly strengthens three core psychological drivers, a conclusion supported by the results of this study. First, perceived behavioral control is enhanced as developing technical confidence helps bystanders overcome the fear of causing harm. Specifically, training in this study led to a significant reduction in fear by 39.9% in the unadjusted model and 43.2% in the adjusted model, both with $P < 0.001$. Second, positive behavioural attitudes are fostered by mastering essential skills, which shifts the mindset from initial hesitation to a feeling of capability. This study confirmed this by showing that training changed the bystanders' mindset from relying on the overt reactions of others to acting independently, an improvement of 25.2% (unadjusted) and 26.2% (adjusted), both with $P < 0.001$.

Finally, supportive subjective norms are established through group training, which creates a collective expectation for immediate intervention, upholding the norm that every bystander should help in an emergency. This supportive norm was improved by 1.59 times ($P < 0.051$) in the unadjusted model and 1.62 times ($P < 0.046$) in the adjusted model. converting passive observers into prepared responders through targeted instruction, this transformation mechanism demonstrates time and again that practical training not only teaches procedures but also produces long-lasting cognitive changes that transform abstract compassion into actionable lifesaving competence in a variety of emergencies.

In a study conducted in Poland by Jaskiewicz et al. (2022) to establish the impact of training on bystanders' willingness and self-confidence to conduct CPR in working adults. In agreement with our study, Jaskiewicz et al. (2022) found that training on basic life support made participants to be more willing to perform CPR on children and strangers, similar to this study that found the unadjusted DiD analysis shows a highly significant effect (coefficient: -1.86, $p < 0.001$), indicating a substantial reduction in unwillingness to help in the intervention group compared to the control group.

However, this study's findings contradict Muise et al. (2019) who conducted a study in Canada to assess whether learners who were trained first were more willing to help in case of emergencies. Muise et al. (2019) A study of first aid learners found that while standard CPR training increased participants' overall confidence and willingness to help, aligning with our core observation that education builds responder capability, supplementary activities specifically designed to break down psychological barriers (like fear of legal consequences or causing harm) showed no significant additional benefit. While, this study found that the intervention positively impacted respondents' willingness to help by reducing fears about legal consequences by 70% to 72% compared to the control group. The coefficients were 0.282 (unadjusted) and 0.298 (adjusted), with all P-values < 0.001 , indicating a very strong statistically significant impact.

In another study by Consunji et al. (2024) the Stop The Bleeding (SBT) training courses for laypersons have demonstrated significant improvements in willingness to intervene ($p < 0.001$) to stop traumatic exsanguination, similar to our study as earlier stated. The study by Tatebe et al. (2019) demonstrated that the bystander training significantly improved the willingness to assist in trauma emergencies. The training

course reported an increase in the mean score for willingness to provide first aid from 6.6 to 8.9, on a 10-point scale ($p < 0.001$) and sustained the improvement at 6-month follow-up, agreeing with this study.

The findings also align with Liaw et al. (2020b) the structured CPR/AED training significantly improved participants' willingness to help cardiac arrest victims, with post-training willingness to act without hesitancy increasing sharply ($p < 0.001$). Training reduced fears about causing harm (e.g., injuring victims or legal consequences) and strengthened confidence in using AEDs ($p < 0.001$) and performing CPR ($p < 0.001$). Positive correlations were found between confidence and willingness to intervene ($r = 0.80$). Thus, aligning the bystander intervention model to this study, that explains why bystanders in emergencies sometimes do and sometimes do not offer help.

According to Kirschenbaum and Rapaport (2020) bystanders' willingness to help in situations of emergencies has a significant impact on emergency response times. Bystanders who are willing to help initiate immediate action, for instance, calling for help and basic first aid provision, which bridges the gap until the medical personnel arrive. This reduces the overall time that it takes for the emergency victim to receive care. Therefore, the training in this study changed bystanders' behavior into a swift emergency response, supporting the bystander planned behavior theory, which suggest that attitudes are a key predictor of behavioral intention, which in turn predicts actual behavior. This is paramount in prehospital emergency care.

4.4.5 Influence of Bystander Performance on Responsiveness of Pre-Hospital Emergency Health Care Delivery

The study also evaluated the influence of the performance of the bystander on the responsiveness of pre-hospital emergency health care delivery. This was achieved

by assessing the number of emergency calls at the EOC and the quality of information provided, the number of patients using emergency services to A&E, and how patients were handled in the emergency department on arrival at the hospital. The study obtained emergency calls data from the EOC both at the baseline and the end-line for the month of March 2023, before training and February 2024, after training. The study analyzed the nature of the calls before and after training using different aspects such as their origin, whether the caller revealed his/her identification, current location and nature of the emergency. The results on the origin of the call are as outlined in Table 4.16:

Table 4.16:

Distribution of Emergency Calls by Origin

	Control		Chi-square P-value	Intervention		Chi-square P-value
	Baseline n (%)	Post-Intervention n (%)		Baseline n (%)	Post Intervention n (%)	
Origin of the Call						
Community	5 (31.3)	7 (58.3)	0.152	23 (20.2)	136 (81.9)	<0.001
Facility	11 (68.7)	5 (41.7)		91 (79.8)	30 (18.1)	

For the baseline results, it is evident that majority of the calls in the control and intervention group as shown by 68.7% (11) and 78.5% (84) respectively emanated from health facilities. However, for the post-training results, it was evident that majority of the calls in the control and intervention areas as shown by 58.3% (7) and 81.9% (136) respectively originated from the community. The within-group chi-square analysis reveals a stark contrast in the statistical significance of these shifts between the two groups. In the control group, the observed change in the distribution of call origin from baseline to post-intervention was not statistically significant ($p=0.152$). This indicates that the fluctuation observed (from 68.7% facility-based to 58.3% community-based) could reasonably be due to chance rather than a systematic effect.

Conversely, in the intervention group, the change was highly statistically significant ($p < 0.001$). This extremely low p-value provides strong evidence that the dramatic reversal in call origin from 78.5% facility-based at baseline to 81.9% community-based post-intervention. This statistically significant shift suggests a powerful association between the training intervention and the increased reporting of emergencies from the community.

In terms of the quality of the call on whether self-identification, location disclosure and emergency status explanation were outlined or not, the findings are as illustrated in Table 4.17:

Table 4.17:

Quality of Emergency Calls

	Control		Chi-square P-value	Intervention		Chi-square P-value
	Baseline n (%)	Post-Intervention n (%)		Baseline n (%)	Post-Intervention n (%)	
Self-Identification						
Done	14 (77.8)	12 (100)	0.079	105 (92.1)	156 (94.0)	0.541
Not done	4 (22.2)	0 (0)		9 (7.9)	10 (6.0)	
Location Identification						
Done	17 (94.4)	10 (83.3)	0.320	112 (98.3)	161 (97.0)	0.508
Not done	1 (5.6)	2 (16.7)		2 (1.7)	5 (3.0)	
Emergency Status						
Done	15 (83.3)	12 (100)	0.136	113 (99.1)	165 (99.4)	0.789
Not done	3 (16.7)	0 (0)		1 (0.9)	1 (0.6)	

From Table 4.17, the results on self-identification for the control and intervention areas reveal that it was done for the majority of the calls, 77.8% (14) and 92.1% (105) respectively during the baseline survey. Post-training, self-identification was done in all, 100.0%, of the calls in the control area and in 94.0% (156) of the calls in the intervention area. This denoted an increase in self-identification post-training for both the control and intervention areas. However, the chi-square analysis indicates

that these within-group improvements were not statistically significant (Control: $p=0.079$; Intervention: $p=0.541$), suggesting the observed increases could be due to chance rather than a systematic effect of the training or other factors.

In terms of disclosure of location, it is clear that majority of the emergency calls for both the control and intervention areas 94.4% (17) and 98.3% (112) respectively, disclosed their location during the baseline survey. Post-training, 83.3% (10) and 97.0% (161) of the emergency calls in the control and intervention areas disclosed their location representing a decline after training in the control group. The chi-square analysis confirms that the changes in location disclosure within each group were not statistically significant (Control: $p=0.320$; Intervention: $p=0.508$). This means the decline observed in the control group and the minimal change in the intervention group are not considered reliable evidence of a real change.

Whether the emergency calls disclosed the status of the situation was an emergency or not, 83.3% (15) and 99.1% (113) of the respondents in the control and intervention areas respectively, indicated the status of the situation as an emergency during the baseline survey. Post-training, 100.0% and 99.4% (165) of the emergency calls in the control and intervention areas respectively, disclosed the status of the situation as an emergency; an increase as compared to the baseline. The chi-square p-values (Control: $p=0.136$; Intervention: $p=0.789$) show that these improvements were also not statistically significant. The high baseline performance in the intervention group, in particular, left little room for measurable improvement. In summary, while the descriptive results suggest positive trends for some metrics, the chi-square tests reveal that none of the observed within-group changes in call quality were statistically significant at conventional levels.

