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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

AWARENESS OF CARDIOPULMONARY RESUSCITATION (CPR) AMONG UNIVERSITY OF GHANA STUDENTS AND AN ASSESSMENT OF THEIR WILLINGNESS TO PRACTICE CPR

BY

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE

OCT, 2019

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DECLARATION

I, YAW GOH ASARE, hereby declare that this project is an original work I have undertaken under supervision. References to other works have been fittingly acknowledged. I further pronounce that this work has not been presented for the award of any other degree elsewhere.

…………………………..   ……………………..

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……………………………   …………………….

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(SUPERVISOR)

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DEDICATION

In memory of Komla Dumor, Cheik Tiote, Marc Vivian Foe and Uriah Asante, I may not have known you personally, but you touched lives during your short stay on the planet.

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ACKNOWLEDGEMENT

I am grateful to God Almighty, the author of all knowledge, who has granted mercies for the completion of this piece of work.

The completion of this study will not be possible without the immense contribution and guidance of my supervisor Dr. Adolphina Addo-Lartey.

I appreciate the efforts of “Grandpa” Dr Alfred Doku for his assistance in the questionnaire development.

I am also gratuitous to my entire family, who have supported me throughout this course.

Lastly, to Mr Akwasi Darkwah and Miss Jennifer Quartey and to all my colleagues, I say thank you for making this course more bearable to me.

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ABSTRACT

Introduction: Sudden cardiac arrest is a gradually emerging global public health issue. Prompt administration of cardiopulmonary resuscitation (CPR) by a bystander is pivotal to improve the already slender chances of surviving cardiac arrest which occurs outside the premises of a health facility. In response, many nations have focused efforts on promoting CPR in the community to increase bystander CPR. Tertiary institutions are considered ideal settings for CPR promotion and training as the students are thought to be apt potential bystanders in the community.

Objective: The aim of the study was to investigate the awareness of cardiopulmonary resuscitation among University of Ghana students.

Methods: The design was a cross-sectional analytical study and it employed a quantitative approach. A total of 350 students were randomly sampled from 4 halls of residence at the University of Ghana, Legon campus. Information on demographic characteristics, previous CPR training, CPR knowledge, willingness to practice CPR and its influencing factors were collected through interviewer-administered questionnaire. The data were analysed using STATA version 15 software. Awareness of CPR was assessed using descriptive statistics. Relationships between CPR knowledge level and willingness level as dependent variables and demographic characteristics and previous CPR training status as independent variables were evaluated using Poisson regression and linear regression.

Results: The mean age was 21.3 years (SD=3.2), predominant age category was 20-25 years and 54.7% of the respondents were males. Most respondents were affiliated to the college of humanities (46.6%) and 16.9% were students from the health sciences. 16.8% respondents lived with a family member who was suffering from a CVD. Of the 320 questionnaires that were fully completed (response rate of 91.4%), 34.4% had no prior knowledge about CPR.

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Among those with prior knowledge of CPR, the most common sources were from movies and TV shows (32%). Only 13.4% of the students had obtained previous CPR training, most of which were from the college of health sciences (44.2%). The average knowledge score was 4.02 (SD = 2.2) out of a total of 10, which was considered inadequate in comparison to studies in other countries. Students with previous CPR training had higher knowledge scores (5.2, SD=1.8) than those without training (3.8, SD=2.2). Respondents' attributes such as age, sex, year of study, religion were not strong predictors of CPR knowledge score. Students had an overall positive willingness towards CPR with 92.5% answering that they were willing to learn CPR if the opportunity arose. However, students had some concerns about performing to strangers due to reasons such as fear of infection, fear of causing harm and lack of confidence (76.6%, 58.8% and 65.2% respectively). Males were more willing to perform CPR than females ($p<0.05$). Respondents who had a cohabiting family member with a cardiovascular disease were more willing to perform CPR than those without this attribute in both univariate and multivariable linear regression (Coeff 2.8 $p<0.05$ and coeff 2.0, $p<0.05$ respectively).

Conclusion: Although the level of knowledge about CPR among the University students was inadequate, they indicated satisfactory willingness to learn and practice CPR. Relevant stakeholders in health care delivery must take advantage of this interest to train university students in basic CPR skills so that they can offer timely bystander CPR and help reduce the mortality associated with sudden cardiac arrest.

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LIST OF ABBREVIATIONS

ABC Airway, Breathing, Circulation

AHA America Heart Association

BLS Basic Life Support

CPR Cardiopulmonary Resuscitation

CVD Cardiovascular Disease

ILCOR International Liaison Committee on Resuscitation

LMICs Low and Middle-Income Countries

NCDs Non-Communicable Diseases

OHCA Out-of-hospital Cardiac Arrest

SCA Sudden Cardiac Arrest

SCD Sudden Cardiac Death

WHO World Health Organization

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DEFINITION OF TERMS

Awareness – refers to public knowledge or understanding about an issue which leads to action or change in behaviour.

Basic life Support - More advanced resuscitative skills than CPR usually required for hospital setting.

Bystander CPR - CPR that is performed by a layperson or a non-health aligned person in public places.

Cardiopulmonary - Relating to the heart and blood vessels and the lungs and airways.

Cardiopulmonary Resuscitation - A set of procedures to restore blood circulation and breathing in a person who is in cardiac arrest.

Cardiovascular diseases- relating to diseases of the heart and blood vessels

Defibrillation - Delivering of an electric shock to stop an irregular heart rate and rhythm.

Out-of-hospital Cardiac Arrest- Cardiac arrest occurring outside the health facility setting.

Resuscitation – The action of correcting physiological disorders (such as lack of breathing or heartbeat) in an acutely ill patient.

Sudden Cardiac Arrest - Abrupt cessation of the heartbeat that can result in death

Sudden Cardiac Death - Sudden death of cardiac origin.

Willingness – the state of being prepared/ready to perform an action if needed.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Developing nations are now facing what has been dubbed “the double burden of disease”. Infectious diseases and under nutrition are still not under control, yet non-communicable diseases such as cardiovascular diseases (CVDs) are on the rise and poses an increasing public health threat. According to the WHO, CVD is the leading cause of death worldwide (World Health Organization, 2017). Also, At least 75% of the world's CVD mortality occur in low- and middle-income countries (WHO, 2017).

With the rise in the number of CVD cases, conditions such as out of hospital cardiac arrest (OHCA) are also on an upsurge since CVDs are responsible for up to 80% of these cardiac arrests (Veronese, Wallis, Allgaier & Botha, 2018). Cardiac arrest is the abrupt, unforeseen loss of heartbeat, breathing and consciousness which can result in sudden cardiac death if not treated immediately (American Heart Association, 2018). US data reports sudden cardiac arrest as the leading cause of all-mortality with over 465000 cases (36% of all causes of death). Out of this number, two-thirds occur outside the premises of a hospital (“CPR facts & stats", 2018). It is estimated that premature deaths from CVD in people aged 35-64yrs are to increase by 41% by the year 2030 (Roger et al 2012). Here in Ghana, among 140 cases admitted into various hospitals in the Eastern Region with sudden collapse in 2012, 34 died (24.3%) and out of 157 admitted in 2013, 31(19.7%) died (Sulemana, 2018). It was however unconfirmed how many of the sudden collapse cases were as a result of a sudden cardiac arrest (SCA).

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Deaths from OHCA can be averted by a proposed concept known as the “chain of survival” (Chamberlain & Hazinski, 2003). It includes prompt lay cardiopulmonary resuscitation (CPR), efficient emergency services, improvement in in-hospital cardiac care. The first and arguably the most important of these factors is prompt and effective bystander CPR. Survival rate is decreased by 10% for every minute of delay in initiating CPR (Go et al, 2013).

CPR is a lifesaving skill essential in cases of accidents, near-drowning, electrical injuries, choking and cardiac arrests (Chamberlain & Hazinski, 2003). Lay/bystander CPR is performed by a non-health aligned person in public places. About 45% of OHCA victims in the U.S survived when bystander CPR was administered ("CPR Facts & Stats", 2018). Global bystander CPR rates (the percentage of cardiac arrest victims who receive CPR) vary between 5% and 80 % (Bottiger et al, 2018).

Training school children to administer CPR has been the norm in Scandinavia since the 1970s as a strategy to promote CPR among the population (Haydon, Van der Riet, Maguire, 2017; Kanstad, Nielson & Fredrikson, 2011). Its success attained was so telling that other developed nations followed suit. Eventually in 2003, the International Liaison Committee on Resuscitation, ILCOR, which is the organization responsible for providing the global best standards in resuscitation, recommended strongly that CPR education be incorporated in the school curriculum globally (Chamberlain & Hazinski, 2003). Presently, in many developed countries such as the USA, Denmark, Norway, CPR training is a compulsory requirement for secondary education (Brown, Lynes, Carroll & Halperin, 2017).

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A limited amount of literature on CPR exists in Africa and other LMICs. Some research has been done on CPR knowledge among health workers in Ghana. Akumiah (2015), in his work at Presbyterian Hospital Koforidua, revealed that the knowledge of nurses on the components of CPR was inadequate. He also concluded that based on a quality scale, the CPR performed by the nurses was below standard (Akumiah & Sarfo, 2015). Sulemana (2018) also concluded in his work that CPR knowledge among health staff was low in Ghana.

There is a strong tendency to conclude that if the literature suggest CPR skill is low among health workers in developing nations then it must be extremely low in lay people hence no need for this study. Granted the above conclusion pertains it is still worth assessing the knowledge and willingness of the community to perform CPR since most OHCAs occur in the home (>70%) and public places (18.8%) where health workers may not be available ("CPR Facts & Stats", 2018; Grasner et al, 2016). Moreover, ILCOR in their 2016 annual meeting concluded that "any CPR is better than no CPR among lay rescuers." They encouraged the use of compression-only resuscitation (the least skill required) among lay resuscitators (Perkins et al, 2017).

Another argument that can be raised is that the chain of survival depends on a good emergency care system (EMS). Therefore in a developing country like Ghana where the EMS is considered ineffective (Sulemana, 2018), performing CPR may just be a way of postponing death since the survivors following CPR will eventually be failed by the weak emergency care system. Alternative perspectives may suggest emphasis on the EMS should take priority over lay CPR. This may seem reasonable. However, a time is coming when the emergency system will improve as Ghana is developing further and the populace's training in CPR must precede that time so that more lives can be saved. Furthermore,

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survival for some other emergencies such as drowning is significantly improved with lay CPR alone (Ewy & Gordon, 2017).

Altogether, it is incumbent on the leaders of developing nations to empower a group of potential bystanders within the population to confidently administer CPR when needed. The cohort of people with a fair level of understanding and developed physical ability to do basic life support is tertiary level students (Lesnik, Lešnik, Golub, Križmarić, Mally & Grmec, 2011). Hence, a study to assess their awareness of CPR and further determine their willingness to learn or perform CPR is of prime concern.

