UNIVERSITY of RWANDA

COLLEGE OF MEDICINE & HEALTH SCIENCES
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ASSESSING THE PUBLIC AWARENESS OF THE 912 RWANDA PREHOSPITAL EMERGENCY MEDICAL SERVICE

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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Medicine in Emergency Medicine and Critical Care, School of Medicine and Pharmacy, College of medicine and health sciences, University of Rwanda

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DECLARATION

I, **Dr. Vizir Jean Paul Nsengimana**, declare that this dissertation entitled "**Assessing the public awareness of the 912 Rwanda prehospital emergency medical service"** is the result of my own research and it has not been submitted for any other degree in the university of Rwanda or any other institution.

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Abstract

Background and Objective: Many deaths from acute illness and injury occur outside of hospitals, necessitating the development of prehospital emergency care. In Rwanda, the ambulance service (Service d'Aide Médicale d'Urgence- SAMU) was established in 2007 to address a variety of emergency medicine situations in the out-of-hospital setting with a countrywide phone number, 912. Despite its growth, the understanding and utilization of the program among the general public has been low. This study assessed public awareness of 912 on the Rwanda prehospital emergency medical service in Kigali City, Rwanda.

Methods: Study participants in this prospective, cross-sectional study were adults (≥18 years) who visited the emergency department at The University Teaching Hospital of Kigali (CHUK) for a medical purpose. Participants were recruited using convenience sampling from March 22rd to April 5th, 2021. Univariate analysis was performed for descriptive statistics. Bivariate analysis was performed using chi-square statistics when appropriate.

Results: A total of 328 participants were surveyed. The majority of the respondents were unaware of prehospital emergency medical services (PHEMS) or ambulance services in Rwanda (n=201, 61.3%). Bivariate analysis showed that the participants' age, resident location, employment, level of education and type of medical insurance regarding awareness of the ambulance service were significantly associated factors. Among all participants, 223 (67.8%) respondents were not aware of the development of the toll-free number 912 to call in case of an urgent need of an emergency medical service in Rwanda. Lack of information and low knowledge of the emergency care system were the major barriers limiting public use of the prehospital emergency medical services (EMS) in Kigali City, Rwanda.

Conclusion and recommendation: Public awareness of SAMU and the 912-emergency number in Rwanda was low. An effort should be made to make the Rwandan general population aware of this affordable service via initiation of different advertisement campaigns.

Keywords: Emergency Medical Service (EMS), prehospital care, Kigali, awareness, medical

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ABBREVIATIONS

AFEM: African Federation for Emergency Medicine

CBHI: Community -based health insurance

CHUK: Centre hospitalier Universitaire de Kigali

CMHS: College of medicine and health sciences

EMS: Emergency Medical Services

EMTs: Emergency medical technicians

IRB: Institutional Review Board

LMICs: Low and-middle income countries

MOH: Ministry of Health

PHEMS: Pre-hospital Emergency Medical Services

RTCs: Road traffic crashes

SAMU: Service d'Aide Médicale d'Urgence

SMUR: Service Mobile d'Urgence et Reanimation

UR: University of Rwanda

USA: United States of America

WHO: World Health Organization

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DEDICATION

To the Almighty God;

To my beloved parents, brothers and sisters;

To my beloved wife;

To my supervisors;

To my classmates and all my friends;

To all patients I saw during my postgraduate training; and

To any person from whom I get knowledge and wisdom,

I dedicate this memoire.

Chapter One: Introduction

1.1 Background

Health systems that recognize the role of emergency medical services can take advantage when it comes to injuries and trauma care. Records of the early emergency medical services date back as early as the Middle Ages in Europe. The Knights Hospitaller were recognized for providing medical care to injured soldiers on the battlefield throughout the Middle Ages. (1) At the end of 18th century, chief surgeon Dominique Jean Larrey of Napoleon Bonaparte (1766-1842) introduced its first ambulatory services on the battlefield for wounded soldiers, where the project was called the Flying ambulance. (2)(3) Ambulatory medical services spiked during the American civil war. (4)

Emergency care has been delivered on the scene in various ways since the beginning of recorded history, from ancient times to the present. In the bible new testament Luke chapter 10 verse of 34 the parable of good Samaritan (5) who rendered service to a beaten man whom he took care of by bandaging and putting him on Donkey and transported him to an inn. Modern prehospital emergency medical services have changed significantly, from personnel to infrastructures, and now ambulances can be motorcycles, boats, airplanes, and vehicles both armored (used in conflict zones for medical evacuation or casualty evacuation) and unarmored. (6)(7)

Pre-hospital care is the care given to a patient in the community (such as at home, school, work, or a recreation area) until the patient is transported to a professional healthcare center that can provide definitive care. A functioning prehospital emergency medical service is a cornerstone of the continuum of all medical care worldwide. Speed and efficiency are critical; each extra minute of prehospital time raises the chance of death by 5%. (8) The critical function of emergency medical service (EMS) can be split into 4 major components: accessing emergency care, care in the community, care during transport, and care upon arrival at the health care facility. (9) (10) Prehospital emergency care provides important benefits to the public, and therefore it should be accessible to all who require it. Emergency medical service systems provide immediate care to individuals with time-sensitive illnesses and road traffic injuries.

Historically, an ambulance’s primary role was transporting patients to health facilities after stabilization with basic medical care. When services began to emphasize diagnosis and treatment at the scene before arriving at a healthcare center, the term "emergency medical service" has become popular. Unwell patients often have delays in seeking treatment due to

delays in requesting medical support, transport delays to a medical facility and in-hospital delays to initiate therapy. There are many factors associated with the delay of the patients to seek prehospital emergency medical care (11), including a lack of awareness of the telephone number to call EMS as well as the ability to communicate with the operator. (12) Early symptom recognition by patients or the general public, which can prompt the dispatch of EMS, is critical for reducing prehospital mortality and morbidity. (13)

An emergency medical system comprises prehospital care in the field, transportation to the health facility, and care on arrival. (14) Mortality due to road traffic crashes is on the rise worldwide. Improving public utilization of prehospital transportation or prehospital care may lead to decreasing preventable deaths. (15) Skilled and motivated people, adequate supplies and equipment, early prehospital emergency care consultation, training and coordination, and management focused on the requirements of the critically ill are all factors that contribute to emergency care being effective in decreasing mortality and disability. (16) Because of shared principles of timely, effective, and integrated care, there is growing evidence that good prehospital treatment systems help patients with non-traumatic emergency situations survive longer. (17)

According to a current Africa-wide EMS survey, less than 9% of Africans are cared for by an EMS system, with the true figure likely to be much lower given numerous identified obstacles to care. (18) In October 2009, a qualitative study in Libreville, Gabon, assessed the population's awareness and attitudes toward the Service d'Aide Médicale d'Urgente (SAMU), as well as the obstacles to people using prehospital emergency medical care. Authors found that people underutilized SAMU due to financial constraints, a lack of understanding of the program, usage of alternative traditional forms of transportation, infrastructural issues, and other misconceptions. (13) A similar research conducted in Zambia indicated that the lack of emergency transportation, healthcare professional shortcomings, an absent of community understanding, and a poor nationwide referral system were all barriers to EMS access. (18)

The African Federation for Emergency Medicine (AFEM) held a meeting in Cape Town, South Africa in April 2015 to assess the consensus on prehospital emergency care access in Africa, and stated that having a single toll-free emergency number is the most important element in helping awareness of the EMS system. They also mentioned that the public has to be educated on how to use the service properly, and they urged community leaders to advocate proper use and oppose abuse of emergency numbers. (18)

The unquestionable need for EMS in Africa to deal with the large burden of disease from acute and emergent conditions was highlighted by the Disease Control Priorities in Developing Countries Project, which stated that developing emergency care systems in developing countries can address approximately 45% of deaths and 35% of disability-adjusted life years. (17)

In Rwanda, there is a prehospital emergency medical services system experiencing rapid growth. In 2007, Rwandan Ministry of Health created the publicly funded prehospital emergency system-ambulance service (Service d' Aide Medicale d'Urgence -SAMU) in the capital city of Kigali. The primary goal of an ambulance service is to address a variety of life-threatening emergency situations in the out-of-hospital setting during primary medical evacuation and inter-health facility transfers. (19) The EMS division is responsible for covering all emergencies for the three districts in Kigali. This was originally targeting only trauma patients. Eventually, the service incorporated other emergency cases such as medical and gynecological/obstetrical cases.

