UNIVERSITY OF SOUTHAMPTON

FACULTY OF HEALTH SCIENCES

Health Sciences

Dispatcher-assisted cardiopulmonary resuscitation: Patient outcomes following out-of-hospital cardiac arrest in a pilot region of Kuwait

by

Dalal Alhasan

Thesis for the degree of Doctor of Philosophy

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ABSTRACT

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Dalal Majed Alhasan

Background:

The goal of this study is to measure the impact of dispatcher-assisted cardiopulmonary resuscitation on out-of-hospital cardiac arrest (OHCA) patients' outcomes in a pilot region of Kuwait.

Methods:

This is a before and after study with a control group of adults with OHCA who activated the Kuwaiti emergency medical services (EMS) in three time periods (1st January-31st October 2016, 21st February-31st May 2017 and 1st June-31st December 2017). Patients' data were collected from Kuwaiti EMS archived data. Dispatcher-assisted cardiopulmonary resuscitation (DACPR) was then implemented in an intervention region. Meanwhile, OHCA patients in the control region received standard Kuwaiti EMS protocol for OHCA incidences. Primary outcome: survival to 30 days. Secondary outcomes: OHCA recognition rate, CPR instruction rate, bystander CPR rate and return of spontaneous circulation. Multivariate logistic regression analysis was used to compare outcomes between groups before, during and after DACPR implementation in the intervention region. Binary logistic regression was used to compare outcomes between intervention and control groups during two study periods: during and after DACPR implementation.

Results:

A total of 664 OHCA cases from the Kuwaiti EMS archived data were extracted. Of these, 377 OHCA cases met the inclusion criteria and fell within the proposed study periods. There were 80 cases in the pre-intervention group, 78 in the intervention group and 219 in the post-intervention group.

DACPR was found to be a complex intervention, requiring a cycle of implementation- evaluation-feasibility and development to ensure its implementation in the Kuwaiti EMS during the post-intervention period. The comparison between groups in the pilot region for before, during and after DACPR implementation found that the survival-to-30-days rate was 29.2% before, 2.1% during and .8% after (p =0.001). OHCA recognition rates were 20.8% before, 2.1% during and 12.9% after, with p = 0.037. CPR instruction for the recognised OHCA cases was 60% before, 0% during and 80% following the implementation of DACPR. The comparison between the pilot and control regions during 2017 was documented; survival-to-30-days rates of 1.1% for the pilot region and 1.7% for the control region were found (p =.954, OR=.93). The CPR instruction rate was 7.5% for the pilot region and 2.5% for the control region (p=.007,OR=13.26). The bystander CPR rate was12.7% for the pilot region and 4.1% for the control region (p = 0.05,OR=3.40).

Conclusion

DACPR is a complex intervention; however, it was implemented in a pilot region of the Kuwaiti EMS. The DACPR intervention resulted in positive impacts on the Kuwaiti EMS system operational outcomes, CPR instruction rates and bystander CPR rates in the pilot region in Kuwait. This caused the activation of the early OHCA survival links, early OHCA recognition and early CPR.

Keywords: Emergency Medical Services, Dispatcher-Assisted Cardiopulmonary Resuscitation, Out-of-Hospital Cardiac Arrest, Kuwait.

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Academic Thesis: Declaration of Authorship

I, Dalal Alhasan, declare that this thesis and the work presented in it are my own and have been generated by me as the result of my own original research.

Dispatcher-assisted cardiopulmonary resuscitation: Patient outcomes following out-of-hospital cardiac arrest in a pilot region of Kuwait
I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. None of this work has been published before submission.

   Signed: Dalal Alhasan ....

Date: May 2018 ....

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Definitions and Abbreviations

Advanced Emergency Medical Priority Dispatch (AEMPD)

A complex, computer-based EMD system that uses callers' responses to scripted questions to categorize cases into numerical, complaint-based categories which are further assigned a priority code (Alpha, Bravo, Charlie, Delta, or Echo) based on their perceived acuity.

Agonal breathing

Gasping respiration or an abnormal pattern of breathing and brainstem reflex characterized by gasping and laboured breathing, accompanied by strange vocalizations and myoclonus. Possible causes include cerebral ischemia, extreme hypoxia or even anoxia.

Bystander CPR

An attempt to perform basic cardiopulmonary resuscitation (CPR) by someone who is not part of an organized emergency response system.

Call taker

A call handler that deals with emergency calls from the public. The call taker makes sure that the right help gets there as soon as possible.

Cardiac arrest

Cessation of cardiac mechanical activity, confirmed by the absence of signs of circulation.

Cardiac registry

A record of every individual who has presented a cardiac arrest, regardless of aetiology. Includes patient's demographic data; comprehensive EMS-related data; detailed bystander and first-responder activity, including the use of an automated external defibrillator (AED)/PAD; as well as pre- and in-hospital treatment and outcome.

Coronary event

Describes a condition which could include a heart attack, angina, acute coronary syndrome and/or coronary artery bypass surgery.

Cerebral Performance Category (CPC)

The CPC score is widely used in research and quality assurance to assess neurologic outcomes following cardiac arrest. The best score is one, which indicates a good outcome, and the worst score is five, which indicates brain death.

Dispatcher-Assisted cardiopulmonary resuscitation (CPR)

Dispatcher-assisted CPR involves the call taker's delivery of simple questions to confirm cardiac arrest and giving simple instructions to initiate hands-only CPR.

Dispatch Unit

A division of the EMS system, where reception and management of requests for emergency medical assistance occurs. It involves two broad aspects: call taking, where calls for emergency medical assistance are received and prioritized, and controlling, where the most appropriate ambulance is dispatched to the emergency.

Emergency Medical Services (EMS)

A system that provides emergency medical care. Once it is activated by an incident that has caused serious illness or injury, the focus of EMS is to provide emergency medical care to the patient(s).

EMS personnel

A pre-hospital emergency care professional who provides immediate care to the critically ill and injured.

Non-shockable

Heart rhythms that are associated with cardiac arrest and do not need an attempted defibrillation (asystole and pulseless electrical activity).

Normalisation process model

This model is used not only to question and measure the effectiveness of the implemented intervention, but also to understand the workability and integration of the research intervention in the study settings, which are dynamic and complex.

Out-of-hospital cardiac arrest (OHCA)

Cessation of cardiac mechanical activity, confirmed by the absence of signs of circulation, that occurs outside of a hospital setting.

Out-of-hospital cardiac arrest incidence

The total number of out-of-hospital cardiac arrest events.

Out-of-hospital cardiac arrest survival to hospital discharge

The patient is discharged from the hospital alive after cardiac arrest that occurred outside the hospital.

ProQA

A guide that helps guide one through the process of collecting the vital information from the caller, obtaining the patient's status, choosing an appropriate dispatch level, and instructing the caller with medically approved protocols until the dispatched units arrive at the scene.

Return of spontaneous circulation (ROSC)

The return of any spontaneous palpable pulse. Does not require a specific pulse duration.

Shockable rhythms

Heart rhythms that are associated with cardiac arrest and need attempted defibrillation (ventricular fibrillation/pulseless ventricular tachycardia).

Signposts

A sign that acts as a guide or indicator.

Survival event

ROSC sustained until arrival at the emergency department and transfer of care to medical staff at the receiving hospital.

Two-tiered EMS systems

Consist of two types of providers, basic life support (BLS) units and advanced life support (ALS) units, each with different capabilities.

Utstein template

A reporting templates which has been used extensively in published studies of cardiac arrest, enhancing understanding of the elements of resuscitation practice and facilitating progress towards an international consensus on science and resuscitation guidelines.

Abbreviations

AHA American Heart Association

AED Automated external defibrillator

A&E Accident and Emergency Department

AEMPD Advanced Emergency Medical Priority Dispatch

ALS Advanced life support

ANOVA Analysis of Variance

BLS Basic life support

CARES Cardiac Arrest Registry to Enhance Survival

CBD Category-based dispatch

CCU Cardiac Care Unit

CPR Cardiopulmonary resuscitation

CPC Cerebral Performance Category

DACPR Dispatcher-Assisted Cardiopulmonary Resuscitation

DNR Do Not Resuscitate

EMS Emergency Medical Services

EMT Emergency Medical Technician

EMD Emergency Medical Dispatch

ILCOR International Liaison Committee on Resuscitation

IT Information and Technology Department

ICU Intensive Care Unit

mRS modified Rankin Scale

NHS National Health Service

OHCA Out-of-hospital cardiac arrest

OUD Operation Unit Director

PAROS Pan Asian Resuscitation Outcomes Study

PAD Public access defibrillation

ROSC Return of spontaneous circulation

SHARE Save Hearts Arizona Registry and Education

Chapter One: Introduction

1.1 Background of the Study

Out-of-hospital cardiac arrest (OHCA) can be a potentially lethal event and continues to cause a global burden (Sasson, 2010). Further, while the OHCA incidence is increasing and robust systems of care are rapidly evolving, the majority of communities do not achieve optimal survival after OHCA incidences (Kim, 2017 and McCarthy, 2018).

The cardiac resuscitation systems revolution started more than 40 years ago when international cardiopulmonary resuscitation stakeholders developed an out-of-hospital cardiac arrest management strategy, which documented minimal improvement in OHCA outcomes. Since then, evidence-based periodic amendments have formulated the "cardiac arrest chain of survival". This chain has been recently revolutionized to "the revised chain of survival" (Deakin, 2018). The latest study on the chain of survival focused on the specific interventions involved in each link, along with each link's potential effectiveness (Deakin, 2018). The analysis of the effectiveness of the links showed that the contribution of each of link diminishes rapidly as OHCA patients go through each link (Deakin, 2018). This decreases the number of patients progressing along the chain, with only few OHCA patients who entered the initial links surviving through to the last link (Deakin, 2018). Deakin, (2018) applied different formulas to estimate the effectiveness of each link; the early OHCA recognition effectiveness level was equal to 1.0. the early CPR effectiveness level was .47, the early defibrillation effectiveness level was .12 and, lastly, the post-resuscitation care effectiveness level was found to be equal to .12. Although increasing the number of patients progressing at all links is essential to improving survival, Deakin's (2018) revised presentation of the survival chain suggests that improving the early link, early OHCA recognition, is the most rewarding.

One recently recognised element of the early link is Dispatcher-Assisted Cardiopulmonary Resuscitation (DACPR). DACPR is an un-ignorable element in the latest chain of survival, according to *2018 American Heart Association, UK resuscitation Council* and the *Scottish Government*, *Cardiopulmonary Resuscitation* guidelines. DACPR's benefits outweigh its risks due to its ability to increase Bystander CPR rates and its cost effectiveness, leading to these recommendations (Vaillancourt , 2007 and Rea, 2003).

For these reasons, cardiopulmonary resuscitation centres of excellence in the United States and Europe have initiated DACPR and introduced many advances in DACPR programming (Gardett, 2016). Yet, the impact of DACPR on OHCA survival is not known (Numer, 2015). This is due to the contradictory results of published studies on DACPR (Bohm, 2011; Song, 2014; Tanaka, 2012 and Bobrow, 2016) and, sometimes, incomplete implementation of DACPR (McCarthy, 2018). In EuReCa ONE, a multinational prospective study in Europe, the proportion of DACPR implementation was 30% in 21 European countries (Grasner, 2016).

This study implemented completely an up-to-date DACPR programme in a region of Kuwait. The researcher wanted to identify the relationship between DACPR and OHCA outcomes and resolve the existing conflict surrounding DACPR's impact on OHCA outcomes. Another reason behind implementing DACPR in pilot region of Kuwait was to introduce the early links of the "cardiac arrest chain of survival" through DACPR. Kuwait did not have a national OHCA outcome improvement plan prior to this study.

1.2 Significance of the study

It is envisaged that the results of this study will describe comprehensively the impact of DACPR on OHCA outcomes in the pilot region of Kuwait. The results will also be useful to EMS policy-makers in planning their OHCA recognition and management strategies by providing supportive evidence for DACPR.
The exploration of DACPR implementation in a pilot region of Kuwait, which involves a heterogonous population, will assist in identifying DACPR implementation methods, challenges and quality assurance and improvement measures. EMS policy-makers, with similar populations, and EMS system,with similar settings, can use the study results to guide their DACPR implementation.
The results of this study are also beneficial in terms of reflecting DACPR accuracy in detecting OHCA cases. Again, EMS policy-makers can refer to the study results during their DACPR implementation evaluation.
Lastly, call takers can benefit from this evaluation in that it helps them to identify what to expect from an application of DACPR in their OHCA calls, including caller terminologies, OHCA call challenges and call evaluation metrics.

1.3 Aims of the study

The aims of this study are to:

1. Describe OHCA incidence, cardiac arrest features (age, gender, location, witnessed arrest and initial rhythm) and Emergency Medical Services (EMS) resuscitation practices in a pilot region of Kuwait.
2. Determine the impact of Dispatcher-Assisted Cardiopulmonary Rsuscitation (DACPR) on the outcomes of OHCA in a pilot region of Kuwait in terms of return of spontaneous circulation (ROSC) and survival to 30 days.

3. Examine DACPR impact on the following outcomes: OHCA recognition rate, CPR instruction rate and Bystander CPR rate.
4. Explore the challenges of DACPR implementation in the Kuwaiti EMS and what recommendations can be made to improve the operational effectiveness of DACPR in Kuwait.

1.4 Organisation of the thesis

This thesis consists of seven chapters. Chapter One outlines the aims and significance of the study. Chapter Two explores out-of-hospital cardiac arrest, including incidence, the significance of OHCA to EMS and the current OHCA recognition and management strategies in the metaphor of the OHCA chain of survival. This chapter also explores the developed EMS systems' approaches to enhancing the different links in the OHCA chain of survival and their impacts on OHCA survival. The present differences between the Middle East and the North American and European centres are also part of this chapter discussion. This chapter finishes by examining OHCA outcomes in the context of the updated Utstein reporting template.

Chapter Three provides an overview of one element of the OHCA chain of survival, i.e., DACPR. This chapter explains the reasoning behind DACPR's inclusion in the OHCA chain of survival. The most recent methods for DACPR implementation are discussed, followed by a description on DACPR programme measurement techniques. The published DACPR challenges are also highlighted in this chapter. The chapter ends with analysing the current evidence on DACPR's impacts on OHCA outcomes.

Chapter Four discusses the methods used to evaluate DACPR's impact on OHCA outcomes. The chapter outlines the aims of the study and discusses the research design, including the intervention used, implementation strategies, methods of data collection, sampling procedure and data analysis techniques employed. A number of practical aspects of DACPR programme evaluation prior to its implementation will also be discussed. Further, a DACPR feasibility assessment for the Kuwaiti EMS is included, as is a discussion of the methodological approaches used in evaluating OHCA outcomes. The chapter concludes with a discussion on the instruments used and developed for the study.

Chapter Five reports on the findings from before and after DACPR implementation in a pilot region of Kuwait. The findings are presented in relation to the research aims and research questions. This chapter examines the impact of DACPR on OHCA outcomes by outlining a comparison between the before – during-- after intervention groups in the pilot region and another comparison between the pilot and a control region.

Chapter Six discusses the findings from the DACPR implementation in a pilot region of Kuwait in the context of the current literature. The chapter evaluates DACPR's impact on the pilot region's OHCA patients' outcomes. Furthermore, this chapter discusses the method followed in DACPR implementation, along with the DACPR level of implementation in the pilot region of Kuwait. Next, DACPR challenges in Kuwait EMS are investigated. The chapter finishes with a discussion on the limitations of undertaking an evaluation of this kind.

In the last chapter; Chapter Seven, the author outlines the overall study conclusion and a number of recommendations identified as a consequence of this evaluation.

Chapter Two. Out-of-hospital cardiac arrest: Incidence, recognition, management strategies and outcomes

2.1 Introduction

Out-of-hospital cardiac arrest (OHCA) is a challenging health condition. Since 1974, when the first OHCA management strategy for cardiopulmonary resuscitation was issued, continuous international efforts to issue the ultimate OHCA recognition and management strategy have been put forth (Carveth, 1974). Yet, to date, OHCA survival rates have not increased substantially in most communities (Sasson, 2010 and McCarthy, 2018). This chapter highlights the current status of OHCA, the significance of OHCA to EMS and the adhered to international and regional recognition and management strategies. The chapter also discusses OHCA outcomes in the context of the updated reporting style.

2.2 Out-of-hospital cardiac arrest

Cardiac arrest is defined as the cessation of cardiac mechanical activity that is confirmed by the absence of signs of circulation (Mauri, 2016). Clinically, agonal breathing or loss of consciousness, pulse or breathing should be considered symptoms of cardiac arrest until proven otherwise (Deakin, 2015). Cardiac arrest can occur at any age; however, the aetiological factors differ between age groups. While coronary artery disease is the most common cause of cardiac arrest among adults who are 50 years old and older, cardiomyopathies and respiratory failure are the underlying causes among younger age groups (Graham, 2015).

Cardiac arrest is a sudden, urgent condition. Without swift recognition and management, it will result in death. It can occur in the hospital, as an in-hospital cardiac arrest (IHCA), or outside of the hospital as out-of-hospital cardiac arrest (OHCA). OHCA is the more frequent and most challenging of the two; in fact, three quarters of cardiac arrests take place outside the hospital environment (Daya, 2015). Moreover, OHCAs occur unexpectedly; up to 50 percent of OHCAs are the first sign of heart disease (Rea, 2003 and McCarthy, 2018). By contrast, most IHCAs are secondary to recognised acute respiratory relapses, with or without cardiogenic shock and with foreseeable deterioration noted before the arrest (Girotra, 2013). Early management stages for OHCAs are based on community efforts, whereas multidisciplinary resuscitation teams manage IHCAs, including physicians, nurses and respiratory therapists. This made the development of an approved, in-hospital Quality Improvement Resuscitation Program for in-hospital cardiac arrest feasible. In-hospital programmes are structured based on the 2015 American Heart Association

(AHA) Guidelines Update for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC) (Kronick, 2015*)*. In comparison, a similarly viable program for OHCAs is still evolving. This is due to the complex, interplaying elements that need to be explored and enhanced in OHCA recognition and management.

It is of note that both IHCAs and OHCAs contribute to an increasing global burden of mortality and morbidity that impacts strongly upon health-care systems (Haymana, 2015), where cardiac arrest is a major international public health problem estimated to be the cause of 15 to 20 percent of all deaths. Furthermore, Taniguchi (2012) states that, after cancer and heart disease, cardiac arrest is the third-leading cause of death worldwide.

2.2.1 Incidence of OHCA

According to Berdowski (2010), the global incidence of OHCA is difficult to estimate. Berdowski's systematic review analysed data from 82 EMS from various countries, including the United States, Germany, the Netherlands, Austria, Norway, Finland, Italy, France, England, Japan, Singapore, Taiwan, Australia and New Zealand The review concluded that the overall global average incidence was 55 adult OHCAs of presumed cardiac cause per 100,000 person-years. There was a ten-fold global variation in OHCA incidences, with North America reporting the highest percentage of all rhythm OHCA cases. These findings were confirmed by the five-multi-state heart rescue project (2017), which aimed to establish an OHCA wide-based registry. Diepen (2017) states that the United States' annual OHCA incidence is approximately 424,000 cases. The author also illustrated a rising incidence of EMS-attended OHCAs between 2011 and 2015 of 20% each year. These incidences are anticipated to increase with an ageing population (Fukuda, 2015). The incidence of OHCA is also high in Europe; a recent cross-sectional study, which included 27 European countries, reported a OHCA rate of 84 per 100,000 (Grasner, 2016).

Turning to more regional (Middle Eastern) OHCA incidences, Irfan's (2016) retrospective study on EMS-attended OHCA in Qatar reported an incidence of 23.5 per 100,000 person-years of presumed cardiac OHCAs. Furthermore, Qatar and the United Arab Emirates reported cardiac-related mortalities of 30% (Qatar Ministry of Public Health, 2017). The State of Kuwait, in which this study took place, is no different from the rest of the Gulf States in terms of health statuses. However, Kuwait has the highest cardiac-related mortality in the region at 46% (World Health Organisation, 2014). This cardiac-related mortality is even higher than the global cardiac-related mortality of 32%(Roth, 2015). Yet, to date, no national EMS-attended OHCA incidence in Kuwait has been reported.

Collectively, global EMS-attended OHCA incidences are high. Regionally, there are high cardiac-related mortalities, yet little is known about EMS-attended OHCA incidences. This explains the current regional interest in measuring and improving EMS-attended OHCA outcomes. Given that Kuwait has the highest cardiac-related mortality incidence in the region, it is important for Kuwait to measure EMS-attended OHCA incidences before developing management strategies for OHCAs. Part of the proposed study is devoted to pursuing this objective.