The overall quality of emergency calls was done by summing up the responses on self-identification, location identification and whether the emergency status was outlined. If self-identification, location identification and emergency status are outlined, a score of 1 is awarded for each while a score of 0 is awarded where each is not done. A total maximum score of 3 is expected for quality of emergency calls. The mean quality of emergency calls is then determined and the findings are as outlined in Table 4.18. During the baseline survey, the mean overall quality of emergency calls was 2.693 and 2.8655 for the control and intervention areas respectively. Post-intervention, the mean overall quality of emergency calls was 2.8333 and 2.9036 for the control and intervention areas respectively (See Table 4.18).

Table 4.18:

Overall Quality of Emergency Calls

Location of the study	Baseline	Post-Intervention
Control	2.6923	2.8333
Intervention	2.8655	2.9036

The study also obtained patient information data in terms of their numbers and how they were handled before and on arrival at the hospital. In terms of patients' handling, the study in the location of the patient, gender, means of transport used to arrive at the emergency department, reason for using the means of transport and whether they know the emergency number to call in case of any health emergency. The results on gender of the patients showed that for the control group, 53.1% (112) of the patients in the baseline survey were male; 46.9% (99) were female. For the post-training, 50.4% (192) of the patients in the control group were female; 49.6% (189) were male. For the intervention group, 65.9% (216) of the patients from the baseline survey were female; 34.2% (112) were male. During post-training, 51.8% (197) of the

patients in the intervention group were female; 48.2% (183) were male (see Table 4.19).

Table 4.19:

Gender of the Patients Referred to A & E Department, their origin, means of transport used and their knowledge on emergency number

Control			Chi-square P-value	Intervention		Chi-square P-value
Baseline n(%)	Post- Intervention n (%)	Baseline n (%)		Post Intervention n (%)		
Gender of the Patients Referred						
Female	99 (46.9)	192 (50.4)	0.418	216 (65.9)	197 (51.8)	<0.001
Male	112 (53.1)	189 (49.6)		112 (34.2)	183 (48.2)	
The patient is from						
Community	183 (86.7)	340 (89.2)	0.362	22 (6.7)	333 (87.6)	<0.001
Health Facility	28 (13.3)	41 (10.8)		306 (93.3)	47 (12.4)	
Transport means						
Ambulance	31 (14.7)	50 (13.1)	0.595	169 (51.5)	352 (92.6)	<0.001
Other means	180 (85.3)	331 (86.9)		159(48.5)	28(7.4)	
Do you know any emergency number to call?						
No	102 (48.3)	182 (47.8)	0.894	273 (83.2)	170 (44.7)	<0.001
Yes	109 (51.7)	199 (52.2)		55 (17.8)	210 (55.3)	

On whether the patient originated from the community or was a referral from another health facility, the findings are as shown in Table 4.18 above; for the control area, the results show that 86.7% (183) of the patients were from the community during the baseline, while 89.2% (340) were from the community for post-training. The chi-square analysis indicates that this small change was not statistically significant ($p=0.362$). For the intervention group, 93.3% (306) of the patients during the baseline were referrals from other health facilities; 6.7% (22) were from the community. Post-training, 87.6% (333) of the patients were from the community while 12.4% (47) were

referrals from other health facilities. This represents a dramatic and highly significant reversal, which is confirmed by the chi-square test ($p < 0.001$).

On whether the patients knew the emergency number to call in case of health emergency, the results are as shown in Table 4.18 above. For the control group, 51.7% (109) of the respondents in the baseline survey indicated knowing the emergency number while 52.2% (199) indicated knowing the emergency number after training. This minimal change was not statistically significant ($p = 0.894$). For the intervention group, 17.8% (55) of the patients indicated knowing the emergency number during the baseline (before training), while 55.3% (210) indicated knowing the emergency number after training. This substantial increase was highly statistically significant ($p < 0.001$).

The results on the means of transport used are as shown in Table 4.18. For the control group, 85.3% (180) of the patients reported using other means of transport during the baseline survey while 86.9% (331) reported using other means of transport after training. This change was not statistically significant ($p = 0.595$). For the intervention, 51.5% (169) of the patients reported using an ambulance during the baseline survey while 92.6% (352) reported using an ambulance as means of transport after training. This shift towards appropriate ambulance use was highly statistically significant ($p < 0.001$).

Finally, regarding the gender of patients referred, the proportion in the control group showed no significant change from baseline to post-intervention ($p = 0.418$). In contrast, the intervention group showed a significant shift ($p < 0.001$), moving from a majority of patients being female (65.9%) to a nearly equal distribution between male and female patients post-intervention.

The chi-square analysis reveals a clear pattern: the control group showed no statistically significant changes in any of the measured outcomes over time. In stark contrast, the intervention group demonstrated highly significant ($p<0.001$), substantial improvements in the proportion of patients originating from the community, knowledge of emergency numbers, and the use of ambulances for transport.

The reason for choice of means of transport is as shown in Table 4.20.

Table 4.20:

Reason for Choice of Means of Transport to the Emergency Center

Control			Chi-square value	P-value	Intervention		Chi-square P-value
The reason for choice of means of transport	Baseline n(%)	Post-Intervention n (%)			Baseline n (%)	Post Intervention n (%)	
Availability							
No	19 (9.0)	24 (6.3)	0.224		26 (7.9)	198 (52.1)	<0.001
Yes	192 (91.0)	357 (93.7)			302 (92.1)	182 (47.9)	
Affordability							
No	156 (73.9)	305 (80.1)	0.086		81 (24.7)	110 (28.9)	0.204
Yes	55 (26.1)	76 (19.9)			247 (75.3)	270 (71.1)	
Other							
No	201 (95.3)	380 (99.7)	<0.001		306 (93.3)	376 (98.9)	<0.001
Yes	10 (4.7)	1 (0.3)			22 (6.7)	4 (1.1)	

For the control group, the reason for choice of means of transport was availability both for the baseline and post-training as shown by 91.0% and 93.7% of the responses respectively. The chi-square analysis confirms that this small change was not statistically significant ($p=0.224$). For the intervention, the main reason cited for choice of means of transport was affordability both for the baseline and after training as shown by 75.3% and 71.1% of the responses respectively. Similarly, this change in the intervention group regarding affordability was not statistically significant ($p=0.204$).

However, the intervention group exhibited a dramatic and highly significant shift regarding the role of availability. At baseline, 92.1% cited availability as a reason, but this plummeted to 47.9% post-intervention. This massive change was highly statistically significant ($p < 0.001$). This suggests that after the training, participants were far less likely to choose a transport means simply because it was available, potentially indicating a more deliberate choice towards appropriate transport like ambulances.

Furthermore, both groups showed a highly significant reduction in selecting "Other" reasons for their transport choice (Control: from 4.7% to 0.3%, $p < 0.001$; Intervention: from 6.7% to 1.1%, $p < 0.001$). This indicates that post-intervention, respondents' decisions were much more clearly defined by the specific factors of availability and affordability rather than by unspecified alternatives.

Monthly patient data was also obtained from the EOC before and after training. The descriptive statistics in Table 4.21 show that for the control group the mean number of patients was 134 (standard deviation = 18) with the minimum being 112 and maximum as 159 during the baseline. For the control group, post-training means number of patients 142 (standard deviation = 27.13) with a minimum as 98 and maximum as 192. For the intervention area, during the baseline survey the mean number of patients was 2325 (standard deviation = 86.23) with the minimum as 2214 and maximum as 2448. Post-training mean number of patients for the intervention group was 3121 (standard deviation = 358.4) with minimum as 2699 and maximum as 3720.

Table 4.21:*Descriptive Statistics for Number of Patients Pre- and Post-Intervention*

	Control		Intervention	
	Baseline	Post-Intervention	Baseline	Post Intervention
Number of Patients				
Mean	134.20	141.75	2325.00	3120.75
Median	132.00	141.50	2320.00	3038.00
Maximum	159.00	192.00	2448.00	3720.00
Minimum	112.00	98.00	2214.00	2699.00
Range	47.00	94.00	234.00	1021.00
Standard Deviation	18.12	27.13	86.23	358.40

Performance of the bystander was assessed in terms of number of emergency calls received, number of patients served and number of ambulances dispatched. From the t-tests, the study established a significant increase in the number of emergency calls received by the bystander, number of patients served and ambulances dispatched. Performance of the bystander measured in terms of number of emergency calls had an insignificant negative correlation with transportation interval. Quality of emergency calls in the Bystander had a significant strong negative association with activation interval, responsive interval and a perfect negative correlation with handover interval. Number of emergency calls had an insignificant negative correlation with transportation interval at 1% level of significance. At 5% level of significance, quality of emergency calls had a weak significant negative association with transportation interval.

Training of bystanders as outlined in Linderoth et al. (2021) has been found to reduce the time required for emergency calls since the emergency response team is able to deliver the required decision more quickly, thus increasing the number of calls and referrals to hospitals' emergency units.