There is no comprehensive prehospital EMS training program in Rwanda. Therefore, qualified nurses and anesthetists are recruited by ambulance service to provide prehospital clinical care. The ambulance service manages the 912 toll-free number as a communication center, which is the backbone of ambulance service (Service d' Aide Medicale d'Urgence - SAMU) and connects SAMU teams to communities seeking emergency medical support. Receiving calls, sending field emergency medical teams to deliver health information and assistance to people who aren't necessarily needing ambulance services, are all part of the 912-communication center's operations.

Since its conception, Rwanda's prehospital emergency medical service has expanded its staff to better manage emergency situations, growing from a team of 12 staff and 4 ambulances to a team of 70 staff and 12 fully equipped ambulances in Kigali City, including one boat ambulance on Lake Kivu. Ambulance service's 912-phoneline receives approximately 3000-3500 calls per month. (16)(19) Although, the average response time for SAMU ambulances was 59 minutes in 2018, 39% of calls were not completed within the golden hour. (20)

Worldwide, the demand of prehospital emergency medical service is rising, but its use is still low especially in developing countries including Rwanda; and this is possibly due to a lack of awareness about EMS in the community. In the study done by Jean Paul NZABANDORA et al. from 1 August 2015 to 30 July 2016 at Kigali University Teaching Hospital (CHUK) found that

of 556 trauma patients, 87.1% used private transport to get to the hospital and the rest arrived by EMS. (21)

Better understanding the realistic features of Rwanda's prehospital emergency medical service in the community is essential to achieving improvements in the EMS service. The data from this research project can be used to develop policies for Rwanda EMS and to establish proper education, research and public relations programs and also raise awareness in the community.

We hypothesize that there is insufficient public knowledge of the 912 toll-free service and the Rwanda Prehospital Emergency medical service. We suspect that there may be a relationship between knowledge level and 912 awareness when stratified by demographic information, including sex, age, marital status, place of birth and residence, type of insurance used, professional status, socioeconomic status and level of education. The aim of this study is to gather information held by population as well as document awareness in the community about Rwanda PHEMS in Kigali City, Rwanda.

1.2 Problem statement

Worldwide, injury is the main cause of death in adults, adolescents, and children, accounting for almost five million deaths each year. (22) Injury also affects many more individuals in terms of lifelong disabilities. However, there are limited resources in developing countries leading to a higher number of preventable deaths due to injuries.

The emergency medical attention is frequently requested from people who are suffering from an acute illness or injury. Hence, personal experience varies to the emergency medical services response time, where the optimal response should be within 60 minutes, "*golden hour*." The current trends reveal that 90% (5 million) of annual injuries occur in developing countries and cause many preventable deaths. (23)(24) The findings on the importance of highly equipped out-of- hospital transport is complex; in some studies, PHEMS with formal pre-hospital resources demonstrates good outcomes from injury-related patients while delays in out-of hospital emergency transport have been associated with an increase in preventable mortality and long term morbidity in other settings. (21)

In Rwanda, injuries account for approximately 25% of deaths, nearly 50% of them occur in the out-of hospital setting. (21) (25) The ambulance service was created in Rwanda as an EMS system to provide high standard pre-hospital medical management. Most of the patients treated by Rwandan ambulance service are due to trauma, primarily road traffic crashes (RTCs), with 5.5% mortality rate overall. (26) Enumah et al. assessed prehospital trauma care in Rwanda and

found that from January 2013 to May 2015, ambulance service received 8,055 patients, with 4,234 patients being from trauma, 2,456 patients being from primary obstetrics and 1,347 patients from other acute conditions. (23)

Despite growth of the Prehospital Emergency medical service, few people utilize it (21); and there have been no studies that have been conducted in Rwanda assessing the factors associated with its low usage. This study was conducted in Kigali, Rwanda in order to assess the awareness of prehospital emergency medical services and to analyze why it is not accessible to everyone who needs it. Findings from this project can serve to help characterize the current awareness of the 912 toll-free service and the Rwandan prehospital emergency medical service in the community, while developing strategies of raising its knowledge and awareness in the community.

1.3 Research question

Is the general public of Rwanda aware of the prehospital emergency medical service available in Kigali City, Rwanda?

1.4 Research objectives

1.4.1 General *objectives*

To assess the public awareness about prehospital emergency medical services among adult patients who visited the emergency department at The University Teaching Hospital of Kigali (CHUK) for a medical purpose.

1.4.2 Specific objectives

- To determine the barriers and obstacles that limit the public to use prehospital EMS.
- To analyze the factors influencing the public to use means of transport to the hospital other than ambulance service.
- Recommend appropriate actions from public opinion on the prehospital EMS services.

1.5 Significance of the study

This research aims to describe the role of emergency medical services and analyze the population's awareness about EMS and barriers to EMS use among adult patients who visited

the emergency department at The University Teaching Hospital of Kigali (CHUK) for a medical purpose. This will help us to increase awareness about EMS and hopefully avoid preventable deaths. We hope that raising the awareness of the 912 toll-free telephone services and the Rwanda Prehospital Emergency Service will contribute to early and quick consultation, which can improve mortality outcomes caused by late consultations in case of emergency conditions, obstetrics cases and injuries. Research in this field is expected to assess the status through interviews and come up with suggestions that will help decrease these barriers and obstacles which limit Rwandan's use of EMS.

Chapter Two: Literature review

This section discusses the definition, theory related to public awareness in the context of prehospital EMS. The section summarizes the nature of the emergency system and level of awareness of the prehospital emergency medical services. Moreover, the chapter presents the theoretical and empirical framework related to the public awareness in the context of prehospital emergency medical services.

2.1 Theoretical framework

The Rwandan prehospital emergency medical care system is an intervention to impact and reduce adverse patient outcomes. Considering the importance of emergency medical services, it provides medical assistance to individuals in the most critical state and reduces the likelihood of fatality and transit into definitive care (27).

Hence, the responsiveness of medical teams within the emergency care service have the responsibility to urgently treat and stabilize patients suffering from illness, injuries or any critical condition. The sub-section reviews the best practices and theories that describe the motivation in emergency medical services system over non-standardized choices and related behavioral changes.

2.1.1 Emergency medical services

Globally, medical care is structured in systems aimed to save patients in timely and adequate manner. (26) (27) Hence, EMS plays a fundamental role in every country's medical care system in either emergency medical needs or trauma care. Furthermore, the emergency medical services should always meet minimum requirement to meet its objectives including provision of the right treatment, in the right time, place and resources as well as sympathy and speed. (19)
EMS subdivides into three major agencies and operates to optimally respond to patient demand. They respond on the free toll (i.e. 911, 912,…), scheduling medical ambulatory care and special care teams to transport emergent or non-emergent patients. (30) Hence, from the literature, the emergency medical service system supports life of patients from prehospital interventions, while its absence might cause increase in morbidity or mortality from severe injuries. (31) In USA, EMS transports millions of injured and sick patients with an infrastructure supporting personnel ready to serve more than 15 million calls annually. (11) (26)

Prehospital Care

The pre-hospital phase is essential in determining the prognosis of critically injured victims. US researchers have demonstrated that good outcomes are linked with adequate pre-hospital emergency treatment times and the quick possible access to definitive medical management in the hospital setting, especially in patients with penetrating trauma. (27) However, studies from Gonzalez et al. and petri et al. show that no survivors have a significantly shorter transport time. McGuffie et al. revealed that there is no link in both rural and urban settings between mortality or morbidity and transport time. (28) (29)

The acute illness can determine the usage of the service, but the patients feel responsible to request emergency medical services when there's severity of illness or in case of disaster including injuries. But, theoretical foundation of EMS indicates that improved community or individual knowledge on the prehospital settings increase the optimal care that patients receive and reverse the damage of the illness. The responsiveness of paramedics and of qualified first aiders give an opportunity to treat and help patients having access to care during transportation to the hospital in case of disaster or illness. The prehospital emergency care chain creates and prepares the patients to reach the hospital in stable condition, and provides opportunity to prioritize the emergency illness transported in the ambulance.

Prehospital Response time

PHEMS has the ability to offer prompt resuscitation and save critically injured individuals who need management at medical facilities. The time in out of hospital setting is an important characteristic of EMS, which can predict trauma patients' prognosis.