1.2 Problem Statement

Sudden cardiac death (SCD) can be explained in simple terms as an unexpected death that occurs following sudden cardiac arrest (SCA) usually due to an underlying cardiovascular disease (Sovari & Rottman, 2014). Non communicable disease burden in Ghana has been well described by WHO, as causing 47% of all-cause mortality across the nation; CVDs accounting for 19 % (WHO, 2018). As CVD is the pathology underlying SCA, it is analogous to expect a rise in SCD. It is estimated that SCD accounts for 7 million deaths per year, worldwide (Sovari & Rottman, 2014). Based on 2016 WHO data, the risk of premature death between ages 30-70 years in Ghana was estimated to be 21 % (WHO, 2018). Morbidity and mortality data on sudden cardiac arrest in Ghana is not readily available.

A cohort study was done in Cameroun where mortality was monitored over 12 months among 86,188 inhabitants aged more 18 and above gives a clear picture of the burden of SCA in Sub-Saharan Africa. In the study, the cause of death was investigated by 2

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physicians and confirmed by 2 pathologists. It was found that there were 27 SCDs out of 288 all-cause mortalities within the period. Out of this 27 SCDs, 17(63%) occurred out-of-hospital (88.2% of this subset occurred at home). Twenty-four (24) out of the 27 SCA cases were witnessed by relatives with lay bystander CPR attempted in only 1 case. (Bony et al, 2017).

SCA is considered graver than other final death pathways of CVDs. It affords little time to its victims as death occurs within 60 minutes of onset of symptoms. Also, whereas other CVD complications target the elderly, SCA usually occurs in the working population and can have negative economic implications to families, the community and the nation at large. This study in neighbouring Cameroon portrays a rising public health problem in sub-Saharan Africa that pre-emptive measures must be developed for control. Bystander CPR, a component of the chain of survival in SCA, has been thoroughly investigated and is a partial remedy to the problem.

SCA and CPR receives little attention from Ghana's medical fraternity as evidenced by scarce research. The media accords short-lived awareness on SCA when an important person dies from a sudden cardiac death. Therefore a study on awareness level of CPR among a population dubbed as good community lay rescuers (university students) is worthwhile and timely (Liberman, Golberg, Mulder, & Sampalis, 2000; Lešnik et al., 2011). It will promote CPR and influence the other links in the "chain of survival" concept to holistically improve SCA survival in Ghana.

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1.3 Justification

The findings from this study will give information on the level of awareness of CPR among university students who represent the lay community as well as their willingness to learn or practice if ever that opportunity is given them. It will serve as a document to influence policies to begin CPR training in the schools in Ghana and in sub-Saharan Africa. The study will highlight the essence of the chain of survival concept and stimulate further research in its other components. This move should improve survival of out-of-hospital cardiac arrest which is a major public health burden in low and middle-income countries. The study will also contribute to the existing literature on CPR to bridge the knowledge gap of the subject matter in the sub-region.

1.4 Research Questions

1.4.1 General Research Questions

1. What are the awareness and knowledge levels of CPR and willingness to practice CPR among University of Ghana students?

1.4.2 Specific Research Questions

1. Is there a relationship between previous CPR training and the level of knowledge of CPR?
2. Is the CPR knowledge level among students influenced by the demographic characteristics of the students?
3. Are the students' willingness to practice CPR influenced by their demographic characteristics?

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1.5 Study Objectives

1.5.1 General Objective

To investigate the awareness of CPR among students of the University of Ghana and their willingness to practice CPR.

1.5.2 Specific Objectives

1. To estimate the relationship between previous CPR training and the level of knowledge about CPR.
2. To assess the relationship between demographic characteristics and the knowledge of the students in CPR.
3. To assess the relationship between demographic characteristics and the willingness of the students to practice CPR.

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1.6 Conceptual Framework

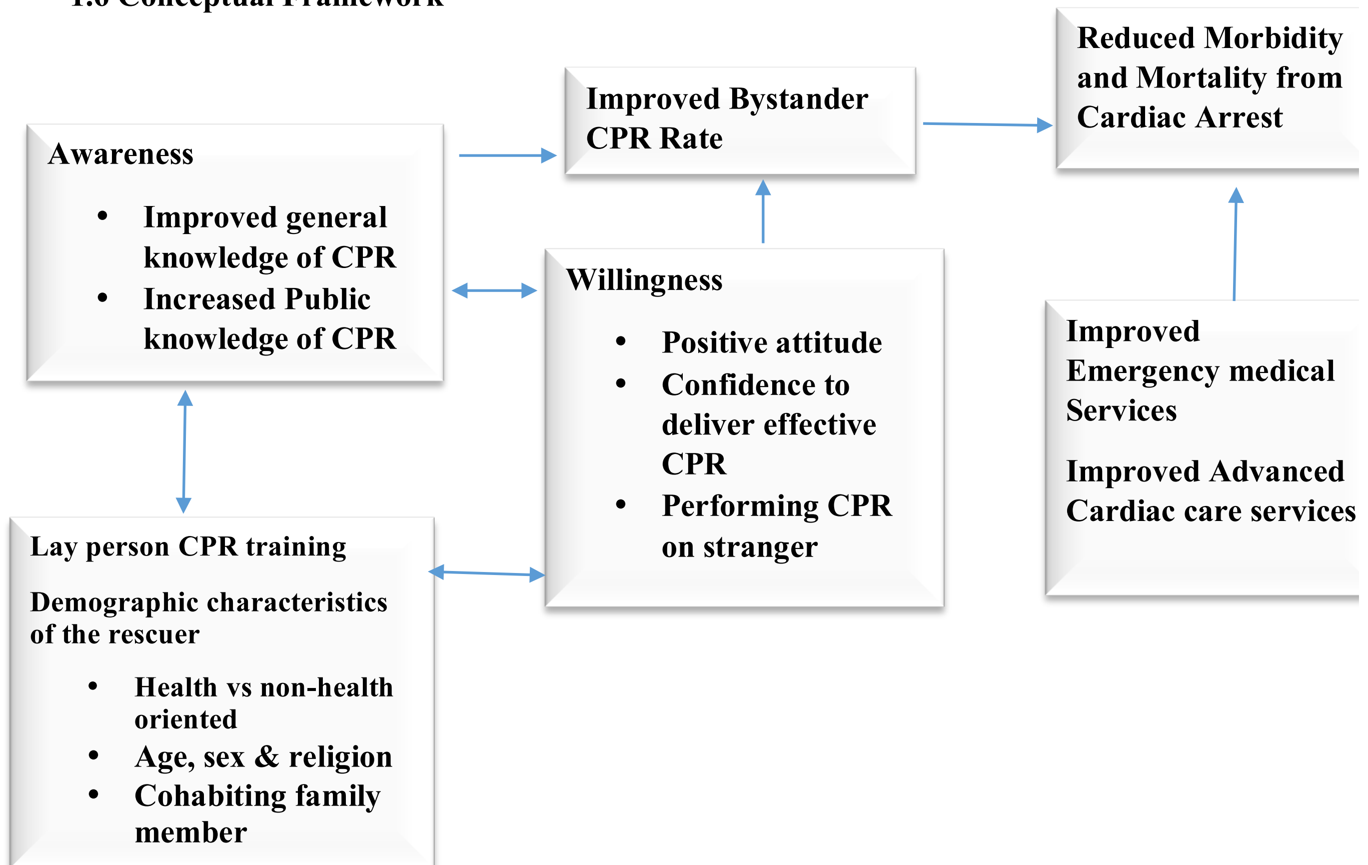

Figure 1. Conceptual Framework: Factors that influence CPR Awareness and Willingness yielding improved Bystander CPR Rates.

1.6.1 Narrative of the Conceptual Framework

Bystander CPR has been found to improve outcomes associated with OHCA. CPR promotion through training in schools, free voluntary CPR training and increased publicity of CPR and education on consequences of cardiac arrest may increase awareness of a greater proportion of the population. The more familiar potential bystanders become with the steps and indication for CPR the more positive their attitude will be towards learning and performing CPR and the more confident they will become to performing effective CPR, even on non-relatives (strangers). Eventually, mortality and poor health outcomes from OHCA is expected to reduce.

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concept of Sudden Cardiac Arrest

2.1.1 Definition of Sudden Cardiac Arrest

Cardiac arrest is defined as a cessation of the heart beat confirmed by the absence of vital signs, such as pulse, blood pressure, respiratory rate and loss of consciousness. It is sudden and unexpected without preceding symptoms or within 24 h of the onset of symptoms (AHA, 2010). The loss of vital signs is due to stoppage of blood flow to vital organs (brain) resulting in death if not intervened. A sudden cardiac death (SCD) is defined as unforeseen death of cardiac aetiology that occurs within 24 hours of symptoms' onset in a person with a history of known or unknown cardiac disease (Sovari & Rottman, 2014). A prevailing sequel among survivors of SCA is neurological damage.

2.1.2 Aetiology of Sudden Cardiac Death

Classification of SCA can be done according to aetiology (cardiac vs. non-cardiac), circumstances (witnessed vs. unwitnessed) and location (out-of-hospital vs. in-hospital). Seventy-five percent of sudden non-traumatic deaths occur in people with previous cardiovascular disease. The remaining 25% is from non-cardiac causes. Most common causes of SCAs are cardiac arrhythmias (abnormal electrical activity), typically ventricular fibrillations (Field et al, 2010).

SCA is not synonymous to heart attack (myocardial infarction). A heart attack is where a part of the cardiac muscle has blood flow cut off usually for more than 20 minutes commonly due to plaques blocking coronary arteries (coronary artery disease). Coronary

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artery disease (CAD) is actually the lead cardiovascular pathology in most SCD cases (Hayashi, Shimizu, & Albert, 2015). Other cardiac causes of SCA include structural diseases of the heart (cardiomyopathy and valvulopathy) and inherited diseases of the heart such as long QT syndrome.

It is possible to reduce a person's risk of SCA by reducing his/her cardiovascular disease risk factors through a healthy lifestyle, getting regular check-up, screening for inherited heart diseases and being compliant to medications if one is known to have a CVD (Hayashi et al, 2015). Respiratory failure, circulatory shock, and metabolic imbalances (e.g. hyperkalaemia) are examples of non-cardiac causes of cardiac arrest.

2.1.3 Epidemiology of Cardiac Arrest

Westernization and modernization of the Ghanaian citizenry has had lots of positives for making life more convenient. On the contrary, along with it comes an ageing population and unhealthy lifestyle practices that put the majority of people at risk of cardiovascular diseases. Exposure to various modifiable risk factors is responsible for at least three quarters of all CVDs (WHO 2017). Cardiac arrest may be the first manifestation of cardiovascular disease and it is often the last, as its survival rate is low worldwide (Sovari & Rottman, 2014). Major risk factors for cardiac arrest include previous coronary heart disease, increasing age and male gender. Other risk factors are a personal history of arrhythmias, a personal or family history of SCA or inherited disorders of the heart's electrical system and drug or alcohol abuse.