Gerwing et al. (2021) also agree with our findings by noting that training bystanders on communication skills during an emergency reduces interaction time, which enables the emergency team to receive other calls, this agrees with this study as after training of bystanders the call to the EOC amounted to a significance increase of 38.5% to 61.5% with P- value of < 0.001 . In France, a study by Derkenne et al. (2020) established that emergency calls increased by 5% every year and attributed this to community training, this is similar to our study, whereby after training bystanders, emergency calls from the community to EOC increased from 20.2% to 81.9% with P-value < 0.001 ; also reducing emergency calls from the facility to the EOC from 79.8% to 18.1% with P- value of < 0.001 .

Further, the study by Derkenne et al. (2020) found more calls identifying emergencies such as cardiac arrest over time, leading to more patients being admitted to the emergency unit, this aligns with our study where after training, patients' knowledge on emergency services at the community increased, those coming from the community to A&E significantly increased from 6.7% to 87.6%, P- value < 0.001 , with a decrease of those coming from other facilities. This increase of emergency patients to the A & E may lead to congestion and long ques, and requiring intense triaging, the reason as to why this study was guided by queuing theory model where priorities of patients' needs are considered despite the ques.

A survey conducted in Nairobi City County by Musyoka and Kioko (2021) indicates low utilization of pre hospital emergency services due to low knowledge of emergency numbers and the ability to take action at the emergency scene; this study disagrees with the survey as after training of bystanders it was evident that the number of patients using emergency ambulance services from the intervention area significantly increased from 51.5% to 92.6% with a P- value < 0.001 and reduction of

use of other means of transport. Also, after training, Patients' knowledge on the emergency number to call significantly increased from 17.8% to 55.3% with a of P - value < 0.001.

4.4.6 Bystander Training on Responsiveness of Pre-Hospital Emergency Health Care Delivery in Nairobi City County, Kenya

The dependent variable of this study was responsiveness of pre-hospital emergency health care delivery in Nairobi City County, Kenya. The dependent variable was measured before and after training of bystanders in the control and the intervention area. This was achieved by evaluating emergency response time intervals obtained from the EOC during the baseline and post-training. The time intervals examined included notification interval, activation interval, response interval, transportation interval and handover interval. All the time intervals were in minutes.

The descriptive statistics results in Table 4.21 show that during the baseline survey, the median activation interval for the control area was 30.00 minutes, while that of the intervention group was 7.00 minutes. The median response intervals during the baseline study were 29.00 minutes and 26.00 minutes for the control and intervention areas, respectively. The median transportation intervals were 30.00 minutes and 23.00 minutes for the control and intervention areas, respectively. The median handover intervals were 17.00 minutes and 15.00 minutes for the control and intervention groups, respectively.

Post-intervention, the median activation intervals were 8.00 and 7.00 minutes, respectively for the control and intervention groups. The median response intervals were 23.00 minutes and 19.00 minutes for the control and intervention groups, respectively. The median transportation intervals were 17.00 minutes and 17.50

minutes for the control and intervention groups, respectively. Lastly, the median handover intervals were 16.00 minutes and 13.50 minutes for the control and intervention groups respectively. Apart from the transportation interval, the intervention group recorded reduced time intervals post-intervention as compared to the control group, an indication that bystander training had an effect on responsiveness of pre-hospital emergency healthcare delivery in the study area.

Table 4.22:

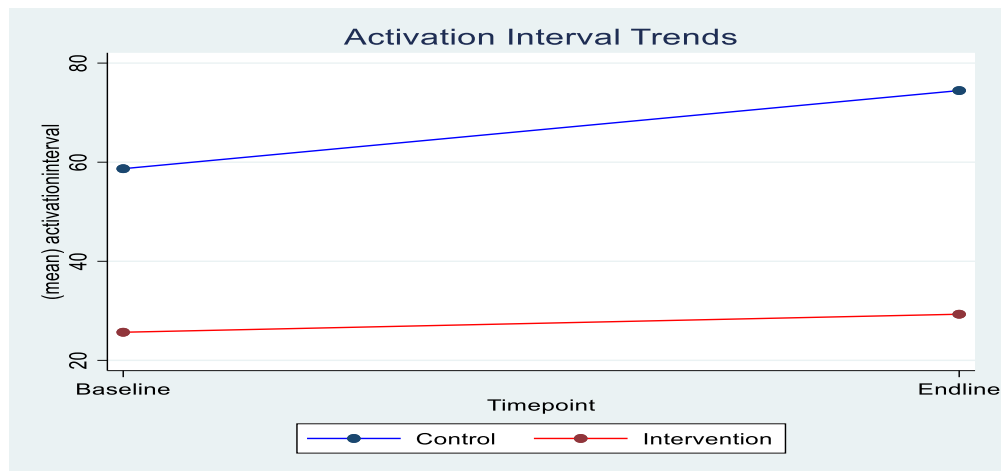
Descriptive Statistics for Time Intervals

		Baseline				Post-Intervention			
		Activati on Interval	Respon se Interval	Transportati on Interval	Handov er Interval	Activati on Interval	Respon se Interval	Transportati on Interval	Handov er Interval
Control	Mean	58.56	102.89	29.11	92.67	74.45	24.70	44.36	80.52
	Median	30.00	29.00	30.00	17.00	8.00	23.00	17.00	16.00
	Minimum	4.00	13.00	10.00	10.00	2.00	10.00	.00	4.00
	Maximum	705.00	697.00	42.00	698.00	1418.00	74.00	733.00	739.00
	Std.Deviati on	227.86	223.09	9.68	227.05	271.54	12.56	124.40	210.08
Interventi on	Mean	24.61	48.93	54.13	24.39	29.32	42.21	45.10	55.12
	Median	7.00	26.00	23.00	15.00	7.00	19.00	17.50	13.50
	Minimum	.00	.00	.00	.00	.00	.00	3.00	2.00
	Maximum	1144.00	746.00	1400.00	710.00	727.00	142.00	807.00	1423.00
	StdDeviati on	104.65	125.33	187.89	65.51	116.29	142.73	129.25	181.21

Further analysis was done, taking into consideration confounding factors that may interfere with the study results, and difference-in-difference for unadjusted model was considered for the analysis time intervals data.

Figure 4.4:

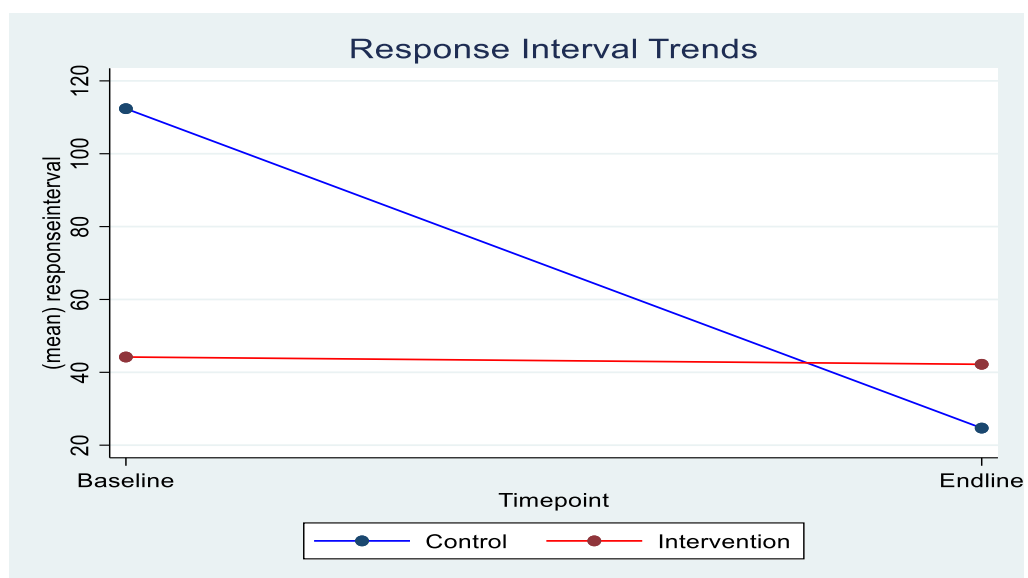
Activation Interval Trends



From Fig. 4.4, at baseline, the control and the intervention depicted parallel trends, but by endline, the control group showed an upward trend in the activation time compared to the intervention group, suggesting no improvements. The intervention group maintained a uniform activation time, indicating that the training failed to reduce activation delays.