Multiples researches have been conducted to identify the relationship between time in out of hospital and outcome; however, no significant correlation has been discovered, and even shorter prehospital time has been linked to lower outcomes. (32) Nine of the studies look at the impact of travel time on mortality or hospital admission days. (33) Eachempati et al. and McCoy et al. show that longer transport time has little effect on mortality. (34) Swaroop et al., on the other hand, found that hypotensive individuals have a much shorter travel time than normotensive patients. (35)

Literature shows that when compared to Western countries, Asian countries have different EMS systems, trauma care provisions, and rural-urban distributions. For example, a survey on rural EMS included 152 systems, 90 of which served populations of less than 6,000 and 25 of which served populations of less than 1,500. Thirty-nine percent of the systems had average response times of more than eight minutes and 7% experienced more than 15 minutes. (7)

Health care providers who practice in remote settings must be trained to provide the essential elements of trauma care. Those providing prehospital trauma care have received formal training in prehospital care, stage, rescue, stabilization and transport. This would prevent dispatchers from dispatching under-equipped EMS vehicles to the location and reducing overall prehospital time.

2.1.2 Public awareness on prehospital emergency care

Individual's prehospital emergency care choices and related service demand (including contacting nearest or preferred health facility in case of emergency need) are related to communications strategy to attract the individual and it's a continuity effort from provider. The prehospital emergency care might be satisfactory to help the patient and there is a need of trade-offs to save their lives (37). The most challenging aspects is changing the individual's behavior and become aware of the prehospital emergency care.

Studies suggest that the adoption of health services such as prehospital emergency care and sustaining the service results from process that involve mainly in two parts: deliberative and implementation phase. The prehospital emergency care should consist behavioral adaptability results from motivational aspects and its sustainability to keep informing the public. This means that the public's perceived need for EMS is related to adequate information that encourage the public to use the prehospital emergency care (34) (35).

However, a number of factors can affect the adoption prehospital emergency care, cultural context, social choice (i.e. peer influence and learning). Personal and or neighbor's experience influence the choice and behavior necessary to adapt the EMS system (40). The public awareness on prehospital emergency medical care remains an interaction of social psychology and service settings. The theory of social psychology brings an attention when the consumer behavior matters over the public services related to health, for example. The perception of the services can characterize the choices and preference but predicting health behaviors remain uncertain.

The theory of social psychology characterizes beliefs, knowledge, attitudes and perception as vital components of prehospital emergency medical services success over the public awareness (37) (38). Hence, the theory itself describes public awareness from a conceptual design based on the evidence, market research and public opinion aimed to understand the factors influencing the individual needs. But, the theory of social psychology does not dictate to rationalize the

people’s decision making in controlled contexts to optimal use of prehospital emergency medical care.

2.2 Empirical framework

2.2.1 Global burden injury and emergency medical services

The world picture of injuries, the most relevant answer reflects to an “accident”(43), while in epidemiological perspectives, the concepts of injuries has neglected and increased day by day in public health. Though, the most current prevalence manifests the degree of injuries as the risk factors of death and long-term disabilities globally (44). Furthermore, the role of public health practitioners is to mitigate with the best alternative interventions that might be used in the prevention procedural actions reduce injuries(45).

Previous research estimates the burden of injuries on either global perspectives and beyond (41) (42). Rwanda and its neighboring countries are experiencing a similar trend of increasing injury burden. According to WHO estimates from 2012, injuries and violence in the African region have record 99.5 death rate per 100 000 population from injuries (48).

2.2.2 Models of Emergency Medical Service (EMS) Systems

EMS can be explained as an integrated part of health system, which is in charge of timely delivering emergency medical treatment in prehospital area and safety services to the injured victims, or patients of sudden illness. (9) The main objective of EMS is based on providing the urgent care to critically injured victims and patients with sudden medical diseases or emergencies to stop preventable mortality or long-term morbidity. (9) (14). It is considered by WHO as a cornerstone of high standard and well-functioning healthcare system. It is the majority of people's first point of contact with health-care services for crises and life-threatening injuries, and it serves as a checkpoint for secondary and tertiary services. (9) (49)

The mode of emergency medical health care delivery in pre-hospital setting has been categorized into two main models of EMS with distinct features according to the philosophy of pre-hospital care delivery, which are the Anglo-American and the Franco-German model (9) (50) (51). Between the 1970s until the end of the twentieth century, there was a substantial difference between these two styles. Currently, most of EMS health systems worldwide have modified the structures from each model.

The Franco-German model is depending on the "stay and stabilize" philosophy (9) (51) (52). The purpose of this system is to transport to the hospital the patient in stable clinical conditions. It is usually run by doctors with high level of practice, where they manage patients at home or at the scenes. This results that many patients being managed at the scene and less transported and admitted in the hospital. This model is largely implemented in Europe in which EMS is new field. Germany, France, Greece, and Austria have all successfully implemented Franco-German EMS systems. (9) (51)

Unlike the Franco-German system, the Anglo-American model is depending on "scoop and run" attitude. (9) (50) The main purpose of this system is to quickly transport patients to the hospital with minimal out-of hospital management. Public safety agencies, such as the police, are normally in charge of it. This model is adopted in the countries where EMS is well developed and known as a distinct medical speciality. This EMS approach is used by countries such as the United States, Canada, New Zealand, and Australia. (9) (50).

Many studies have tried to be done in the comparison of the two model systems regarding patients' outcomes and expenses. However, they don't appear to be comparable because they operate in various way with different types of demands to meet (9) (52). Furthermore, comparisons between the two models are problematic due to the lack of common standards. As a result, there is currently no proof that one model is superior to the other, and studies continue to provide contradictory results.

The main purpose of EMS is to provide adequate medical treatment in the pre-hospital setting and quick transport to the nearest emergency department depend on the clinical condition of the patient. Multiple prognostication tools has been established for EMS but they were limitations to particular clinical situations, like trauma (53). To apply the current triage methods and early warning scores to EMSs, many actions have been made, but have not performed satisfactorily (54). In PHEMS, accurately triage for critical care is essential for the early recognition for critically sick and high-risk of patients.

2.3 Knowledge Gap

The care provided in prehospital settings has changed significantly since longtime ago. It has been rapidly transformed to an integrated part of the nationwide healthcare system. (55) Organizations face significant problems as a result of this rapid shift. Emerging literature that examines the role of prehospital emergency medical care have focused mostly on the

epidemiology of injuries and its outcomes, know how procedures and integration of the system into medical programming, and have resulted in low awareness to the public (19). There is a consensus that as more public become aware of the prehospital emergency medical care, it can in turn improve the medical outcomes (56). Ideally, each population should be aware of the availability of means of transport of critically sick or injured people to the closest appropriate health care facility to look for emergency medical care, weather it is a public or private hospital.

Chapter three. Methodology

3.1 Study design, setting and data collection

This was a cross-sectional observational analysis study. Survey data was gathered from patients who visited the emergency department at The University Teaching Hospital of Kigali (CHUK) for a medical purpose during a 2 weeks period (March 22rd to April 5th 2021).

3.2 Inclusion criteria

The study included all patients visiting emergency department at CHUK during a 2 weeks period (March 22rd to April 5th 2021), who are greater than 18 years of age and those who agree to sign the consent form.

3.2 Exclusion criteria

This study excluded patients under 18 years of age and patients who refused to participate in the study. The study also excluded critically sick patient, those with altered mental status with inability to complete the survey, those who can't read and write.

3.3 Sampling strategy and sample size

A convenience sampling approach was employed to enroll the respondents to understand the factors associated with prehospital EMS use and modes of transport to the hospital. The sample size was determined by the number of patients who visited the emergency department at The University Teaching Hospital of Kigali (CHUK) for a medical purpose over the period of the study. Study personnel were present 24/7 to enroll patients and gather data. All eligible patients who consented to participation were included in the study sample. The nurses at triage desk were served as research assistants.

3.4 Data collection and analysis

To be eligible for inclusion in the study, participants had to be older than 18 years of age and have visited the emergency department for a medical purpose. Data collections were anonymous names, addresses, or other identifying information were not collected. Quantitative data results facilitated the identification of segments based on knowledge, attitudes and behaviors.

Data was collected and analyzed with different variables including socio-demographic information (age, sex, marital status, and type of insurance), knowledge about ambulance service (SAMU), reasons why people call prehospital EMS in the community, barriers limiting them to use ambulance service (SAMU), and community suggestions. The last question in the survey was an open ended-qualitative prompt with purpose of raising ideas of how to increase awareness about the 912 Rwanda Prehospital Emergency Medical Service to the Rwandan public.

Data was entered into Excel and analyzed using STATA software. Descriptive statistics with frequency and percentages for categorical data were calculated. Data was then stratified by those aware of pre-hospital services and those unaware. Bivariate relationships were assessed using chi-square statistic or fisher exact tests for categorical variables or an independent t-test for continuous ones. This was done in order to identify statical differences in variables between those aware and unaware of pre-hospital services.