Sudden cardiac death is a growing health problem in many states. More than 7 million lives per year are estimated to be lost, globally, to SCD (Bottiger et al, 2018). "There are

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approximately 326,200 OHCA and 209,000 in-hospital cardiac arrests in the USA yearly ("CPR Facts & Stats", 2018). This finding is no different in other regions of the world. Incidence of patients with OHCA considered for resuscitation per 100,000 population is 55 in Asia, 86 in Europe, 103 in North America and 113 in Australia. The incidence of OHCA where resuscitation was attempted per 100,000 population is 32 in Asia, 35 in Europe, 58 in North America, and 44 in Australia". (Sayre et al, 2010). The latter concept describes the term bystander rate; i.e. the number of OHCA cases that receive attempted resuscitation. It is obvious the bystander rate is low across the globe which means most victims of OHCA die without receiving any intervention.

There is evidence to suggest that survival after SCA is improving. This has been attributed to improvement in the elements of the "chain of survival" concept such as CPR quality and quality of post-arrest/post-resuscitation care (Sayre et al. 2010).CVDs and SCA are not given the required attention they deserve as with other non-communicable diseases in Africa. There are many unenforced policies and national programs for CVD and surveillance and reporting systems are also non-functional (WHO, 2017)

2.1.4 Recognizing Sudden Cardiac Arrest

The initial sign of sudden cardiac arrest is typically sudden collapse or loss of consciousness concurrently occurring with, no audible heartbeat or palpable pulse, no breathing. Other symptoms that may precede arrest are palpitations, chest tightness, shortness of breath, dizziness. Most of the time, there are no warning signs prior to SCA (Sovari & Rottman, 2014). Recognition of SCA may be difficult even for some inexperienced healthcare providers. It is for this reason that the 2010 CPR guidelines

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simplified recognition by restricting it to assessing unresponsiveness and absence of normal breathing (no breathing, or gasping). Therefore, the traditional “Look, listen and feel” is no more applicable in the simplified basic life support. (BLS) algorithm. (Field et al, 2010)

2.2 Chain of Survival Concept

It is a universal concept theorized to improve survival following a cardiac arrest event. The fundamental principles underlying a cardiac event’s resuscitative effort are linked in steps of this so-called “chain of survival” (see figure 2 below). It was developed by the AHA in 1991(Cummins, 1993). Since its inception it had improved cardiac arrest survival worldwide and if applied effectively, survival can approach 50%. Unfortunately true survival probabilities have varied between 5-50%. (Möhr, 2011). The links include;

1. Early recognition of arrest and appropriate activation of emergency medical systems
2. Prompt CPR; regardless of the quality.
3. Early Defibrillation.
4. Early advanced care and continued care at tertiary cardiac care units i.e. intensive cardiac care units. Post-cardiac arrest care also includes rehabilitative services for survivors.

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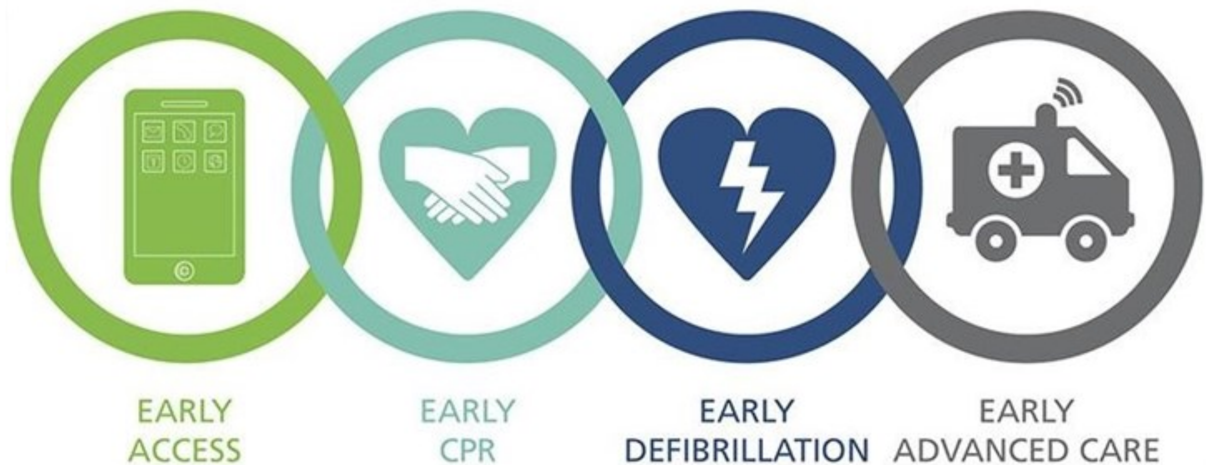

Figure 2 Diagram Showing the Links of the Chain of Survival Concept.

(Source: AHA, 2015)

2.3. Elements of Cardiopulmonary Resuscitation

CPR is a subset of basic life support (BLS). BLS training is more advanced and encompasses practices of increased complexity and deeper coverage of CPR fundamental principles that are usually required for the hospital setting for health workers (Andrade, 2018). Ensuing discussions in this chapter will be based on fundamental skills of CPR, although they may be used interchangeably.

All other resuscitation councils' algorithms are derived from the universal ILCOR cardiac arrest algorithm (see Figure 3).

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2.3.1 Chest Compressions

Following recognition, the next step in the resuscitation efforts is effective chest compression. Compressions are best delivered with the victim is positioned supine on a firm surface. The compressive force is applied over the lower half of the sternum to a depth of 5 cm. The optimal compression rate is at least 100/minute (AHA, 2010). The number of chest compressions per minute delivered during CPR is a strong determinant of return of spontaneous circulation (ROSC) and post- arrest survival with good neurologic function (AHA, 2010). There should be a 3:1 ratio of compressions to ventilations, with 90 compressions and 30 breaths to achieve approximately 120 events per minute. (AHA, 2010).

During a cardiac arrest the heart stops and fails to function (pump out blood). Chest compression squeezes the heart in between the sternum and the spine (increasing intrathoracic pressure) which establishes improvised cardiac pump mechanism to drive out blood into the systemic circulation to be delivered to the vital organs.

CoSTR 2015(the 2015 International Consensus Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations) proposes Hand-only CPR especially for lay rescuers (Kitamura, 2016). Compressions are preferred over ventilation for the following reasons:

1. Blood to be pushed to the brain is already oxygenated and lungs typically contains enough oxygen to prevent serious hypoxia.
2. Brain cells are more susceptible to ischemia than hypoxia.
3. It is generally easier to commence compressions. (Möhr, 2011).

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2.3.2 Airway management and ventilation

Traditional resuscitation sequence stipulated tackling problems concerning airway, breathing, and circulation (ABC) in that order. However following review in the 2010 CoSTR guidelines, this concept has been replaced with circulation, airway, breathing (CAB) sequence bringing into sharp focus the importance of chest compressions (Ewy & Gordon , 2017). It also serves to reiterate the point that all airway interventions should be performed swiftly in order not to delay chest compressions. Simple airway opening manoeuvres include the head-tilt or chin-lift which is done when the victim has been cleared of head or neck injury (if suspected, a jaw thrust is preferred). The assistance of ventilation is achieved by offering rescue breaths adequate to visibly raise the chest (Möhr, 2011).

2.3.3 Electrical therapy

Defibrillation basically delivers a dose of electrical current to the heart to re-establish normal heart rhythm following a cardiac arrest (Möhr, 2011). Defibrillation is only indicated in ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT). In asystole or pulseless electrical activity, defibrillation is not recommended (Ewy & Gordon, 2017). Prompt CPR prolongs VF, retards asystole, and lengthens the gap for successful defibrillation.

Typically, defibrillation shocks are delivered using an automated external defibrillator (AED) which is commonly found in public places such as malls and sports arenas in the developed world (Sovari & Rottman, 2014). AEDs diagnose electrical abnormality and

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shocks victim automatically. The machine usually gives step by step voice instructions to users and it is good for lay rescuers (Möhr, 2011).

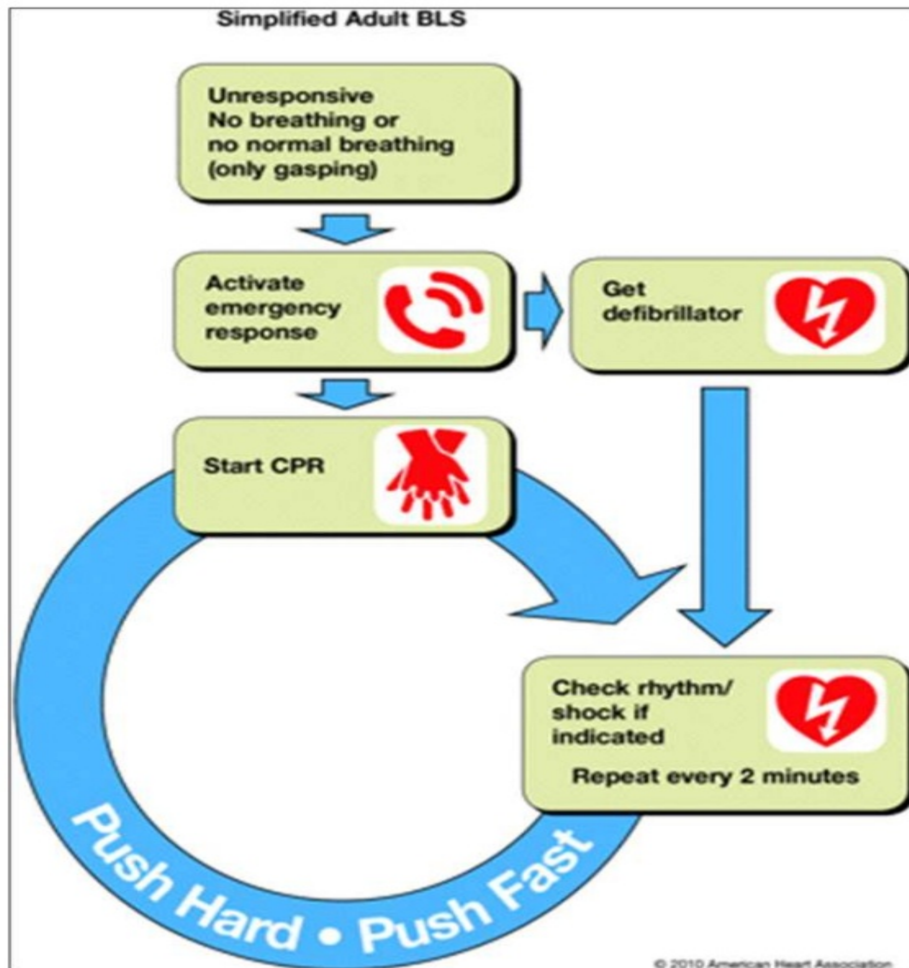

Figure 3. Diagram of Steps Involved in a Simplified Adult BLS.
(AHA, 2010)

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2.4 Effectiveness of Cardiopulmonary resuscitation

Table 1-The Return of Spontaneous Circulation (ROSC) and Survival Percentages in Different Cardiac Arrest Situations.