Figure 4.5:

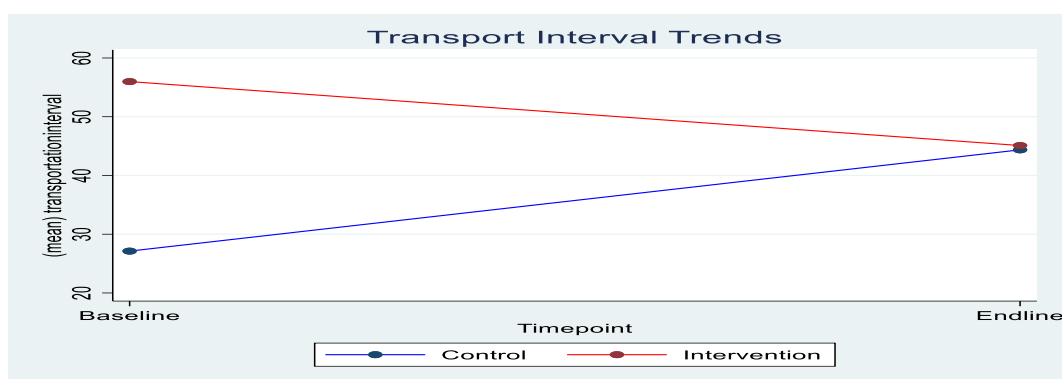
Response Interval Trends



From Fig. 4.5, at baseline, the control group showed longer response times than the intervention group, but at endline/post-intervention, the control group showed greater improvement while the intervention group remained stable, which demonstrated that the training failed to improve emergency responses.

Figure 4.6:

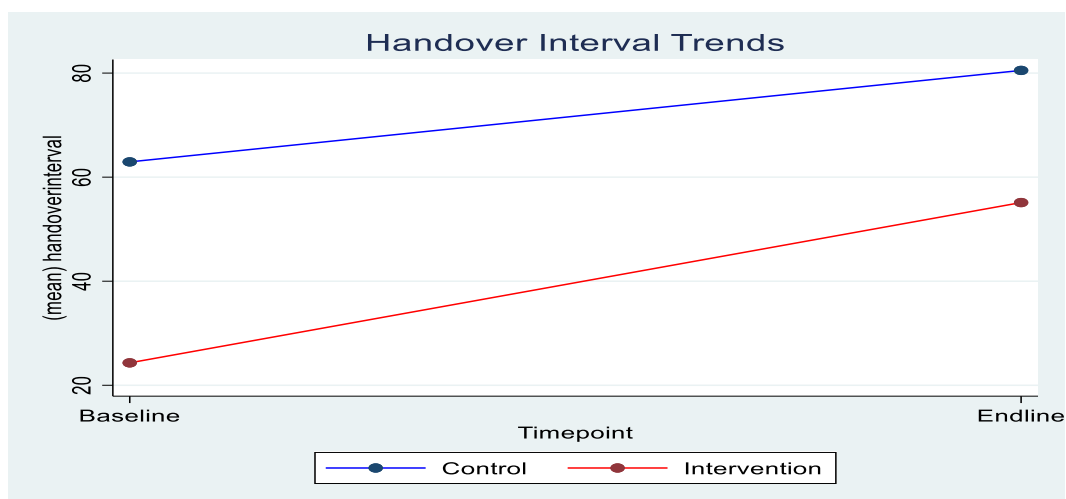
Transport Interval Trends



From Fig 4.6, at baseline, both the control and the intervention groups had similar transport time intervals, but at post-intervention, the intervention group showed a steeper reduction in transport times compared to the control group, showing that the training improved efficiency in patient's transportation.

Figure 4.7:

Handover Interval Trends



From Fig 4.7, the handover interval trends for both the control and the intervention groups were upward and parallel throughout the study period, indicating worsened transfer delays.

Table 4.23:

Difference-in-Difference Results for Time Intervals

	DID (Unadjusted)			DID (Adjusted for Traffic Jam)		
	Coeff.	CI	P-value	Coeff.	CI	P-value
Activation Interval	-12.131	-139.16 to 114.90	0.851	-15.371	-142.42 to 111.68	0.812
Response Interval	85.678	-27.03 to 198.39	0.136	87.811	-24.43 to 200.05	0.125
Transportation Interval	-28.125	-87.71 to 31.46	0.354	-30.773	-94.76 to 33.22	0.345
Handover Interval	13.226	-99.74 to 126.19	0.818	14.419	-98.99 to 127.83	0.803

From unadjusted difference-in-difference model in Table 4.23 above, the Activation interval (-12.1, p-value = 0.851), the intervention group was 12.1 minutes faster than the control group, but this difference was not statistically significant (p-value > 0.05). The 95% Confidence Interval (-139.2 to 114.9) is very wide, showing that the effect could range from the intervention group being 139 minutes faster to 115 minutes slower. Response interval (85.8, p-values = 0.136), the intervention group had 85.7 minutes longer response time than the control group, but this was not significant (p-value > 0.05). The confidence Interval (-27.0 to 198.4) suggested the difference in response interval could range from 27 minutes faster to 198 minutes slower. Transportation interval (-28.1, p-value = 0.354), the intervention group was 28.1 minutes faster than the control group, but this difference was not statistically significant (p-value > 0.05). The Confidence Interval (-87.7 to 31.5) suggested that the difference in the transportation interval times could range from 87.7 minutes faster to 31.5 minutes slower. Handover interval (13.2, p-value = 0.818), the intervention group

had 13.2 minutes longer handovers than the control group, but this was statistically insignificant ($p\text{-value} > 0.05$). The Confidence Interval (-99.7 to 126.2) was very wide, indicating no meaningful difference in the handover time intervals.

For the adjusted model, the time intervals were adjusted for the traffic jam during the patients' transportation to the hospital. Activation interval, the coefficients (-15.371) indicated that after accounting for traffic jams, the activation time was slightly faster. The wide confidence interval (-142.4 to 111.7) indicated a wide interval, while the high $p\text{-value}$ (0.812) indicated that the traffic jam did not significantly influence the activation time. For the response interval, the positive coefficient (87.8) after adjusting for the traffic implied that the response time increased by 88 minutes on average, while the $p\text{-value}$ (0.125) showed no statistical significance, implying that the traffic jams might have delayed the response time. The transportation interval had a negative coefficient of -30.8, suggesting that after controlling for traffic, the transportation time was 31 minutes shorter on average, but the $p\text{-value}$ of 0.345 indicated that the traffic jams did not significantly prolong the transportation of the patients to the hospital. Handover interval has a small positive coefficient of 14.4 indicating that the handover time increases by 14 minutes on average, the $p\text{-value}$ of 0.803 showed no statistical significance, indicating that the traffic jam had no impact on handover delays.

The notification interval was also determined in a range of 0-5 minutes, 6-10 minutes, 11-15 minutes, and above 15 minutes. According to Table 4.26, it is evident that for the control group, the majority of notifications were above 15 minutes, 12 (75 %) at the baseline survey and 11-15 minutes, 11 (33.3%) at the post-intervention. Similarly, for the intervention group, the majority of the notifications took above 15 minutes, 90 (80.4%) during the baseline survey and 0-5 minutes, 127 (87%) during the

post-intervention survey. This is an indication that training of bystanders led to a reduction in notification intervals, eliminating excessive delays by enhancing rapid emergency response.

Table 4.24:

Notification Interval

	Control		Intervention		DiD	
	Baseline n (%)	Post- Intervention n (%)	Baseline n (%)	Post- Intervention n (%)	Unadjusted Coefficient	P-value
Notification Interval						
0 to 5 minutes	1 (6.3)	5 (15.2)	0 (0)	127 (87)	38.366	< 0.001
6 to 10 minutes	1 (6.3)	9 (27.3)	8 (7.1)	10 (6.9)		
11 to 15 minutes	2 (12.5)	11 (33.3)	14 (12.5)	3 (2.1)		
Above 15 minutes	12 (75.0)	8 (24.2)	90 (80.4)	6 (4.1)		

DiD Analysis

The notification interval was categorized into two groups: group one with 0-5 min and 6-10 minutes, and group two with 11-15 min and above 15 minutes to perform difference in difference for the unadjusted model. The P-value < 0.001 reveals a very statistically significant effect of the bystander training on improving the notification interval time. The unadjusted difference-in-difference coefficient of 38.4, a very large positive value, indicates that the intervention had a greater increase in quick emergency notifications compared to the control group.