3.5 Ethical considerations

This study was approved by UR/CMHS IRB No 363/CMHS IRB/2020 and CHUK ethical committee Ref: EC/CHUK/035/2021 before collecting the data. It was a prospective study where informed consent was signed before asking questions.

There was no risk to subjects. In this study, participants were given an informed consent by completing an informed consent form. The participants remained anonymous. The names and personal identifiers of participants were not used. Each participant was assigned a unique ID number or code so that the worker's name was not used and the received data was remained confidential and stored in password-protected and encrypted files on a computer to which the researchers and members of the research team were having access.

There was no conflict of interest. Research participants' right to privacy was respected and the researcher was at all times ensuring that all information of participants was safely stored, used and subsequently destroyed to protect the participant's identities. The researcher ensured that participants were informed about their right to withdraw at any time for any reason, to ask questions, confidentiality, possible risks and benefits associated with the study, before consenting to participate.

3.6 Dissemination of Research Result

The findings will be shared to the Prehospital Emergency Medical Services Division/SAMU for sensitization about the importance of SAMU. We plan to publish our study on social media to sensitize and increase awareness to the community. This will help to increase the number of people who access ambulance service and improve the quality of life in all populations who need prehospital care, including injured patients and those with acute medical conditions.

The final report will also be submitted to different ambulance services to improve prehospital care and prevent barriers that lead people not to use ambulances for prehospital transport. Results from this study may also be submitted to international journals for academic and clinical advancements. They may be presented as oral presentation in different research meetings and conferences for health quality improvement.

Chapter Four. Results

Over the study period, a total of 328 patients seeking care in the emergency department at CHUK were screened for study inclusion. Of these all 328 patients consented, enrolled and were included in the present analysis. In total, 201 (61.28%) respondents were unaware of ambulance service in Rwanda (Table 1).

4.1. Socio-demographic profile

Socio-demographic characteristics of participants include gender, age, participants' address, occupation, marital status, education level, medical fees coverage, wealth (Ubudehe) category.

Among the 328 participants in the study, 185 (56.4%) were male and 143 (43.6%) were female (Table 1). Most patients resided in Kigali (219 participants, 67.8%). The majority were married (204 participants, 62.2%), followed by single participants (84, 25.61%). The median age was 37(28-52) and the majority of respondents' age was between 28-52 years. The youngest participant was 18 years old and the oldest person was 91 years old.

Many of the respondents showed to pay their medical fees through community-based health insurance (Mutuelle de Santé) (265, 80.79%), followed by those with private insurance (41, 12.50%) (Table 1). Overall, 159 (48.62%) respondents used ambulance service to arrive at the emergency department of CHUK, while 97 (29.66%) respondents used a private car, and 47 (14.37%) participants arrived via a taxi. Additionally, 15 (4.59%) participants arrived by foot, while 14 (4.28%) and 6 (1.83%) respondents used motorbike and public transport respectively.

Table 1. Participants' socio-demographic characteristics

Characteristics	n (%) / median (IQR)
Gender	
Male	185(56.4%)
Female	143(43.6%)
Age (Years)	37(28-52)
Occupation	
Employed	50(15.24%)
Self-employed	153(46.65%)

Temporary occupation	65(19.82%)
Others (i.e. student, unemployed)	60(18.29%
Participants address	
In Kigali	219(67.80%)
Out side Kigali	104(32.2%)
Marital status	
Married	204(62.2%)
Single	84(25.61%)
Widowed	33(10.06%)
Divorced	7(2.13)
The level of education	
None	42(12.80%)
P Level	99(30.81%)
O Level	46(14.02)
A Level	110(33.54%)
University level	31(9.45%)
Medical fees	
Community based health insurance (Mutuelle de Sante)	265(80.79%)
Others insurance (Private Insurance such as, RSSB, MMI, Britam etc.)	41(12.50%)
Private (No insurance coverage)	22(6.71)
Ubudehe category	
Category 1	30(9.15%)
Category 2	136(41.46%
Category 3	141(42.99%
Category 4	6(1.83%)
Category 5	0
Category 6	0
No category	15(4.57%)
Travel to the hospital	
In an ambulance	159(48.62%)
By car	97(29.66%)

By taxi	47(14.37%)
On foot	15(4.59%)
On public transport	6(1.83%)
On moto	14(4.28%)
Aware of SAMU-Service d'Aide Medical d'urgence in Rwanda	
Yes	127(38.72%)
No	201(61.28%)

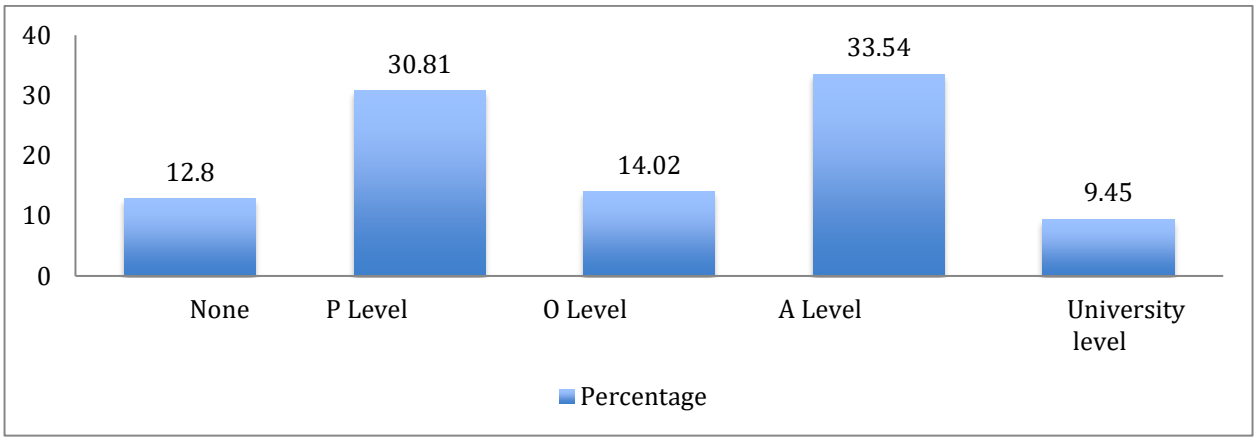

Figure 1. Distribution of participants by level of education

Figure *1* above is showing the distribution of participants by level of education. In terms of education, the majority holds an advanced high school level and primary education, 110 (33.54%) and 99 (30.81%) participants, respectively.

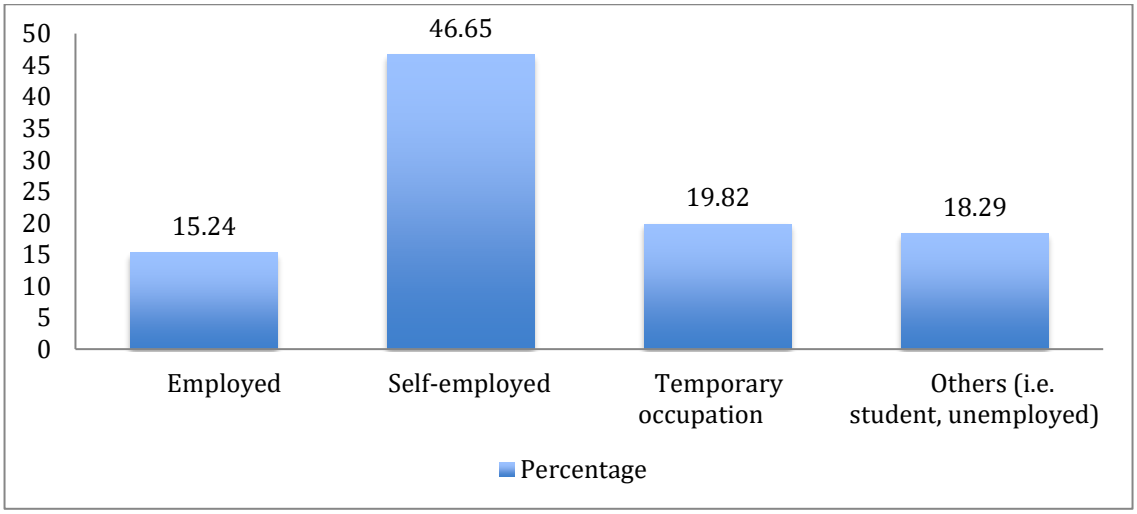

Figure 2. Distribution of participants by occupation

Figure *2* above is showing distribution of participants by occupation. The majority of the respondents are self-employed 153 (46.6%), followed with those with temporary occupation 65(19.8%) participants.