Situation	ROSC (%)	Survival (%)
Witnessed in-hospital cardiac arrest	48	22
Unwitnessed in-hospital cardiac arrest	21	1
Bystander cardiopulmonary resuscitation	40	4
No bystander CPR	15	2
Defibrillation within 3-5 minutes	74	30

(Botha, Geyser & Engelbrecht, 2012)

The table above demonstrates that the probability of achieving return of spontaneous circulation (ROSC) and surviving a witnessed arrest is generally higher than that of an unwitnessed arrest. Percentage of ROSC and survival is also lower in bystander resuscitation than in in-hospital resuscitation. This is obvious as the highly skilled human resource such as anaesthetists and equipment needed to keep people alive are readily available. The importance of early defibrillation is clearly realized on the percentages of both the ROSC and the survival of patient. To reiterate, effective chest compression delays tissue death and provides a brief window of opportunity for defibrillation leading to successful recovery without permanent brain damage (Botha et al, 2012)

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2.5 Cardiopulmonary Resuscitation Guidelines

The International Liaison Committee on Resuscitation (ILCOR) was founded in 1992 with the purpose of providing a platform for collaboration between predominant resuscitation organizations worldwide. Member representation includes, the American Heart Association (AHA), the European Resuscitation Council (ERC), Heart and Stroke Foundation of Canada, Resuscitation Council of Asia and Australian and New Zealand Committee on Resuscitation (Field et al, 2010). Africa's only representative on the committee is the Resuscitation Councils of Southern Africa (RCSA). All other African countries have no recognized resuscitation body and adopt policies and guidelines from some of the above-listed organizations. In Ghana, for instance, the AHA basic life support (BLS) and advanced cardiac life support (ACLS) courses sets the standard for resuscitation care. It may be noticed that most of the facts in the text is in reference to the AHA guidelines.

ILCOR reviews international knowledge and evidence on CPR to offer new recommendations every 5 years. The latest review, the CoSTR 2015 document (i.e. the 2015 International Consensus Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations) was released in 2015 (Perkins et al, 2017). The various resuscitation organizations base their respective guidelines on this consensus guideline provided by ILCOR.

2.6 Bystander Cardiopulmonary Resuscitation.

Bystander CPR is defined as CPR that is performed by a layperson or a person who is not part of the organized emergency-response system in a community (Rivera, Kumar, Bhandari, & Kuma, 2016). An OHCA's survival rate is estimated to be even lower,

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between 2% to 15 % than one occurring in a health facility. This rate is doubled or even tripled when a bystander promptly performs CPR according to AHA (AHA 2015). Bystander CPR is entirely a hands-only CPR and it involves only chest compressions unlike the traditional CPR.

Global bystander CPR rates widely vary between 5% in developing nations and 80 % in the developed world (AHA, 2018).

A 2006 United States studied the circumstances surrounding 868 cardiac arrests. Of the bystanders, 54.1% had been taught CPR at some point in the past. In 21.2% of cases, the bystander immediately started CPR. Common barriers to initiating CPR included: 37.5% stated that they panicked, 9.1% perceived that they would not be able to do CPR correctly, 1.1% cause injury to patient. Other include fear of disease transmission especially MTM, legal implications. (Honeycutt et al 2006). These drawbacks to CPR practice which is occurring in a highly developed region such as the USA only leaves a researcher to wonder what pertains in Africa. There is, therefore, a need to improve global bystander rates through CPR promotion.

2.7 Promotion of Cardiopulmonary Resuscitation

Following the above discussions about the pivotal role bystander CPR plays in the elements of the chain of survival, the significance of CPR promotion among the lay population is widely recognized. Most CPR promotion activities across the globe target a sub-section of the population since accessibility and financial constraints prevent the use of the whole population, Non-health workers that receive mandatory CPR training include men of service such as soldiers, firemen, police men. Voluntary training is reserved for gym instructors, teachers, day care workers, sports trainers, coaches and sportsmen. There are

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also voluntary training centres in the developed world for training the public and offering CPR certification. In Ghana, the Ghana Red Cross Society and Africa Partners Medical are known to organize voluntary training to lay people. CPR promotion is carried out through other activities such as adverts on media space and setting up a day to promote CPR such as "world save a heart day" which is celebrated every October 15 (Bottiger et al, 2018).

2.7.1 Cardiopulmonary Resuscitation Training in Schools

CPR promotion to students started in the Eastern European countries such as Denmark and Norway (Kanstad et al, 2011). CPR education among students and the public is highly recommended by ILCOR (Chamberlain, Hazinski 2003). The AHA has included CPR into the school curricula such that it is a compulsory requirement for all high school graduates as of 2018 (AHA, 2018).

The question to answer is at what level should CPR be taught to students? A few studies done to investigate the feasibility of imparting resuscitation skills to school children found that although students under 9 years of age easily learned and understood the skills, their physical attributes limited their ability to sustain adequate depth of chest compressions and ventilation volumes (Fleischhackl et al, 2009). Liberman et al (2000) concluded that as teenager's age, their skills improve. There have been several studies on the CPR knowledge, attitudes and effectiveness of CPR training among students of high school or secondary school which have found them to be good candidates for curriculum inclusion (Kanstad et al, 2011; Ma et al, 2015; Zinckernagel et al, 2016). Also, CPR-trained students were generally more willing to practice their skill and have a higher probability to perform

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CPR in a real emergency situation than non-trained persons (Bray, 2017) For instance, studies that investigated high school students' knowledge and skills of BLS in Korea, German and Denmark reported that there was significant improvement in knowledge level, confidence and willingness to perform after training in CPR (Aaberg et al, 2014; Min, 2015). In addition, the confidence in resuscitation skills was positively related to the knowledge and willingness to perform CPR (Zinkernagel et al, 2016).

2.7.2 Cardiopulmonary Resuscitation among Tertiary students

The tertiary level of education which includes colleges and universities have been purported to be the ideal settings for CPR curricula inclusion. Studies have concluded that students in these institutions have adequate physical and mental development to assimilate and practice CPR (Lešnik et al, 2011; Liberman et al, 2000). The findings from recent studies on CPR among tertiary students suggested that they recognized the importance of CPR training and were ready to participate although their knowledge level was inadequate (Lu et al., 2016; Hung et al, 2017). Studies with pre and post-tests findings showed that students' willingness, knowledge and self-efficacy increased after training (Govander et al, 2010).

Hung's (2017) study in Hong Kong revealed the following:

The mean knowledge score was 4.97 out of 10 with a standard deviation of 1.61. Over half of the respondents (n = 194, 55.3%) had attended a CPR course before. The mean attitude score was 26.53 out of 30, and the standard deviation was 2.68. Most of the respondents (87.0%) showed a willingness to perform CPR. The reasons for attending CPR training

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were mainly “interest” (n = 106, 46.5%), followed by “extra-curricular activity” (n = 37, 16.2%), “to help family and friends in need” (n = 37, 16.2%) and “others” (n = 29, 12.7%) such as to fulfil job or academic requirement. The most frequently reported inhibitors of performing bystander CPR were a lack of confidence due to forgetting CPR procedures (28.8%) and lack of confidence due to not having received any CPR training (19.1%).(Hung et al, 2017) As noticed above, there are no African studies among the referenced studies, a gap this project seeks to bridge.

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CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

This study is a quantitative cross-sectional survey in which data about the respondents' knowledge on CPR and their willingness to practice the technique was assessed simultaneously. The study was conducted in May and June 2019 with data collected over a month's duration through questionnaire administration.

3.2 Study Location

The study was conducted at a centre for tertiary education precisely the University of Ghana Legon campus located about 13 kilometres North-east off the centre of Accra. The University of Ghana is the premier public university established in 1948. It is also the largest, with a student population of over 38,000 of which two-fifths are females. Included in this number are about 3000 postgraduate students and about 3000 students on modular or sandwich programmes. The institution additionally has international students from 70 different countries. The university is run on a collegiate system which includes college of basic and applied sciences, college of education, college of health sciences, and college of humanities. The survey sampled students from across these colleges. The university has 14 halls of residence and 2 hostels ("Overview, University of Ghana", 2018).

3.3 Study Population

The target population was students (undergraduate or postgraduate) of all ages at the University of Ghana.

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3.4 Sampling

3.4.1 Sample Size Estimation

The sample size was computed using the Cochran 1977 formula. From previous studies, the proportion of bystanders who performed CPR was found to be between 5 and 20% for many developing nations (Bottiger et al, 2018, Grasner et al, 2016). Following thereof, we will assume 20% as proportions for this study.

$$N = \frac{Z^2pq}{d^2}$$

Z = z score for 95% confidence interval

P = estimated prevalence

q =complement of estimated prevalence

d = precision (fixed at 5%)

$$\frac{1.96^2 X\ 0.3 X\ 0.7}{0.05^2} = 245$$

Adding an excess of 100 students to cater for nonresponse and to obtain a larger sample size for more reliable inferences eventually yielding a total sample size of 350.

3.4.2 Sampling Approach

Sampling was done on the Legon campus using two stages of multistage random sampling. Four randomly selected halls of residence which have students from all year groups were selected by balloting. Pieces of paper with names of all the 14 halls of residence was folded in a similar technique. Through a process of selection with replacement all the 4 halls were selected. The selected halls of residence after balloting were Mensah Sarbah Hall, International students Hostel, Jubilee Hall and Elizabeth Sey Hall with an accommodated student capacity of 1900, 427, 816, and 1980 respectively. Current information on capacity was sought from the respective hall administrators with the permission of the hall tutors.

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The total number of students in all the halls, 5123, was then computed as the sum of the number of students in the individual halls.

Following that, proportionate stratified random sampling was employed to find the number to be sampled from each hall based on a sampling fraction 'n'. Sampling fraction 'n' was calculated as the desired sample size (350) divided by the total number of students in the 4 halls (5123). The required number of students to be sampled from each hall then becomes sampling fraction multiplied by the total number of students who resided in that hall. Simple random technique with a yes/no ballot was then used to select students at the hall of residence till the number required from that hall was achieved. From the description above 130, 30, 60 and 130 were sampled from the Mensah Sarbah Hall, International students Hostel, Jubilee Hall and Elizabeth Sey Hall respectively.

3.5 Data Collection

The questionnaires were administered using in-person interviews at the halls of residence with prior consent from the respective hall tutor or hall representative. This was selected ahead of self- administered questionnaires based on the higher incomplete response rate which was revealed during the pre-test due to students being unaccustomed to the scope of the topic CPR. They understood the concept only when a further explanation was given by the interviewer despite making available a participant information sheet which gives a brief background to study. Using an interviewer ensured that students were encouraged to fully complete questionnaires.

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The respondents were expected to complete the questionnaire at an estimated time of 10 minutes determined during the pre-testing. Pre-testing was done among 15 students from the 2018/2019 Master of Public Health class to enhance validity of the questionnaire.

A total of four data collectors (one of them was a University of Ghana MPH graduate and 3 other undergraduate students from the University of Ghana) were recruited to assist with data collection. It was ensured that they were all fluent in English language and have had some experience in data collection in Public Health research or similar disciplines. The training was held for data collectors one month prior to data collection. Training topics entailed a description of the concept behind the research with an explanation of the questions in the questionnaire as well as importance of conforming to the ethical guidelines of the study. Data collection was done between the months of May and June 2019.