Figure 4.8:

Notification Interval for Control

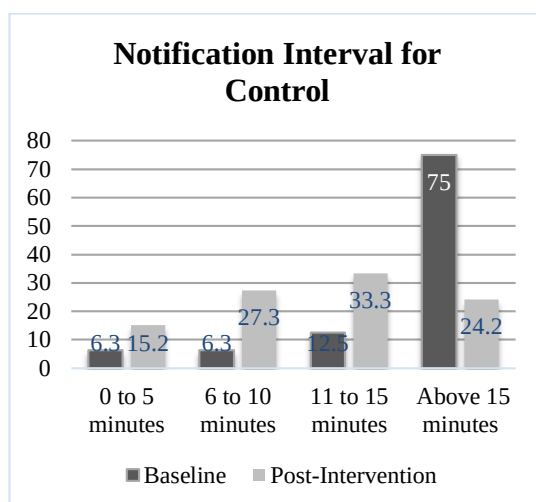
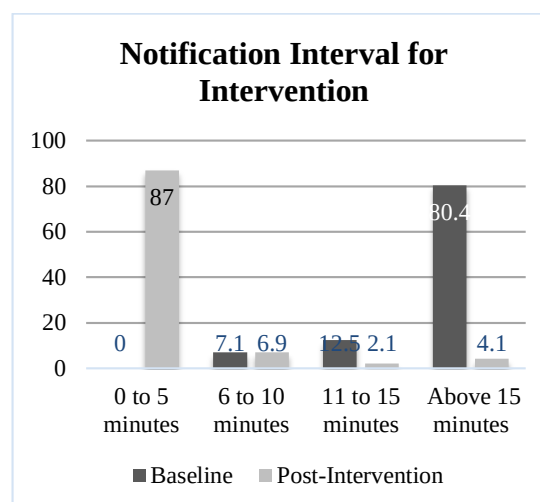


Figure 4.9:

Notification Interval for Intervention



According to Fig. 4.8, for the control group, almost no notifications were addressed within 0-5 minutes, while most alerts faced extreme delays (above 15 minutes) at the baseline survey and 0-5 minutes response showed a moderate improvement as the proportions increased and reducing the above 15-minute notification delay at the post-intervention survey. According to Fig. 4.9, the intervention group transformed from having no 0-5 minutes response notification at baseline to having a larger proportion of 0-5 minutes notification at the post-intervention survey, while simultaneously reducing the above 15 minutes response delays from 80.4% to 4.1%, a 76 % reduction, demonstrating the training's effectiveness in accelerating early emergency recognition without improving delayed responses.

Similar research supports the findings that bystander training programs significantly reduce emergency notification delays. For example, Kettrey et al. (2019) documented a nearly identical 36.7-unit increase ($p < 0.001$) in immediate reporting post-intervention, reinforcing that these programs consistently accelerate emergency

response by building bystanders' confidence and sense of responsibility. This similarity in effect size (36.7 vs. 38.4) underscores a robust pattern: structured training transforms passive observers into proactive responders, slashing dangerous delays through quicker threat recognition and decisive action, supporting the golden hour theory, that emphasizes on reducing emergency services response time

The findings on emergency response acceleration are reinforced by a research on bystander intervention, a study by Hoxmeier et al. (2024) showed that the targeted training program increased the intervention in a high-risk situation, reducing delayed responses by 69%, closely matching our 76.3% reduction, with identical statistical significance ($p < 0.001$), confirming that the bystanders who received proper training are more likely to act swiftly when faced with an emergency. Moreover, the study explains the effect very well by noting that the bystander intervened “most of the time across emergencies” after the training, with the most common outcome being “no further harm was caused”, directly supporting how timely interventions can interrupt escalating emergencies.

Overall, this study found no significant reduction in all time intervals after bystander training a part from notification time interval. The results are in agreement with a study by Derkenne et al. (2020) who demonstrated how specialized emergency response protocols dramatically accelerated life-saving actions(response). Through the application of the Hand on Belly method, which rapidly detects cardiac arrest during emergency calls, dispatchers were able to cut call response times and emergency team deployment times to levels that exceeded international guidelines. By training contact center employees to employ this focused strategy, the system was able to predict cardiac arrests with a 93% accuracy rate (up from 54%) and reduce critical reaction

times, demonstrating how organized training makes emergency call centers into quicker, more efficient first responders.

Further, Waring et al. (2021b) while conducting a study in the UK, found that the training significantly improved the emergency response teams' preparedness. The study on healthcare emergency exercise shows that practitioners' confidence was greatly increased by realistic simulation training in three crucial areas: organizational preparedness, team coordination, and personal readiness. The study also found that exercise realism, preparatory effort, and training frequency were the main factors that contributed to these improvements, which in turn translated into faster response execution during simulated emergencies.

This aligns with our findings by showing that well-designed training doesn't just impart knowledge, it builds the practical response capabilities that reduce critical time delays during actual emergencies. The acceleration of emergency response times after the training aligns with Xu et al. (2022) research on team-based CPR education for bystanders. Participants in their before-and-after simulation trial, which involved 135 medical students, received organized team training that placed a strong emphasis on communication, role distribution, and coordinated action in the event of cardiac arrest. This shows that providing bystanders with team-based practices helps to minimize essential time delays in emergency care.

A study by Taylor et al. (2024) indicated that bystander-initiated video livestreaming fundamentally transforms emergency decision hierarchies by enabling real-time visual triage when dispatchers directly observed trauma scenes through bystander smartphones (successful in 85% of activation requests), they accelerated resource allocation decisions by eliminating 37% of traditional verbal verification steps, allowing ambulance dispatch confirmations to occur within seconds rather than

minutes during critical interventions where every 60-second delay reduces survival odds by 7-10%, thus reducing response time for emergency services. This study did not align with our study; it was conducted in a more advanced software at the EOC and also a setting where more bystanders can use videos at the emergency scene and are authorized. Therefore, is an area of improvement in this study.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The first objective of the study assessed influence of bystanders' training on knowledge in Pre-Hospital Emergency Healthcare delivery in Nairobi City County, Kenya. Knowledge was assessed in terms whether the respondents know the toll-free number to call, what to do at an emergency scene, who to call first during an emergency and the message to convey. During the baseline survey, majority of the respondents in the control group seemed not knowledgeable while majority in the intervention group were knowledgeable.

Further, there were significant differences in knowledge levels between respondents in the control and intervention areas. Post-training, there was a significant increase on the number of respondents who indicated they knew the toll-free number to call in case of health emergency. As compared to the baseline survey, a larger number indicated the toll-free number to be 1508 after training and they had actually called EOC for help. Also evident after training is an increase in the proportion of respondents who seemed knowledgeable with the DiD indicating a significant increase in knowledge levels after training. The intervention area also scored high in knowledge levels as compared to the control area. They knew what to do at the scene of the emergency, assessing the safety of the scene, assessing the condition of the patient to confirm that the patient is breathing, checking the pulse rate and positioning the patient into a recovery position. However, they required more skills on provision of on the scene first AID, as mentioned by the focused group discussion.

In the second objective, influence of bystander training on decision making in pre-hospital health emergency was assessed. Respondents were assessed on how they interpreted occurrences such as defining an emergency, not breathing, no movement, difficulty breathing, bleeding, screaming, head injury, screaming in labour and crying aloud as health emergencies. Further, decision making was assessed in terms of the mode of transport that the respondents would contact in case of health emergencies. Before training, majority of the respondent in both the control and intervention had above average level of decision making with the two-area having statistically significant differences in level of decision making.

In the intervention group, statistically significant differences in decision making levels were noted before and after training with respondents scoring higher in decision making score after training. This means that training improved bystanders' decision making in pre-hospital emergency healthcare delivery, by determining what an emergency condition is like a patient with head injury, a mother in labor with ruptured membranes and a patient with difficulty in breathing were all identified as emergencies, and they were able to choose the appropriate means of transport to a patient in emergency crisis, thus majority choose ambulance services of which it provides treatment and care on transits. Again, they look forward for a community-based model as first responders for quick action. The FGD added that as how much they have gained insights on decision making, they look forward for a law to govern them on performing cardiopulmonary resuscitation (CPR) at the emergency scene

The third objective evaluated the influence of bystander training on willingness to help in pre-hospital emergency healthcare delivery in Nairobi City County, Kenya. Before training, slightly more than six tenths of the respondents in the control and intervention groups had an above average score in willingness to help in pre-hospital

emergency health care delivery; no statistically significant differences were noted in willingness to help between the control and intervention groups. Post-training, an increase in willingness to help was noted in the intervention group while change in willingness to help in the control group remained almost at the same percentage. The change in willingness to help showed that the increase post-training was statistically significant. Therefore, training of bystanders led to significant increase in willingness to help in pre-hospital emergency health care delivery, as it allayed their anxiety and fear on legal implications, only that they were afraid where they did not have adequate skills like performing CPR where the heart rate was low and weak. Even though the willingness to help increased after bystanders training, through FGD it was clear that, they needed a law that governs them in providing first AID to emergency victims.

In this study's fourth objective, influence of bystander training on performance of the bystander was assessed. To achieve this, the study assessed the number of calls and patients at the bystander. Post-training, the results showed the quality of the emergency calls in terms of self-identification, location disclosure and explanation of the emergency status by the bystanders improving for the intervention group. An analysis of the number of emergency calls at the bystander represents a statistically significant increase after training of bystanders. Further, an assessment was done on the number of patients treated at the bystander with chi square test representing a statistically significant increase in the number of patients treated at A & E, with increased knowledge on emergency and able to choose appropriate means of transport.

In the fifth objective, the study analyzed the effect of bystander training on pre-hospital emergency health care delivery in Nairobi City County, Kenya. This was achieved by evaluating time intervals obtained from the EOC including activation interval, response interval, transportation interval and handover interval. All the time

intervals were in minutes. Based on the findings, the study noted improvement in time intervals as declines were noted in all the time intervals after training. However, only changes in notification interval significant, and there were no significant changes in activation interval, response interval, transportation interval and hand over interval, warranting for a call for wake up to the emergency response unit team.