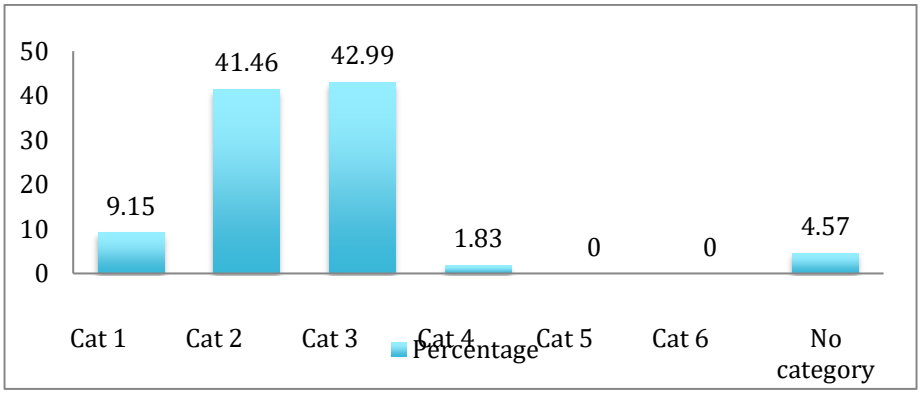

Figure 3. Distribution of participants per wealth (Ubudehe) Category

Figure *3* above is showing the distribution of participants per wealth (Ubudehe) category. Per wealth (Ubudehe) category, most are from CAT 3 of ubudehe with 141(42.99%) participants, followed by those from CAT 2 with 136(41.46%) participants

4.2 Knowledge and Perception on Prehospital EMS

Table 2. Knowledge and perception on prehospital EMS

Characteristics	n (%) / median (IQR)
Knowledge of any contact to call in case of emergency medical service	
Yes	199(60.67%)
No	85(25.91%)
Missing	44(13.41%)
The means of emergency transport to hospital do you know	
SAMU-Ambulance	95(29.41%)
Private car	160(49.54%)
Taxi	43(13.31%)
Police car	7(2.17%)
Others, …….	18(5.57%

Aware of the development of a toll-free number 912 to call in case of an emergency medical service	
Yes	102(31%)
No	223(67.79%)
	*3(0.91%)patients do not respond
Ever called the emergency medical service and asked for an ambulance	
Yes	82(25%)
No	246(75%)
If you have ever called the emergency medical service, time to reach home	
<10 min	7(8.47%)
10 min -15 min	31(37.51%)
15 min -30 min	23(27.83%)
30 min-1 hour	15(18.29%)
1hour- 2hour	1(1.21%)
>2hours	0
Missing	*5(6.69%)patients did not respond the question
Knowledge of anyone who have called/Used SAMU-Service d'Aide Medical d'urgence in Rwanda	
Yes	95(28.96%)
No	233(71.04%)
Who do you think can use SAMU- *Service d'Aide Medical d'urgence* in Rwanda*	
Vulnerable or poor people	32(9.79%)
People with Disability	42(12.84%)
Pregnant women	36(11.01%)
People fall in coma	65(19.94%)
Designed for special people and rich	0
I do not know	233(71.25%)

Regarding knowledge and perception of participants on PHEMS in Rwanda, **Table *2*** above shows that 199 (60.67%) respondents had knowledge of any contact to call in case of an emergency. Interestingly, 160 (49.54%) and 95 (29.41%) respondents stated that the means of emergency transport to hospital they know are private car and SAMU-ambulance, respectively. Among the participants in the study, 223 (67.79%) respondents were unaware of the development of a toll-free number 912 to call in case of an emergency medical service in Rwanda, while 82 (25%) respondents had ever called the emergency medical service and asked for an ambulance; 95 (28.96%) participants knew anyone who have called/used SAMU-Service d'Aide Medical d'urgence in Rwanda. Among those who have ever called the emergency medical service and asked for an ambulance, 31 (37.51%) participants stated that the time to reach home was 10 min -15 min, followed by 23 (27.83%) participants with 15 -30 minutes.

Table *2* shows what respondents think on those who can use ambulance service (Service d'Aide Médicale Urgente-SAMU). The majority of respondents do not know who can use ambulance service (233, 71.25%). In addition, 65 (19.94%), 42 (12.84%), 36 (11.01%) and 32 (9.79%) participants thought that ambulance service (Service d'Aide Médicale Urgente-SAMU) used by people fall in coma, people with disability, pregnant women and vulnerable or poor people, respectively.

Table 3. Reasons why people need to call 912 SAMU

Seeking for medical care	209(63.72%)
Seeking for financial support	3(0.91%)
I don't know why people call SAMU	42(12.80%)
Seeking for information regarding sports/leisure	2(0.61%)
Other	1(0.30%)
Missing	71(21.65%)

Table *3* above shows the reasons why people stated they call 912 SAMU. From the 328 participants in the study, 209 (63.72%) respondents said that the reason why people need to call 912 SAMU is for seeking medical care, followed by 42(12.80%) respondents do not know why people call SAMU, 3(0.91%) for seeking for financial support, 2(0.61%) for seeking for information regarding sports/leisure. 71(21.65%) participants did not respond this question.

Table 4. Reasons why Rwandan people do not call EMS-SAMU/Ambulance

Free call number 912 is not known	101(30.70%)
Not comfortable to call	2(0.60%)
Feel embarrassed calling	11(3.34%)
Afraid of patient's clinical condition	10(3.04%)
Rwanda prehospital emergency medical service is not known	15(4.56%)
I am aware of PHEMS but because of the time of the day like weekend or night, I can't call	2(0.60%)
I do not know	186(56.54%)
	*1(0.30%)patient do not respond

Table *4* above shows the reasons why Rwandan people do not call EMS-SAMU/ambulance. From 328 participants in the study, 186 (56.54%) participants did not know the reason why the Rwandan people do not call EMS-SAMU/ambulance. 101(30.70%) participants said that the free call number- 912 is not known, followed by 15 (4.56%), 11 (3.34%) and 10 (3.04%) participants that Rwanda prehospital emergency medical service is not known, feel embarassed calling, and afraid of patient's clinical condition, respectively.

Table 5. The barriers limiting most of people to use SAMU ambulance in case of emergency

It is expensive	12(3.65%)
No information about it	8(2.43%)
It does not help much	278(84.75%)
Unknown	26(7.92%)
	*4(1.21%)patients do not respond

Table 5 above shows the barriers limiting most of people to use SAMU. From 328 participants in the study, 278 (84.75%) participants said that it does not help much, followed by 26 (7.92%) participants responding that they do not know, 12 (3.65%) participants responding that it is expensive, and 8 (2.43%) participants that no information about it.

4.3. Awareness of PHEMS

Overall, the majority of participants were unaware of PHEMS/ ambulance service (SAMU) in Rwanda (201, 61.28%). In a bivariate analysis stratified by those who are aware of PHEMS and those not, there was no statistical difference in gender (p=0.933). There was a statistically significant difference in age between who are aware of ambulance service and those unaware of ambulance service in which younger participants are more likely to be aware of ambulance service (p=0.012). The median age of those who are aware of PHEMS was 37 years (IQR: 29-45 years). In comparison, those who were unaware of PHEMS had a median age of 38 years (IRQ: 28-55 years).

Participants who are aware of PHEMS/ ambulance service are more likely to live in Kigali City compared to those who live outside of Kigali (88.89% vs. 54.31%, p=0.000) and be formally employed (22.05% vs 10.95%, p=0.023). There was a significant statistical difference between participants' educational level who are aware of ambulance service and those unaware of ambulance service (p=0.000). Those with a higher educational level were also more likely to be aware of ambulance service (14.17% vs. 6.47%). As well, as having private medical insurance (22.83% vs 5.97%, p=0.000). Per wealth (Ubudehe) category, the study found in Table 6 that for those aware of PHEMS, the majority was from CAT 3 with 62 (48.82%) participants, followed by those from CAT 2 with 51 (40.16%) participants. For those unaware of PHEMS, the majority of respondents were from CAT 2 with 85(42.29%) participants, followed with 79(39.30%) and 25(12.44%) participants from CAT 3 and CAT 1, respectively. There was a significant statistical difference between wealth (Ubudehe) category who are aware of ambulance service and those unaware of ambulance service (p=0.031). Those in CAT 1 are less likely to be aware of ambulance service (3.94% vs 12.44%).