2.2.2 Cultural context and setting

Cultural context

Kuwait has a distinct culture; as ‘do not resuscitate’ requests do not exist in Kuwait, EMS personnel are required to provide resuscitation to every cardiac arrest patient unless there are evident signs of death, such as rigor mortis or lividity. Additionally, as no distinction is made between gender, a family member will not prohibit male EMS personnel from resuscitating a female relative during cardiac arrest. Although Kuwait’s EMS guidelines are based on the North American model, they also include specific resuscitation instructions from the Ministry of Health regarding female resuscitation, stating that male EMS personnel should not expose female chests during CPR. This aligns with the Islamic recommendation to preserve female dignity at all times. Moreover, there remains a preference in the community for female health professionals to treat female patients. However, the lack of female EMS personnel means that this is not always possible, and this fact is well understood by patients and their families.

Setting

Kuwait’s population is heterogeneous, comprising 1.191 million Kuwaitis and 2.57 million non-Kuwaitis (Central Statistical Bureau 2011). Kuwait consists of six provinces: Al-Asimah, Hawali, Mubarak Al-Kabeer, Al-Jahra, Al-Farwanya and Al-Ahmedi. Hawali Province is a heterogeneous urban area with 192,778 Kuwaitis and 480,132 non-Kuwaitis (General Population Census 2011). As the ratio of Kuwaitis to non-Kuwaitis (1:2.5) is representative of the overall ratio in the country, the selection of Hawali province as the intervention site ensures sample generalizability. Al-Farwanya Province was selected as the control site. Although heavily populated, its population demographics are similar to those of Hawali Province. Moreover, there is an evident gender disparity present in both provinces. The reason for this disparity is the higher rates of single male immigrants in these provinces (Public Authority for Civil Information, 2017). Table 2.1 shows demographic data for Al-Farwanya and Hawali provinces for the year 2016.

Table 2.1 *Demographic data for Al-Farwanya and Hawali provinces for the year 2016.*

2016	Hawali	Al-Farwanya
Population served	939,507	1,169,302
Kuwaiti	24% (227,913)	20% (234,359)
Non-Kuwaiti	76% (711,954)	80% (934,934)
Male	55% (523,879)	70.1% (820,232)
Female	44% (415,628)	29.8% (349,070)

Hawali province has eight ambulance stations with 30 ambulances, 65 Emergency Medical Technicians (EMTs) and 24 paramedics. Al-Farwanya province has nine ambulance stations with 25 ambulances, 72 EMTs and 15 paramedics. The EMS level of service is equivalent to North America's Basic and Advanced Life Support level. The Ministry of Health EMS is a two-tiered system, with two EMTs for each of 46 ambulances, and one EMT and one paramedic staffing the remainder.

Cardiac arrest calls activate initially those ambulances that are geographically nearest to the patient. Cardiac arrest is characterized by sudden loss of consciousness and absence of normal respiration, and treatment is based on the Kuwait Ministry of Health EMS protocol. EMTs are trained to perform one cycle of CPR at the scene as per the 2010 AHA CPR guidelines, with a 30:2 compression-to-ventilation rate while using bag-valve-mask ventilation and defibrillation. However, the protocol states that EMTs cannot remain at the scene beyond one CPR cycle and rhythm analysis and they must transport the patient to an emergency department while continuing to perform CPR during ambulance transport (Kuwait Emergency

Medical Services Training department ,2015).

Kuwait has a single, centralized dispatch centre for all ambulance services; this is an Arabic-based system which receives calls for EMS and inter-hospital transportation. For emergency calls, Kuwait follows a European emergency response system. The emergency phone number 1-1-2 connects to a switchboard that locates the address and categorizes the requirement as police, fire department or medical assistance. If medical assistance is needed, the call is forwarded to an EMS call taker who answers the call, reconfirms the address and responds by activating the nearest ambulance. All call processes, including the medical priority dispatch system, are in Arabic. Table 2.2 describes key features of Kuwait's EMS.

The average number of calls per year is approximately 90,244, including 9,427 cardiac cases (Operation Department Annual Report, 2013). All calls are taken by a primary call taker (usually an accident and emergency nurse with certified emergency medical dispatch training as per the International Academies of Emergency Dispatch). The call taker first locates the patient and then enters a primary report of the patient's complaint into the ProQA software system (Emergency Priority Dispatch version 12.1). The call limit is 2 minutes. The patient's details are then transferred to a secondary call taker, who dispatches the nearest ambulance to the patient location, providing the ambulance crew only with the patient's primary complaint and location.

Table 2.2 *Key features of Kuwait Emergency Medical Services*

Call volume in 2017 (incidence/1000 inhabitants/year)	139,751/1000 inhabitants/year
Proportion of calls resulting in ambulance	All calls receive an ambulance
Index/dispatch priority tool	All calls are high priority
Manual/electronic use of Index Dispatch Priority tool	Electronic North American Emergency Medical Priority Dispatch (ProQA version12.1)
Mandatory/optional use of Index	Optional
Call taker certification and education	125 nurses (73%), 47 EMTs (26%), 3 paramedics (1%) 1-day intensive course: DPCPR SHARE

	course (70)
Approximate number of call takers/24h shift	25 call takers/shift
Ambulance services (2017 numbers)	114,525 missions 173 ambulances, 3 helicopters
Mean response time	11.3 minutes
First responder system	No first responder system
Public automated defibrillator	Not installed
Certification of ambulance providers	Paramedics 150 (25%), EMTs 450 (75%)

2.2.3 Significance of out-of-hospital cardiac arrest for emergency medical services

Measuring the quality and the effectiveness of an EMS is challenging. The Institute of Medicine (2016) defined quality as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge”. The Institute also described the six dimensions of quality care: a care that is safe, effective, patient-centred, timely, efficient and equitable. When applying this to an EMS, many challenges emerge, such as the broad range of medical conditions presented to the EMS, under-reporting of data, lack of uniformity in data collection and lack of agreement on performance indicators (Alsayed, 2012). Hence, EMS leaders recognise the need to identify a health condition that is time-sensitive and can reflect the performance of all EMS elements.

OHCA has been selected as the most appropriate health condition to test the integrity of an EMS, as it is time-sensitive and can reflect all elements of the system’s performance, including call takers, in-the-field EMS personnel, system logistics, readiness of equipment and reporting. OHCA outcome indicators include survival to hospital discharge, return of spontaneous circulation (ROSC), neurological performance and bystander CPR rate. Hence, many North American EMS leaders – including centres of excellence, Arizona Health Services and King County, Seattle – rely on OHCA outcomes in evaluating their organisations’ performances. More specifically, witnessed ventricular fibrillation outcomes are the most quantifiable benchmark of these services' effectiveness (Bobrow, 2016). Similarly, a study in Europe aiming to describe the European systems' quality of structure, process and performance chose cardiac-related symptoms and short-term survival after cardiac arrest as the study's endpoints (Fischer, 2011). The European Emergency Data Project included EMS centres from four countries, the United Kingdom, Spain and Germany, and a site from the United States for comparison. The project managed to obtain many EMS performance and effectiveness indicators by selecting OHCA short-term outcomes as the study's endpoint, including the availability of health professionals, response time, EMS utilisation, EMS demand for critical conditions and level of care provided by the EMS (Fischer, 2011).

Nationally, Kuwait's EMS system was certified by the International Organization for Standardization (ISO) in 2006, ensuring that EMS standard procedures are applied. However, ISO did not obtain or analyse Kuwait's EMS outcomes; therefore, it was an inappropriate tool for examining the quality and effectiveness of Kuwait's EMS system. According to the previously discussed literature, a more potent quality and effectiveness measurement method for the Kuwaiti EMS is to measure Kuwait's EMS-attended OHCA baseline, along with its recognition and management strategies. Part of the intent of this study is to identify these indicators, which will be the first to reflect Kuwait's EMS system's quality and effectiveness.

2.3 Out-of-hospital cardiac arrest recognition and management

For every minute that elapses after cardiac arrest without appropriate intervention, a patient's chance of survival decreases by 10%. Immediate cardiopulmonary resuscitation and the use of an automated electrical defibrillator (AED) can more than double a patient's chance of survival (American Heart Association, 2013). An OHCA is time-sensitive and, because it takes place out of the health services setting, its recognition, management and outcomes depend totally on the public. Hence, public awareness of OHCA symptoms, the role and availability of DACPR, and optimal CPR techniques are fundamental aspects needed to improve an OHCA patient's chance of survival. International cardiopulmonary resuscitation stakeholders' continuous research has revolutionised the "out-of-hospital cardiac arrest chain of survival", which has not only highlighted the public's role in OHCA recognition and management, but also succeeded in revealing other interplaying parties (Neumar, 2015). Fortunately, the international cardiopulmonary resuscitation stakeholders cherish their public role and the need for their engagement in OHCA management and recognition. This will be elaborated on more in the following section on the OHCA chain of survival.

2.3.1. Out-of-hospital cardiac arrest chain of survival

The cardiac arrest chain of survival sequences the resuscitation process by calling for early recognition and calls for help, early CPR, early defibrillation and post-resuscitation care. The (2018) out-of-hospital cardiac arrest chain of survival consists of six steps, as illustrated in Figure 2.1. Here, the current literature suggests the need to improve public awareness of OHCA symptoms, CPR "public readiness'' and OHCA aftercare to enhance the OHCA chain of survival management strategy in terms of its impact on OHCA outcomes (Scottish government, 2018). The present literature also demonstrates that a number of elements structure each step. In fact, some elements can overlap and enhance a number of steps. Chain of survival interpretation and application has been modified by some centres in the United States and Europe with the intention of making drastic improvements in the chain and to crystallise new strategies for cardiac arrest recognition and management (Hutin, 2017 and King County, 2018). The focus of these centres is on generating an evidence-based system to mend OHCA recognition and management, which has been the key to the overall improvement in their cardiac arrest outcomes (Scottish Government, 2018).

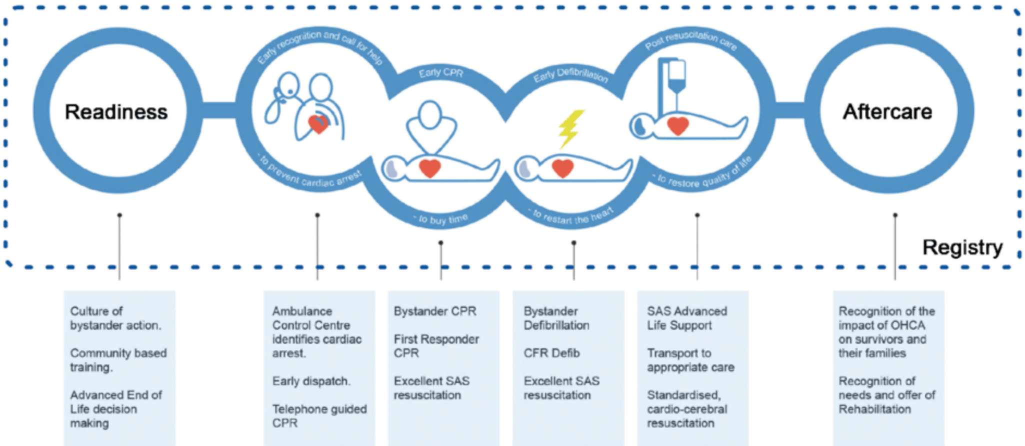

Figure 2. 1 'OHCA chain of survival'. Source: Scottish Government, 2018.

2.3.2 Centre-of-excellence strategies for out-of-hospital cardiac arrest

There are significant disparities in OHCA survival rates across cities in the United States and Europe. The overall OHCA survival rate in the United States is less than 6 percent (Graham, 2015), whereas, in Europe, it ranges from 2.6 to 9.9 percent (Mauri, 2016). Leading United States medical centres, such as Seattle's King County and the Arizona State Bureau of Emergency Medical Services and Trauma System, have reported changing outcomes related to OHCA, boosting a 19% survival rate in 2009 to 21% percent in

2013 and an 8.9% survival rate in 2007 to 14.4% in 2012, respectively (Public Health Seattle and King County, 2014 and Spaite, 2014).

Both Seattle and King County's systems have enhanced the early links in the chain of survival, i.e., early recognition and early CPR. They have also placed great emphasis on prehospital care and high-performance CPR, as well as on cardiac registries (Resuscitation Academy, 2013). Similarly, the Arizona State Bureau of Emergency Medical Services and Trauma System implemented a DACPR bundle in its well-prepared community and subsequently recorded promising OHCA survival rate improvements (9.1% to 12.1% in one year) (Bobrow, 2016). The Arizonian EMS is an evidence-based and community-customised system which has chosen to adopt many unique OHCA recognition and management strategies, including an exclusive prehospital care protocol, "cardio-cerebral perfusion".

2.3.3 International strategies for out-of-hospital cardiac arrest recognition and management

OHCA survival rates have also been explored in Europe. England's National Health Service (NHS) reported an OHCA survival rate increase from 7% in 2011 to 8% in 2014. The NHS correlated this improvement with increased community engagement in OHCA recognition and management, but also with increased focus on the early links in the chain of survival, namely, early recognition and early CPR (Perkins, 2015). However, unlike in the United States, this was achieved via training (British Heart Foundation, 2011). Similar practices were utilized by the Scottish government and resulted in improvement in OHCA survival to 30 days from 6.2% to 7.7% over 12 months (Scottish Government, 2018). The Scottish government reports three elements behind their project success: a cardiac registry, improving EMS personal data reporting (by providing electronic tablets for in-the-field data reporting) and the 'Save a Life for Scotland' public campaign (Scottish Government, 2018). In Sweden, the increase in OHCA survival rates from 4.8% in 1992 to 10.7% in 2011 was achieved in a similar manner through the enhancement of early survival links, but with the addition of early defibrillation through a well-structured public-access defibrillation program (Hasselqvist, 2015 and Ringh, 2015). In the same vein, a region of the Netherlands reported a high OHCA survival to hospital discharge rate (43%) for the period April 2011 to December 2012, which was accomplished via high public awareness of OHCA symptoms and management and high post-cardiac care availability. High public awareness led to a high OHCA witness rate (67%) and early use of AEDs (39%). Both contributed to the favourable OHCA survival to hospital discharge rate (Boyce, 2015). Furthermore, the location of a cardiac centre in this region led to constant advanced post-cardiac care availability.

The most important lesson learned from these centres of excellence is the need to build a healthcare system on evidence-based practices, including the application of a chain of survival. This can be made possible by customising the early links and applying them to suit a given community, followed by periodic performance measurements and strategy amendments. These are the first steps towards successful OHCA recognition and management.

2.3.4 Middle Eastern strategies for out-of-hospital cardiac arrest recognition and management

There is an undeniable performance gap between North American and European centres and Middle Eastern health care systems in OHCA recognition, management and outcomes. The lack of evidence-based practices in the Middle East has resulted in a 4.8% OHCA survival rate, with more than half of patients in a Beirut retrospective observational study being discharged with a poor neurological outcome (Alsayed, 2017). A low survival rate for OHCA patients has been similarly identified in a prospective descriptive study conducted by a university hospital in Riyadh (Bin Salleh, 2015). Similar findings relating to Riyadh have been previously published, including a retrospective observational study on a seven-year OHCA case registry, which reported a 5.1% OHCA survival to discharge rate (Conroy, 1999).

In contrast, the United Arab Emirates took part in the multinational Pan Asian Resuscitation Outcomes Study (PAROS) prospective cohort trial. In the first phase of the study, completed in 2011, it reported a 3% survival to discharge rate with overall poor neurological outcomes in Dubai (Ong, 2015). In the second phase of the study, the Northern Emirates joined PAROS (Batt, 2016). PAROS Phase 2 focused on implementing a unified DACPR protocol and registry for all participating countries (Ong, 2015). The preliminary results of the one-year cohort study reported a low ROSC rate as the primary OHCA outcome (3.1%) (Batt, 2016). Batt did not publish the survival to hospital discharge rate, as this is reserved for publication in PAROS Phase 2. The Northern Emirates National Health Services followed King County's dispatch and call-taking processes in OHCA cases, the American Heart Advanced Cardiac Life Support protocols during on-field interventions and PAROS data collection processes. Batt (2016) reasoned that the low ROSC rates were due to the low prevalence of early EMS activation, low rates of bystander CPR and the poor availability of public-access defibrillators.
Qatar also joined PAROS, and the study's retrospective preliminary results for the country have been published. The OHCA survival to hospital discharge rate in Qatar was 8.1%, with 68% of surviving patients discharged with a good neurological outcome (Irfan, 2016). Such a result is comparable to Western countries. Qatar's EMS is a three-tiered system in which each OHCA call receives DACPR according to the emergency medical priority dispatch system and causes the dispatch of supervisor, ambulance and

critical care paramedic (CCP) units in order to ensure on-scene advanced cardiac life support.

It is evident that the Middle Eastern region has begun to recognise the significance of cardiac arrests as a public burden and that it has initiated a number of studies on OHCA, following the international trend. Although the Middle Eastern studies identified baseline OHCA characteristics, the absence of customised OHCA recognition and management strategies led to low OHCA survival rates (3-8%). Instead, the Middle Eastern countries have implemented updated North American OHCA recognition and management strategies, regardless of their own community structures and resource availability. This could explain the low OHCA survival rates, except in the case of Qatar, which has comparable rates to Western countries. Qatar’s higher OHCA survival rates are due to its very advanced EMS, which most of the other countries lack.

Unlike the generic strategies adopted by the rest of the region, the proposed study develops a customised Kuwaiti strategy for recognising and managing OHCA via DACPR implementation, based on the available resources of the EMS and the country’s community structures.

2.4 Out-of-hospital cardiac arrest outcomes

In the 1980s, an international group of investigators in the field of resuscitation research noted a lack of common nomenclature, definitions, and consistency in scientific reports on sudden cardiac arrest. In response to these problems, the first Utstein conference on resuscitation research took place at the Utstein Abbey in Stavanger, Norway, in June 1990 (Idris, 1996). The conference issued the first framework for data reporting in resuscitation research. Repeated revisions of the Utstein reporting template have taken place and modifications of the reporting style have been based on the relevance, significance and practicality of the collected data to resuscitation clinical research. This section will give an overview of the updated Utstein template, in addition to the intended outcomes for this study (Perkins, 2015).

2.4.1 Utstein-style data reporting template

According to the updated Utstein template (2015), resuscitation studies should assess all EMS-treated cardiac arrests by citing the primary aetiology (medical or non-medical). The updated template has also divided OHCA data reporting into the following domains: system, dispatch/recognition, patient variables, resuscitation and post-resuscitation processes, and outcomes. Each domain consists of core and supplementary elements, as elucidated in Figure 2.2 Core elements are the most important data to be captured. In this study, the researcher retrieved Kuwaiti data for all of the OHCA core elements except for neurological outcome, target temperature management and reperfusion attempts (the omissions were due to time limits).

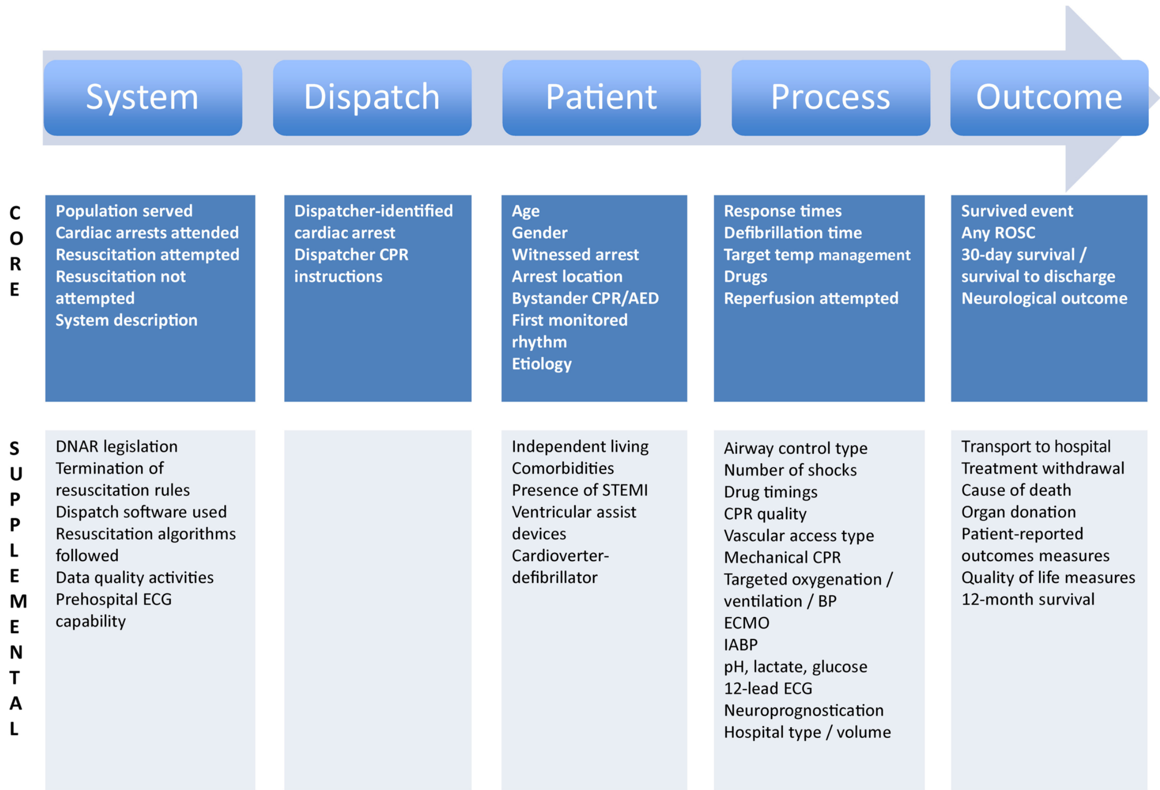

Figure 2.2 The Utstein template domains and their respective core and supplementary elements. Source: Perkins, 2015.