5.2 Conclusion of the Study

From the findings of the study, the following conclusions can be made:

- i) That bystander training has a significant effect on knowledge in pre-hospital emergency health care delivery. Training increases the knowledge of bystanders in pre-hospital emergency health care delivery in aspects such as knowing the emergency numbers to call in case of health emergencies, what to do in case of an emergency, who to call first and the message to convey when calling for help. It can further be concluded that bystanders' knowledge has a negative association with pre-hospital emergency healthcare delivery.
- ii) Bystander training has a significant effect on decision making in pre-hospital emergency health care delivery. Training of bystanders help them improve their interpretation of health emergency occurrences such as difficulties in breathing, head injury, bleeding, screaming in labour and crying aloud. Further, decision making is also improved in terms of the mode of transport to contact in case of health emergencies. Further, it can be concluded that bystanders' decision making has a negative effect on pre-hospital emergency healthcare delivery.
- iii) Training also significantly improves bystanders' willingness to help in pre-hospital health emergencies. When bystanders are trained in pre-hospital

emergency health care delivery, they believe that it is their role to help in the event of an emergency, work as a team and have less fear in terms of the consequences such as legal and being superseded by superior personnel because of acting as bystanders in emergency events. Bystanders' willingness to help was also found to have a negative association with pre-hospital emergency healthcare delivery.

- iv) Training of bystanders helps improve the performance of the bystander of a hospital in terms of the number of patients handled at the bystander and the number of calls received at the same unit. When bystanders are trained on pre-hospital emergency health care delivery, they are able to interpret health emergencies and refer them to the bystanders for treatment. Further, training on communication minimizes interaction time and makes communication clear thus increasing the number of calls at the bystander. It can also be concluded that the performance of the bystander has a negative association on pre-hospital emergency healthcare delivery.
- v) Lastly, training of bystanders helps in pre-hospital emergency health care delivery in terms of reducing time intervals such as notification, activation, response, transportation and handover intervals. When bystanders are trained in pre-hospital emergency health care delivery time required to respond to calls is reduced and the duration for sending the emergency response team to the emergency scene is reduced. Further, when bystanders are trained on the necessary steps to take in case of health emergency, the emergency response team will take shorter duration attending to the victim at the emergency scene thus reducing time required to take the patient to the health facility. This, was so when the ambulance teams who interacts

closely to the community were able to make a change in faster response and transportation intervals, though not statistically a significant. However, the activation and hand over times interval, which interacts direct to the EOC and A & E staff, had no change after the training and this calls for training in communication and coordination in these areas. However, notification interval that interacts with bystanders directly, had statistically a significant change after the training.

In conclusion, the responsiveness of pre-hospital emergency healthcare delivery is not solely dependent on the EMS system itself, but significantly influenced by the complex knowledge, decision-making processes and willingness to help of bystanders. Understanding the psychological barriers that lead to inaction and actively promoting strategies that empower citizens to notice, interpret, assume responsibility, know how, and act are crucial for maximizing the effectiveness of emergency medical services and ultimately saving more lives.

5.3 Recommendations of the Study

The findings of this study provide a robust evidence base for policy and programmatic interventions aimed at strengthening the pre-hospital emergency care system in Kenya. The following recommendations are proposed for implementation by relevant stakeholders, including the Ministry of Health, County Governments, emergency response services, and community-based organizations.

1. Institutionalize and Systematically Scale Up Bystander Training Programs

The study conclusively demonstrates that training significantly improves bystander knowledge, decision-making, and willingness to help. To capitalize on these benefits, a structured and national approach is required.

- **Action for Policymakers:** The National and County Ministries of Health should formally integrate a standardized bystander training curriculum into the national health strategy. This involves allocating specific budgetary lines for program development, trainer recruitment, and community mobilization.
- **Action for Implementers:** To ensure widespread accessibility, training must be decentralized and delivered at the community level. Utilizing the existing network of Community Health Promoters (CHPs) is a strategic entry point. Furthermore, training sessions should be conducted in highly accessible and frequented venues such as marketplaces, religious institutions, social halls, and school compounds. This removes logistical barriers and increases participation across diverse demographic groups.

2. Develop Demographically-Tailored and Contextually-Relevant Training Modules

A universal training module is less effective than one adapted to the audience's needs, literacy levels, and interests.

- **Action for Curriculum Developers:** Training content and delivery methods should be differentiated. For instance, programs for older adults should focus on practical, hands-on skills in short, concise sessions without an emphasis on theoretical knowledge or certification. Conversely, for younger, tech-savvy populations, modules can incorporate mobile applications, video-based simulations, and social media challenges to boost engagement and knowledge retention.
- **Action for Legislators:** To mitigate the fear of legal repercussions a significant barrier to helping policymakers should advocate for and enact

"Good Samaritan" legislation. Such a law would provide legal protection to laypersons who act in good faith to provide emergency assistance, thereby encouraging more bystanders to intervene without hesitation.

3. Embed a Culture of Continuous Learning and Integrate Training into Public Systems

The effectiveness of a single training session diminishes over time. A sustainable model requires mechanisms for reinforcement and institutional integration.

- **Action for Public Health Planners:** Public awareness campaigns should explicitly communicate the need for periodic skill refreshers. A strategic approach is to link mandatory brief emergency response training with routine public services, such as the renewal of driving licenses, national identity cards, or professional licenses. This ensures a consistent re-education of a large segment of the adult population.
- **Action for Educational and Community Leaders:** For long-term societal impact, basic emergency response education should be incorporated into the primary and secondary school curriculum. Educating students not only creates a generation of prepared citizens but also transforms them into agents of change who can disseminate knowledge within their families and wider communities, creating a multiplier effect.

4. Foster Multi-Sectoral Partnerships for Program Sustainability and Efficacy

The resource-intensive nature of widespread training necessitates collaborative efforts to ensure longevity and expanded reach.

- **Action for Program Managers:** County health departments should actively form partnerships with non-governmental organizations (NGOs), corporate

entities under their Corporate Social Responsibility (CSR) initiatives, media houses for public awareness, and international development partners. These collaborations can pool financial resources, technical expertise, and logistical support.

- **Action for Emergency Services:** Building on the trained public, a formal "Community First Responder" model should be developed. This involves equipping and linking motivated, trained bystanders with the official Emergency Operations Centre (EOC). In this model, the EOC can dispatch the nearest registered community first responder to provide immediate care while a professional ambulance is enroute, effectively bridging the critical gap between the emergency occurrence and the arrival of advanced medical help.

5.4 Suggestion for Further Studies

To build upon the findings of this research and address its limitations, the following areas are recommended for future scholarly inquiry:

1. **A Longitudinal Study on Skill and Knowledge Decay:** This study measured outcomes immediately post-intervention. A critical next step is to conduct a longitudinal cohort study that tracks trained bystanders over 12, 24, and 36 months. This research should quantitatively measure the rate of decay in knowledge (e.g., recall of emergency numbers) and psychomotor skills (e.g., CPR quality). The findings would provide an evidence-based answer to the crucial question of "how often" refresher training is needed to maintain competency, allowing for optimal resource allocation.
2. **Comparative Effectiveness Research on Training Modalities:** While this study demonstrated the efficacy of a CHP-led model, it is vital to explore

alternative and potentially more scalable methods. Future research should employ randomized controlled trials (RCTs) to compare the cost-effectiveness, knowledge retention, and practical application of training delivered via mobile health (mHealth) applications, virtual reality simulations, and traditional in-person sessions. Additionally, studies could investigate the impact of using other respected community figures, such as teachers or local religious leaders, as trainers to assess if trust in the messenger influences training outcomes.

3. Disaggregated Analysis of Training Impact by Bystander

Characteristics: This research focused on the aggregate effect of training. A more nuanced understanding is required to ensure equity and maximize impact. Future studies should intentionally stratify their samples and analyze how factors such as age, gender, educational attainment, socioeconomic status, and prior exposure to emergencies moderate the effect of training. This will allow for the design of highly targeted, sub-group-specific training interventions that address unique barriers and leverage specific motivations.

4. Qualitative Inquiry into Systemic Response Barriers: The finding that training improved notification times but not other response intervals (transport, handover) indicates significant bottlenecks within the formal emergency response system itself. A follow-up study using in-depth qualitative methods—such as process mapping, focus groups with EOC dispatchers, and ethnographic observation of ambulance teams—is essential. This research would identify the specific operational, logistical, and communication barriers that cause delays after the initial call, providing a clear roadmap for internal system reform and quality improvement within emergency medical services.

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APPENDICES

Appendix I: Consent form for Researcher Administered Questionnaire

Dear participants

Introduction

I am Felistus Musyoka, a Ph.D. student of health systems management at Kenya Methodist University. I am carrying out a study on the effect of bystander training in pre-hospital emergency care delivery in Nairobi City County, Kenya.

Purpose

The purpose of this study is to improve delivery of pre-hospital emergency care system through bystander training that will empower the public on emergency numbers to call in emergencies and access emergency services within the shortest time possible to save lives.