3.6 Data Collection Instrument

The questionnaire was developed after review of other questionnaires used in previous studies like in Saudi Arabia and Jordan (Ahmed et al 2018; Pei-Chuan Huang et al, 2018; Hung et al, 2017; Alsharari et al, 2018; Jalaly et al, 2008). The questionnaire was reviewed by a local cardiologist, emergency physician and 2 experienced American Heart Association BLS instructors. It was validated through pretesting and reliability estimated with Cronbach's alpha score of 0.8. Following pre-test, it was decided that the knowledge questions be reviewed to true or false questions to reduce the level of non-response as the students considered the original best-choice format laborious. The structured questionnaire, written in English consisted of four parts: personal characteristic information, information related to CPR awareness and training, CPR knowledge and willingness to practice CPR

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responses (including factors which might affect willingness to practice). Most of the questions in the first two parts required one answer with few questions allowing multiple responses.

3.7 Study Variables

The dependent variables for the study was knowledge score and the willingness scores. The knowledge score was a composite score from 10 questions on CPR knowledge with "true" or "false" or "don't know" answer choices. One mark was allocated for each correct answer for knowledge item questions resulting in a possible total score ranging from 0 to 10. "Don't Know" answers were treated similarly to incorrect choices. Four Knowledge questions were based on deciding on which cases will require CPR, the assessment of CPR and early response measures. Also the knowledge on the emergency number of Ghana's ambulance services was assessed. 4 questions were based on the CPR steps proper with a question on correct adult CPR sequence, compression location, number and rate of compression (See appendix 1 for questionnaire). This work was restricted to adult CPR and not paediatric as the latter presents a more complex problem and it requires more skilled rescuers.

The assessment of willingness to practice CPR had 2 parts. Part 1 assessed people to whom participants will readily offer CPR and part 2 described the concerns a person may have to prevent him from offering CPR to a stranger (causing harm, contracting a contagious disease from the procedure, legal concerns etc.). Each item in this scale scored between 5 "strongly disagree" 4 "agree" 3 "neutral" 2 "disagree" and 1 "strongly agree" for the first part and 1 "strongly disagree" in that order to 5 "strongly agree" for the second part (Scores

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for each question with negative statements were reversed as seen above). The scale for the scores of the individual items was then totalled with potential scores ranging from 11 to 55. Higher scores represented the more positive willingness to practice CPR. Questions on factors which might affect CPR will lay emphasis on barriers to performing CPR.

Table 2-Study Variables and their Scales of Measurement

Variable Type	Name of Variable	Scale of measurement
Dependent variables	Willingness score	Multiple ordinal variables- composite score (continuous)
	Knowledge score	Composite score (treated as count)
Independent Variables		
	Age	Continuous
	Sex	Binary
	Religion	Nominal
	Program of study	Nominal
	Year of Study	Nominal
	Cohabiting family member with CVD?	Binary
	CPR training status of participant	Binary

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3.8 Data Analysis

Data was transcribed from the questionnaire and captured into Microsoft excel before importing into Stata 15 software for data processing and analysis. Descriptive statistics were used to analyse the data on personal characteristics information and the information related to CPR awareness and training.

The correct answers for knowledge were provided in a marking scheme based on which individual scores for CPR knowledge was totalled and entered into excel spreadsheet. Knowledge score was treated as a count data as the number of correct responses. Description statistics of this score was then performed as well as the relationship of demographic factors and this score evaluated with Poisson regression with the robust standard error computation and p-value < 0.05 indicated statistical significance. Univariable Poisson regression was then done to answer the third objective of estimating the relationship between knowledge score and CPR training status. Chi test was used to compare correct responses for individual knowledge item questions between students with previous CPR training and those with no previous training.

The score for total willingness was computed by adding the scores given to the individual responses on a Likert scale questionnaire. Simple Linear regression was then used to identify significant differences in the CPR willingness scores between respondents who had previous CPR training and those who had no training in CPR. And also multiple linear regression used to estimate the effect of demographic factors on the willingness score, p-value < 0.05 indicated statistical significance. A spearman correlation was then used to examine relationship between the CPR knowledge score and the willingness to practice score.

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3.9 Ethical Consideration

Clearance for study was sought from the Ghana Health Service Ethical approval committee (ERC) for the Community–based study which involves humans with the reference number GHS/RDD/ERC/Admin/App 19/102.

Voluntary Consent/Withdrawal: Participation in the study was voluntary with no inducing or coercing of respondents. Respondents were given the right to opt out from the study at any point of participation without recourse to explain the reason for exit and no ramifications.

Consent: In the form of signing approval forms was sought from respondents by research assistants after they have been informed about the objectives of the study and given assurance of confidentiality of their information. No compensation was given to respondents for their time and efforts spent to fill the questionnaire.

Privacy and Confidentiality: No names, personal identifiers were used in distinguishing between questionnaires. Identifiers used were anonymous codes. Questionnaires were protected under lock and key in a cabinet at the principal investigator's office at work. Raw data is to be destroyed 3 years after completion of the study. Data entered into the computer is to be protected with a password only known to the principal investigator and it is solely for academic and publication purposes only.

Potential Risks/Benefits: The study was not expected to pose any harm to the participants but rather, the outcome of the study would help inform policy to improve services provided to patients with sudden cardiac arrest.

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Conflict of Interest: The researcher had no conflict of interest. This study was solely for academic purpose.

Permission for Study: Introductory letters from the school of public health were sent to the dean of students and the hall tutors of the respective halls where this study was conducted.

Funding: The entire research was funded by the principal investigator.

The findings of this research are to be submitted to the School of Public Health in partial fulfilment of the requirements for the award of a Master of Public Health Degree. The findings may also be published in a reputable journal.

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CHAPTER FOUR

4.0 RESULTS

4.1 Background Characteristics

In all, 320 questionnaires were fully completed from 350 gathered resulting in a response rate of 91.4%. The main characteristics of the participants are demonstrated in Table 3. The mean age was 21.3 years (SD=3.2), predominant age category was 20-25 years and 54.7% of the respondents were males. Most respondents were affiliated to the college of humanities (46.6%) and 16.9% were students from the health sciences. 16.8% of the respondents lived with a family member who was suffering from a CVD.

4.2 CPR Awareness

About 210 participants (65.6%) had heard of CPR prior to being involved in the study. The most common source of CPR information for those who had prior knowledge (n=215) was from movies and television shows (32 %). A good number of people heard it from reading (18%), the internet (18%) and school work (16%). (See Figure 4)

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Table 3- The Demographic Characteristics of the Respondents

Variables	Frequency(n=320)	Percentage (%)
Age Category		
<20	96	30.0
20-25	193	60.3
26-30	23	7.2
>30	8	2.5
Sex		
Male	175	54.7
Female	145	45.3
Religion		
Christianity	288	90.0
Islam	25	7.8
Traditional	1	0.3
No Religion	6	1.9
College		
Health Sciences	54	16.9
Humanities	149	46.6
Education	35	10.9
Basic & Applied Sciences	82	25.6
Year of Study		
First Year	60	18.8
Second Year	113	35.3
Third Year	75	23.4
Fourth Year	37	11.6
Postgraduate Studies	35	10.9
Cohabiting family member with CVD		
Yes	54	16.88
No	251	78.44
Refuse to answer	15	4.69

CVD – Cardiovascular Disease

4.3 Previous CPR Training

Only 43 of the participants had received prior CPR training resulting in a CPR training proportion of 13.4 %(95% CI: 10%-17%). Most of the people were affiliated to the health sciences (Figure 5) and gave a reason for taking the course as a work or school requirement. Most respondents had taken course in the last year (Table 4).

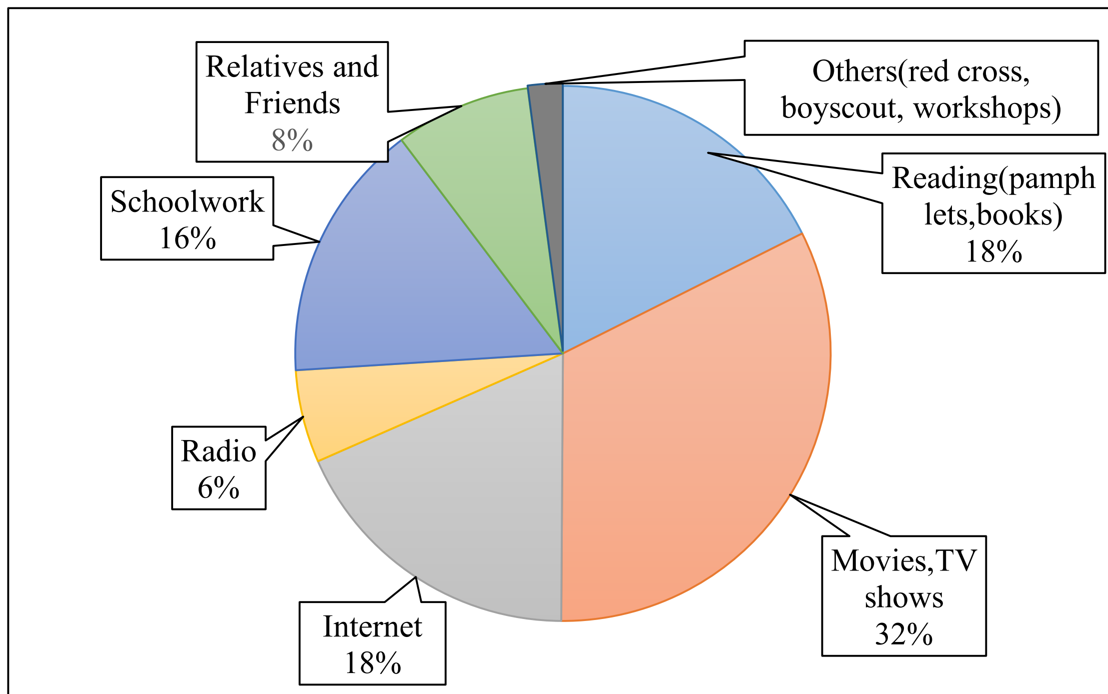

Figure 4 Students' CPR Knowledge Sources

Table 4: Previous CPR Information and Training Status of Respondents

Variable	Frequency(n=320)	Percentage (%)
Ever heard of CPR?		
No	110	34.4
Yes	210	65.6
Attended CPR Training Course?		
No	277	86.6
Yes	43	13.4(CI 95% = 0.10-0.17)
Last time of Training Course(n=43)		
In the past 1 year	15	34.9
Past 2 to 5 years	15	34.9
More than 5 years ago	11	25.6
Cannot Remember	2	4.7
Reason for taking Course(n=43)		
Work Requirement	22	51.2
School Requirement	20	46.5
Personal Choice	9	20.9
Previous Experience	1	2.3
Other(Junior US army)	1	2.3