Furthermore, the updated Utstein template specifically restricts non-numerical data to the following responses: yes, no, unknown or not recorded. This restriction has been implemented to improve the clarity of scientific communication and the comparability of scientific investigations (Perkins, 2015). The researcher applied the updated Utstein template reporting style in this study.

2.4.2 Survival to hospital discharge

The Utstein update (2015) recommends that clinical researchers seeking to evaluate OHCA clinical outcomes make either rate of survival to discharge or rate of survival to 30 days the primary clinical outcome indicator. As mentioned earlier, the global OHCA survival to hospital discharge rate is approximately 7% (Sansson, 2010), while the Middle Eastern regional OHCA survival to hospital discharge ranges between 3 and 8.1% (Ong, 2015 and Irfan, 2016). The Kuwaiti OHCA survival rate to 30 days is not known; thus, for this study, the survival to hospital discharge rate will serve as the primary outcome indicator.

2.4.3 Neurological function outcome

Patients' neurological functions are evaluated according to cerebral performance categories (CPCs), the modified Rankin Scale (mRS) or the Glasgow coma scale-extended. The CPC was the most widely used neurological function measurement tool after successful cardiac arrest resuscitation prior to the Advisory International Liaison Committee of Resuscitation's latest recommendations in the Core Outcomes of Cardiac Arrest in Adults 2018 (Haywood, 2018). The CPC is a five-point scale that ranges from 1 (good neurological performance) to 5 (dead). CPC scores of 1 and 2 are associated with favourable clinical outcomes, while CPCs of 3 and below are associated with non-favourable outcomes (Cumin, 1991). The CPC assessment was done at hospital discharge using the adapted evaluative method, i.e., hospital notes, physical examination or both. There are no published studies on global OHCA favourable neurological outcomes. However, from the literature review, the rate of favourable neurological performances (CPC of 1 or 2) of OHCA patients at hospital discharge at the EMS Centre of Excellence, King County, was high at 85% (Phelps, 2013). To date, the United Kingdom has not recorded the rate of OHCA favourable neurological outcomes (National Cardiac Arrest Audit, 2016). In the Middle Eastern region, favourable neurological performance rates range between 53 and 68% (Alsayed, 2017 and Irfan, 2016). These details have been provided for background since the mRS has so recently replaced the CPC as the tool of choice for measuring OHCA patients' neurological functions (Haywood, 2018). The mRS can be completed via direct interview of the OHCA patient or caregiver, review of hospital records or chart review by a health professional (Haywood, 2018).

2.4.4 Return of spontaneous circulation

The Utstein template accepts the return of any manually detectable pulse from a major artery as evidence of ROSC, regardless of its duration. According to Cummin (1991), ROSC is a surrogate endpoint[1] in clinical research. This is not the case in the recent literature, in which ROSC has been upgraded to a primary outcome. This is because of ROSC's close correlation with high OHCA survival rates (Abraham, 2011). Furthermore, Chen (2015) believes that ROSC is more reflective of pre-hospital-care performance than survival rates to hospital discharge. He argues

[1] Surrogate endpoint: measures that are not of direct practical importance but are believed to reflect outcomes that are important.

that reliance on ROSC to assess post-OHCA events eliminates the effect of hospital care and focuses primarily on the impact of pre-hospital care on OHCA events. Again, no singular international ROSC rate has been reported, but the ROSC rate at the EMS Center of Excellence, King County, was high at 86% (Ziv, 2011). Meanwhile, the Middle Eastern ROSC rates varied between 0.7 and 23.1% (Alsayed, 2017 and Irfan, 2016). In this study, the investigator will evaluate ROSC rates in a region of Kuwait as a primary outcome indicator.

2.5 Conclusion

Out-of-hospital cardiac arrest is a time-sensitive, mostly lethal health condition. The global average incidence of OHCAs of presumed cardiac cause is 55 adults per 100,000 person-years. Emergency medical services use OHCA recognition and management strategies and OHCA outcomes to evaluate their overall performance. Currently, OHCA recognition and management strategies are symbolised by the chain of survival, while OHCA outcomes are survival rates to hospital discharge, neurological performance outcomes and the return of spontaneous circulation. The updated Utstein reporting template recommends including all these outcomes as core elements in OHCA clinical research. To date, the global OHCA survival to hospital discharge rate is low (7%) (Sasson, 2010). High OHCA survival to discharge rates have been reported in some regions of the United States and Europe (24.3% and 21.4%, respectively) (Boyce, 2015; Seattle & King County Emergency Medical Services, 2015). The former region also declared high rates of ROSC (86%) and favourable neurological outcomes (85%) (Ziv, 2011 and Phelps, 2013). Paying closer attention to these EMS systems' strategies reveals a trend towards customising OHCA chain of survival recognition and management elements according to the local community structure and resource availability.

Moving to the Middle Eastern studies, there is a regional trend of capturing OHCA characteristics and adapting Western OHCA recognition and management strategies to Middle Eastern EMS systems. This has resulted in low OHCA survival to hospital discharge rates of 3-8% (Ong, 2015 and Irfan, 2016), low ROSC rates of 0.7-23.1% (Alsayed, 2017 and Irfan, 2016) and low favourable neurological performance outcome rates of 53-68% (Alsayed, 2017 and Irfan, 2016). Only Qatar has OHCA outcomes comparable to those of the United States or Europe due to an EMS system which is much more advanced than in most countries in the region (Irfan, 2016).

Kuwait is no different from the rest of the region in term of health status, community structure and resource availability. In fact, Kuwait has a cardiac-related mortality of 46% (World Health Organisation, 2014). Although Kuwait's EMS was the first to be implemented in the Middle East, its lack of evidence-based practices has led to a failure to capture OHCA characteristics and use OHCA as an evaluative tool for the system's performance. This study will initiate EMS evidence-based practices by measuring Kuwait's OHCA baseline and outcomes. This should reflect Kuwait's EMS performance. Moreover, the study will develop an OHCA recognition and management strategy in the form of an updated, customised DACPR appropriate to Kuwait's community structure and the resources available to the EMS.

Chapter Three: Dispatcher- Assisted Cardiopulmonary Resuscitation

3.1 Introduction

Dispatcher-assisted cardiopulmonary resuscitation (DACPR) entails the call taker's delivery of simple questions to recognise cardiac arrest and simple instructions to initiate hands-only CPR (Wasick, 2015). Hands-only CPR is CPR without mouth-to-mouth resuscitation. It is recommended for use by people who see a teen or adult collapse suddenly in an out-of-hospital setting (American Heart Association, *n.d.*).The 2015 American Heart Association Guideline Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care indicates that DACPR in OHCA resuscitation is beneficial as a Class 1 recommendation (the benefits greatly outweigh the risks), based on the scale established by the Consensus on CPR and Emergency Cardiac Care Science with Treatment Recommendations (Neumar, 2015). Consolidating DACPR was also part of a 2015 strategy by the Scottish Government to tackle cardiac arrest, per the latest United Kingdom Resuscitation Council recommendations (Deakin, 2015). However, many aspects of DACPR's role in the OHCA chain of survival in terms of the advantages, disadvantages, implementation methods, efficacy and effects are yet to be established. This uncertainty explains why DACPR is evaluated repeatedly in the current literature. The present study's literature review revealed that more than 30 studies on DACPR were published in 2017 alone. This volume indicates that the present investigation examines an area that is of current interest. Furthermore, the 2017 studies exposed many previously unknown aspects concerning DACPR implementation and challenges. Therefore, prior to proceeding to an examination of DACPR, it is necessary to highlight the current evidence: the reasons for including DACPR in the OHCA chain of survival, DACPR implementation and DACPR effects on out-of-hospital cardiac arrest outcomes. Such outcomes include survival to hospital discharge, neurological performance outcomes, return of spontaneous circulation and bystander CPR rates; these are all discussed in this chapter.

3.2 Reasons for including DACPR in the OHCA chain of survival

3.2.1 DACPR effect on the bystander CPR rate

The provision of bystander CPR more than doubles an OHCA patient's chances of survival (Hasselqvist-Ax, 2015). The best method by which to increase bystander CPR rates in communities is not known (Graham, 2015) since the rates of bystander CPR vary greatly among communities, ranging from between 10% to 65% (Navarro Patón, 2017). The idea of DACPR was first conceived in the early 1970s to improve bystander CPR rates (Graham, 2015). DACPR's potential to improve bystander CPR rates is evident in the current literature (Kronick, 2015). A systematic review by Vaillancourt (2008) on understanding and improving low bystander CPR rates concluded that DACPR is a powerful tool for improving bystander CPR rates. Moreover, a randomised clinical trial (Painter, 2014) confirms DACPR's ability to reduce the time to initiation of bystander CPR. Two other quasi-experimental studies have come out in favour of the application of DACPR to improve bystander CPR (Vaillancourt, 2007 and Stipulante, 2014). Vaillancourt, (2007) increased bystander CPR rates from 16.7% to 26.4% in one year after introducing DACPR, while Stipulante (2014) in a two-year, before-and-after study in a region of Belgium documented an increase in the bystander CPR rate with the use of DACPR from 9.9% to 22.5%. In addition to an observational cohort study done by Wander (2014) in King County in the US, where higher bystander rates were present (52%), DACPR was able to improve the bystander CPR rate by only 2%. Lastly, a retrospective observational study in a region of Arizona carried out by Lewis (2013) also reported DACPR's ability to enhance the bystander CPR rate to 62%, concurring that bystander CPR improves as a result of DACPR. More recently, an Italian prospective simulated study recruited 109 participants to examine DACPR's ability to increase bystander CPR rates. This study came to the same conclusion that DACPR increases bystander CPR rates (Savastano, 2017).

With regards to the present study, there was one attempt made to enhance the Kuwaiti community bystander CPR rate in 2015. A national bystander CPR campaign, which targeted 10% of government employees, took place in February 2015. To the best of this researcher's knowledge, there were no published studies on bystander CPR rates in Kuwait before or after the campaign; therefore, the impact of the intervention is unknown. This study establishes bystander CPR rates in Kuwait for the first time. The investigation implements DACPR, which is known to improve bystander CPR rates and examines DACPR's potential to enhance bystander CPR rates in the Kuwaiti community. The study is therefore carried out on the regional level and examines early links in the chain of survival, including early recognition and early CPR. On an international level, the study adds data to the debate on the extent to which DACPR is the best method by which to improve bystander CPR rates. This is because, to date, no other links in the chain of survival have been implemented in Kuwait. Kuwait is a blank slate in this respect and can test DACPR's effect on bystander CPR rates.

3.2.2 Benefits and risks of DACPR

The 2015 American Heart Association Guideline Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care indicates that DACPR in OHCA resuscitation is beneficial as a Class 1 recommendation (the benefits greatly outweigh the risks), based on the scale established by the Consensus on CPR and Emergency Cardiac Care Science with Treatment Recommendations (Neumar, 2015). This is mostly based on White's (2010) prospective cohort study. The author reported the presence of a 50% risk of incorrectly diagnosing patients with OHCA during DACPR. Among the incorrectly diagnosed OHCA patients, there is a 12% risk of chest discomfort and a 2% risk of rib fracture when DACPR is administered. Moriwaki's (2012) observational study reported similar results, and the author analysed the presence of potential complications in OHCA patients who underwent bystander CPR. Very low bystander CPR-related complications were observed: 11.5% (3) of patients suffered complications (tracheal bleeding, minor gastric laceration and chest pain). Given the fact that bystander CPR doubles to triples the OHCA survival rate, and given DACPR's evident ability to increase the bystander CPR rate, it is claimed that the benefits of DACPR outweigh the risks to patients (Neumar, 2015). More recently, a before-and-after study in Switzerland (Plodr, 2016), while examining DACPR's effect on OHCA outcomes, documented no negative outcomes linked to hands-only CPR in incorrectly diagnosed OHCA cases.

Moreover, implementing the DACPR protocol, as in this study, has been identified as reducing the number of incorrectly diagnosed cardiac arrests by 37% (Hallstrom, 2000). Additionally, the DACPR launching process exposes the degree of the Kuwaiti EMS' sensitivity in detecting OHCA cases in Kuwait for the first time and tests the effects of incorrect OHCA diagnosis. The last point is significant since, other than that presented by Plodr (2016), evidence regarding the effects of incorrect OHCA diagnosis is scarce in the literature.

3.2.3 DACPR cost effectiveness

Another reason for including DACPR in the OHCA chain of survival is the presence of growing data regarding DACPR's cost-effectiveness from the EMS databases in Seattle's King County and the State of Arizona, both of which are leaders in OHCA survival (Resuscitation Academy, 2013), as well as other sources. In the United States, the cost per year-of-life saved by an EMS system with DACPR is 2,834 USD versus 4,834 without DACPR (Valenzuela,1992). More recently, a prospective observational study (Dami, 2010) has verified DACPR's superiority as a cost-effective tool in early OHCA recognition over the standard Advanced Emergency Medical Priority Dispatch System (AEMPDS) in Switzerland. Ng (2017) also highlighted DACPR's ability to enhance the first three links within the chain of survival and its importance as a very low cost, but highly effective, means with which to raise bystander CPR rates in an environment with limited resources. Hence, although DACPR alone cannot be the solution for the high cardiovascular mortality rates in Kuwait, it may be a cost-effective solution with which to establish an OHCA baseline and initiate the early links in the Kuwaiti community, i.e., early recognition and early CPR.

3.3 DACPR implementation

Other than Ng (2017), the EMS databases in Seattle's King County also recommended DACPR implementation in EMS systems wishing to initiate the OHCA chain of survival with limited resources. This is because the King County EMS views DACPR as a low-cost tool that has an impact in terms of lives saved (Resuscitation Academy, 2017). The Resuscitation Academy (2017) (a joint training programme administered by Seattle Medic One and King County EMS) elaborates further by disclosing that, in practice, most dispatch centres claim to have dispatcher-assisted CPR protocols in place; however, they do not frequently offer CPR instructions to bystanders. This is confirmed by the results of the Italian Resuscitation Council national survey in 2017. Seventy-nine directors of EMS centres in Italy completed a telephone-based interview regarding DACPR implementation (Di Marco, 2017). The survey revealed that instructions for DACPR were routinely deployed by 97% of the EMS centres, although it was included as a standardised procedure by only 58% of the centres. DACPR included chest compression CPR instructions in 54% of EMS centres (Di Marco, 2017). Hence, there is a lack of transparency regarding DACPR implementation. Moreover, it is difficult and stressful for call takers to determine the presence of cardiac arrest and provide CPR instructions. Subsequently, EMS dedication to implementing factual DACPR in their systems can be a key step in initiating the early OHCA chain of survival and hopefully improving OHCA outcomes.

Although DACPR is increasingly recommended, the best method for DACPR implementation is not known. In 2016, the AHA published six programs and five performance recommendations for DACPR implementation: commitment to DACPR by both the emergency communications centre and the dispatch centre director, the provision of training and continuing education in DACPR for all call takers, conducting on-going quality improvement for all calls in which a cardiac arrest is confirmed by EMS personnel and in which resuscitation is attempted, communication between the emergency communications centre and responding EMS agencies to measure implementation and effectiveness, designation of a medical director to issue protocols and work closely with the responding EMS agencies, and recognition for outstanding performance (Eisenberg, 2017) (performance recommendations are discussed in Section 3.3.2, Measuring DACPR programme outcomes).

The six AHA recommendations provide broad guidance to EMS systems in terms of DACPR implementation methods. There was no further elaboration on any of the recommendations by the AHA. It was only in 2017 that the Resuscitation Academy published an explanation of the AHA's recommendations for DACPR implementation (Eisenberg, 2017). Table 3.1 illustrates the Resuscitation Academy's explanation of the AHA's recommendations for DACPR implementation, published in 2017.

Table 3.1 Resuscitation Academy's explanations for each of the AHA's recommendations for DACPR implementation

Programme Recommendation #1 Commitment to DACPR	• The emergency communications centre will commit to providing effective DACPR. • The dispatch centre director must provide leadership and hold the staff accountable for implementation.
Programme Recommendation #2 Provision of training and continuing education in DACPR for all call takers	• Require initial training for 100% of call takers and dispatchers. Initial training will require an estimated 3–4 hours. • Require on-going continuing education. This will require 2–3 hours annually.
Programme Recommendation #3 Conduct on-going quality improvement (QI) for all calls in which a cardiac arrest is confirmed by EMS personnel and in which resuscitation is attempted	• 100% of calls in which resuscitation is attempted must have the dispatch call audited for QI purposes. • The QI must collect key time intervals, reasons for non-recognition of cardiac arrest and reasons for delays. • Individual QI review of every cardiac arrest call provided by the supervisor (or designated QI person), including helpful feedback. • QI reports must be summarised annually and secular trends reported. • QI reports should be used to identify training needs.
Programme Recommendation #4 Connection to EMS agency	• Close engagement with the EMS agency is required to link data from dispatch audio with EMS-run report data. • Linkage with EMS is required to identify the denominator of total cardiac arrest cases and the percentage of all cardiac arrests which are recognised as cardiac arrest by the call taker/dispatcher.
Programme Recommendation #5	• There must be a designated communications centre medical director, who will issue the dispatch protocols for DACPR and be able to

Designation of medical director	work closely with the EMS agency. Ideally, there should be a combined medical director for the dispatch centre and EMS agency.
Programme Recommendation #6 Recognition of outstanding performance	• Call taker recognition programme for outstanding performance in the recognition of cardiac arrest and delivery of DACPR instructions.

The Resuscitation Academy has been the organisation behind the success of the King County EMS in implementing DACPR for more than a decade. The Resuscitation Academy collects OHCA call data continually, analyses it and, subsequently, provides evidence-based recommendations and training to the King County EMS staff (Resuscitation Academy, 2017). This led to a substantial growth and variation in the resources available to the King County EMS system. However, the organisation of OHCA seen in King County is not present in most EMS systems; it is argued that the AHA recommendations elaborated on by the Resuscitation Academy are only feasible for EMS systems similar to that of King County (Eisenberg, 2017). Eisenberg's (2017) analysis of Langlais' (2017) retrospective study findings confirms this. Eisenberg (2017) argues that some AHA recommendations and performance metrics are unreliable. This is because Langlais (2017) encountered barriers to DACPR in approximately 26% of the OHCA calls that activated the Arizona EMS system, although the calls were handled according to AHA (2017) recommendations. During these calls, the call takers could not overcome these barriers when adhering to the restricted protocol. Eisenberg (2017) interprets these findings as OHCA calls having situational factors and unusual circumstances that can preclude the delivery of DACPR. The best DACPR implementation, therefore, needs further shaping. It may be best to encourage training in performance rather than solely in protocol for call takers and laypersons.

Collectively, the AHA recommendations and performance metrics provide general guidance to EMS systems in DACPR implementation. However, due to the variety of EMS systems and OHCA calls, there is no single DACPR implementation strategy that fits all EMS systems. It is therefore necessary to review DACPR implementation methods from the literature before examining DACPR in Kuwait.