Your participation

Questions will be asked to you about the influence of bystander knowledge, the influence of bystander decision-making on emergencies, the influence of bystander willingness to help, the influence of the bystander, and the effect of bystander training in delivery of pre-hospital emergency health care system in Nairobi City County. Your participation in this study is completely voluntary and there are no consequences to you or your organization if you chose not to participate. You may refuse to answer any question or choose to stop the interview at any time. There is no payment for participation in this study.

Benefits/ Risks

There is no direct benefit to you from participating in this study. However, your responses will be aggregated, summarized, and analyzed for the award of the university degree, and at the same time policymakers of health systems, the Division of health emergencies and referral services, and health care facilities in Nairobi will utilize the study results to improve delivery of pre-hospital emergency health care systems.

There is minimal risk in participating in this study. We will ensure that all information you provide will be kept confidential and identifiers will link specific responses to you as an individual. Names and cellphone numbers are not required in this study,

Should you have any questions about the study? Please feel free to contact Kenya Methodist University.

Do I have your agreement to proceed? Yes..... No.....

Name & cellphone of respondent

Signature of respondent

Date

Appendix II: Questionnaire for the Households

Section A: Demographic Information

Please provide honest information to support us improve on pre-hospital emergency care delivery in Nairobi City County

(i) What is your age in years?.....

(ii) Please select your gender

1.	Male		
2.	Female		
3.	Other:		

(iii) Select your Marital status

1.	Married	
2.	Single	
3.	Separated	
4.	Divorced	
5.	Widowed	

(iv) Education completed

i.	None	
ii.	Primary	
iii.	Secondary	
iv.	Post secondary	

(v) Sub-County of residence

i.	Embakasi Central	
ii.	Embakasi West	
iii.	Kibra	

(vi) Residence: Along major highway/Along major road () Interior ()

(vii) What is your employment status?

1.	Fully employed	
2.	Casual labourer	
3.	Unemployed	
4.	Self employed	
5.	Other:	

(viii) What is your profession.....

Section B: Bystander Knowledge

Please provide honest information to support us improve on pre-hospital emergency care delivery in Nairobi City County.

1. Do you know the toll-free number to call in case of health emergencies yes/No

2. If yes what is the number---

3. Have you saved this number in your phone?

1. Assume you are the first to witness an emergency at the scene; in a scale of 1 to 3 where:

3= Agree

2= undecided

1= disagree

Rate yourself on the following statement:

Statement	agree	undecided	disagree
I know what to do at an emergency scene			
I know the emergency number to call			
I know who to call first in an emergency			
I know the message to convey			

2. Whether the toll number is known or unknown How likely are you to call any toll number in case of an emergency? (Tick appropriately)

Statement	
I will automatically call	
Am likely to call	
Am somehow likely to call	

Am unlikely to call	
I can't call	

3. How likely does knowing the presence of health care staff in ambulance influence your decision to call for an ambulance (tick appropriately)

Very likely	
Somehow likely	
Very unlikely	

2. Have you ever been trained on what to do in the event of an emergency?

1.	Yes	
2.	No	

3. Are you willing to be trained on how to respond when an emergency happens?

1.	Yes	
2.	No	

Section C: Bystander Decision-Making

1. This statement is about decision making on what an emergency is and when to call for emergency services. In a scale of 1 to 3, where 1 is disagree and 3 is agree, rate yourself on the statements concerning patient's condition below:

	Statement	agree	undecided	disagree
i	I am able to define what an emergency is			
ii	Patient not breathing is an emergency			
iii	Patient with no body movement is an emergency			
iv	A patient with difficulty breathing is an emergency			
v	Bleeding patient is an emergency			
vi	A patient who is screaming is an emergency			
vii	Head injury is an emergency			
viii	Expectant mother with broken waters is an emergency			
ix	A mother screaming in labour is emergency			
x	Crying aloud is an emergency			

2. Which one of the following modes of transport are you most likely to immediately call-in case an emergency occurs? Tick appropriately

1.	Ambulance	
2.	Police care	
3.	Uber/ Taxi	
4.	None	

Section D: Bystander Willingness to help during emergencies

4. Please rate your agreement with the following statements

Statement	Agree (4)	Neutral (3)	Disagree (2)
Every bystander should help in the event of an emergency			
Bystanders should work as a team			
Another bystander in the group should offer help and not you			
I fear being judged by others when acting publicly			
I fear being superseded by a superior helper			
I fear offering unwanted assistance			
I fear facing legal consequences of offering inferior and possibly dangerous assistance			
I rely on the overt reactions of other bystanders in order to offer help			
I fear that helping could lead others to believe that I am a perpetrator (wrong doer)			

Appendix III: Key Informant Interview Guide

Please provide honest information to support us improve on pre-hospital emergency care delivery in Nairobi City County.

Bystander knowledge

1. How would you assess the knowledge of the community regarding their knowledge on emergency care in the following aspect:
 - Knowledge on toll-free numbers to call in case of medical emergencies
 - Their conduct in an emergency scene
 - Likelihood to call for help through the toll-free number

Bystander decision making

1. What means of transport is mostly used for emergencies by the members of the community in this area? And why?

Bystander willingness to help

1. In your opinion how do bystanders work in an emergency scene?

Appendix IV: Focused Group Discussion Guide

Please provide honest information to support us improve on pre-hospital emergency care delivery in Nairobi City County.

Bystander knowledge

1. What toll number (direct number for public use) do you know to call in case of an emergency?
2. Assume you are the first to witness an emergency e.g. accident, what would you do at the emergency scene?
3. Assume you are the first to witness an emergency e.g. someone has collapsed; are you likely to call a toll number for emergency help? Who would you call first?

Bystander decision making

1. Are you in position to define an event as an emergency? If yes, what are some of the events that would qualify as emergency medical events?
2. What means of transport would you call for an emergency? And why

Bystander willingness to help

1. In case of an emergency, whom do you think is best suited to help the victims?
2. How should bystanders work in an emergency scene?
3. What are the main reasons or factors that prevent you from stepping in to help during an emergency?

Appendix V: Bystander (A&E, EOC, Emergency team)

1. Accident and emergency (A & E)

i) Hospital Patient Arrival Checklist (A & E)

No	Date/Month	Gender 1=Male 2=Female	Ambulance (Indicate 1= NCCG 2=Other (specify)	If other 1=Private (personal car/van) 2= Police van 3= Motorbike 4= On foot/ Supported by other people	Reason for choice of means of transport 1=Availability 2=Affordability 3=Other(specify)	<i>Fill post- intervention only</i> were you trained on emergency response 0=Not trained 1=Trained
1						
2						
3						
4						
5						
6						
7						

ii) Hospital Infrastructure Checklist (A& E)

Handing over requirements	0=Absent; 1=Partially present 2=Fully Present	Details
Reception/ registration desk/ room		
Triage		
Registration tool (register)		
On transient monitoring tool		
Resuscitation equipment		
The emergency team trained in emergency care courses		
Structured handing over procedure		

2. EOC Checklist

(i) Daily Calls Register Date.....

No	Time of call (0000hours)	Clarity of information			Type of Emergency (1=Road Traffic Accident) 2= Illness 3=Pregnancy related 4=Respiratory related 5=Other (specify)
		Self identification 0=Not done 1=Done	Location 0=Not done 1=Done	Emergency status 0=Not done 1=Done	
1					
2					
3					
4					

(ii) Emergency Ambulance services

1. Is there availability of the following at the emergency ambulance services?

Infrastructure	Total no. Of ambulances	Available	Not Available
Radio Communication			
Dispatch System			
GPS Trackers			
Availability of life- saving medications			
Availability of analgesics in the vehicle			
Availability of oxygen in the vehicle			
Hands-off protocols			
Transfer protocols			

Working hours schedule of the ambulance crew			
--	--	--	--

(iii) Time intervals recorded in 24hours format (EOC)

Date	Time EOC is notified (Notification interval)	Time of Ambulance dispatch (Activation interval)	Time of Arrival at Emergency Scene (Response interval)	Remarks	Type of Road used	Time of leaving Emergency Scene	Time of Arrival at Health Facility	Remarks	Type of Road used	Time Hand over process begins	Time Handover is complete (Hand over interval)	Remarks	Type of Emergency (1=Road Traffic Accident) 2=Illness 3=Pregnancy related 4=Respiratory related 5=Other (specify)	Was the entire evacuation well lit 0=poorly lit 1=Partially lit 2=well lit	Weather 0= Not Rainy 1= Rainy
				0=Not traffic 1=Moderate Traffic 2=Much traffic	1=Tarmac 2=Marum 3=Both Tarmac and Marum 4=Very rough road			0=Not traffic 1=Moderate Traffic 2=Much traffic	1=Tarmac 2=Marum 3=Both Tarmac and Marum 4=Very rough road			0=No issues 1=Issues (specify)			

(iv) Performance check list for EOC

The following are available at the emergency operations centre?