Table 6 is shows that those aware of the ambulance service, 84 (66.67%) respondents were aware of the development of a toll-free number 912 to call in case of an emergency medical service whereas 42 (33.33%) respondents were not aware of the development of a toll-free number 912 to call in case of an emergency medical service. For those unaware of the ambulance service, the majority with 181 (90.95%) respondents was not aware of the development of a toll-free number 912 to call in case of an emergency medical service. There was a significant statistical difference between awareness of the development of a toll-free number 912 to call in case of an emergency medical service who are aware of the ambulance service and those

unaware of the ambulance service (p=0.000). Those aware of the development of a toll-free number 912 to call in case of an emergency medical service are more likely to aware of the ambulance service (66.67% vs 9.05%).

For those who have ever called the emergency medical service and asked for an ambulance, 69 (54.33%) respondents were aware of the ambulance service whereas only 13 (6.47%) respondents were unaware of the ambulance service. For those who have not ever called the emergency medical service and asked for an ambulance, 58(45.67%) respondents were aware of the ambulance service whereas 188(93.53%) respondents were unaware of the ambulance service. There was a significant statistical difference between ever called the emergency medical service and asked for an ambulance who are aware of the ambulance service and those unaware of the ambulance service (p= 0.000). Those who have ever called the emergency medical service and asked for an ambulance are more likely to know the ambulance service (54.33% vs 6.47%).

Table 6 revealed that those who knew anyone who have called/used SAMU in Rwanda, 79(62.20%) and 16(7.96%) respondents were aware of PHEMS and unaware of PHEMS, respectively. Whereas those who did not know anyone who have called/used SAMU in Rwanda, 48(37.80%) and 185(92.04%) respondents were aware of PHEMS and unaware of PHEMS, respectively. There was a significant statistical difference between knowledge of anyone who have called/used SAMU in Rwanda who are aware of the ambulance service and those unaware of the ambulance service (p=0.000). Those with knowledge of anyone who have called/used the ambulance service in Rwanda are more likely to be aware of the ambulance service (62.20% vs 7.96%).

Table 6. Awareness of PHEMS-SAMU

	Aware about PHEMS	**Not aware about PHEMS**	**P value**
Characteristics	**n (%) / median (IQR)**	**n (%) / median (IQR)**	
Gender			
Male	72(56.69%)	113(56.2%)	0.933
Female	55(43.31%)	88(43.78%)	

Age(Years)	37(29-45)	38(28-55)	0.012
Occupation			
Employed	28(22.05%)	22(10.95%)	
Self-employed	60(47.24%)	93(46.27%)	0.023
Temporary occupation	19(14.96%)	46(22.89%	
Others (i.e. student, unemployed)	20(15.75%)	40(19.90%)	
Participants address			
In Kigali	112(88.89%)	107(54.31%)	0.000
Out side Kigali	14(11.11%)	90(45.69%)	
Marital status			
Married	81(63.78%)	123(61.19%)	
Single	34(26.77%)	50(24.88%)	0.025
Widowed	7(5.51%)	26(12.94%)	
Divorced	5(3.94%)	2(1%)	
The level of education			
None	6(4.72%)	36(17.91%)	
P Level	32(25.20%)	67(33.33%)	0.000
O Level	19(14.96%)	27(13.43%)	
A Level	52(40.94%)	58(28.86%)	
University level	18(14.17%)	13(6.47%)	
Medical fees			
Community based health insurance (Mutuelle de Sante)	89(70.08%)	176(87.56%)	
Others insurance (Private Insurance like RSSB, MMI, Britam etc)	29(22.83%)	12(5.97%)	0.000
Private (No insurance coverage)	9(7.09%)	13(6.47%)	
Ubudehe category			
Category 1	5(3.94%)	25(12.44%)	
Category 2	51(40.16%)	85(42.29%)	
Category 3	62(48.82%)	79(39.30%)	0.031

Category 4	4(3.15%	2(1%)	
Category 5	0	0	
Category 6	0	0	
No category	5(3.94%)	10(4.98%)	
Knowledge of any contact to call in case of emergency medical service			
Yes	90(84.11%)	109(61.58%)	0.000
No	17(15.89%)	68(38.42%)	
The means of emergency transport to hospital do you know			
SAMU-Ambulance	59(46.46%)	36(18.27%)	
Private car	45(35.43%)	115(58.38%)	
Taxi	16(12.60%)	27(13.71%)	0.000
Police car	0	7(3.55)	
Others	6(4.72%)	12(6.09%)	
	*1 patient did not respond	*4 (1.99%)patients did not respond	
Aware of the development of a toll-free number 912 to call in case of an emergency medical service			
Yes	84(66.67%)	18(9.05%)	
No	42(33.33%)	181(90.95%)	0.000
	*1 (0.79%)patient did not respond	*2(1%)patients did not respond	
Ever called the emergency medical service and asked for an ambulance			
Yes	69(54.33%)	13(6.47%)	0.000
No	58(45.67%)	188(93.53%)	
If you have ever called the emergency medical service, time to reach home			

<10 min	5(3.94%)	5(2.49%)	
10 min -15 min	33(25.98%)	18(8.96%)	
15 min -30 min	32(25.20%)	17(8.46%)	0.000
30 min-1 hour	17(13.39%)	14(6.97%)	
1hour- 2hour	3(2.36%)	9(4.48%)	
>2hours	1(0.79%)	18(8.96%)	
Missing	36(28.35%) patients did not respond	*120(59.70%) patients did not respond	
Knowledge of anyone who have called/Used SAMU-Service d'Aide Medical d'urgence in Rwanda			
Yes	79(62.20%)	16(7.96%)	0.000
No	48(37.80%)	185(92.04%)	
The reasons why people need to call 912 SAMU			
Seeking for medical care	113(88.98%)	96(47.76%)	
Seeking for financial support	0	3(1.49%)	
I don't know why people call SAMU	8(6.30%)	34(16.92%)	0.000
Seeking for information regarding sports/leisure	0	2(1%)	
Other reasons,	0	1(0.50%)	
	*6(4.42%)patients did not respond	*65(32.34%)patients did not respond	
The reasons why the Rwandan population not call EMS-SAMU/Ambulance			
Free call number 912 is not known	113(93.39%)	96(70.59%)	
Not comfortable to call	8(6.61%)	34(25%)	
Feel embarrassed calling	0	3(2.21%)	0.000

Afraid of patient's clinical condition	0	2(1.47%)	
Rwanda prehospital emergency medical service is not known	0	1(0.74%)	
I am aware of PHEMS but because of the time of the day like weekend or night, I can't call	0	0	
I do not know	0	0	
The barriers limiting most of people to use SAMU ambulance in case of emergency			
It is expensive	5(4%)	7(3.52%)	
It does not help much	7(5.60%)	1(0.50%)	0.006
No information about it	108(86.40%)	170(85.43%)	
Unknown	5(4%)	21(10.55%)	

4.4. Raising awareness of 912 and PHEMS

The study did show patterns indicating that the respondents lacked awareness regarding 912 and prehospital emergency medical service (SAMU) and should be made to raise awareness to the general population regarding the ambulance service and its toll-free number 912.

Every participant in the study has been asked his/her opinion on the way of increasing Rwandan public awareness about 912 PHEMS in Rwanda. Most of the respondents have suggested some ways like advertisement using posters, microphones in the village, publicity on radios and televisions, educational mobilization in rural areas, publication using posters in mass gathering locations, and by using social medias. An effort to raise awareness among the general public regarding this service especially those who are unaware like older people, those with low education level, unemployment, people outside Kigali city, people using CBHIs and those with low socioeconomic status is needed. Education of those unaware of 912/ ambulance service will need to take a multi-pronged approach to reach a diversity of populations and age groups in Rwanda.

Chapter Five. Discussion

There is still a controversy regarding the extent of prehospital emergency medical care that should be administered in both developing and developed countries. EMS has been shown in studies to be a valuable public service that can improve health outcomes. (13)(14) Mock et al. studied trauma mortality in three foreign towns with varying economic levels and discovered that the majority of deaths occurred outside of the hospital, and that the lack of an EMS system was linked to longer prehospital delays and higher pre-hospital mortality. (12) (57) (58) Like the introduction of SAMU in Benin, there was a reduction of death from 8% to 3.3% for patients given any pre-hospital care, and to less than 1% for those managed by the mobile hospital units of the SAMU, known in French as the Service Mobile d'Urgences et Reanimation (SMUR).(13) Since 2007, Rwanda, through the Ministry of Health/ Prehospital Emergency Medical Services Division, developed and managed the operation of the ambulance service (SAMU), including toll free 912 communication service. Patients are able to call and request the ambulance service with primary objective of managing different life-threatening emergency conditions in the prehospital environment during primary and secondary medical evacuation.