3.3.1 Methods for implementing DACPR

Implementation of DACPR includes two steps that need to be taken by the EMS call taker: recognizing OHCA and giving the caller clear CPR instructions. The current literature describes different modalities to ensure these steps are performed successfully. Some authors argue that DACPR needs to be joined to other instruments, such as high public awareness, to have a fully implemented DACPR; this is known as a 'DACPR bundle' (Bobrow,2016 and Harjanto, 2016). Others view DACPR as a sole tool that should be enhanced by different EMS strategies (Bray, 2009; Berdowski, 2011; Tanaka, 2012; Song, 2014 and Huang, 2017). Also, only a limited number of writers view DACPR as EMS recognition of OHCA cases only (without giving CPR instructions) or as a partial application of DACPR. A summary of three modalities of DACPR implementation follows: DACPR in bundle, DACPR as a sole tool and partial application of DACPR.

i. DACPR in bundle

In a DACPR bundle, different joint instruments are used to enhance the effect of DACPR on OHCA outcomes, such as a school CPR training program, public mass campaigns, compulsory CPR certification when issuing vehicle licenses, and so forth. It is widely believed that DACPR is only effective in communities with high CPR awareness. This belief is based primarily on a King County press release that ‘Bystander CPR rates can reach 70–80% in communities with well-implemented community CPR and dispatcher-assisted CPR programs, and increased bystander CPR rates are associated with a three-and-a-half fold increase in 1-year survival’ (Wu, 2017).

This outlook explains the recent European trend, seen in Germany, Denmark and the United Kingdom, to include compulsory hands-only CPR training in school programs and/or when issuing vehicle licenses (Europa.eu, n.d.; Nolan, 2006 and Perkins, 2016). This is due mainly to the hypothesis that a bystander’s previous knowledge of CPR can enhance a call taker’s recognition of OHCA and enable a higher quality hands-only CPR. While two small, simulated trials conducted by Navarro-Patón (2017) and Savastano (2017) in the current literature support this hypothesis, another, more rigorous, Korean cross-sectional study concluded that high bystander CPR rates, regardless of DACPR implementation, have better effects on OHCA outcomes (Ro, 2017). Different results were documented in Lee’s (2017) retrospective observational study in Korea. The author investigated whether CPR awareness in a community is associated with recognition of cardiac arrest, CPR instruction given by the call taker, and bystander CPR rates. The author concluded that there was no better call taker OHCA recognition in communities with a higher CPR awareness level. However, better rates of bystander CPR and CPR instructions by call takers were found in communities with higher CPR awareness levels.

Collectively, the relationship of DACPR to public awareness is not yet fully understood, according to the present literature. Most countries seem to have drifted from implementation of the DACPR bundle for several reasons: the high cost (Swor, 2009), long periods (Bobrow, 2016), questions over whether a high level of public awareness is necessary for effective DACPR (Bobrow, 2016) and the absence of a best method for improving public awareness in the literature (Kronick, 2016).

The present study's literature review of DACPR bundles studies their effect on OHCA outcomes. These bundles are described in Table 3.2, which illustrates three different joint instruments that have been used to enhance the effect of DACPR on OHCA outcomes: high school CPR training in Japan (Tanaka, 2012), a public campaign in Singapore regarding DACPR (Harjanto, 2016) and a five-year public mass CPR training campaign in Arizona (Bobrow, 2016).

Two of these studies showed the DACPR bundles have positive impacts on OHCA survival (the exception being Harjanto, 2016), Kuwait needs a swift, cost-effective tool to initiate the early links of the OHCA survival chain and identify the areas most in need of improvement in the chain. The implementation of DACPR bundles in the three reviewed studies ranged from 1.5–6 years, while shorter implementation periods and comparable results were attained with DACPR implementation as a sole tool. The latter is from a discussion in the recent literature of various implementation techniques that use DACPR as a sole tool.

Table 3.2 *Various joint instruments that enhance the effect of DACPR on OHCA outcomes*

No.	Author	Bundle	Design	Country	Sample	Year	Results
1	Harjanto	DACPR (protocol, 1-day intensive training and QI in the form of an audio record review) Dispatcher Assisted First Responder (DARE) programme (educate the public to follow call takers' instructions)	Before and after	Singapore	(2968) 1820 cases in the BEFORE period, 475 cases in the RUN-IN period and 673 cases in the AFTER period	2016	The survival rate of the DACPR group was equal to that the non-BCPR group. Best survival rates with spontaneously initiated BCPR.
2	Bobrow	Novel protocols, training modules, case and system-level data collection, reporting and feedback to individual health care professionals + Cardiocerbralprefusion (CCP) intervention + 5 years prior to the study BCPR public awareness campaign	Before and after	US (Arizona)	2334 OHCAs	2016	DACPR was associated with better OHCA survival outcomes (9% to 12%).
3	Tanaka	(1) Enforcement of a uniform telephone-CPR manual for CC-only CPR (2) A standard educational approach on how to detect and recognise OHCAs with agonal breathing, emesis and anoxic seizure as well as an impending cardiac arrest (3) Behaviour modification for call takers (4) Conferences between EMTs and call takers to resolve discrepancies in their information (5) High school BCPR training campaign	Before and after	Japan	4995 OHCAs with resuscitation attempted	2012	DACPR improved BCPR rates and survival outcomes (different resuscitation techniques for the before and after groups can be the reason for better survival results).

**Notes: BCPR=bystander CPR; EMT=emergency medical technician.*

ii. DACPR as a sole tool

The current literature examines a large number of conceptual models of DACPR as a sole tool. This is illustrated in Table 3.3. The reviewed studies adopted various strategies during DACPR implementation. This confirms two facts: EMS systems implement DACPR on the basis of their present resources, and the search for the best strategy by which to implement DACPR is an on-going process. On looking closely at their implementation methods, there are three main strategies by which DACPR is implemented as a sole tool:

1. New DACPR protocol: A new protocol for recognition of OHCA symptoms and hands-only CPR instructions (Takahashi, 2018; Wu, 2017; Fukushima, 2017; Plodr, 2016; Hiltunen, 2015; Sanson, 2015; Bray, 2011 and Berdowski, 2009).
2. Training for call takers on DACPR and the new DACPR protocol (Viereck, 2017 and Tsunayoma, 2017)
3. Training for call takers on DACPR, the new DACPR protocol and quality assurance measures (Ro, 2017; Hardeland, 2017; Huang, 2017 and Song, 2014).

Table 3.3 *Studies implementing DACPR as a sole tool*

No.	Author	Intervention	Design	Country	Sample	Year	Notes
1	Ro	Every dispatch centre has two levels of call takers. Primary call takers are charged with detecting out-of-hospital cardiac arrests and handing over the call to medical control call takers, who provide CPR instructions. Most primary call takers are fire fighters, whereas medical control call takers are either paramedics or nurses. + QI (feedback at the organisational level and by individual call taker) + 20 hours of continuous education every year for all staff members + electronic DACPR registry	Retrospective observational	Korea	37,924 patients	2017	No public automated defibrillator (PAD) in Korea. Initial DACPR training took the following form: the education programme included didactic sessions for dispatcher-assisted CPR, interactive skill sessions and direct feedback. More than 90% of call takers completed the course by 2011. After the in-class courses were delivered, all call takers received refresher training through a Web-based self-learning programme that was developed by the Foundation for International Emergency Medicine Education.
2	Takahashi	The call taker offers CPR instruction on either spontaneously-initiated CPR or compression-only CPR. All conversations are electronically recorded by synchronised radio-controlled watches.	Retrospective observational	Japan	37,899 witnessed cardiogenic out-of-hospital cardiac arrests (OHCA)	2018	

No.	Author	Intervention	Design	Country	Sample	Year	Notes
3	Hardeland	Intervention: (1) Lectures focusing on agonal breathing and interrogation strategy (2) Simulation training (3) Structured call taker feedback (4) Web-based, telephone-assisted CPR training programme	Before-and-after interventional study.	Norway (Oslo)	561 OHCA adult patients	2017	
4	Viereck	Manned with medical call takers who are educated paramedics or registered nurses with experience in emergency care and have received six weeks of additional training in emergency medicine and communication. Medical call takers are assisted by a category-based dispatch (CBD) tool via priority A, the Danish Index for Emergency Care.	Retrospective observational	Denmark	548	2017	High level of public awareness: • Life Saver and AED training is mandatory in elementary schools and when an individual obtains a driver's license. • Approximately 300,000 lay people are educated in BLS and AED and use them annually. Advanced EMS system Mobile Critical Care Unit + call takers directing the lay person to the nearest AED.
5	Wu	Not reported	Prospective observational	Taiwan	243 OHCA patients	2017	

No.	Author	Intervention	Design	Country	Sample	Year	Notes
6	Takyu	Not reported.	Retrospective observational	Japan	277,957	2017	
7	Wu	Dispatch centres with protocols based on AHA guidelines that provide compression-only CPR instructions for adult arrests of presumed cardiac origin.	Retrospective observational	US (Arizona)	2310	2017	
8	Fukushima	Predefined protocol (chest compression-only for untrained CPR, and 30 chest compressions:2 breaths instructions for trained BCPR).	Prospective observational	Japan	688	2017	
9	Tsunayoma	Protocol and call taker training (seven hours on OHCA call handling)	Before-and-after study	Japan	532	2017	

No.	Author	Intervention	Design	Country	Sample	Year	Notes
10	Huang	1) SHARE protocol + A duty nurse was available from 8:00 am to 10:00 pm on weekdays. During these hours, the duty nurse provided medical instructions on the telephone whenever the call takers identified a critical case. When the nurse was not available, the call takers provided phone instructions. + QI in the form of an education and training programme. A 1-day training course for all call takers, including a didactic portion and practice drills for different scenarios, designed to teach the new protocol. 2) Monthly debriefing meetings. A medical director reviewed randomly selected samples of audio recordings. The performance levels of the call takers and their degrees of compliance with the protocol were assessed. The medical director debriefed all call takers about their performance with respect to identifying cardiac arrests and providing DACPR. 3) Commendations. The final part of the plan was implemented by merit citations whenever an OHCA patient experienced ROSC and whenever an OHCA patient survived with a successful DACPR. This not only increased the call takers' morale, but also had positive effects on their annual performance appraisal scores.	Before-and-after study	Taiwan	130	2017	

No.	Author	Intervention	Design	Country	Sample	Year	Notes
11	Song	DACPR protocol + Quality assurance	Double pre-test, single post-test	Korea	8144 patients	2014	
12	Plodr	New protocol	Before-and-after study	Switzerland	152 call recordings with DACPR were evaluated in period 1 and 174 in period 2	2016	
13	Bray	New protocol	Before-and-after study	Australia (Melbourne)	3121	2011	Old bystander practice (2:30); Melbourne is three-tiered: (1) Advanced-life-support (ALS) – Crews are comprised of paramedics who have some advanced life support skills (laryngeal mask airway, intravenous epinephrine); (2) Mobile intensive care ambulance (MICA) paramedics who are authorised to perform endotracheal intubation and administer a wider range of medications; (3) Basic-life-support trained fire-fighters equipped with AEDs dispatched as part of a first responder programme.

No.	Author	Intervention	Design	Country	Sample	Year	Notes
14	Hiltunen	New protocol	Secondary prospective observational study	Finland	299	2015	
15	Sanson	New protocol				2015	
16	Berdowski	New protocol	Retrospective observational	Netherlands	508	2009	Random sample audio call record review.

Although DACPR was implemented primarily through changing the protocol for recognizing OHCA symptoms and giving CPR instructions, recent researchers adapted different quality assurance and improvement measures during their implementation processes (Ro, 2017; Hardeland, 2017; Huang, 2017 and Song, 2014). This reflects two issues: the potential challenges associated with call takers' adherence to the new DACPR protocol, and the significance of high-quality DACPR. Although there is no single definition of high-quality DACPR, the general features are discussed in Section 3.3.2, Measuring DACR outcomes.

Collectively, DACPR with high-quality measures is the latest trend in using DACPR as a sole tool (Ro, 2017; Hardeland, 2017; Huang, 2017 and Song, 2014). The exploration of the best DACPR implementation strategy is an on-going process. Moreover, EMS systems' new trend is to select a DACPR implementation strategy on the basis of their given resources. Subsequently, EMS systems with very limited resources may well ask whether partial implementation of DACPR, in the form of OHCA recognition only, can be an efficient tool. This is discussed in the following section.

iii. Partial Application of DACPR

Without sufficient OHCA recognition rates by EMS systems, OHCA outcomes cannot be improved (Moller, 2016). Call takers must swiftly and accurately recognise cardiac arrests in order to dispatch the EMS personnel as quickly as possible. However, it is not known what effect reliance on only OHCA recognition without CPR instruction might have on OHCA outcomes. This is because two retrospective observational studies (Sanson, 2016 and Axelsson, 2010) reported contradictory results. In a study conducted in Italy, Sanson (2016) attempted to identify the weakest links in the chain of survival. He found no better survival rates in OHCA patients who were identified by a dispatch centre. Axelsson (2010), however, reported better outcomes were associated with correct OHCA recognition and CPR instructions by call takers in Sweden (see Table 3.4). Hence, despite the scant evidence regarding partial application of DACPR, one can conclude that eliminating CPR instructions from DACPR is not an acceptable practice. EMS systems should conform to the AHA's latest DACPR guidelines, which include both OHCA recognition and hands-only CPR instructions (Kleinman, 2015).

Table 3.4: Studies with partial applications of DACPR

No.	Author	Recognition Scheme	Design	Country	Sample	Year
1	Axelsson	The dispatch of ambulances based on an OHCA coding system rather than symptoms	Retrospective observational	Sweden	250	2010
2	Sanson	Colour-coding system in which OHCA cases labelled red are a high-priority call with the least response time	Retrospective observational	Italy	264	2016

With regards to the current study, DACPR has been modified continually to meet the available resources of the Kuwaiti EMS system and Kuwait's distinct culture. Efforts to ensure high quality are made, and DACPR is implemented in the form of a sole tool, with training for call takers, a new DACPR protocol and quality assurance and improvement measures.

3.3.2 Measuring DACPR programme outcomes

i. Programme level

In 2016, the AHA recommended four DACPR performance metrics: percentage of OHCA cases correctly identified by the call taker, percentage of correctly identified OHCA cases that were deemed recognizable versus those that were not because of complicating factors (e.g., language barriers, caller hang-ups, CPR already in progress), percentage of victims who received DACPR, median time between a 911 call and recognition by the call taker of cardiac arrest and median time between 911 call and first TCPR-directed chest compressions (Eisenberg, 2017). However, little is known about the benchmark criteria for a successful DACPR programme. The Resuscitation Academy (2017), Viereck (2017) and Moller (2016) established the optimal DACPR sensitivity to recognise OHCA cases. This confirms the use of OHCA recognition rate as a DACPR programme success benchmark and is in line with the AHA (2016) recommendations. Others believe that acheiving exact outcomes to spontaneously-initiated bystander CPR should be the DACPR programme success benchmark (Rea, 2001).

a) OHCA recognition rate

A recognition rate of 75% within one minute and a DACPR rate of 75% in cases in which the call takers have the opportunity of assessing consciousness and breathing have been suggested as the performance standard following the 2015 Utstein meeting on 'implementation of best practices in community resuscitation' (Eisenberg, 2016). Although the DACPR programme success benchmark is defined here, there are some elements of subjectivity in this definition. OHCA recognition should not be subjected to chance, and the call taker should be competent enough to recognise the OHCA case (Eisenberg, 2017).

In the same vein, Viereck (2017) argues that in order to use OHCA recognition as a benchmark to compare the results of DACPR and improve EMS systems, result reporting must be standardised so that results can be compared. The author conducted a systematic review to evaluate and compare studies reporting recognition of OHCA patients during emergency calls. He concluded that there are significant disparities in 'recognised OHCA' reporting. For the current DACPR systems in the included studies, the median sensitivity rate of OHCA recognition was 73.9%. The author also outlined the definition of 'recognised OHCA' in order to make these results interpretable for readers and comparable between organisations:

1. Recognition should be assessed by evaluating emergency call recordings.
2. Recognised OHCAs should be defined as cases in which the caller or the call taker expressed the presence of 'OHCA', the need for 'CPR' or the need for an 'AED'.
3. The following cases should be excluded: EMS-witnessed, missing/corrupted emergency call recording, cases in which the patient was obviously alive during the call, cases in which bystander CPR was initiated prior to the emergency call, and cases in which the caller was unable to assess the patient.
4. The data collection should be reported in a standardised flowchart and results should include incidence, sensitivity, and the positive predictive value (PPV), if possible (Viereck, 2017).

The use of the OHCA recognition rate and the inaccuracy related to its use was found in Moller's (2016) retrospective observational study in Denmark. The researcher and his colleagues compared the EMS systems of two European regions (Denmark and Sweden), aiming to evaluate and compare the accuracy in recognising OHCA by medical call takers using the same dispatch tool in two different regions in two countries. The study showed large differences in data registration practices despite the use of similar dispatch tools (both had a category-based system with a Norwegian dispatch tool). The author of the initial search of cardiac arrests showed a recognition rate of 40% in Denmark and 70% in Sweden. But when listening to audio records, the systems reported high and comparable OHCA recognition rates: 81% in Denmark and 86% in Sweden. Medical call takers used other codes (e.g., respiratory distress, unconsciousness) for cardiac arrest cases.

Hence, to use the OHCA recognition rate as a success benchmark for a DACPR programme, there must be a clear definition of 'recognised OHCA' and transparent reporting.

b) DACPR equivalent competence to spontaneously-initiated bystander CPR

The target of the DACPR programme is to provide CPR that is equivalent to spontaneously-initiated bystander CPR (Rea, 2001). A number of current researchers have estimated their DACPR programme success benchmarks by comparing their DACPR outcomes to their national spontaneously-initiated bystander CPR outcomes (see Table 3.5). For instance, Takahashi's (2018) large retrospective study investigated whether DACPR would have the same effect as spontaneously-initiated bystander CPR. The author categorised witnessed OHCA cases that activated the EMS system into four groups: spontaneous bystander CPR, no bystander CPR, DACPR that caused layperson performance of CPR and DACPR that did not cause layperson performance of CPR. He then compared the effect of each of these cases on OHCA outcomes.

While spontaneous bystander CPR had the best effect on good neurological function (adjusted Odds Ratio (aOR)=1.99, and 95% CI; 1.81–2.17), DACPR came in second (aOR=1.66, and 95% CI; 1.55–1.80). Moreover, spontaneous bystander CPR and DACPR had equal effects on ROSC (aOR=1.40, and 95% CI ; 1.30–1.51, aOR=1.42 and 95% CI ;133–1.52, respectively). Viereck (2017) carried out a similar examination in Denmark of DACPR's competence in acting as spontaneous bystander CPR; his study demonstrated comparable results. The author compared the OHCA outcomes of two groups: 'bystander CPR initiated prior to the emergency call' and 'DACPR'. Rates of ROSC and survival to 30 days were equal in the 'bystander CPR initiated prior to the emergency call patients' group and the 'DACPR' patients' group.

While Takahashi (2018) and Viereck (2017) demonstrated effective DACPR systems providing similar OHCA outcomes, Ro's (2017) cross-sectional study in a region of Korea concluded with contradicting results. The author also compared the OHCA outcomes between two groups: a DACPR patient group and spontaneously-initiated bystander CPR. The author concluded that DACPR had no impact on OHCA survival when compared with spontaneously-initiated bystander CPR. This can be explained by the lesser quality of the CPR provided by DACPR (Fukushimas, 2017). Fukushima's (2017) prospective observational study comparing the CPR quality of the two groups (spontaneously-initiated bystander CPR and DACPR) found different results regarding the systems' similarities. The researcher and his colleagues again categorised the OHCA calls as 'spontaneously-initiated bystander CPR' and 'CPR initiated by DACPR'. The EMS field personnel assessed the quality of the CPR that was in progress upon their arrival; the quality of the CPR was compared between the two groups. The author concluded that spontaneously-initiated bystander CPR was of better quality. Similar results were documented by two retrospective simulation studies (Savastano, 2017 and Navarro Patón, 2017), in which the authors also concluded that spontaneously-initiated bystander CPR provides better quality CPR than DACPR.