Policies and guidelines	No	Yes
Availability of clear emergency guidelines		
Audits to track performance and outcomes		
Benchmarks to track performance and outcomes		
Indicators to track performance and outcomes		

Quality improvement initiatives		
Protocols for support supervision		
Injury prevention policies		

3. Emergency Response team (Workforce)

(v) The emergency team is trained in emergency care courses; tick appropriately

Pre-hospital emergency care training ()

First Aid training ()

Basic life support ()

Advanced cardiac life support ()

Trauma care ()

Triage Training ()

Structured medical major incident training ()

Emergency preparedness & management ()

Emergency communication ()

Appendix VI: Secondary Data Collection Checklist

Section A: Bystanders Performance on Pre-Hospital Emergency Health Care responsiveness in Nairobi City County

Outcome 1: Number of calls to the emergency operations centre

Month	No of calls Pre- Intervention	No of calls post intervention
1		
2		
3		
4		

Outcome 2: Casualties using ambulance services to A & E

Month	No. of casualties using emergency ambulance services before intervention	No. casualties using emergency ambulance service after intervention
1		
2		
3		
4		

Pre-Hospital Emergency Health Care Delivery

Outcome 3: Emergency Response time

Response time	Average Response Time before intervention	Average Response Time after intervention
Notification interval		
Activation interval		
Provider response		
Transportation interval		
Hand over interval		

Appendix VII: Guideline for Bystander Training

TRAINING ON PREHOSPITAL EMERGENCY HEALTH CARE DELIVERY (2hrs)		
Purpose	The goal of this unit is to familiarize participants with the concept of prehospital emergency health care delivery. This will empower bystanders with emergency identification, notification and response. Thus, strongly linking bystanders with the health care system, especially emergency services.	
Expected Learning Outcomes	By the end of the session, the participant will be able to: i. Explain what Prehospital emergency health care delivery means ii. explain who are key player in prehospital care and their roles iii. Explain the process of emergency notification, using 1508 the emergency no for Nairobi City County, and the key message to provide iv. Explain what to do at the emergency scene	
Unit Contents	Sessions	Duration Session
	1.1: Definition of Prehospital emergency care, bystander and dispatcher, EOC, A &E. The components of prehospital emergency care	30 minutes Session
	1.2: The key players in prehospital emergency care and their roles	30 minutes Session

	1.3: The process of emergency notification and the message to convey. Role plays by the participants	30 minutes
	1.4: What to do at the emergency scene. Role play	30 minutes
Preparation	Materials ready at least 30 minutes before training begins.	
Materials needed	For the training sessions • Marker pens • Flip chart paper • Stick notes • LCD projector • Speakers • Laptop • Videos • For each participant • Pens • Notebooks • Training schedule • Stickers with guidelines	
Teaching Methods	• Mini lectures • Role plays • Exercises • Discussions • Group discussions	
Evaluation of Learning	• Question and answer during the sessions and at the end of the session.	



1508
(FREE Calls)

NCCG Emergency Operations and Dispatch Centre
NAIROBI CITY COUNTY HEALTH SERVICES

GUIDELINES FOR BYSTANDERS DURING EMERGENCIES

#EffectiveAndEffientResponse

What should you do in case of emergency?
In case of any emergency or disaster within Nairobi City County,
Please call 1508 to inform and get assistance.

IMPORTANT

- Save the Number 1508 as Emergency Response Number, in your phone
- Call to report when an emergency or disaster happens
- Share the number with your families, friends, neighbors and colleagues.

1508 is a FREE Emergency Response Number.
You shall not be charged for calling.

IMPORTANT DETAILS TO SHARE WHEN YOU CALL

- Your Name
- Your Telephone contacts
- Contact person - their name and contact
- Location of incidence or accident
- Describe the type of emergency or disaster
- Time of occurrence
- Number of people involved
- Condition of the person(s) involved
- Safety of the scene



NAIROBI CITY COUNTY

EMERGENCY OPERATION CENTRE



Emergency Ambulance Services



All Health Emergencies

TOLL FREE NO:
1508

Appendix VIII: Approval from Kenya Methodist University Scientific Ethics and Review Committee


KENYA METHODIST UNIVERSITY
P. O. BOX 267 MERU - 60200, KENYA
TEL: 254-064-30301/31229/30367/31171
FAX: 254-64-30162
EMAIL: INFO@KEMU.AC.KE

January 24, 2023 KeMU/ISERC/HSM/01/2023

FELISTUS NDANU MUSYOKA
HSM-4-3654-3/2016

Dear Felistus,

SUBJECT: EFFECT OF BYSTANDER TRAINING IN PREHOSPITAL EMERGENCY HEALTH CARE DELIVERY IN NAIROBI COUNTY, KENYA

This is to inform you that Kenya Methodist University Scientific Ethics and Review Committee has reviewed and approved your research proposal. Your application approval number is KeMU/ISERC/HSM/01/2023. The approval period is 24th January, 2023 – 24th January, 2024.

This approval is subject to compliance with the following requirements:-

- I. Only approved documents including (Informed contents, study instruments, MTA) will be used.
- II. All changes including (amendments, deviations, and violations) are submitted for review and approval by Kenya Methodist University Scientific Ethics and Review committee.
- III. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KeMU SERC within 72 hours of notification.
- IV. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KeMU SERC within 72 hours.
- V. Clearance for export of biological specimens must be obtained from relevant institutions.
- VI. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- VII. Submission of an executive summary report within 90 days upon completion of the study to KeMU SERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.


DR. HERBERT NDEBE
SECRETARY (SERC)

Appendix IX: Introduction Letter from Postgraduate Studies



KENYA METHODIST UNIVERSITY

P. O. Box 267 Meru - 60200, Kenya
Tel: 254-064-30301/31229/30367/31171

Fax: 254-64-30162
Email: deanrd@kemu.ac.ke

DIRECTORATE OF POSTGRADUATE STUDIES

January 25, 2023

Commission Secretary,
National Commission for Science, Technology and Innovations,
P.O. Box 30623-00100
NAIROBI.

Dear Sir/Madam,

RE: FELISTUS NDANU MUSYOKA – (REG. NO. HSM-3-3654-3/2016)

This is to confirm that the above named person is a bona fide student of Kenya Methodist University, in the School of Medicine and Health Sciences, Department of Health System Management undertaking a Masters' Degree in Health System Management. She is conducting research on; "Effect of Bystander Training in Prehospital Emergency Health Care Delivery in Nairobi County, Kenya".

We confirm that her research proposal has been presented and approved by the University.

In this regard, we are requesting your office to issue a research license to enable her collect data.

Any assistance accorded to her will be appreciated.



Dr. John M. Mwachiri (PhD)
Director, Postgraduate Studies

Cc: Dean SMHS
CoD, HSM
Program Coordinator -HSM
Student Supervisors

Appendix X: Research Permit from NACOSTI

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 723908	Date of Issue: 01/March/2023
RESEARCH LICENSE	
	
This is to Certify that Mr. Festus Ntamu Muiyoka of Kenya Methodist University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: EFFECT OF BYSTANDER TRAINING IN PREHOSPITAL EMERGENCY HEALTH CARE DELIVERY IN NAIROBI COUNTY, KENYA for the period ending : 01/March/2024.	
License No: NACOSTI/P/23/23640	
723908 Applicant Identification Number	 Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Verification QR Code 	
NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.	
See overleaf for conditions	

Appendix XI: Research Authorization from Nairobi City County

NAIROBI CITY COUNTY

Telephone 020 344194
Web: www.nairobi.go.ke



City Hall,
P. O. Box 30075-00100,
Nairobi,
KENYA.

HEALTH, WELLNESS & NUTRITION

REF: NCCG/HWN/REC/318 **DATE: 9th March 2023**

FELISTUS MUSYOKA,
KENYA METHODIST UNIVERSITY
NAIROBI

Dear Ms. Felistus,

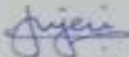
RE: RESEARCH AUTHORIZATION

This is to inform you that the Nairobi City County – County Health Services Research Ethics Committee (REC) reviewed the documents on the study titled "Effect of Bystander training in prehospital emergency healthcare delivery in Nairobi County, Kenya."

I am pleased to inform you that you have been authorized to carry out the study in Nairobi County. The researcher will be required to adhere to the ethical code of conduct for health research in accordance with the Science Technology and Innovation Act, 2013 and the approval procedure and protocol for research for Nairobi.

On completion of the study, you will submit one hard copy and one copy in PDF of the research findings to the REC. In addition, you will disseminate recommendations of the research at a virtual meeting organized by the REC. By copy of this letter, the Medical Superintendent – Mama Lucy Kibaki & Mbagathi Hospitals, In charge – EOC, Sub County Medical Officers of Health – Kibra and Embakasi West Sub Counties are to accord you the necessary assistance to carry out this research study.

Yours sincerely,



DR. IRENE MUCHOKI
CHIEF OFFICER MEDICAL SERVICES

Cc: Chief Officers – Public Health and Health Facilities
Medical Superintendent – Mama Lucy Kibaki & Mbagathi Hospitals
In charge – EOC,
Sub County Medical Officers of Health – Kibra and Embakasi West

Appendix XII: Map of the Study Area