However, there has been slow uptake and recognition by the public, despite being a public asset (20). To the understanding of the authors, this study is among the first from the sub-Saharan African region, specifically in Rwanda, assessing public awareness about the 912 toll-free number and the Rwandan prehospital emergency medical services in Rwanda.

This study found that the majority (61.28 %) of participants were unaware of the PHEMS/ the ambulance service (Service d'Aide Médicale Urgente-SAMU) in Rwanda (**Table *1***), and over 75% of participants had never called the emergency medical service to ask for an ambulance for emergency medical service (**Table *2***). Low awareness of prehospital emergency medical services has been found to be frequent in areas of developing countries where prehospital emergency medical services may only have been recently created. We found the level of awareness and usage of prehospital emergency medical services to be similar to other studies conducted in Ghana, Gabon, Zambia and Saudi Arabia. (13) (18) (59) (60) The study conducted in Ghana by Mould-Millman et al. found that only 44% of respondents were aware of a public access number for emergency medical service, only 37% aware that it was toll free, and 4.5% reported that they have ever used an ambulance service in emergency conditions. (59) In Libreville, Gabon, researchers found that low access of PHEMS is associated with misunderstanding, unawareness, use of other means of transport, and expenses were all

obstacles to accessing prehospital emergency resources. (18) Broccoli et al., in Zambia revealed that the barriers to access PHEMS included lack of emergency transports, shortage of healthcare providers, unawareness of community, and a low standard nationwide referral system. (18) Another study performed by Hamam et al. in western Saudi Arabia found that only a third of the population knew the emergency dispatch number and this was linked to that the majority of the general population were not able to access the EMS because they were not aware what number to call (60). These findings were contrary to those found by Pranav et al. in India, 2018 with 76.2% of the respondents recognized the communicating number to call in case of a medical emergency. The authors recommended that strategies should be made to make all the general population aware of this service by starting different advertisement campaigns. (61)

Overall, this study established that younger people, those who are employed, live in Kigali city, of a higher class of ubudehe category, and have private health insurance are more likely to be aware of the ambulance service (Service d'Aide Médicale Urgente-SAMU). Younger people tend to be connected to social media platforms that increase their exposure to new programs. More study is needed for comparative findings with assessment of factors favoring younger people to be aware of the ambulance service than older people. These other known characteristics are all related to socio-economic status, family values and social structure. People with higher socioeconomic status often used social media platforms, having radio and television at their home, reading the news with more exposure to public messages and advertisements. Lower class people may have difficulty knowing and accessing the PHEMS in part because of beliefs that the SAMU-ambulance may not enter into the poor neighborhoods, into the neighborhoods that are very deprived, where there are no roads, in the locations that are difficult to reach. Those living in Kigali city are also more likely to be aware of PHEMS. This is maybe associated that prehospital emergency system-Service d'Aide Medicale Urgente (SAMU) created by Rwandan Ministry of Health (Kigali, Rwanda) in the capital, Kigali as the only publicly funded and it was originally targeting only trauma patients in Kigali City. This is also may be associated with that citizen populations are more aware of the public programs through urban exposure.

Regarding the reasons why Rwandan people do not call ambulance service, the study has found that the majority (56.54%) of participants did not know the reason why the Rwandan people do not call ambulance service (SAMU); followed by 101(30.70%) participants said that the free call number- 912 is not known (Table 4). Among the barriers limiting most of people to use ambulance service in Rwanda, the study revealed that over 80% of participants said that it does

not help much (Table 5). Factors such as lack of public knowledge or trust, misperceptions, alternative forms of transport to the hospital, cost, low level of education, living outside Kigali may all be associated with lack of awareness from the public about PHEMS. This may discourage Rwandans from using this government-funded emergency medical service, as it is uncertain how widely EMS contact information is communicated in Rwanda. Many participants in this study also stated that the ambulance service "does not help much." Given the persistent need for improved awareness of the ambulance service these results of the current data may be used to inform more efficacious and targeted outreach education in Rwanda about prehospital emergency services and the ambulance service.

Limitations

The following are some of the study's limitations: First, the period of data collection was only 2 weeks (March 22rd to April 5th 2021), which is a short period thus limits the number of people surveyed and cannot capture seasonal variations in who comes to the emergency department. Second, there were significant missing responses to questions, as some participants who did not provide information to some questions, which resulted of lacking reliable data and limited the scope of analysis and can introduce bias. This can be a significant obstacle in data analysis, making it difficult to draw conclusion. Third, the participants in the study who were sick presenting to emergency department looking for medical care were not fit and comfortable to complete a survey. This might create a significant bias their answers to the survey. The study did not also capture patients with severe illness or head injury and those who cannot read and write, so may have introduced bias into your study sample. Fourth, recruiting people who already arrived at emergency department favor those who may already know about the ambulance service (SAMU). The survey tool was also not available in Kinyarwandan; this may excluded people who did not speak English. Fifth, the study was a single centered study and patients were recruited using a convenience sample, which limits the generalizability of the study's findings to other centers. Sixth, the study's small sample size undermines the internal and external validity of study.

Chapter six. Conclusion and recommendation

6.1 Conclusion

In this study, approximately 39% of participants were aware of the ambulance service (Service d'Aide Médicale Urgente-SAMU) and 61% were not known about the ambulance service. The significant statistical difference factors between who are aware of SAMU and those unaware of SAMU include age, occupation, participants' address, education level, wealth (Ubudehe) category, and means of paying medical fees.

Public awareness of the toll-free 912 number and PHEMS in the study population was low, only at 31% of the participants. Strengthening of the prehospital emergency care system has a vital impact in the trauma and emergency system globally, but when it comes in the developed countries, the prehospital emergency care can be a channel of saving millions of cases from the morbidities and mortalities. In Rwanda, where the ambulance service division/SAMU remains a public property and in charge of full operations. This is the first study that assesses the public awareness about prehospital emergency medical services in Rwanda.

6.2 Recommendation

Prehospital emergency medical systems are an important component of nationwide health systems worldwide. The development of prehospital care and high standard EMS systems have linked with significant decline in trauma-related mortality and morbidity in developed countries. The political administration including ministries of health in these states need to pay a particular alertness in the development of prehospital emergency medical systems and making sure that its progression is both evidence-based and appropriate to their country's needs.

The findings of this study revealed that among the barriers and obstacles limiting public to use prehospital EMS in Kigali City, lack of information and low knowledge of emergency care system were the key limiting public to use the services. The findings inform to strongly improve its recognition to the public as a source of its development.

An effort should be made to make 100% of the population especially the older people, those with low education level, unemployment, people outside Kigali city, people using CBHIs and those with low socioeconomic status aware of this service. One important step for raising public awareness would be initiating different advertising campaigns via radio, Television adverts, symposia, social media, public boards and public gathering locations.

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APPENDIXES

1. Questionnaire (Data collection tool)

Instructions

Complete the questionnaire by putting "X" next to the relevant answer where applicable and by writing answers in the lines provided. The information will be kept confidential.

Section A. Socio-demographic characteristics of respondents

1. What is your age (years)?.....

2. What is your gender? ☐Male ☐Female

3. What is your occupation? ☐Employed ☐Self-employed ☐Temporary occupation ☐Others (i.e. student, unemployed)

4. What is your marital status? ☐ Married ☐Single ☐Widowed ☐Divorced

5. What is your place of residence (Provide/ District/Sector): ……

6. What is your highest level of education?

☐None ☐P Level ☐O Level

☐A Level ☐University level

7. How do you pay medical fees?

☐Community based health insurance (Mutuelle de Sante)

☐Others insurance (Private Insurance like RSSB, MMI, Britam etc…)

☐Private (No insurance coverage)

8. What is your UBUDEHE Category (Old category)?

☐Category 1 ☐Category 2 ☐Category 3 ☐Category 4 ☐Category 5 ☐Category 6 ☐No category

9. Do you aware of *SAMU-Service d'Aide Medical d'urgence* in Rwanda?

☐Yes ☐No

Section B: Mode of Arrival and access to emergency medical service

1. How did you travel to the hospital?

☐In an ambulance ☐By car ☐By taxi

☐On foot ☐On public transport ☐Other, specify,……

2. Who do you think can use SAMU- *Service d'Aide Medical d'urgence* in Rwanda?

☐Vulnerable or poor people ☐People with Disability

☐Pregnant women ☐People fall in coma

☐Designed for special people and rich ☐ I do not know

Section C: Knowledge and Perception on Prehospital EMS

1. Do you have knowledge of any contact to call in case of emergency medical service?

☐SAMU ☐Nearest hospital emergency contact

☐Community health care workers ☐ I do not have any knowledge

2. What are the means of emergency transport to hospital do you know?

☐SAMU-Ambulance ☐Private car ☐Taxi

☐Police car ☐Others, ……...