Table 3.5 *The extent of the differences in OHCA survival rates between spontaneously-initiated Bystander CPR and DACPR*

Study	Authors	Sample Size	Year	Survival Rate to Hospital Discharge	Time Period	Comments
Early Cardiopulmonary Resuscitation in Out-of-Hospital Cardiac Arrest	Hasselqvist and Riva	30,381 Subgroup analysis (35% of the total sample)	1990-2011 (time period 2009-2011)	DACPR group (10.9%) Spontaneously-initiated BCPR group (15.4%) Significant difference	11 years Subgroup 3 years	observational study 30% of the Swedish population are trained in CPR Dual dispatch system, 2006
Effects of DACPR programme and location of OHCA on survival and neurological outcome	Ro and Shin	37,924	2017	DACPR group (7.3%) Spontaneously-initiated BCPR group (8.4%) Non-significant difference	2 years	Cross-sectional National BCPR training campaign (7,065 per 10,000 persons) + PAD installation + First-responder SMS system during study period (Lee, 2015)
Does dispatcher-assisted CPR generate the same outcomes as spontaneously delivered bystander CPR in Japan?	Takahashi and Sagisaka	37,899	2018	Survival to hospital discharge is not included as primary or secondary outcome	2008–2012 (4 years)	Retrospective observational (Instead, ROSC is primary and CPC1or 2 is secondary)

Effect of bystander CPR initiation prior to the emergency call on ROSC and 30 day survival—An evaluation of 548 emergency calls	Viereck, and Møller	548	2017	DACPR group (16.7%) Spontaneously-initiated BCPR group (27.2%) Non-significant difference	1 year	Retrospective observational Comparison between BCPR-initiated outcomes (27.2%) and DACPR outcomes (16.7%), statistically non-significant with adjusted ratio (1.14)
Outcome comparison between a community-wide bystander defibrillation programme and dispatcher-assisted CPR in out-of-hospital cardiac arrest at public locations	Wu and Shih	271	2017	DACPR (25.9%) versus PAD group (57.1%) significant difference	2 years	Prospective observational PAD has better OHCA outcomes than DACPR
Telephone cardiopulmonary resuscitation is independently associated with improved survival and improved functional outcome after out-of-hospital cardiac arrest	Wu	2,310	2018	DACPR group (12%) Spontaneously-initiated BCPR group (15%) Significant difference	3 years	Retrospective observational A comparison between 3 patient groups (TCPR, BCPR and No BCPR)
Evaluating Dispatch-Assisted CPR Using the CARES Registry	Shah and Bartram	3,335	2018	DACPR group (12%) Spontaneously-initiated BCPR group (17%) Significant difference	2 years	Retrospective observational A comparison between 3 patient groups (DACPR, BCPR and No BCPR)

In general, DACPR's effect on OHCA outcomes' superiority or equivalence to national spontaneously-initiated bystander CPR effects on OHCA outcomes is not established. Hence, estimating a DACPR programme success benchmark by comparing DACPR outcomes to national spontaneously-initiated bystander CPR outcomes is not clearly endorsed in the literature.

In the current study, the researcher used OHCA recognition rates to estimate the installed DACPR success benchmark. The investigator used a predefined 'recognised OHCA' comparable to Viereck's (2017) systematic review recommendation, in which cases are labelled as recognised adult cardiac arrest when one of the following is present:

1. DACPR sheet is submitted.
2. Coded as ‘cardiac arrest’, ‘suspicion of death’ or ‘heart’.
3. The reviewed audio record showed that the call taker recognised the arrest or gave CPR instruction.
4. EMS-witnessed, missing/corrupted emergency call recording and cases in which the patient was obviously alive during the call (incorrectly diagnosed OHCA cases).
5. Matched with the in-the-field EMS personal diagnosis of cardiac arrest of unknown aetiology.

   An OHCA case will be considered missed when the call taker codes the call with any code other than the above-mentioned codes, i.e., ‘cardiac arrest’, ‘death suspicion’ ‘heart’, while the EMS personnel diagnose the same case as an OHCA event on scene.

c) Call level

As stated earlier, the AHA (2016) defined five DACPR performance metrics. The metrics are now down to call success benchmarks: the median time between a 911 call and recognition by the call taker of cardiac arrest and median time between a 911 call and the first TCPR-directed chest compressions. Moreover, Centers of Excellence, including King County Medical Services and Arizona Health Services, have specified the targeted median times for OHCA recognition (less than 1 minute) and first chest compression (less than 2 minutes). Eisenberg (2017), however, argued that these figures were unreliable (see Section 3.3, DACPR implementation).

The current study includes the median time to OHCA recognition and first chest compression in the DACPR training course, but not in the DACPR call performance assessment. Call performance was omitted because it would include the review of all audio records, which was not feasible within the timeframe and resources of the study.

3.3.3 Quality assurance and improvement measures

The section above outlined what to look for during the evaluation of a DACPR success benchmark. Quality assurance measures are the tools used for evaluating these metrics. For instance, what tools are used to estimate the DACPR OHCA recognition rate? The recent trend in implementing DACPR with high-quality measures (see Section 3.3.1.2, DACPR as a sole tool) revealed multiple quality assurance tools that can measure and improve a DACPR programme, including review of audio records, feedback, commendations, an electronic DACPR registry and assigning specialised employees to take the OHCA calls. Although most studies used more than one quality assurance tool, the most widely used quality assurance tools are reviewed below.

a) Audio recording review

In Viereck's (2017) attempt to standardise the reporting style of DACPR outcomes, namely, 'Recognised cardiac arrests', the author recommended the review of emergency call audio recordings to ensure OHCA recognition. This was done by various researchers using two main approaches:

- *All cardiac arrests were coded and audio recordings with the relevant codes were reviewed:* In a number of retrospective studies, the main data collection method was audio recording review (Harjanto, 2016 and Wu, 2017); in Moller (2016), however, audio recording review was a quality assurance tool. Moller (2016) initially reviewed cardiac arrest coded cases in two EMS systems in two different regions of Europe (Sweden and Denmark); the OHCA recognition rate was 40%–73%. The author then reviewed the audio recordings for other codes related to cardiac arrest (respiratory distress and unconsciousness) and found that the OHCA recognition rates were 81% and 83%, respectively.
- *Sample of cardiac arrest coded cases:* Interventional studies tend to review a predefined sample of audio recordings. Ro (2017) reviewed more than 10% of all DACPR audio recordings, Tanaka (2012) reviewed OHCA cases that were missed by call takers and Huang (2017) reviewed a random sample of OHCA audio recordings. Lastly, Bobrow (2016) reviewed audio recordings, but the method used was not clear.

b) Feedback

Feedback can be either organizational or individual. In organizational feedback, a medical supervisor collects all OHCA cases and the recognition rate, management and outcomes, then debriefs the dispatcher chief. In individual feedback, the medical supervisor gives each call taker feedback on their individual performance. Harjanto (2016), Ro (2017) and Hardeland (2017) used individual call taker feedback as their quality assurance and improvement tool, whereas Tanaka (2012) and Song (2014) gave monthly organisational feedback. Huang (2017) gave both organisational and individual call taker feedback.

c) Assigning specialised employees

Little is known about the significance of the professional background needed to carry out a successful DACPR programme. Huang (2017) assigned a specialised nurse to answer the cardiac arrest calls and give hands-only CPR instruction; when the nurse was not present, the call takers were permitted to do so. Ro (2017) divided his call-taker crew into two teams: one team that recognised the cardiac arrest and one team that gave CPR instructions. The dynamic of this process is not clear. Another study by Moller (2016) compared two similarly structured EMS systems, but with staff having different professional backgrounds. Moller found no difference in recognition of OHCA, even though the professional backgrounds and training of the medical call takers varied greatly.

The present study used the following quality assurance and improvement tools: organisational and individual feedback and a review of samples of OHCA audio recordings (missed and recognised). These tools were applied gradually; this is explained in detail in Chapter 6. The next section discusses possible challenges in DACPR implementation.

3.3.4 Challenges in implementing DACPR

DACPR seems like a straightforward intervention, yet recent studies demonstrate the many challenges that hinder its successful implementation. Bray (2017) categorised DACPR challenges into three subtypes:

a. Procedural barriers: time lost due to language barriers and communication issues; telephone problems (Nuño, 2017).
b. CPR knowledge: late identification of cardiac arrest, skill deficits; perceived benefit.
c. Personal factors: physical frailty or disability; patient position; emotional factors. The most common personal factor is changing a patient's position (Langlais, 2017).

In the same vein, a qualitative study done by Linderoth (2015) categorised DACPR challenges into three subtypes: situational awareness, communication and attitude. While the first two subtypes were addressed by Bray (2017), Linderoth (2015) was the first to address the significance of call taker attitude. Linderoth (2015) stated that the call taker should have leadership skills in order to guide the OHCA call; otherwise, the OHCA case could be missed.

The countries of the Arabian Gulf have a distinct cultural context with different challenges to DACPR implementation. These challenges include low EMS system activation rates. Salleeh (2015) and Batt (2016) concluded that EMS were called in only 26% of acute coronary syndrome cases in regions of Arabia and the United Arab Emirates; death at home was preferred.

In the current study, most of these challenges were addressed in a feasibility assessment prior to DACPR examination. Given Kuwait's distinct cultural context, different DACPR challenges are raised (see Chapter 6).

3.4 Current evidence of DACPR's effects on out-of-hospital cardiac arrest outcomes

This section explores DACPR's effect on OHCA outcomes. Eighteen studies explored DACPR's effect on OHCA outcomes (Berdowski, 2009; Axelsson, 2010; Bray, 2011; Bohm, 2011; Tanaka, 2012; Ong, 2014; Song, 2014; Hiltunen, 2015; Sanson, 2015; Bobrow, 2016; Harjanto, 2016; Nishi, 2016; Podlr, 2016; Ro, 2017; Huang, 2017; Viereck,2017; Wu, 2017 and Takahashi, 2018). A number of OHCA outcomes were evaluated by these studies: rates of survival for hospital discharge, neurological performance, ROSC, and bystander CPR rates. The following is a discussion of the different OHCA outcomes.

3.4.1 Survival to hospital discharge

The Utstein update (2015) recommended that its participants evaluate OHCA clinical outcomes. It was expected that the rate of survival for hospital discharge or survival to 30 days should be the primary clinical outcome in clinical research.

All retrieved studies, except those by Viereck (2017), Harjanto (2016), Tanaka (2012) and Berdowski (2009), evaluated DACPR's effect on OHCA rates of survival for hospital discharge. A typical DACPR programme consists of OHCA recognition and hands-only CPR instruction from call takers. Two cohort studies (Axelsson, 2010 and Sanson, 2015) explored a part of DACPR-OHCA recognition and the coding system's effect on OHCA survival rate to hospital discharge. Each country's EMS uses certain response codes to categorise their responses to reported events. Generally, response codes higher on the scale require shorter response time and the use of audible and visible ambulance equipment. In these studies, response codes were colour-coded. Red generally indicated cardiac arrest or potential cardiac arrest and was the highest on the emergency scale. Although both of these studies examined the EMS coding system effect on OHCA outcomes, they had different findings. Sanson (2015) conducted a retrospective cohort study to identify the weakest link in the OHCA chain of survival in Trieste, Italy, over a one-year period, comprising 678 OHCA incidences. The author examined DACPR in the form of OHCA recognition and emergency codes, with red again being the highest on the emergency scale. In suspected OHCA calls, the red codes were dispatched to the nearest EMS team. The activated EMS team then approached the scene with the knowledge that they were probably about to deal with an OHCA case. The study concluded that patients identified immediately as OHCA by the dispatch centre showed non-significant trends towards improved OHCA survival rates to hospital discharge. Due to this study's observational nature, it was beyond its scope to define direct causal inference clearly (Viswanathan, 2013). Similarly, Axelsson's (2010) prospective cohort study focused on the effectiveness of DACPR in the form of OHCA recognition and cardiac arrest codes improving OHCA survival rates to hospital discharge. It was small in scale, with 250 patients over a 17-month study period, and 20% of OHCA patients were coded as cardiac arrest (CA) and 80% were coded as symptoms-related or missed. The survival rate to hospital discharge in the CA-coded group was higher than in the missed-coded group by 7.5%. In contrast to Sanson (2015), Axelsson (2010) concluded that DACPR did improve OHCA survival rates to hospital discharge. However, the study had poor external validity and inconclusive results.

Unlike Axelsson's (2010) and Sanson's (2015) studies, Berdowski (2009) and Hiltunen's (2015) cohort studies examined typical DACPR programmes (OHCA recognition and CPR instruction). Two small-scale studies (Berdowski, 2009 and Hiltunen, 2015) also had contradictory results. Hiltunen (2015) tested an up-to-date DACPR programme (OHCA recognition and hands-only CPR instruction) on 164 patients in Finland, reporting OHCA survival after hospital discharge to be 44.4% in the OHCA-recognised group and 37% in the OHCA-unrecognised group. In comparison, Hiltunen's (2015) study showed that typical DACPR implementation had no effect on OHCA survival after hospital discharge. However, due to poor external validity, the reliability of much of the published research on this issue is problematic.

In contrast, and although not directly measured, Berdowski (2009) showed that DACPR implementation had a favourable effect on OHCA patients' three-month survival rate. Berdowski recruited 349 participants and subjected them to a now-outdated DACPR programme (OHCA recognition, rescue breaths and chest-compression CPR instruction) and the dispatch of two ambulances. As a result, 203 cardiac arrest patients were correctly recognised, 82 were missed and 62 were incorrectly recognised as being in cardiac arrest. A comparison between the three-month survival rates of correctly recognised cardiac arrest patients (203 patients) and missed cardiac arrest patients (82 patients) found that the three-month survival rate was 9% higher in the cardiac arrest-recognised group than the cardiac arrest-unrecognised group ($p = 0.04$). Berdowski (2009) included patients who received advanced life support (ALS) only. Thus, similar to Hiltunen (2015), generalising the results from Berdowski (2009) may be problematic due to the exclusion of patients who received Basic Life Support (BLS) from the study and the use of the out-dated DACPR programme. Different results are captured with the use of chest compression-only CPR during DACPR. Hupfil's (2010) meta-analysis of three randomised clinical trials confirmed that during DACPR chest compression, only CPR recipients have better survival to 30 days when compared to the outdated CPR (rescue breaths and chest-compression CPR instruction).

Comparable to Berdowski (2009), Bray (2011) also examined DACPR's ability to improve OHCA survival after hospital discharge in Melbourne's advanced EMS system (critical care, ALS and BLS). This before-and-after study examined the effect of changing DACPR instruction to 400 chest compressions by comparing two groups: before intervention (1021 patients in 2006–2007) and after intervention (2101 patients in 2007–2009). The author reported an 8% improvement in OHCA survival to hospital discharge (p = 0.003). That said, these results of Melbourne's advanced EMS system cannot be compared to the more widely spread two-tiered EMS system.[2] Hence, Bray's (2011) results may not be applicable to other systems.

Moreover, Tanaka (2012), Song (2014), Bobrow (2016) and Plodr's (2016) before-and-after studies confirmed Berdowski (2009) and Bray's (2011) positive findings. The authors declared DACPR has a favourable effect on OHCA outcomes. Tanaka (2012) examined the effect of a DACPR quality assurance programme in the form of a national DACPR programme and training programmes in high schools. Bobrow (2016) described the positive effect of various comprehensive DACPR programmes on survival after hospital discharge. However, more recently, Huang's (2017) small-sample before-and-after study (130 participants) concluded that DACPR does not have any effect on OHCA survival to hospital discharge. In Huang's study, DACPR took the following form: new-protocol DACPR, one day of intensive training and high quality assurance and improvement measures (namely, 10% audio recording review, personal and organisational feedback and hiring a specialised nurse to handle OHCA calls). Despite the improvement in OHCA recognition rates (54%–68%) and CPR instruction rates (50%–72%) with his new intervention, the author reported no significant effect on survival to hospital discharge (3%–10.9%) (Huang, 2017). Similarly, a broader perspective was adapted by Harjanto (2016) in a before-and-after study in Singapore. Harjanto argued that the implementation of a DACPR programme in the form of a community education programme, DACPR standardised protocol, call taker training and DACPR quality assurance programme did not significantly increase the OHCA survival rate over a 30-day period.

Song (2014) and Plodr (2016) both focused on DACPR's solitary effect on the OHCA survival rate after hospital discharge in a simple one-group, pre-test/post-test study and a double pre-test/post-test study, respectively. Both studies concluded that DACPR improved OHCA patients' survival to hospital discharge and their 30-day survival, but Song (2014) and Plodr's (2016) studies have made greater contributions to the current literature. Tanaka's (2012) small sample of 230 patients for the DACPR quality assurance programme in the Ishikawa (Japan) EMS system showed an improved OHCA one-year survival rate of 38% in the after-intervention group (126 patients in 2007–2010) and 21% in the before-intervention group (23 patients in 2004–2007). However, the results cannot be attributed wholly to DACPR, because CPR school training campaigns were also implemented as part of the intervention tool. Moreover, Harjanto's

[2] A two-tiered EMS system is a system in which some ambulances are staffed by paramedics and others are staffed by basic emergency medical technicians (EMT-Bs) who provide basic life support (BLS) care (Stout, 2000).

(2016) large-scale before-and-after study of 2,968 cases from Singapore's national DACPR programme (including a call taker training programme, quality assurance programme, standard DACPR protocol and a dispatch-assisted first-responder community campaign) reported statistically insignificant OHCA survival rates. There was a 30-day survival improvement of just 3.6% in the before-intervention group (1,820 patients in 2010–2011) compared to 4.6% in the after-intervention group (673 patients in 2012–2013), with an adjusted OR=1.29 (95% CI:0.71- 2.29). The author also documented interesting results from analysing the data of OHCA patients post-intervention. Harjanto (2016) compared the OHCA survival rates to 30 days between three subgroups of the post-intervention group: patients that received DACPR (52), patients that received bystander CPR (769) and patients that received no DACPR or bystander CPR (2,147). The author found that there was no survival benefit to patients receiving DACPR compared to the group with no bystander CPR. The author explained his results by suggesting that CPR by a trained individual may prove to be superior to CPR performed by a layperson under the guidance of a call taker. These results are opposite those for previous studies.

In the same vein, Bobrow's (2016) study recruited 2,334 patients in Arizona to examine whether the effect of a DACPR bundle programme (protocol, training and quality improvement process) as a sole tool improved the OHCA rate of survival to hospital discharge. Just over two-thirds of the sample were in the after-intervention group (1,499 patients in 2011–2013), and one-third were in the before-intervention group (789 patients in 2010–2011). The results were promising: survival to hospital discharge rose from 24.7% in the pre-intervention group to 35.0% in the post-intervention group, with an aOR of 1.70 (95% CI; 1.09-2.65; p = .02). Yet multiple confounders reduced the study's external validity. One such confounder was that the latent effect of a 2005–2010 CPR public awareness campaign that was not eliminated. The other confounder was that the resuscitative practice of field emergency personnel of the Arizona Emergency Health Services for OHCA has been cardiocerebral resuscitation (CCR, comprising chest compression-only CPR, defibrillation and epinephrine) from 2005 to date (Arizona Department of Health Services, 2015). Both the CPR public campaign and the CCR EMS resuscitative practice are unique to the Arizona Emergency Health Services and may have contributed to Bobrow's favourable OHCA survival to hospital discharge results.

From studies that examined the effect of a number of different comprehensive DACPR programmes on OHCA survival, this literature review now moves to a more recent, simple, small-scale pre-test/post-test study in a rural region of the Czech Republic (Plodr, 2016), which assessed the effect of DACPR as a sole tool on OHCA survival to hospital discharge. Plodr's nine-month study period was divided into three periods: the before-intervention period (January–April 2015, patient group=152), an implementation period (April-May) and the post-intervention period (June–September 2015, patient group=174). The researcher tested a customised standardised DACPR protocol for OHCA emergency call processing. The customised

DACPR protocol improved OHCA survival to hospital discharge from 38.7% in the pre-intervention group to 48.4% in the post-intervention group (p.=.442). Although the study results appear to be statistically significant, the small sample size of the study and the absence of clear inclusion criteria bring the validity of the study results into question. Furthermore, DACPR is only one part of the cardiac arrest chain of survival, and Plodr (2016) did not include the effects of other elements of OHCA management in the analysis. Likewise, the author did not adopt multivariate regression analysis to analyse the effects of coexisting confounders (such as co-existing diseases, ALS and post-resuscitation efforts). Instead, he compared the means of multiple points between the before and after groups by using a Student's t-test. Plodr's weak statistical methods present a major source of uncertainty. Therefore, the study needs to be repeated on a larger scale, using multivariate regression analysis and better reporting to establish DACPR's effect on OHCA survival to hospital discharge.