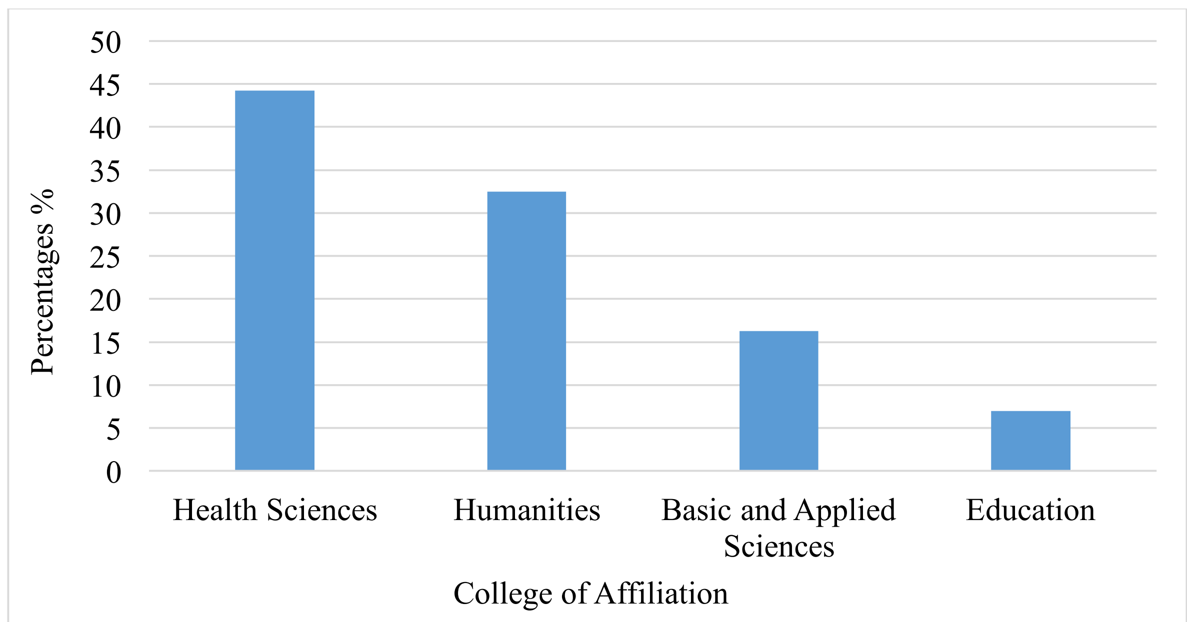

Figure 5 : Distribution of Participants who Attended CPR Training Course by College of Affiliation.

4.4 CPR Knowledge

The mean composite knowledge score was 4.04 out of a total of 10, standard deviation of 2.24 (C.I 95% 3.8 to 4.3). The mean for those affiliated to health sciences was 5.2(SD=1.8) and that of non-health courses was 3.8(SD-2.2). Only 99 of the respondents representing 30.9 % answered correctly the question on the emergency contact number of Ambulance services in Ghana Table 5). Also, question on CPR procedure; compression rate, correct sequence and compression location were answered correctly by 15.9%, 43.4% and 56.3% respectively. Question on compression rate had the most "Do not know" answer (65.9%). The best-answered question was knowing that CPR skills are also useful in other emergencies such as near drowning, electrocution and drug overdose (67.2%). Most questions were better answered by CPR trained students than non-trained students for at least 7 questions based on a chi test. (See p values in Table 5).

Table 5 Correct CPR Knowledge Items Comparing Respondents with Previous CPR Training to those without Training (N = 320)

Knowledge Items	No. (%) of Respondents with Correct Responses			
	All (n=320)	CPR Trained (n=43)	CPR Non-trained (n=258)	P value
1. The correct steps when you encounter a situation	188(58.8)	34(79.1)	154(55.6)	0.004*
2. Assessing an arrest victim for unconsciousness	100(31.3)	28(65.1)	72(25.9)	<0.001*
3. Prompt CPR for arrest victim	138(43.1)	28(65.1)	110(39.7)	0.002*
4. CPR skills useful in other emergencies	215(67.2)	40(93.0)	175(63.2)	<0.001*
5. The Emergency Medical Services contact number	99(30.9)	12(27.9)	87(31.4)	0.644
6. Chest location to perform chest compressions	180(56.3)	31(72.0)	149(53.8)	0.024*
7. The correct sequence for CPR- CAB	139(43.4)	24(55.81)	115(41.5)	0.078
8. Recommended CPR rate	51(15.9)	16(37.2)	35(12.6)	<0.001*
9. Firm surface necessary for CPR	72(22.5)	14(37.2)	58(20.9)	0.090
10. CPR as a component of chain of reaction	118(36.9)	22(51.2)	96(34.7)	0.037*

*- means statistically significant

The unadjusted Poisson regression model revealed that students with previous CPR training are likely to have a 41% increase in the expected log count of the number of correct knowledge items than those with no training ($p<0.001$). This effect was maintained when the other personal characteristics were controlled for in the adjusted model (coefficient=0.18, $p<0.05$). Respondents who confirmed they had sufficient knowledge to handle an arresting encounter had 41% ($p<0.001$) increase in the expected log count of the number of correct knowledge items than those who answered in the negative to handle the

encounter. This significant association was maintained in the adjusted model (coeff-0.26, p<0.001).

Table 6 -Poisson regression models for assessing the relationship between the independent variables and knowledge score

Variables(n=320)	Unadjusted Model		Adjusted Model	
	Coefficient	P value	Coefficient(CI)	P value
CPR training				
Yes	0.41	<0.001*	0.18(0.26-0.33)	0.021*
No	1		1	
Age Category				
<20	1		1	
20-25	0.19	0.010*	0.20(0.04-0.37)	0.018*
26-30	0.44	<0.001*	0.18	0.208
>30	0.54	<0.001*	0.20	0.189
Sex				
Male	1		1	
Female	-0.01	0.925	0.00	0.963
Religion				
Christian	1		1	
Islam	0.01	0.907	0.00	0.999
Traditional	0.22	<0.001*	-0.22	0.083
No Religion	0.03	0.901	-0.14	0.539
College				
Health Sciences	1		1	
Humanities	-0.39	<0.001*	-0.18(-0.34 to -0.03)	0.020*
Education	-0.15	0.110	-0.05	0.620
Basic&Applied Sciences	-0.25	0.002*	-0.02	0.817
Year of Study				
First Year	1		1	
Second Year	-0.08	0.337	-0.13	0.153
Third Year	-0.07	0.405	-0.26(-0.47 to -0.38)	0.021*
Fourth Year	0.11	0.273	-0.11	0.350
Postgraduate Studies	0.28	0.004*	-0.08	0.533
Family History of CVD				
Yes	0.25	<0.001*	0.1	0.129
No	1		1	
Is your knowledge sufficient?				
Yes	0.41	<0.001*	0.26(0.12-0.39)	<0.001*
No	1		1	

CI- Confidence Interval * means statistically significant

Family history of cardiovascular disease was associated with 25 % ($p<0.001$) increase in the expected log count of the number of correct knowledge items, but was not significantly related in the adjusted model. Knowledge score was not different between the two sexes and among the religious groups. Respondents affiliated to the college of humanities had a 39% reduction in expected log count of the number of correct knowledge items than that of the students affiliated to health sciences($p<0.001$). This association was significantly maintained when the other demographic characteristics were controlled for (coeff-0.18, $P<0.05$). Knowledge score did seem to be higher in postgraduates (with higher education) compared to respondents in the first year undergraduates in the univariate Poisson regression (coeff- 0.28, $p<0.05$). However this finding was debunked in the adjusted model (coeff- -0.08, $p>0.05$, Table 6)

4.5 Willingness to Practice CPR

The respondents' had an overall positive willingness to learn or practice CPR. The mean willingness to practice CPR score was approximately 35(SD 6.1) which is beyond the 50th percentile of a possible range of scores between 11 and 55. The maximum score and minimum willingness score by the respondents was 55 and 17 respectively. In addition, only 5 respondents(1.56%) disagreed that it is necessary for the general public to know CPR and only 24 respondents representing 7.5% declined to learn CPR if given the opportunity. Of the 24 students who will not learn CPR reasons given included, "only necessary to health professionals", "too complex" and "not necessary to me" with frequencies of 8, 6, 6 students respectively. Students were fairly split on decision to

recommend CPR training in schools. 40% thought it should be optional and 46.9 % of the respondents thought it should be mandatory for all students (graduation requirement).

The questions in the questionnaire that was used to estimate the willingness score also reveals information on factors that may facilitate or inhibit CPR practice. The most frequent facilitating factors were if victim is a family member (same habitat) or other relatives by blood (91.3 % and 89.4% of the students respectively agreed to this). Only 34.4 % agreed to perform CPR to strangers.

The most reported inhibitor of bystander practice to a stranger was the fear of contracting a contagious disease with 76.6% respondents agreeing to this. Respondents also reported fear of causing harm (58.8%) and a lack of confidence (52.2%) to perform CPR.

Figure 6 showed that the willingness scores were approximately normally distributed, with a skewness of 0.15 and a kurtosis of 3.6 Skewness Kurtosis (Jacques Berra) test for normality of data also confirmed the normality of the willingness score($p>0.05$).

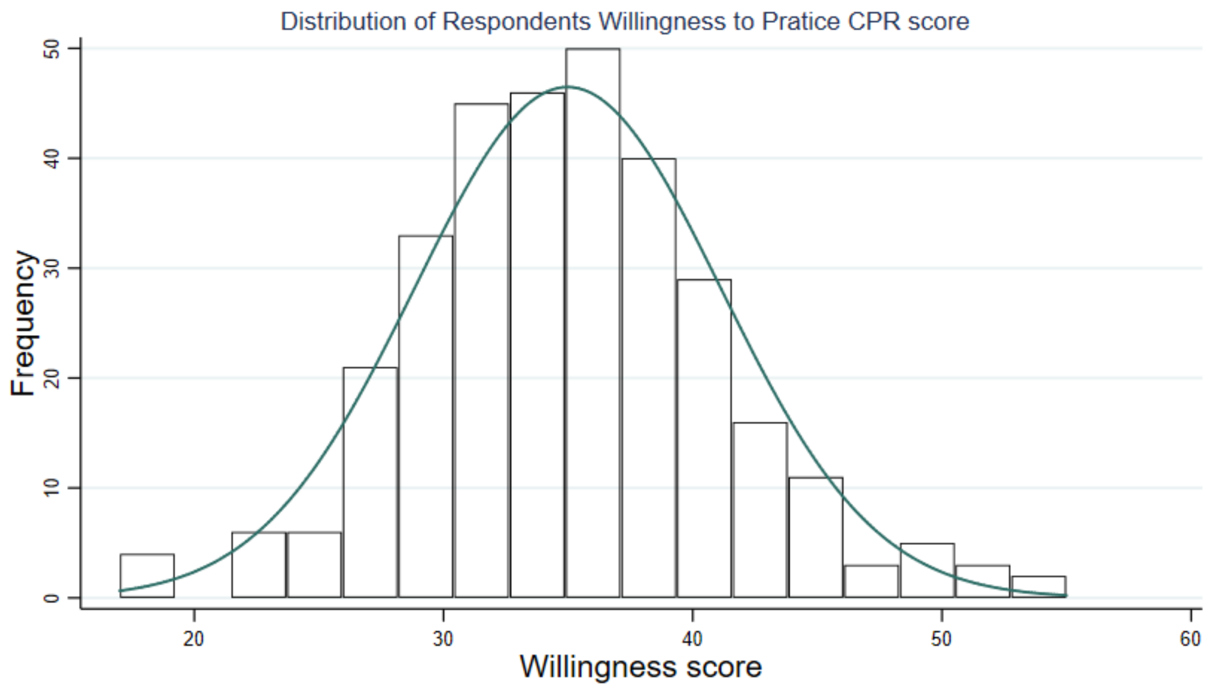

Figure 6 Distribution of Respondents' Willingness to Practice CPR Score

Spearman's correlation was used to examine the relationship between CPR knowledge score (not normally distributed) and willingness toward CPR score, a significant positive correlation was found between them ($r = 0.17$, $p < 0.05$).