3. Are you aware of the development of a toll-free number 912 to call in case of an emergency medical service?

☐Yes ☐No

4. Have you ever called the emergency medical service and asked for an ambulance?

☐Yes ☐No

5. If you call the emergency medical service from your home, how long do you think it would them to arrive?

☐<10 min ☐10 min -15 min ☐15 min -30 min

☐30 min-1 hour ☐1hour- 2hour ☐ >2hours

6. Do you know anyone who have called/Used SAMU-Service d'Aide Medical d'urgence in Rwanda?

☐Yes ☐No

7. What do you think the reasons why people need to call 912 SAMU?

☐Seeking for medical care ☐Seeking for financial support

☐I don't know why people call SAMU ☐Seeking for information regarding sports/leisure

☐Other reason, specify, …….

8. Why does the Rwandan population not call EMS-SAMU/Ambulance?

☐ Free call number 912 is not known ☐Not comfortable to call

☐Feel embarrassed calling ☐Afraid of patient's clinical condition

☐Rwanda prehospital emergency medical service is not known

☐I am aware of PHEMS but because of the time of the day like weekend or night, I can't call

☐I do not know

9. What are the barriers limiting most of people to use SAMU ambulance in case of emergency?

☐It is expensive ☐No information about it

☐It does not help much ☐Unknown

☐Others, ……

10. Evaluation of satisfaction of the care received when come at hospital
(Completed according to the qualification of the service, in accordance with the parameter below: 1. Terrible 2. Bad 3. Regular 4. Good 5. Excellent 6. I do not know)

3.1.	Was the means of transport comfortable, according to your health needs?	
3.2.	Did the means of transport arrive in considerable time to where you were?	
3.3.	The safety demonstrated by the staff during your service was	
3.4.	During the care, has your privacy been preserved?	
3.5.	EMS-Ambulance is more equipped than the other means of transport	

11.If you want to raise awareness about 912 Rwanda Prehospital Emergency Medical Service to the public, what would you do?

……
……
…….

2. Informed Consent Form

Introduction:

Hello, my name is **Dr Vizir J.P Nsengimana**, I am an Emergency Medicine and Critical Care doctor in training at University of Rwanda/College of Medicine and Health Science studying "**Assessing of the Public Awareness of the 912 Rwanda Prehospital Emergency Medical service"**. I request your participation in our study and wish to share with you important information about the project so you may understand, ask questions, and choose whether to participate or not.

Purpose of Study:

The purpose of this study is to analyze information held by the population about prehospital emergency medical service and the barriers they face limiting them to access as well as raise awareness of Prehospital Emergency Medical Service (PHEMS). This will include analyzing data with different variables including socio-demographic information (age, sex, marital status, type of insurance), the knowledge about SAMU, and the barriers limiting them to use SAMU. This study will be conducted at emergency department at CHUK, Rwanda.

Confidentiality: All information collected will be kept confidential and viewed only by members of the research team. No identifiable information will be collected and information will be randomized with confidentiality. All data will be used for research purposes only and disposed of following completion of the study.

Risks and Benefits: There are minimal risks of participation in the study, although some questions might make you feel uncomfortable. Risk will be minimized by keeping all information confidential with no identifiable characteristics recorded. Data will be shared only with members of the research team and for research purposes with disposal following the study. Careful attention will be paid to protect information recorded. No information will be shared with outside parties. The benefit of participating in the study is helping our team better understand the factors held by population associated with low usage of Rwanda Prehospital Emergency Medical Service in Kigali city, Rwanda. Although participants will not directly benefit from participation, the results of the study will help improve healthcare in Kigali and raise awareness of Emergency Medical Care for all Rwandans.

Right to Refuse or Withdraw from the Study: Participants are permitted to refuse or withdraw from the study at any time without any adverse consequences.

Contact Details: For further information or If you have any concerns or complaints about this research study, its procedures or risks and benefits, you should ask me. You should contact me at any time if you feel you have any concerns about being a part of this study.

My contact details are:

Names: Vizir J.P. Nsengimana

Phone number: +250785395837

Email: vizojpaul@gmail.com

You may also contact my research supervisor:

Names: Dr Ndebwanimana Vincent

Email: ndebwanimana@gmail.com

If you feel that any questions or complaints regarding your participation in this study have not been dealt with adequately, you may contact:

Dr Stefan Jansen, chair IRB CMHS/UR: Tel: +250784575900

Dr Rusingiza K. Emmanuel: Chairperson of Ethic Committee University teaching hospital of Kigali in Rwanda(CHUK)

Phone number: +250785466254 Email:erkamanzi@gmail.com

Munyaneza Emmanuel; University teaching hospital of Kigali in Rwanda(CHUK)/ Ethic Committee secretary. Phone number: +250788213765

Certificate of Consent:

I (patient/next of kin) have been explained the foregoing information. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Print Name of Participant/next of kin_____

Signature of Participant/ next of kin _____

Date _____/_____/_____

Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands his participation to this study. I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Print Name of Researcher/person taking the consent_____

Signature of Researcher /person taking the consent_____

Date _____/_____/_____

Day/month/year

3. CHUK and UR/CMHS IRB Ethical committee Approval

CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

Quality Health Care Training & Research

Ethics Committee / Comité d'éthique

22nd Mar,2021 Ref.:EC/CHUK/035/2021

Review Approval Notice

Dear Vizir Jean Paul Nsengimana,

Your research project: ***"Public Awareness of 912 and the Rwanda Prehospital Emergency Medical Service "***

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 22nd Mar,2021 to evaluate your request for ethical approval of the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your research project.

You are required to present the results of your study to CHUK Ethics Committee before publication by using this link:www.chuk.rw/research/fullreport/?appid=278&&chuk.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

Dr Emmanuel Rusingiza Kamanzi
The Chairperson, Ethics Committee,
University Teaching Hospital of Kigali

ETHICS COMMITTEE
CHUK

Scan code to verify.

" University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations "

Web Site : www.chuk.rw ; B.P. 655 Kigali- RWANDA Tél.: 00 (250) 252575462. E-Mail: chuk.hospital@chuk.rw

UNIVERSITY of RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

DIRECTORATE OF RESEARCH & INNOVATION

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, the 10th /11/2020

Dr Ntengimana Vizir Jean Paul
School of Medicine and Pharmacy, CMHS, UR

Notice of Renewal of Approval for Research Project: No 363 /CMHS IRB/2020

Your Project title *"Public awareness of 912 and Rwanda Prehospital Emergency Medical Service"* has been evaluated by CMHS Institutional Review Board.

		Involved in the decision		
			No (Reason)	
Name of Members	**Institute**	**Yes**	**Absent**	**Withdrawn from the proceeding**
Prof Kato J. Njunwa	UR-CMHS	X		
Dr Stefan Jansen	UR-CMHS	X		
Dr Brenda Asiimwe-Kateera	UR-CMHS	X		
Prof Ntaganira Joseph	UR-CMHS	X		
Dr Tumusiime K. David	UR-CMHS		X	
Dr Kayonga N. Egide	UR-CMHS	X		
Mr Kanyoni Maurice	UR-CMHS		X	
Prof Munyanshongore Cyprien	UR-CMHS	X		
Mrs Ruzindana Landrine	Kicukiro district		X	
Dr Gishoma Darius	UR-CMHS	X		
Dr Donatilla Mukamana	UR-CMHS	X		
Prof Kyamanywa Patrick	UR-CMHS		X	
Prof Condo Umutesi Jeannine	UR-CMHS		X	
Dr Nyirazinyoye Laetitia	UR-CMHS	X		
Dr Nkeramihigo Emmanuel	UR-CMHS		X	
Sr Maliboli Marie Josee	CHUK	X		
Dr Mudenge Charles	Centre Psycho-Social	X		

After reviewing your protocol, **Continuation of Approval has been granted to your study.**

Please note that approval of the protocol and consent form is valid for **12 months**.

Email: researchcenter@ur.ac.rw P.O Box 3286 Kigali, Rwanda www.ur.ac.rw

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrollment of participants
3. All consent forms signed by subjects should be retained on file. The IRB may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval.
5. Failure to submit a continuing review application will result in termination of the study.
6. Notify the Rwanda National Ethics committee once the study is finished.

Sincerely,

Date of Approval: November 23rd, 2020
Expiration date: November 23rd, 2021

Dr Stefan Jansen
Ag Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Innovations, UR