Song's (2014) study, on the other hand, offers what is probably the most comprehensive empirical analysis of DACPR's sole effect on OHCA survival to hospital discharge published in the current literature using a sample of 8,144 patients. This large-scale, Seoul-based, single-group, double pre-test/post-test study revealed better survival to hospital discharge among the after-intervention DACPR group (2,698 participants) than the before-intervention group (6,455 participants). The before-and-after study design and up-to-date DACPR intervention implementation used are similar to the design used in the present study; however, the differences between study populations may highlight different results. Song's (2014) research was conducted with a homogenous population (World Population Review, 2015), whereas the current study will be conducted in Kuwait, which has a heterogeneous population (1.2 million Kuwaitis and 2.8 million non-Kuwaitis) (World Population Review, 2015). Hence, the present study results may yield different contributions to the literature.

Bohm's (2011) study is the only systematic review in the current literature that has been critical of the work done by Berdowski (2009), Axelsson (2010), Bray (2011), Tanaka (2012) and Song (2014) in their five retrospective before-and-after studies addressing the effect of DACPR on OHCA survival rates to hospital discharge. The five studies are of varying levels of quality, from moderate to low. Bohm (2011) contended that all lacked the statistical power to draw significant conclusions, meaning that there was a lack of sufficient evidence for DACPR effectiveness; therefore, Bohn identified the need to conduct more rigorous studies in order to identify the relationships between DACPR and OHCA outcomes. While this systematic review followed the International Liaison Committee on Resuscitation's (2010) evidence evaluation process, it had a few limitations. For example, the DACPR programmes it studied were now out-dated (i.e., rescue breathing in addition to chest compressions) in light of current guidelines that support OHCA recognition and hands-only CPR instruction (Neumar 2015).

More recent studies, specifically Ro (2017), Takahashi (2018), Viereck (2017) and Wu (2017), follow different modalities in establishing DACPR's effects on OHCA outcomes. The more recent authors compare DACPR's effects on OHCA outcomes to spontaneously-initiated bystander CPR effects on OHCA outcomes to establish DACPR's efficacy. The authors again report conflicting evidence on DACPR's effects on OHCA outcomes. Ro's (2017) cross-sectional study and Viereck's (2017) retrospective observational study find no favourable effects on OHCA survival to hospital discharge rates when compared to spontaneous bystander CPR (7.3%. and 16.7% versus 8.4% and 27.2%, respectively). Wu's (2017) large-scale, before-and-after study in Arizona demonstrated that DACPR increases independently survival to hospital discharge and is as effective as spontaneous bystander CPR.

In the same vein, Wu (2017) conducted another study in Taiwan in which he compared DACPR outcomes to a Public Automated Defibrillator (PAD) programme outcome. The author established PAD superiority over DACPR by comparing OHCA survival to hospital discharge rates.

These studies, with the exception of Tanaka (2012), Harjanto (2016), Plodr (2016), Huang (2017) and Ro (2017), used survival rates to hospital discharge as the primary outcome of DACPR evaluation studies, since this is most reflective of OHCA outcomes. However, due to the anticipated poor archival quality of the Mubarak Al-Kabeer Hospital medical records, the present study will use survival to 30 days as the primary outcome (see Chapter 4, p.111). This outcome has been chosen because a review of the Mubarak Al-Kabeer Hospital medical records can determine whether a patient has survived to hospital discharge or not for the prospective data only. The Mubarak Al-Kabeer Hospital medical records registry destroys all patient archival data if the patient does not seek a hospital medical consultation within a year. This study is a before-and-after study and needs a primary OHCA survival outcome that is constant throughout the retrospective and prospective study periods, i.e., survival to 30 days. Therefore, given the context of the Mubarak Al-Kabeer hospital medical records registry practices, survival to 30 days is used as the primary OHCA survival outcome in this study. Survival to 30 days for the retrospective period can be collected by reviewing death registry archival data and collected for the prospective study period by reviewing Mubarak Al-Kabeer Hospital medical records. Although this is not the current trend in the literature, it is an acceptable estimate of survival and still reflective of OHCA outcome (Perkins, 2015); it is also the most feasible outcome for this study.

Moreover, the extent of change in the rate of survival in the before-and-after studies described in this section can serve as a useful reference tool to estimate the targeted change in survival rate that is required in order to state that the study's intervention has had a positive effect on survival to 30 days. Table 3.6 illustrates changes in the rate of survival of all of the before-and-after studies included in this literature review.

Table 3.6 The extent of the change in OHCA survival rates in before-and-after studies

Study	Authors	Sample Size	Year	Survival Rate to Hospital Discharge	Time Period	Comments
Dispatcher-assisted bystander cardiopulmonary resuscitation in a metropolitan city: A before-after population-based study	Song and Shin	8144	2014	2% (from 7% to 9%)	1 year	
A before-after interventional trial of dispatcher-assisted cardio-pulmonary resuscitation for out-of-hospital cardiac arrests in Singapore	Harjanto	2968	2016	1% (from 3.6% to 4.2% to 4.6%)	1 year	
Implementation of regional TCPR programme and outcomes after out-of-hospital cardiac arrests	Bobrow	2334	2016	3% (from 9% to12%)	2 years	
Effect of introduction of standardised protocol in DACPR	Plodr	326	2016	5% (from 9% to 14%)	4 months	
The continuous quality improvement project for TCPR increased BCPR and improved the outcomes of OHCA	Tanaka	4995	2012	11% (from 16% to 27%)	3 years	
Changing EMS DACPR to 400 chest compressions before mouth-to-mouth improved BCPR rates	Bray	3122	2011	3% from 2006 (9.5%) to 2009 (12.5%)	3 years	
Validation of a dispatch protocol with continuous quality control for cardiac arrest: A before-and-after study at a city fire department-based Sdispatch centre	Huang	130	2017	7% from 2014 (3%) to 2016 (10%)	2 years	Before-and-after study
Targeted simulation and education to improve cardiac arrest recognition and telephone-assisted CPR in an emergency medical communication centre	Hardeland and Skåre	330	2017	Survival to hospital discharge is not included as a primary or secondary outcome	1.7 years	Before-and-after study 331 and 230 calls pre- and post-intervention. OHCA recognition rate is the primary outcome of the study

The next section will discuss neurological performance as an OHCA outcome in the reviewed studies.

3.4.2 Neurological function

One of the core outcomes for reporting on the effectiveness of studies on cardiac arrest in adults is neurological function (Haywood, 2018). Neurological function is usually reported according to Cerebral Performance Categories (CPCs), both structured and extended; the Glasgow Coma Scale-extended (GSC); or the modified Rankin Scale score (mRS). Prior to the recommendations contained within the Advisory Statement from the International Liaison Committee on Resuscitation on the Core Outcome Set for Cardiac Arrest in Adults (2018), CPCs were the most widely used scores used to report OHCA patient neurological function. Whereas CPCs of 1 and 2 are associated with favourable clinical outcomes, CPCs of 3 and below are associated with non-favourable outcomes (Cumin, 1991). However, due to the structured CPC lack of discrimination between scores and the potential for ceiling effects, overestimation of function and lack of extended CPC and GSC uses, the modified Rankin Scale score (mRS) has been recommended to replace the CPC as the tool to use for neurological function measurement in cardiac arrest survivors(Haywood, 2018). The mRS captures impairment of physical and cognitive abilities (Haywood, 2018), and mRS completion is preferably measured by direct interview with the patient and any relevant caregiver, either face-to-face or by telephone at hospital discharge, after 30 days survival or both (Haywood, 2018).

Various studies (Tanaka, 2012; Song, 2014; Hiltunen, 2015: Sanson, 2015; Bobrow, 2016; Harjanto, 2016; Nishi, 2016; Takahashi, 2018, Wu, 2017 and Ro, 2017) have evaluated OHCA clinical outcomes using CPC scales. Hiltunen (2015) assigned a neurologist to evaluate CPC status for OHCA survivors at six months when examining the association of an up-to-date DACPR programme with OHCA outcomes. Because CPCs of 1 and 2 were recorded for 11 survivors in the intervention group and 18 survivors of the non-intervention group, Hiltunen (2015) concluded that there was no difference in clinical outcomes between the intervention and non-intervention groups since favourable CPC results could be seen both with and without DACPR implementation.

Sanson’s (2015) retrospective cohort study to identify the weakest link in the OHCA chain of survival used neurological performance as a primary endpoint. CPCs were assessed in OHCA survivors upon hospital discharge. Of the 12 patients who survived to hospital discharge, 11 had CPCs of 1 or 2 and one had a CPC of 3. Sanson (2015) did not clearly correlate DACPR with CPCs.

Bobrow's (2016) before-and-after study on the effect of a DACPR bundle on OHCA outcomes also assessed the CPC of OHCA survivors upon hospital discharge. An in-person interview was carried out and a CPC score of 1 was rated as good cerebral performance. Bobrow found that a favourable neurological performance outcome was significantly higher in the post-intervention group (8.3%) than in the pre-intervention group (5.6%), with an aOR of 1.68 (95% CI ;1.13–2.48; p = .01).

The results of Harjanto's (2016) before-and-after study on the effect of a DACPR bundle on OHCA outcomes were consistent with Bobrow's (2016) study, which was published in the same year. In Harjanto's study, the CPC evaluation at 30 days after surviving the OHCA showed an improvement in the CPC rate from 2.2% in the pre-intervention group to 3.2% in the post-intervention group (aOR=1.54, 95% CI; 0.69- 3.23). However, these results are not valid because Harjanto was not clear about the method used for CPC assessment or the definition of good CPC. The wide range of the confidence interval also contributes to the results' lack of validity.

Similarly, Nishi (2016) assessed the CPC at 30 days after surviving an OHCA. Nishi's retrospective study classified the various geographic regions of Japan as basic, intermediate or advanced on the basis of bystander CPR rates and the quality of DACPR provided. Nishi tried to identify which regions were associated with good CPC at 30 days of OHCA survival. The author concluded that advanced regions were associated with better CPC following OHCA survival. However, the difficulty in disassociating the effect of bystander CPR rates from DACPR in those advanced regions, as well as other distinct features of the regions (such as the provision of advanced life support and a higher number of ambulances and emergency hospitals), called the conclusion into question. In the same vein, Plodr (2016) also recorded favourable neurological performance at hospital discharge in his before-and-after study on DACPR effects; however, the author's methods of measuring neurological performance are not clear.

Song (2014) used neurological performance as a second outcome in his before-and-after study on DACPR effects. The author concluded that DACPR is positively associated with OHCA neurological performance. This was confirmed by Tanaka's (2012) before-and-after study on the effect of a DACPR quality assurance programme on OHCA outcomes, which set one-year survival with favourable neurological performance as a primary outcome. That being said, these results contradicted Hiltunen's (2015) findings.

Recent research, including Takahashi (2018), Wu (2017) and Ro (2017), all documented good neurological performance at hospital discharge as their primary outcome. The authors also concluded DACPR had effects similar to spontaneously-initiated bystander CPR on OHCA neurological performance at hospital discharge.

Considering this evidence, it seems that CPC was the preferred method for assessing neurological function after successful OHCA resuscitation. Ten out of the 13 studies reviewed used CPC as a primary or secondary outcome (Cummin, 1991), including recent studies (Takahashi, 2018; Wu, 2017 and Ro, 2017). However, given the Advisory International Liaison Committee of Resuscitation's recent recommendations on the core outcome set for cardiac arrest in adult patients, mRS should be the tool of choice for neurological function reporting. Due to the limited number of DACPR studies that have used mRS during OHCA patient neurological function evaluations, future research can be done in this area.

The present study does not set neurological function as an outcome due to limited available resources.

3.4.3 The Return of Spontaneous Circulation

The Utstein-style data-reporting template accepts the return of any manually detectable pulse from a major artery, regardless of its duration, as ROSC. According to Cummin (1991), ROSC is a surrogate endpoint[3] in clinical research. This is not the case in the recent literature, however, where ROSC has been upgraded to a primary outcome. This is because of ROSC's close correlation with high OHCA survival rates (Abraham, 2011). For this reason, the update to the Utstein template categorises ROSC as a core outcome (Perkins, 2015). Furthermore, Chen (2015) believed that ROSC is more reflective of pre-hospital care performance than survival rates to hospital discharge. The author argued that reliance on ROSC to assess post-OHCA events eliminates the effect of hospital care and focuses primarily on the effect of pre-hospital care on OHCA events. All the studies reviewed, except for Bohm's (2011) systematic review, i.e., Harjanto (2016), Takahashi (2018), Viereck (2017) and Huang (2017) included the ROSC as a surrogate endpoint.

In some cohort studies that explored DACPR, OHCA recognition and the coding system were found to improve OHCA survival rates to hospital discharge. In these, ROSC was evaluated as a surrogate endpoint and found to have a close correlation with a high OHCA survival rate (Axelsson,

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[3] A surrogate endpoint is a measure that is not of direct practical importance but is believed to reflect outcomes that are important.

2010; Sanson, 2015). Song (2014) and Hiltunen (2015) also studied the effect of up-to-date DACPR on OHCA outcomes and confirmed that ROSC was closely correlated with high OHCA survival rates to hospital discharge. Song (2014) and Hiltunen (2015) also found higher ROSC rates in the DACPR (intervention) group when compared to the non-DACPR (non-intervention) group.

Tanaka (2012) and Bray's (2011) before-and-after studies were no different from Song (2014) and Hiltunen's (2015) studies in setting ROSC as a surrogate endpoint. The authors reported higher ROSC rates in after-intervention groups than in before-intervention groups; however, they did not correlate ROSC with survival rates.

More recent studies, such as those of Bobrow (2016), Plodr (2016) and Wu (2017), have also followed the traditional use of ROSC as a surrogate endpoint and recorded higher rates of ROSC in the post-intervention groups than in the pre-intervention groups. Unlike Harjanto (2016), the authors not only compared ROSC rates between the pre-intervention and post-intervention groups, but also evaluated ROSC as one of the OHCA outcomes. Harjanto (2016) did not clearly state that ROSC is a primary or secondary outcome. However, in the post-intervention group, he examined DACPR's effect and the bystander CPR effect on ROSC rates. This author was the first to find that approximately a quarter of OHCA patients who received DACPR achieved ROSC, and that a third of the OHCA patients who received bystander CPR achieved ROSC. Surprisingly, he did not correlate ROSC to survival to hospital discharge.

The latest studies by Takahashi (2018) and Viereck (2017) compared the effect of DACPR versus spontaneously-initiated bystander CPR on ROSC (2017). The studies set ROSC as a primary and secondary outcome, respectively. The authors found contradicting results. Viereck's (2017) prospective observational study on 548 emergency calls for OHCA patients receiving bystander CPR either before (spontaneously-initiated bystander CPR) or during the emergency call (DACPR) in Denmark concluded that DACPR has no effect on ROSC. Takahashi concluded that DACPR was equal to spontaneously-initiated bystander CPR in improving ROSC rates in OHCA patients.

DACPR's favourable effect on ROSC was confirmed by Huang's (2017) before-and-after study on DACPR's effect on OHCA outcomes. Huang set ROSC as a secondary outcome and observed significant improvement in ROSC rates (before-intervention group=7.6% versus after-intervention group=20.3%, p = 0.036).

The evidence presented in this section suggests that ROSC is most frequently considered a surrogate endpoint in clinical research. ROSC is closely correlated with rates of survival to hospital discharge. This caused a recent shift in setting ROSC as a primary or secondary outcome. The present study included ROSC as a secondary outcome, based on its close correlation with survival rates to hospital discharge and on Perkins and Chen's (2015) recommendation to increase the evidence for ROSC's ability to measure pre-hospital care performance in OHCA events. This will support Harjanto's (2016) and Huang's (2017) findings and increase the body of literature on DACPR's effect on ROSC. The following section will discuss bystander CPR as an OHCA outcome.

3.4.4 Bystander CPR

A bystander is a person who happens to be near a victim. When a bystander activates an EMS response and provides CPR, doing so can double to triple a victim's chance of survival (Hasselqvist-Ax, 2015). While an optimal method for increasing bystander CPR rates among the public has not yet been identified (Hasselqvist-Ax, 2015), some authors have suggested that DACPR could increase bystander CPR rates (Vaillancourt, 2008; Lewis, 2013). This section explores the results of the reviewed studies on DACPR with regards to bystander CPR. Again, all the reviewed studies discussed bystander CPR as a surrogate endpoint, except for Bobrow (2016) and Harjanto's (2016). Several reported that DACPR implementation increased the success rates of bystander CPR (Bohm, 2011; Bray, 2011; Song, 2014 and Hiltunen, 2015).

Tanaka (2012) also confirmed the ability of a DACPR quality assurance programme to increase bystander CPR rates. The author documented the rates of bystander CPR performed at citizens' own initiatives (without DACPR implementation) and rates of bystander CPR with DACPR implementation for both groups. On the other hand, Axelsson's (2010) study on the OHCA coding system unexpectedly showed an increase in bystander CPR rates in the cardiac arrest-coded group. The author could not explain this improvement, as the study did not test for CPR instruction.

This differs from Bobrow (2016), who set bystander CPR rate as a secondary outcome. The author documented an increase in bystander CPR rate with DACPR implementation by comparing the bystander CPR rates of the pre-intervention group (61.8%) to the post-intervention groups (68%). However, the results were hampered by the inclusion of bystanders who performed CPR before the call taker's instructions were given to the post-intervention group. Similarly, Harjanto (2016) set bystander CPR as a secondary outcome. The author demonstrated DACPR's favourable effect on bystander CPR rates and also compared OHCA outcomes between the following subgroups of the post-intervention group: DACPR only, bystander CPR only and no bystander CPR. Given that 30-

day survival and good neurological performance were the primary outcomes, Harjanto reported an increase in the rate of 30-day survival and good neurological recovery in patients receiving spontaneously-initiated bystander CPR, as compared to those who received DACPR. The author's results suggest that CPR rendered by a trained individual may prove superior to CPR rendered by a layperson under the guidance of a call taker. Moreover, there was no survival benefit of DACPR compared to the group with no bystander CPR.

Harjanto's (2016) before-and-after study is the first of its kind to compare the effects of DACPR and bystander CPR on OHCA outcomes. Yet, although Harjanto demonstrated the superiority of bystander CPR training over DACPR in improving OHCA outcomes, he did not show how previous knowledge of CPR affected DACPR rates.

Furthermore, Phase 2 of the Pan-Asian Resuscitation Outcomes Study (PAROS) used DACPR as a tool with which to increase bystander CPR rates. PAROS's Phase 1 results demonstrated an urgent need to implement a five-step strategy to improve OHCA outcomes in participating Asian countries, where increased bystander CPR (Ong, 2014) is of key importance. Thus, the PAROS research committee chose DACPR as the interventional tool with which to increase bystander CPR rates. The results of this study have been published on some sites (Ong, 2016). Huang (2017) is part of PAROS's Phase 2 study. This previously discussed before-and-after study in Taiwan demonstrated that high-quality DACPR improved bystander CPR rates (before-intervention group=50% versus after-intervention group=72%).

The most significant finding emerging from this section is the ability of DACPR to improve bystander CPR. The methods for increasing bystander CPR rates in Kuwait and measuring these rates have not yet been published. Therefore, for the present study, the researcher must use bystander CPR rates as a secondary outcome. This will provide a baseline value on which to measure future bystander CPR rates in Kuwait. The following section presents a summary of the study's scope.

3.5 Conclusion

DACPR is an early link in the cardiac arrest chain of survival. It was first implemented in the 1970s (Gardett, 2016). However, studies of its practice to date have been focused entirely on increasing bystander CPR rates, whether or not benefits outweigh risks and cost effectiveness. This explains why DACPR is evaluated repeatedly in the current literature. More than 30 studies on DACPR were published in 2017 alone. The high interest in defining the best modality for DACPR has also been extended to include centres of excellence. Seattle's King County recommended DACPR implementation in EMS systems that want to implement the OHCA chain of survival but have limited resources (Resuscitation Academy, 2017). Although the AHA (2016) published general guidelines for DACPR implementation for EMS systems, the optimal method of implementation is not known. The present study's literature review revealed that high-quality DACPR implementation on the basis of EMS-provided resources, in the form of a sole tool, is the latest trend in the literature. There are two ways to determine a DACPR programme's success level: attaining an OHCA recognition rate and comparing DACPR to spontaneously-initiated bystander CPR in improving OHCA outcomes. Having said that, the lack of transparency in EMS reporting and the vague definition of 'recognised OHCA' are the two main obstacles in validating the best modality with which to measure DACPR programme outcomes. Hence, various DACPR quality assurance and improvement methods have emerged, including audio recording reviews, personal and organisational feedback and assigning specially trained employees to call taking duty. The effect of using DACPR quality assurance tools has not been established, and the optimal quality assurance and improvement tool has not been identified. DACPR implementation is not a straightforward process; it carries predefined challenges that can hinder its operation, including procedural barriers, CPR knowledge and personal factors.