A multiple logistic regression model with all assumptions satisfied was carried out with training status, participants' demographic characteristics and knowledge score as independent variables to evaluate their effect on willingness score. From Table 7 below, although training status of students had significant association in the simple regression model (Coeff- 4.3, $p<0.001$), it has no significant association in the multivariable analysis ($p>0.05$). Willingness score was increased per unit rise in knowledge score by 0.54($p<0.001$) and 0.35 ($p<0.001$) in both the simple regression and after controlling for

other factors. This buttresses the positive correlation earlier reported with spearman's method. Males had a higher willingness score compared to females in the adjusted model. (Table 7). Respondents who had a cohabiting family member with a cardiovascular disease where more willing to perform CPR than those who without this attribute in both the unadjusted and adjusted models (Coeff- 2.0, $p<0.05$). Year of study, college of affiliation and age of respondent were not strong predictors of high willingness scores in the adjusted model.

Table 7 Linear regression models for assessing the relationship between the independent variables and Willingness score

Variables(n=320)	**Unadjusted Model**		**Adjusted Model**	
	Coefficient	P value	Coefficient(CI)	P value
CPR training				
Yes	4.29	<0.001*	1.60	0.152
No	1		1	
Age Category				
<20	1		1	
20-25	-0.13	0.860	-1.80(-3.5 to -0.01)	0.042*
26-30	3.77	0.008*	-1.43	0.454
>30	4.96	0.026*	-2.33	0.398
Sex				
Male	1		1	
Female	-5.7	0.408	-1.48(-2.8 to -0.12)	0.033*
Religion				
Christian	1		1	
Islam	-2.83	0.026*	-2.98(-5.5 to -0.5)	0.019*
Traditional	-5.10	0.401	-10.4	0.075
No Religion	5.89	0.019*	5.29(0.2-10.4)	0.041*
College				
Health Sciences	1		1	
Humanities	-2.29	0.018*	-0.95	0.351
Education	-4.33	0.001*	-3.97(-6.6 to -1.3)	0.003*
Basic&Applied Sciences	-2.80	0.009*	-1.95	0.084
Year of Study				
First Year	1		1	
Second Year	0.45	0.641	0.67	0.498
Third Year	0.61	0.405	1.41	0.237
Fourth Year	1.80	0.273	1.92	0.162
Postgraduate Studies	4.44	0.003*	3.04	0.092
Family History of CVD				
Yes	2.8	0.002*	2.0(0.16-3.84)	0.033*
No	1		1	
Knowledge composite score	0.54	<0.001*	0.36(0.05-0.66)	0.024*

CI – Confidence Interval   * means statistically significant

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

Prompt delivery of effective bystander CPR and BLS ensures improved survival probabilities and improved neurological and health outcomes of a cardiac arrest or accident victim. It is for this reason that this study seeks to explore the awareness of university students to CPR. This cohort is considered suitable potential bystander rescuers in the communities.

5.2 CPR Awareness and Previous CPR Training Status

Out of the 320 University of Ghana students surveyed, 65.5% were aware of CPR before the study. This proportion lags behind that found in other studies; 90% in a Taiwanese study, 72% in a Saudi Arabian Study (Pei-Chuan Huang et al, 2018; Al sharari et al, 2018). The most common sources of the respondents' knowledge were movies and television shows (32%), reading (18%) and school work (18%). This finding exists in many other studies. (Ahmad et al, 2018; Jalaly et al, 2008). Today, young adults would rather spend time watching a CPR movie/TV show than to read a book. Therefore, more promotion and publicizing in the media space is necessary since it is the most common source for acquisition of CPR knowledge (Nielson et al 2013). Stakeholders must therefore take advantage of the common learning sources to design educational interventions to promote CPR. University students could be a good initial target for this education before scaling up to involve the general public.

Only 13.4 %(CI 95% 10-17%) of the respondents had received prior CPR training mostly as a work or school requirement. The CPR training proportion for the Ghanaian population

therefore is expected to be between 10% and 17% with 95% confidence. This is vastly lower than that found in the developed nations. The results further depicted that of the 13.4% who had received training, most were from the health science courses, 44.2% (Fig 5). This implied that the general non-health respondents in the study had little or no training in CPR. CPR training rates in some other countries, for comparison, are as follows: 79% in Washington in United States (Sipsma, Stubbs & Plorde, 2011), 70% in Japan (Omi, Taniguchi & Inaba, 2007), 74% in New Zealand (Larsen & Pearson, 2004), 55.3% in Hong Kong (Hung et al, 2017), 40.2% in Turkey (Ozbilgin et al, 2015) 34.7% in Taiwan (Pei-Chuan Huang et al, 2018).

CPR training in some of these countries is a requirement for certain services leading to higher training rates. In Turkey, for instance, it is obligatory in the Law on Occupational Health and Safety that one out of every 10 employees in a workplace should hold a basic life support (BLS) certificate (Ozbilgin et al, 2015). There is also obligatory CPR training in driving schools. In the United States, mandatory CPR training as a graduation requirement in high schools is being enforced in over 21 states following recommendation by AHA in 2011. (AHA, 2018).

Most of the respondents of the study obtained CPR training as a school or work requirement (51.6% and 46.5% respectively). CPR Training in Ghana is usually restricted to health workers, fire service men and sports coaches. The Ghana Red Cross Society distributes flyers inviting the general public for CPR training. In countries where CPR training has been well incorporated into school curriculum or extracurricular activities, it has led to improved bystander rates and furthermore, better OHCA outcomes (AHA 2018, Bray 2017). Respondents in this study were split between 'mandatory for all students' (46.9%)

and ‘optional’ (40%) in their choice of strategy to teach CPR. This is a conundrum that will obviously require further investigation.

5.3 CPR Knowledge

The 10 item knowledge questions in this questionnaire were adopted from similar research done in other countries all based on the AHA guidelines which are the most used teaching materials worldwide. The average CPR knowledge level of the students (4.04 out of 10) in this study was inadequate comparing to a study by Hung et al (2017) in another developing nation where an average score of 4.9 out of 10 was also considered inadequate. Most participants of this study knew that CPR skills can also be used in other emergencies such as near drowning and electrocution which is desirable. A third of the respondents knew the number of emergency ambulance services in Ghana.

Knowledge was significantly higher (18% more) among students with prior CPR training as evidenced in the multivariable analysis ($p<0.05$, table 6). A similar finding is seen in other tertiary students population in other countries (Ahmad et al; 2018, Jalal et al, 2008) Students with prior training fared better on the questions on CPR procedure such as knowing the chest compression location, rate and correct steps and assessment when a victim is encountered. About 55.8% of the students who had previously been taught CPR knew the correct CAB (circulation, airway, breathing) sequence. This may indicate a shortcoming in training where teaching materials lag far behind new changes to guidelines since the change from ABC(airway, breathing, circulation) to CAB is a recent guideline (AHA, 2015).

Students affiliated to the health sciences also fared better in the knowledge questions than those affiliated to non-health courses such as the college of humanities. This is a similar finding to that of Al sharari et al (2018) done in Saudi Arabia. This is obviously what is to be expected since the scope of CPR falls within the health sciences. However, even for the health students, the average knowledge was poor with a mean of the number of correct knowledge answers of 5.2. Bystander CPR is necessary for all and hence a need to improve CPR awareness and knowledge among the general public.

From the multivariable Poisson regression in Table 6, it is realized that demographic characteristics such as age, sex, religion, year of study did not strongly predict knowledge scores. This is to suggest that CPR knowledge concepts can easily be grasped by the lay person regardless of some of the above attributes.

5.4 Willingness to Practice CPR

The general willingness of the respondents in this study to learn or practice CPR was very positive. A common finding in most studies (Hung et al 2017; Al sharari et al 2018). The majority (98.4% and 92.5%) of the respondents respectively answered in the affirmative the need for the public to learn CPR and their own interest in learning. Unlike in the other studies, students with prior CPR training were not significantly more willingness to practice than students with no prior training after controlling for other demographic characteristics. The attitude to CPR is positive, notwithstanding training status, indicating a stronger will to practice CPR among the sample of University of Ghana Students.

In line with other studies, most participants in this study would readily perform CPR for cohabiting family and relatives but were hesitant to perform bystander rescue to strangers

due to health and safety concerns. Even in the countries where CPR bystander rates are high, for example, Australia and Japan, rescue to strangers is of a big concern (Jelinek et al, 2001; Kuramoto et al, 2008). The major barriers to the practice of CPR to strangers as evidenced by many studies are fear of contracting an infectious disease, lack of confidence and fear of causing harm to a stranger and its legal implications.(Honeycutt et al 2006; Ahmad et al 2018). They were the main inhibiting factors among the University of Ghana students as well.

Fear of being infected turned out to be the most important barrier especially when performing the mouth to mouth ventilation. To remedy this concern, the AHA in 2017 introduced the concept of Hands-Only CPR which has comparable health outcomes with the traditional CPR (AHA, 2017) This has allayed the fears of many lay respondents and encouraged the practice of CPR to strangers (Urban, Thode, Stapleton, & Singer, 2013; Ma et al., 2015). Public education is another effective strategy to disabuse minds on the low risk of infection posed by mouth to mouth (MTM) assisted ventilation. Education on legal issues such as the Good Samaritan law (offers protection of rescuers against liability) is also necessary.

The issue of a lack of confidence may improve once the individual gets first-hand practice of CPR in a real emergency situation. A finding commemorated in the study Aloush et al, (2018) where respondents who had performed in the past performed CPR were more confident to repeat the technique. Confidence is also built through the acquisition of knowledge and skills (Aaberg et al., 2014, Ma et al 2015). The multivariable linear regression model in Table 6 showed that respondents with higher knowledge score were more willing to perform CPR. This finding is in line with several global studies where

students who had received training had a higher self-perceived ability and were more confident to perform CPR (Lu et al., 2016). This highlights the importance of training and reinforcement of knowledge to CPR bystander practice. Studies has suggested that persons with a cardiac event in the family tend to be more willing to practice CPR than those without such an attribute (Lu et al, 2016). This finding was observed in our study. Such persons' positive attitude to CPR may be based on an emotional and psychological attachment they have to their relative with the cardiovascular disease. Also males were more willing to offer CPR than women as found in some studies (Nielson et al, 2013). Other studies reported equal willingness (Bray et al, 2017). A possible explanation for this disparity is that females may find mouth to mouth ventilation (component of CPR) obnoxious.