There is no direct evidence of DACPR's effectiveness in improving OHCA outcomes (Neumar, 2015). While some studies have tested DACPR's effects on improving OHCA survival rates to hospital discharge, many—such as Sanson (2015), Hiltunen (2015), Axelsson (2010), Berdowski(2009) and Nishi (2016)—have significant limitations. Specifically, their observational nature prevented the establishment of direct causal inferences from their observed correlations. Tanaka's (2012) before-and-after study is no different because it did not test DACPR on its own and included a prefectural school training programme as part of an intervention; furthermore, it failed to separate the effects of the two intervention methods during its analysis. This was also seen in the most recent before-and-after studies, in which the effects of a number of different comprehensive DACPR programmes on OHCA outcomes obscured the sole DACPR effect on OHCA outcomes, such as in Bobrow (2016) and Harjanto (2016). Although Bobrow (2016) and Wu's (2017) study results support DACPR application to improve OHCA outcomes, Harjanto (2016) and Huang's (2017) results do not.

Bohm (2011) conducted the only systematic review of DACPR and OHCA outcomes published to date. However, this work was based on observational and before-and-after studies on outdated DACPR practices and thus suffers from similar constraints. Song's (2014) moderate-quality study, which found favourable OHCA outcomes and was based on up-to-date DACPR implementation, seems to oppose the findings of previous studies; furthermore, its generalizability may be limited due to its use of a homogenous population. Finally, the results from Bray's (2011) before-and-after study on Melbourne's advanced EMS system and a DACPR programme with instruction in 400 chest compressions do not contribute knowledge to the more common two-tiered EMS system.

As evidenced by the initiation of PAROS Phase 2, a large, multinational, prospective controlled study, there is an on-going need to identify the effect of DACPR on OHCA outcomes. Ong (2014) selected DACPR to improve bystander CPR rates and OHCA outcomes in PAROS Phase 2. However, because of the study's limitations, further research is still needed.

Collectively, the researcher chose DACPR to implement the OHCA chain of survival in Kuwait; given the Kuwaiti EMS's limited resources, this is in line with recommendations from centres of excellence . The researcher also implemented DACPR in the form of a sole tool, including call taker training, the new DACPR protocol and quality assurance and improvement measures. All of this was included to ensure up-to-date DACPR implementation. Moreover, the study's intervention has been continually modified to meet the Kuwaiti EMS's available resources and Kuwait's distinct culture. For the present study, the method selected to measure the DACPR programme outcome is the OHCA recognition rate. This will help in identifying the implemented DACPR's success benchmark. The investigator used a predefined 'recognised OHCA' comparable to Viereck's (2017) systematic review recommendation, in which cases are labelled as recognised cardiac arrest when one of the following is present:

1) Manual DACPR sheet is submitted
2) Coded as cardiac arrest or suspicion of death
3) The reviewed audio record showed that the call taker recognised the arrest or gave CPR instruction
4) EMS-witnessed, missing/corrupted emergency call recording and cases in which the patient was obviously alive during the call (misdiagnosed OHCA cases)

The researcher has also foreseen DACPR's potential challenges during the feasibility assessment, which took place prior to DACPR examination. However, given Kuwait's distinct cultural context, different DACPR challenges emerged (see Chapter 6. p.159). Lastly, the present study may help to resolve the conflicting evidence on the effects of an up-to-date DACPR programme on the following OHCA outcomes: survival to hospital discharge, return of spontaneous circulation and bystander CPR.

Chapter Four: Research Design and Methods

4.1 Introduction

This chapter describes the methods used to evaluate OHCA outcomes following implementation of DACPR in a pilot region of Kuwait. After outlining the aims of the study, this chapter describes the research design, including the form of intervention, instruments employed, methods of data collection, sampling procedure and data analysis techniques. As OHCA is a potentially lethal and time-critical condition, ethical issues related to inclusion/exclusion criteria, do not resuscitate and using a control group are also discussed.

4.2 Aims and research objectives

4.2.1 Aim of the study

The aim of this study is to determine the impact of dispatcher-assisted cardiopulmonary resuscitation on the outcomes of OHCA in a pilot region of Kuwait.

4.2.2 Research objectives

The study addresses the following research objectives:

1. To measure the baseline incidence of OHCA prior to and after the introduction of DACPR in the pilot region.
2. To measure the recognition rate of OHCA cases in the pilot region's EMS prior to and following the introduction of DACPR.
3. To measure the CPR instruction rate for OHCA cases in the pilot region's EMS prior to and following the introduction of DACPR.
4. To measure the baseline bystander CPR rate before and after DACPR implementation in the pilot region and the difference in the rates between the two groups (before and after the introduction of DACPR).
5. To measure the prevalence of bystanders with previous knowledge of cardiopulmonary resuscitation during DACPR implementation.
6. To identify the impact of previous knowledge of CPR on DACPR implementation.

7. To measure the baseline return of spontaneous circulation (ROSC) rate before and after DACPR implementation in the pilot region and the difference in OHCA ROSC rates between the two groups (before and after introduction of DACPR).
8. To measure the baseline survival rate before and after DACPR implementation in the pilot region and the difference in OHCA survival rate between the two groups (before and after introduction of DACPR).
9. To explore current Kuwaiti EMS processes in OHCA cases and what recommendations can be made to improve the operational effectiveness of DACPR.
10. To explore the challenges of implementing DACPR in Kuwait's EMS.
11. To explore the strategies available to overcome the challenges of implementing DACPR in Kuwait's EMS.
12. To identify the caller demographics in OHCA calls.

4.3 Research Design

Using a before-and-after design, this study measures the difference between OHCA outcomes before and after the introduction of DACPR. In the pre-introduction group, OHCA patients received standard Kuwaiti EMS treatment, which includes cardiac arrest recognition and dispatch of the nearest EMS personnel to the patient. In the post-introduction group, patients were identified as OHCA, bystanders received hands-only CPR instructions and the nearest EMS personnel were dispatched to the patient. As a new form of intervention introduced to Kuwait's EMS, DACPR enables evaluation of OHCA routine measures, including OHCA characteristics, resuscitation efforts and outcomes. At the same time, randomized controlled trials cannot be applied because OHCAs can be lethal, and it would be unethical to withhold DACPR from specific patient groups. It is also impossible to use other rigorous study designs, such as interrupted time series, which would reduce the sample size and, consequently, the study's power. Additionally, it is difficult to withhold the hands-only CPR instructions provided by call takers in interrupted time periods. The before-and-after study design used here suffices to evaluate effectively this healthcare intervention and enables a historical comparison with a control group.

Given the potential threats to the internal validity of this design, an additional non-equivalent control group was added (Shadish, 2002). This addition should reduce temporal trends, regression to the mean and maturation threats (Axelrod, 2006).

Data were collected from both groups (intervention and control) for the outcome of interest – i.e., the same dependent variables were collected – in the pre- and post-test phases; the control group was carefully selected to strengthen the design.

A single pre-test, post-test design with a non-equivalent control group is useful for measuring the impact of an intervention and can reveal even small impacts (Portela, 2015). This is relevant in the present context because changes in survival rates in previous studies using a before-and-after design were relatively small (1%–11%) (See Chapter 3, p.73). As these were large-scale studies, a much lower change in survival rate is expected in the present case; therefore, use of a non-equivalent control group is appropriate.

Furthermore, Shadish (2002, 136) also highlighted that a non-equivalent control group can only be useful if it is accompanied by pre- and post-test measures. This should permit the identification of differences between groups and their impact on the OHCA outcome, showing clearly the extent of the selection bias. Selection bias is the major threat to before-and-after studies with non- equivalent control group study designs (Crutis, 2013, 204). The addition of a control group was also viewed as a plus in this study because it allowed a more accurate measurement of the intervention's impact on outcomes. Goodcare (2015) confirmed this fact by stating that before-and-after study designs without control groups reported exaggerated intervention impacts on outcomes. This is the first study of DACPR in the literature that uses a control group.

In relation to our binary outcome, the proposed study design and the use of statistical analyses to identify the impact of DACPR on OHCA outcomes is appropriate. Such an advantage is not present in randomised control trials (Hróbjartsson, 2012). Randomized controlled studies examine intervention impacts on binary outcomes directly, without statistical manipulation (ruling out confounding effects) (Hróbjartsson, 2012). This is a source of a substantial bias (Hróbjartsson, 2012).

The pre-implementation period was February–December 2016, the during implementation period was 21 February-31 May 2017 and the post-intervention period was 1 June–31 December 2017. The included OHCA cases were collected in the following sequence:

1. Pre-test groups (Baseline data): pre-intervention and control one (1 January–31 October 2016)

2. DACPR implementation: intervention and control two (21 February-31 May 2017). Intensive one-day DACPR educational programme+ new DACPR protocol and quality assurance tool

3. Post-test groups: post-intervention and control three (1 June–31 December 2017)

4. Follow-up period: 31 March 2017–31 January 2018 (to determine survival to 30 days)

The pre-test group was independently sampled because the OHCA participants in the intervention and control group for the retrospective period (2016) differed from those in the prospective 2017 samples (i.e., the during implementation and post-test groups) but were presumed to be similar, as both sets of participants were adult OHCA patients from Hawali and Al-Farwanya provinces in Kuwait. This is set out in Figure 4.1 below.

Intervention group (Hawali Province)	(2016) O1	X	(2017) O2	(2017) O3
--				
control group (Al-Farwanya Province)	O1		O2	O3

Figure 4 .1 Outline of data collection periods for the intervention and control groups

4.4 Selection of study participants

The target population included adult patients (> 16 years old) with OHCA from Hawali and Al-Farwanya provinces. These patients activated the dispatch centre for OHCA and were assessed, transported and treated by the Ministry of Health EMS before finally being transported to Mubarak Al-Kabeer Hospital or Al-Farwanya Hospital. Participants were selected by applying the Utstein template. Figure 4.2 is a flow diagram of the data selection process. In the pre-test phase, data were collected retrospectively by the researcher, while, in the post-test phase, the call takers were given instruction to identify the OHCA cases and apply the intervention. The identification was done by consulting the Case Entry information (address, telephone, age, and chief complaint) and applying the inclusion and exclusion criteria before providing CPR instruction. The call taker was also instructed to ask a few questions for assessment and to establish the caller's knowledge of cardiopulmonary resuscitation and whether cardiac arrest was witnessed (see Appendix I: DACPR data sheet).

4.4.1. Inclusion criteria

- Any call reporting unresponsiveness, apnoea, agonal breathing or snoring
- Cardiogenic aetiology
- Witnessed and non-witnessed cardiac arrest
- Males and females
- Aged 16 years and older
- Hawali province

4.4.2. Exclusion criteria

- Paediatric population
- Women in late pregnancy
- Non-cardiogenic aetiology (drug overdose, trauma, electrocution, drowning)
- Patients for whom resuscitation is not attempted (decapitation, rigor mortis and dependent lividity)
- Unidentified patients (owing to difficulty of follow-up)

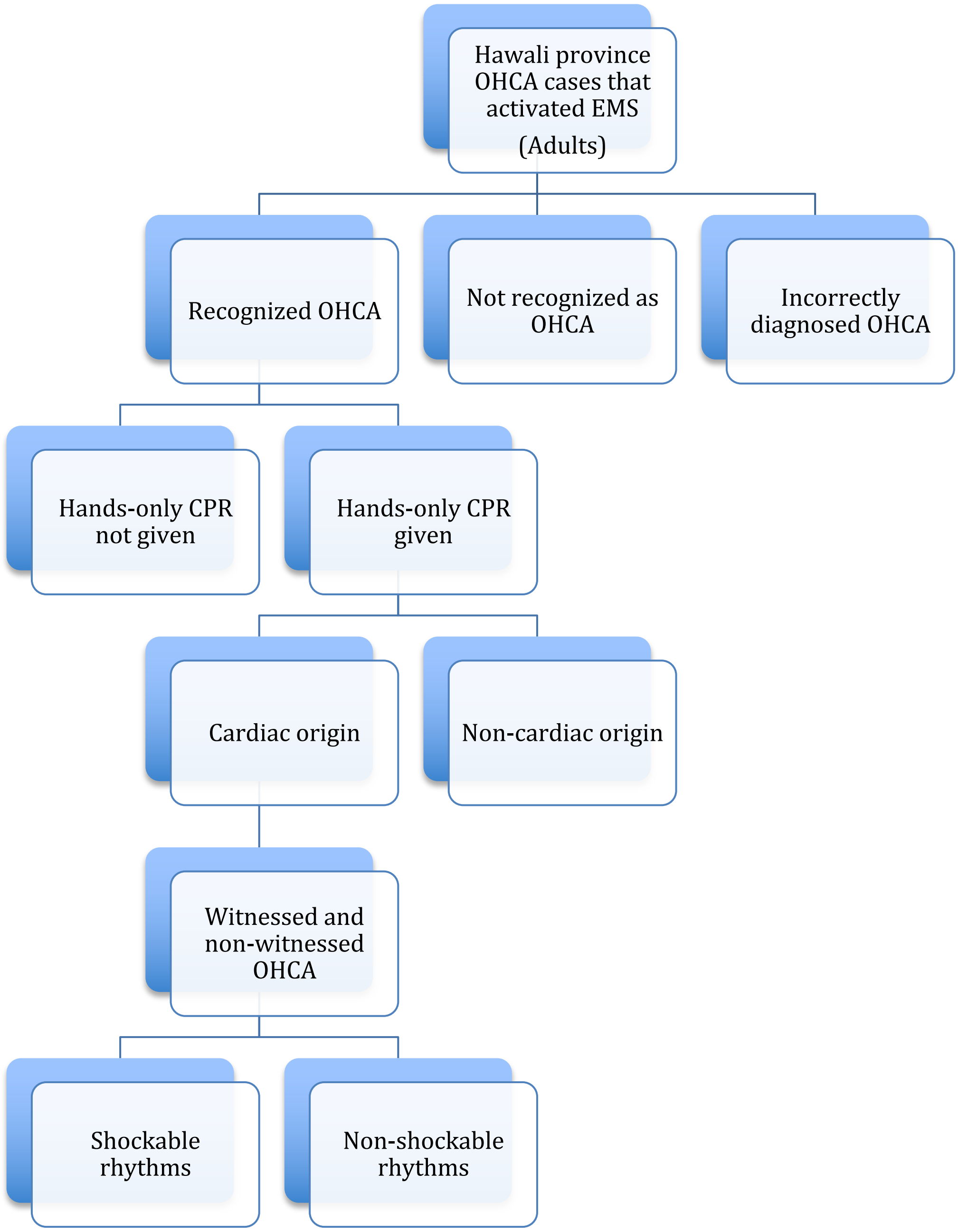

Figure 4.2 *Flow diagram for OHCA data collection*

If a patient did not meet the inclusion criteria, the call taker followed the Kuwaiti EMS standard protocol: recognizing cardiac arrest only according to Advanced Emergency Medical Priority Dispatch version 12.1 and dispatching the nearest ambulance to the patient location. For instance, if a caller called to report a case of drowning, the call taker followed ProQA version 12.1 CPR instructions by asking the caller to check response and then giving two breaths: thirty chest

compression instructions. Evidence-based basic life support was also to be provided to all modalities of cardiac arrest (paediatric, late pregnancy, traumatic, and so on)
Moreover, other OHCA cases from other provinces were not excluded from this Kuwaiti standard EMS practice (i.e., recognize OHCA and dispatch the nearest EMS personnel to the event).

4.4.3 Bystanders

Bystanders who received instructions were aged 11 years and above. This is based on Beard's (2015) findings concerning the age at which untrained youngsters can successfully perform compression-only CPR. The author concluded that from 11 years of age on, they can effectively perform DACPR by compressing the chest at an appropriate rate and depth. Although no calls were received from younger children, call takers were instructed to ask younger children to seek other adults in the vicinity to continue the phone call while the nearest ambulance crew was being dispatched to the emergency location. The study inclusion/exclusion criteria were similar to those used by Beard (2015).

i. Inclusion criteria

- Above the age of 11 years.

ii. Exclusion criteria

- Physical disability that would affect CPR performance.

4.5 Intervention

The selected study intervention was DACPR. This intervention was implemented initially in the form of a single tool; call takers attended a one-day intensive DACPR training course, the new DACPR protocol was used and quality assurance and improvement tools were included. Selection of this DACPR modality was informed by three elements: the best DACPR programme is not known in the resuscitation guidelines (Brikenes, 2015), the DACPR implementation methods reported in the reviewed studies (Berdowski, 2009; Sanson, 2010; Bray, 2011; Tanaka, 2012; Song, 2014; Hiltunen, 2015; Bobrow, 2016; Harjnato, 2016 and Plodr, 2016) and the fact that DACPR was not previously practised by Kuwait's EMS Dispatch Centre.

A one-day intensive DACPR training course took place on 19th February 2017 at the Kuwaiti EMS training unit at Sabhan. This one-day intensive DACPR training course was repeated 10 times throughout the intervention and post-intervention periods. The reason for repeating the DACPR training programme was to consolidate the intervention. The initial DACPR training course was delivered consistently over ten days. It was then followed by a default DACPR protocol institute on 20 February 2017 at the Emergency Unit Dispatch Centre, EMS Kuwait, Sabhan and quality assurance and improvement measures to ensure intervention implementation via electronic cross-checking and manual matching with OHCA patient's report forms. In terms of the installation of a DACPR protocol in the Kuwaiti EMS, the absence of an approved international DACPR protocol in the literature (Maier, 2016) necessitated the specification of an innovative DACPR protocol.

4.5.1 Training modules

The present study ensured uniformity of OHCA call processes among Kuwait EMS call takers during the study period by having the call takers complete a DACPR training programme just before the post-intervention period (1 June– 31 December 2017), which was comprised of lecture, videos and workshop (see Appendix V). While the researcher delivered the lecture, the workshop were conducted by the dispatch instructors under the researcher's supervision.

Training course structure

- Length: One day. Although the Resuscitation Academy recommends 40 hours of training (DACPR toolkit, 2010), most EMS centres provide one day of intensive training (Harjnato, 2016; Arizona Health Services, Centre of Excellence, 2016 and Beirkenes, 2015). The length of this study's training course was also based on the limited time frame and call takers' existing dispatch experiences (See Appendix V). Nonetheless, the training course was repeated over different call taker patches to ensure maximum call taker involvement in the study process.

- Lecture structure: The following topics were included in the training programme: cardiac anatomy and physiology, initial OHCA rhythms, 'Why OHCA?', 'Why DACPR?', the national figures for OHCA from the 2013 audit, the call taker's role in the OHCA survival chain, the research objectives, the call taker's role in the research, hands-only DACPR principles, OHCA call structure, time metrics, possible challenges and risks, and benefits and ethical issues. The lecture was delivered in Arabic, in line with Kuwait EMS call-taking processes. The lecture were structured by the researcher, as, prior to this study, the Resuscitation Academy 2010 highlighted some points to be included in the lecture content, such as cardiac anatomy and physiology, but not all of points addressed by the researcher.

- Save Hearts Arizona Registry and Education (SHARE) online training course: The participating call-takers completed eight chapters of this computer-based DACPR training course. Content included: the significance of DACPR, OHCA recognition, giving CPR instructions, DACPR barriers, agonal breathing, automated external defibrillator instructions, and cases involving paediatric patients, pregnant women and non-cardiogenic instances. This online training course was selected due to its source (Arizona Health Services, Centre of Excellence) and the availability of an Arabic version.

- Workshops: The workshops were based on case scenarios, as many adult learners favour an inductive approach (Boston University, n.d). The researcher designed the workshops by customizing AEMPD case scenarios and following transformative learning principles (Mezirow,1991). The workshops included material on OHCA cases only , a call barrier (position or panicking caller), measurement of time metrics, filling in the DACPR data sheet, all while permitting each call taker to play two roles in two different case scenarios, i.e., those of caller and call taker. The workshop was delivered by the dispatcher instructor and supervised by the researcher.

4.5.2 DACPR protocol

i. Structuring the DACPR protocol

The proposed DACPR protocol was structured on the basis of DACPR processes specified by Centres of Excellence (Arizona Health Services, 2015 and Resuscitation Academy, 2013), available Kuwaiti EMS resources (preinstalled AEMPD and call processing operational unit) and the DACPR protocols described in the reviewed studies (Table 4.1).

Table 4.1 DACPR protocols in the reviewed studies.