The findings of this study are so important and timely in the sub-region because it sheds light on a global public health issue which has the propensity to burden the health and economic sectors of Africa, yet the literature has been silent on. The revelations from this study should sensitize the policy makers to create an environment that encourages the training and practice of CPR and pave the way for more research into the CPR in Africa.

Like any study, this is also devoid of limitations. First of all, conclusions were drawn from questions posed to respondents about their willingness to practice CPR in a hypothetical situation. This obviously is a weaker assessment of willingness to practice compared to studies in which respondents were real emergency bystanders (Honeycutt, 2006). Secondly, although using true or false questions in the knowledge items section made the subject matter less laborious to respondents, it left room for some guess work, lowering valid responses. Also, more contributory factors that affect CPR knowledge and

willingness to practice CPR could have been included in the regression models so that their effect on the adjusted models could be determined. Lastly, some respondents might have given false information in order to look good to the interviewer (social desirability) bias.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In conclusion, cardiopulmonary resuscitation is an essential skill needed by inhabitants of a country to be used in case of emergencies such as cardiac arrest and road traffic accidents. Timely administration of effective CPR improves survival and health outcomes following a cardiac arrest. This study explored the familiarity of a sample of University of Ghana Students (deemed potential bystanders) to CPR and assessed their willingness to practice the skill in the eventuality of an emergency. Students were aware of CPR to a good extent however they had a low knowledge of the components and procedures of the skill. The respondents, however, showed positive willingness to learn and practice CPR to people in need except for strangers where they had strong concerns about risk of contracting infection, lack of confidence, legal consequences, and fear of causing harm.

6.2 Recommendations

1. Awareness programs such as CPR campaigns, CPR day celebrations, promotion via social media platforms and phone applications could be employed by the stakeholders of the health sector to sensitize the public about CPR.
2. CPR training in universities could begin on a small-scale by including CPR among the options for extra-curricular activities and later further studies done to ascertain if scaling up to become mandatory requirement in the university will be feasible.

3. Further studies can be done to assess pre-training knowledge of CPR compared to post-training knowledge of some respondents and their willingness in order to ascertain how easily the Ghanaian Student assimilate CPR teachings.
4. In addition, studies can be done on the modules of training materials whether use of video tutorials or use of didactic lectures and practice sessions will be appropriate for the Ghanaian public.
5. Other studies could assess knowledge and willingness to practice among the general Ghanaian population.

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APPENDICES

APPENDIX 1- QUESTIONNAIRE

AWARENESS OF CARDIOPULMONARY RESUSCITATION AMONG UNIVERSITY OF GHANA STUDENTS AND AN ASSESSMENT OF THEIR WILLINGNESS TO PRACTICE CPR.

Instructions: Please answer every question as honestly as possible. Do not leave any question unanswered. You may select more than one choice where appropriate.

Respondent Number – Date –

PART ONE: DEMOGRAPHIC INFORMATION (tick appropriately)
1. Age in years [ ]
2. Gender: 1. Male [ ] 2. Female [ ]
3. Religion: 1. Christian [ ] 2. Moslem [ ] 3. Traditionalist [ ] Others……………………….
4. Which college of study do you belong to? 1. Health Sciences[ ] 2.Humanities [ ] 3.Education[ ] Basic&Applied Science[ ]
5. Current year of study? 1. First [ ] 2. Second [ ] 3. Third [ ] 4. Fourth [ ] 5. Postgraduate
6. Does any of your family members living with you have a cardiovascular disease such as hypertension or stroke? 1. Yes [ ] 2. No [ ] 3. Refusal to answer [ ]

PART TWO: AWARENESS OF CPR

7. Have you ever heard of cardiopulmonary resuscitation (CPR) before today?
   1. Yes [ ]
   2. No [ ] (if No proceed to Question 9

8. (If yes in Q7) Indicate the source of your information about CPR.

   1. [ ] Reading (Pamphlets, Books,)
   2. [ ] Movies or TV shows, TV documentaries
   3. [ ] Internet
   4. [ ] Radio
   5. [ ] School work
   6. [ ] Relatives or friends
   7. Other (specify) :__________________________ (multiple selections accepted)

9. Do you think the knowledge you have is sufficient enough to help you assist a victim when you encounter one?
   1. Yes [ ] 2. No [ ]

10 Have you ever taken a CPR training course in the past?
   1. Yes [ ] 2. No [ ] (if no proceed to Question 13)

11 (If yes in Q10) what encouraged you to take the course?
   1. Work requirement [ ]
   2. School requirement [ ]
   3. Personal choice (Optional) [ ]
   4. Previous experience proved the importance of CPR [ ]
   5. Other:____________________________________ (multiple selections accepted)

12 (If yes in Q10) when was last time you attended a training course?
   1. In the past 1 year [ ]
   2. More than 5 years ago [ ]
   3. Past 2 to 5 years [ ]
   4. Cannot remember [ ]
   5. Other (specify) ____________________________________

Complete the following table, indicating with a tick (√) whether the statements are true or

No.	Statement	True	False	Don't know
13	The correct steps involved when you encounter a situation that requires CPR is to check victim for unconsciousness, start CPR immediately before you call the emergency services.			
14	Checking whether a cardiac arrest victim is unconscious involves calling out aloud "are you okay "or shaking the victims shoulder.			
15	In ideal situations, it is better to rush victim of a cardiac arrest to the hospital than to waste time to start CPR on the victim.			
16	CPR skills are important in other emergency situations such as near drowning, electrocution and drug overdose.			
17	The Emergency Medical Services (ambulance service) contact number in Ghana is 193			
18	The central chest is the ideal location to perform chest compressions			
19	The correct sequence for adult CPR is chest compressions first then airway and breathing(CAB) in that order			
20	The recommended adequate rate of chest compressions is 60 compressions per minute			
21	Delivery of chest compressions on a mattress or other soft material provides effective and adequate compressions while protecting the victims back.			
22	CPR alone can guarantee the survival of a victim who has suffered a cardiac arrest.			

PART 3: WILLINGNESS TO LEARN OR TO PRACTICE CPR

23. Should the public learn CPR to help their family members or someone else when necessary? 1. Yes [ ] 2. No [ ]
24. Would you want to learn CPR if given the opportunity? 1. Yes [ ] 2. No [ ] (if Yes proceed to Q26)
25. (If no in Q24) why do you not want to learn? (Multiple selections accepted) 1. Busy schedule [ ] 2. Not necessary to me [ ] 3. Too complex [ ] 4. Only necessary to health professionals [ ] 5. Other (specify):________________________

26) Do you think CPR training courses should be made:

1. Mandatory for all students (graduation requirement) [ ]
2. Mandatory for some majors [ ]
3. Optional [ ]
4. Don't support implementation of training courses [ ]

If sudden cardiac arrest is to occur among the following people, for whom would you readily conduct CPR ie. Chest compressions and mouth to mouth ventilation?

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
27	Family you live with					
28	Relatives by blood or marriage					
29	Close friends (including boyfriend/girlfriend)					
30	Acquaintances					
31	Stranger					

What concerns may prevent you from giving CPR to a stranger?

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
32	Causing harm -bone fractures or damage to organs					
33	Contracting a contagious disease					
34	I find mouth to mouth resuscitation disgusting					
35	To avoid legal problems					
36	Not confident of my skill					
37	If the person is of opposite gender					

THANK YOU FOR YOUR PARTICIPATION

APPENDIX 2 – CONSENT FORM

Project Title: Awareness of Cardiopulmonary Resuscitation among University of Ghana Students and an Assessment of their willingness to learn or practice CPR.

PARTICIPANTS' STATEMENT

I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and satisfactorily explained to me in a language I understand (English). I fully understand the contents and any potential implications as well as my right to change my mind (ie withdraw from the research) even after I have signed this form.

I voluntarily agree to let be part of this research.

Name or Initials of Participant………………………….. ID Code ……………………………..

Participants' Signature ………OR Thumb Print………… OR Mark (Please specify)………….

Date:………………………………….

INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher's name……………………………………….

Signature ………………………………………………….

Date…………………………………………………………

APPENDIX 3 – PARTICIPANT INFORMATION SHEET

Project Title: Awareness of Cardiopulmonary Resuscitation among University of Ghana Students and an Assessment of their willingness to learn or practice CPR.

Introduction: I am YAW GOH ASARE, a student of the Department of Epidemiology in the School of Public Health, University of Ghana, Legon, pursuing a Master of Public Health Degree Programme. My number is 0208985971 and e-mail is ygasare@st.ug.edu.com.

Background and Purpose of research- Survival from cardiac arrest and other emergencies such as drowning can be improved by a bystander performing timely CPR. University students are potentially good community bystanders. This study seeks to assess the knowledge of the students and their willingness to learn or perform CPR.

Nature of research

This is a cross- sectional survey on the University of Ghana Legon Campus. It involves the use of questionnaire to elicit information from students.

Participants' Involvement: As part of the study, your participation will be appreciated to achieve the objectives of the study. You will be asked specific questions based on your existing knowledge of the CPR technique and whether you will be willing to learn or perform CPR if the opportunity arose. Please respond carefully and sincerely to the best of your knowledge. The questionnaire should take between 10 to 15 minutes to complete.

Potential Risks

The potential risk of this study to the respondents is the time lost in filling questionnaires during this interview.

Benefits

No direct benefits are to be expected except that outcomes from the study may influence national and regional policies and help improve the overall health of the public.

Costs: Participating in the study will not come with any cost.

Compensation: There will be no monetary or material compensation for the study.

Confidentiality

All information given will be kept confidential and used for the research purpose only. All responses obtained would be kept confidential. Forms for each participant would be kept under lock and key. The electronic data would be locked with a password which would be known to the principal investigator to prevent access to unauthorized people.

Voluntary participation/withdrawal

Participation in this survey is completely voluntary and you are free to withdraw your participation at any stage of this study without giving any reason. There would be no consequences on health care provision.

Outcome and Feedback

Findings and recommendations would be available at the School of Public Health.A copy of the results will be submitted to the Ghana Health Service non-communicable disease department for consideration.

Funding information

This study is self-funded.

Sharing of participants information/Data

Names are not required for this study. Participant's data and information is solely for the principal investigator and will be kept under lock and key.

Provision of Information and Consent for participants

A copy of the information sheet and consent form will be given to you to keep after it has been signed or thumb-printed.

Thank you.

For further clarification about participation in this study, please contact

RESEARCHER'S CONTACT

Yaw Goh Asare

Department of Epidemiology

School of Public of Health

Telephone: 0242728541

E-mail: ygasare@st.ug.edu.com

For further clarification about ethical issues and rights as a participant of this study, please contact

ETHICAL REVIEW ADMINITRATOR

Hannah Frimpong

Ethics Review Committee

Ghana Health Service

Adabraka

Telephone: 0507041223