Borrow 2016	Unresponsive? Is he breathing normally? Any, no or don’t know. Give hands-only CPR.
Harjnato 2016	Unresponsive? Is he breathing normally? Any, no or don’t know. Give hands-only CPR.
Plodr 2016	Check response. Optimize patient position. Check breathing. Check if the caller is alone. Give hands-only CPR instruction.
Song 2014	Altered mental status? Abnormal breathing? If both yes, give hands-only CPR.
Tanaka 2012	Unconscious, not breathing, agonal breathing, emesis, anoxic convulsion. Give chest compression CPR.
Bray 2011	Medical Priority Dispatch (version 11.3): recognize cardiac arrest; give chest compression instructions: 400 chest compression then 30; 2 cycles; target: 100 compressions/minute.
Hilutnin 2015	Unresponsive? Is he breathing normally? Both no: give hands-only CPR.
Sanson 2015	OHCA not stated; symptoms; specify recognition. Red-code alert. No CPR instruction.
Axelsson 2010	Not specified
Berdowski2009	Not specified
Nishi 2016	Not specified
Bohm 2011	Different protocols from five studies (all before 2010); hands-only CPR protocol.

Collectively, the DACPR pre-set protocol consisted of two steps: OHCA recognition and giving hands-only CPR instructions. This was also provided in two languages (Arabic and English, see Appendix IV) because Arabic is the official language of Kuwait and the EMS system. The next section describes briefly the pre-set steps for DACPR.

Step 1. Implementation of OHCA recognition: The initial call taker completed the digital case entry sheet in less than 30 seconds, including the following information: patient's address, primary complaint, consciousness level and breathing. Figure 4.3 shows an example of a case entry information sheet. If the patient's primary complaint met the standardized pre-set cardiac arrest-related symptoms (unresponsiveness and/or not breathing, or not breathing normally) and the patient was from Hawali province, the initial call taker would transfer the citizen's call to an interventional call taker. The initial call taker also transferred the call details (patient's name, primary complaint and address) to the ambulance call taker, as usual. This enabled dispatch of the nearest ambulance crew to the OHCA case as per Kuwait's EMS protocol and ensured that the DACPR intervention did not interfere with the Kuwaiti EMS' regular management practice in OHCA cases. The interventional call taker who received the OHCA case confirmed the OHCA case within less than one minute. Once OHCA was confirmed, the interventional call taker moved to step 2.

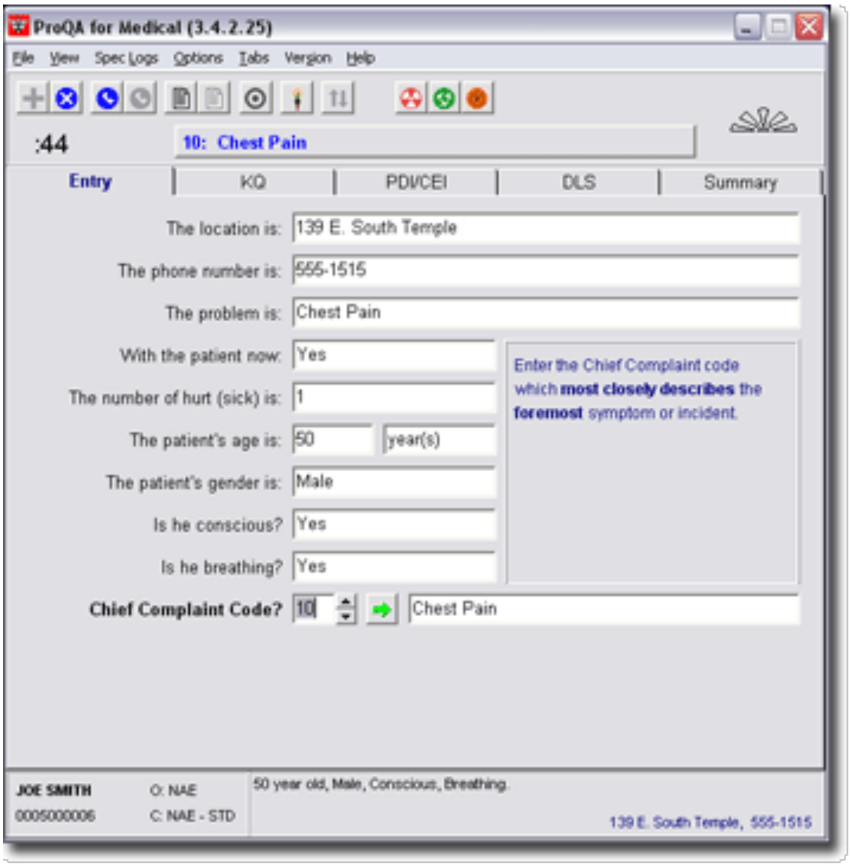

Figure 4.3 Example of digital case entry information sheet for chest pain as primary complaint

In contrast, OHCA calls from Al-Farwanya province (post-intervention control group) implemented regular EMS call-taking processes based on the standard Kuwaiti EMS approach, which is based mainly on the North American Emergency Medical Priority Dispatch version 12.1 ProQA system.

Step 2, Giving hands-only CPR instruction: In step 2, if the bystander was an adult, the assigned call taker assessed the bystander's previous knowledge of CPR before giving hands-only CPR instructions. The call taker ascertained their level of knowledge by asking the caller 'Have you performed CPR before?' In the case of a bystander with previous knowledge of CPR, call takers were still instructed to give hands-only CPR instructions, as rescue breathes were not used. However, if the bystander was a child, the assigned call taker assessed the bystander's age and any physical disabilities by asking the child 'How old are you?' and 'Do you have any health problems?' The call-taker then gave CPR instructions (hands-only CPR) according to a pre-set protocol within less than two minutes (see Appendix IV). In all OHCA cases, the assigned call taker gave hands-only CPR instructions only if the bystander was above 11 years of age (Beard, 2015). The call-taker also withheld hands-only CPR instructions in cases where a non-cardiogenic cause was recognized. Non-cardiogenic causes include electrocution, trauma, drowning, drug overdose and suicide.

Benchmark for the measurement of DACPR programme success was defined in terms of the OHCA recognition rate. This was again because of the absence of a pre-specified AHA (2016) performance metrics recommendation for DACPR programme success at the time this study commenced. For that reason, the researcher set the benchmark for programme success as follows: at least 75% of OHCA cases activating the Kuwaiti EMS in Hawali province are recognised by call takers and receive hands-only CPR from bystanders. This target follows the systematic review of the EMS system's sensitivity to recognising cardiac arrest giving the percentage of recognized cases at 75% (Deakin, 2017).

At the call level, the success benchmark followed the AHA (2016) DACPR performance metrics recommendation: OHCA recognition within less than one minute and first chest compression within less than two minutes of the call. As stated earlier (see Chapter 3, p. 64), the researcher classified an OHCA case as recognized if one of the following criteria was met:

1. The call taker submitted a DACPR sheet for the OHCA case.
2. The electronic code of the OHCA case was either "cardiac arrest", "death suspicion" or "heart".
3. Audio recording review revealed that the call taker confirmed OHCA or gave CPR

instructions.

ii. Standardized individualized DACPR protocol

The standardized DACPR protocol was applied to OHCA cases in Hawali province that activated the Ministry of Health Emergency Unit Dispatch Centre with cardiac arrest-related symptoms (unresponsiveness and/or not breathing normally). The initial call taker evaluated the presence of these symptoms before transferring the call to the interventional call taker to determine whether the intervention (hands-only CPR instruction) was needed. When non-cardiac-origin OHCA was recognized, intervention was not encouraged; instead, the call taker followed regular EMD ProQA instructions. OHCA of cardiac origin was defined as sudden unresponsiveness and/or not breathing normally owing to unknown aetiology. Challenges for intervention implementation (hands-only CPR instruction barriers) were defined as caller hung up, caller refused, caller could not move the patient, language barrier, phone call was not clear, EMS personnel arrived before CPR could be administered, cardiac arrest was non-cardiogenic and other reasons. The interventional call takers were entitled to address the presence of any challenge during their call. The intervention (hands-only CPR instruction) was stopped if the patient moved or spoke or if EMS personnel arrived.

Emphasis was placed on the citizen's previous knowledge of bystander CPR, optimal patient position (on the floor or other hard surface), bystander hand location (centre of patient's chest) and posture (kneeling beside patient with elbows straight), CPR technique (pushing fast and hard) and counting (at least 100 compressions per minute). The interventional call taker completed a DACPR data sheet for the call and had direct access to the protocol leaflet.

DACPR was implemented with a caution about minor risks, as call takers may incorrectly diagnose OHCA in ~50% of cases (Resuscitation Academy, *n.d.*). In these cases, 12% of patients may experience discomfort, and 2% may suffer rib fractures as a result of hands-only CPR (White, 2010).

4.5.3 Quality assurance and improvement measures

Initially, three main quality assurance and improvement measures were used in this research, i.e., random audio recording review, retrospective sample collection and computer cross-checking during the intervention period (February-May 2017). However, more quality assurance and improvement tools were added throughout the course of the post-intervention period (June-December 2017), Table 4.2 lists the quality assurance and improvement measures used in this study. The identified outcomes and advantages and disadvantages of each quality assurance and improvement tool are discussed in Chapter 6 (see Table 6.2).

Table 4.2 *List of the quality assurance and improvement measures used in this study*

Quality assurance and improvement tool	***Method***	***Literature***
Audio-recording review	Researcher gave the case number and dates to the dispatch co-chief, who retrieved the recordings; the researcher analysed the data and gave feedback to the dispatch co-chief	Ro (2017): 10% of calls monthly reviewed by the dispatch director. Viereck (2017): 100% of the calls reviewed by the researcher; Huang (2017) randomly selected audio records reviewed by the dispatch director.
Call takers' work-assessment sheets	Researcher retrieved call takers' names from OHCA cases' electronic files and counted the workload of each call taker monthly	Not known to have been used before
Shift's supervisor monitoring sheet	A sign-off paper was placed on shift supervisors' desks. On each shift, the supervisor needed to ensure that one interventional call taker was present at all times during the 24 hr shift, document each OHCA call on the shift, retrieve the completed DACPR sheet and hand it to the dispatch chief's office at the end of the 24 shift.	Not known to have been used before
Retrospective sample collection	A serial number was assigned to each call and used by in-the-field EMS personnel to complete the patient report form. In-the--field EMS personnel returned the patient report forms to the EMS Audit Department after ~1 month. Report sheets for OHCA cases were extracted from Audit Department archival data storage. And, as their serial number was the one provided by the dispatch centre, they were then extracted from the dispatch electronic database in order to review	Not known to have been used before

	their dispatch codes and call handling processes. For the present purposes, this helped to identify correctly recognized and missed OHCA cases and their initial outcomes (such as ROSC).	
Computer cross-checking	Using the electronic dispatch data base, the dispatch instructor and computer engineer collect all of the cases coded as cardiac arrest by interventional call takers on a monthly basis. The researcher reviewed the caller details and matched the call serial number with the in-the-field EMS diagnosis; this matching process permits the estimation of the incorrectly diagnosed OHCA cases, hence the estimation of the positive predictive value of DACPR.	Not known to have been used before
Feedback	i. Organisational feedback: April–Dec. (by researcher). The the researcher wrote up a monthly report on outcomes of all OHCA calls and met with the dispatch chief and co-chief to discuss the reports and set future plans. ii. Shift supervisor feedback: Sept.–Dec. (instructor and researcher). Researcher and dispatch instructor met with each shift supervisor and discussed the rate, outcome barriers, best interventional call taker and areas of improvement. ii. Call taker personnel feedback. Sept.-Dec. (supervisor and co-chief). The shift supervisor and dispatch co-chief gave personal feedback for each call taker during OHCA call handling.	Tanaka (2012), Song (2014), Plodr (2016), Hardeland (2017) used personal feedback; Ro (2017) used personal and organisational feedback; Huang (2017) gave monthly organisational feedback
Usage of OHCA case recognition and management as an assessment tool for call taker performance (Ministry of Health investigation and violation warnings)	Researcher reported call takers who inappropriately handled OHCA cases during their call taking to the dispatch co-chief after reviewing the audio recordings. The co-chief listened to the audio recording and referred the call takers' malpractice for a Ministry of Health investigation	Not known to have been used before

In summary, the selected study intervention, DACPR, evolved throughout the study. This evolution occurred because, although the intervention was always in the form of a single tool (one-day intensive training course, new DACPR protocol and a few quality assurance and improvement measures) , those parts were altered repeatedly throughout the study based on repeated periodic outcome evaluations. The reason this approach was followed was to consolidate the intervention in the Kuwaiti EMS dispatch system; this is well-explained in Section 4.8.2 of this chapter.

4.6 Assessment of the introduction of the DACPR protocol to Kuwait's Emergency Dispatch System

Prior to the study intervention's implementation, a feasibility assessment was carried out to evaluate the practicality of implementing DACPR in Kuwait's emergency dispatch system. This provided an objective assessment of the strengths and weaknesses of the existing dispatch system and assessed whether or not there were any identifiable threats in the dispatch system environment which might hinder full implementation of DACPR (Georgakellos, 2009). To this end, the intended DACPR was assessed in the context of available technical, operational and legal resources, as well as timeframes (Bause, 2014).

1. **Technical feasibility**
   Aim: To determine whether the existing emergency dispatch system included the necessary technical expertise to handle completion of the proposed study.

   - A brief description of the emergency dispatch system to assess any factors that might hinder the intervention.

   - Kuwait's EMS dispatch system's single centre receives all emergency and inter-hospital transfer calls from all regions of Kuwait. This system is based on the North American system and uses the Advanced Emergency Priority Medical Dispatch version 12.1 (ProQA program) to answer emergency calls.
   - The dispatch staff includes call takers, ambulance dispatchers, supervisors, instructors, a dispatch chief, a dispatch co-chief and an operations unit director (OUD).
   - These personnel usually work in four 24-hour shifts (A, B, C and D). Staff on each shift include call takers, ambulance dispatchers and a supervisor. Instructors, the dispatch chief and co-chief and the OUD work daily and are on call during non-working hours.

- Once an emergency call activates the dispatch centre, the initial call taker takes down the caller’s address and principal complaint. These details are then transferred to the ambulance dispatchers to match the nearest available ambulance to the caller. The supervisor takes over during any mass events.
- The monitoring process is left to instructors, who randomly listen to audio records, assess performances and provide feedback to call takers and the dispatch chief.

- Elements of the dispatch system to be examined

The study examined the implementation of updated OHCA call processes in Kuwait and the impact of OHCA recognition and hands-only CPR instructions provided by call takers. Eight call takers were assigned initially for this purpose, and one instructor monitored the process.

- Human and economic factors

- Human factors:
  The total dispatch staff included 175 dispatch personnel.
  For each 24-hour shift, there are at least 11 dispatch personnel, along with one supervisor, five call takers and five ambulance dispatchers.
  Most call takers are Accident and Emergency nurses, as are most ambulance dispatchers.

- Economic factors:
  There is no anticipated economic factor.

- Possible solutions to the problem.

<u>1. Missing OHCA cases:</u>

The OUD specified the names and number of intervention staff. The OUD was certain that this number would cover every shift efficiently, with two interventional call takers to ensure that no OHCA cases were missed.

<u>2. Incorrectly diagnosing OHCA cases:</u>

The instructor was positive that the interventional call takers were sufficiently skilled as to correctly diagnose OHCA cases and give hands-only CPR instructions.

3. Barriers to CPR instructions:

Based on Ho's (2016) finding that barriers to DACPR were present in 37% of cases, the author was able to estimate the incidence of barriers, and this information was included in lecture for call takers. Table 4.3 lists the barriers and solutions adopted in the present study.

Table 4.3 Barriers and solutions adopted in the present study

Anticipated DACPR barrier	Solution
Changing patient position (27%)	If the caller cannot move the patient to the floor, ask the caller to place the patient wherever they are (bed or sofa) on their back and to perform CPR.
Caller refusal (15%)	Be assertive and do not give options.
Caller hung up (11%)	Call back.
Caller not with the patient (5%)	Ask the caller to provide a number at the scene or to call you when they get there.
Language barrier (3%)	Ask the caller to give the phone to anyone who speaks English or Arabic.

3. Operational feasibility

i. Main objective of DACPR programme:

- To recognize 75% of OHCA cases in Hawali province that activate the EMS (Deakin, 2017).

Kuwait's EMS dispatch system has a well-structured information technology (IT) system, in which any call that activates the EMS dispatch is given a serial number, and its contents are recorded in audio and written formats. Using the call serial number, one can examine call handling by the call takers, ambulance dispatch processes, on-site EMS personal notes and the hospital's initial management steps and diagnoses.

As the serial number assigned to each call is the same as the one used by on-site EMS personnel to complete the patient report form, OHCA recognition can be checked electronically through the dispatch IT system and manually by reviewing patient report forms, making the process achievable, reliable, sustainable and affordable.

Additionally, electronic cross-checking was facilitated at any time during the study period by the dispatch instructors, dispatch co-chief and dispatch chief. While these personnel are using the

dispatch IT system, a team of computer engineers maintains the system's operations. This IT team works 24 hours a day for 6/7 days a week to ensure that the system remains operational.
Manual cross-checking is possible 1–2 months after a call. In-the-field EMS personnel return patient report forms to the EMS Audit Department after ~1 month. Report sheets for OHCA cases can be extracted from the Audit Department archival data storage, as serial numbers are those provided by the dispatch centre, enabling extraction of early call activation processes for OHCA cases. For the present purposes, this helped to identify correctly recognized and unrecognized OHCA cases and their initial outcomes (such as ROSC).

ii. Main objectives of call:

The main objectives of the call are to recognize OHCA within less than one minute and to ensure that the caller performs the first chest compression within less than two minutes of commencing the call.

Again, using the well-established dispatch IT system, audio and written records were saved for each OHCA call. The dispatch instructor checked the audio and written records of some OHCA cases to determine the time metrics of OHCA recognition and first chest compression performed by the caller.

These time metrics can also be checked manually on the DACPR report sheets completed by call-takers for each OHCA call.

4.Schedule feasibility

DACPR is usually implemented through dispatch protocol changes. Further, only one of the 16 studies in the literature review allocated a run-on period to launch DACPR in their dispatch system (Harjanto, 2016). Unlike the majority of the published studies, a three-month run-on period was allocated for the proposed study. This is because this research was the first to be carried in a Kuwaiti EMS setting and integrating new practice can take time (National Health Services of England, 2007). Additionally, the period required to assess the impact of DACPR on OHCA outcomes is unknown because the post-intervention period varies in the literature. The shortest such period was four months, and the longest was three years (see Chapter 3, p.73). The post-intervention period for the present study was six months. Given the limited timeframe for PhD studies, the researcher did not collect data for analysis at the end of the post-intervention period.

Instead, partially repetitive collection of data during the post-intervention period meant that mandatory PhD deadlines could be met, as shown in Table. 4.4.

Table 4.4 Project timetable

Post-intervention period and data collection processes	Feb–Mar	Apr–May	Jun–Jul	Sept–Oct	Oct–Nov	Nov–Dec	Dec–Jan
DACPR implemented	X	X	X	X	X	X	
Follow-up	X	X	X	X	X	X	X
Maintenance interim report	X	X	X	X	X	X	X
Amendment plan	X	X	X	X	X	X	

In conclusion, the assessment confirmed that Kuwait's dispatch system had the technical expertise to handle the completion of the study and there was no legal conflict between the study and local EMS regulations. On examining the operational feasibility of Kuwait's dispatch system, it was found that dispatch operations were adequate for assessing and implementing the DACPR program and setting objectives. Finally, the project timetable was scheduled to meet research deadlines. In summary, DACPR implementation was feasible in the given context.

4.7 Implementation strategies

4.7.1 Pre-intervention group and control group 1 (January to 31 April 2017)

Data for the pre-intervention group 1 and control group 1, who received standard Kuwait EMS recognition and management protocols, were collected after ethical approval was obtained. Using the following extraction processes, the Audit Department team searched through 12,000 patient report forms in boxes over a period of 3 weeks, extracting 206 patient report forms. Over five days, the researcher analysed these and identified 179 cardiogenic OHCA cases. The researcher then went to the Mubarak Al-Kabeer hospital registry and searched through ledger notes in an attempt to match 2016 OHCA patients through hospital records. Since Mubarak Al-Kabeer Hospital destroys all records of patients not returning to the hospital within one year, only a few names could be matched. Thus, the researcher approached the Death Registry department. All 2016 deaths were printed out and manually matched to the 179 cardiogenic OHCA cases to obtain the 30-day OHCA survival rate. Matching was based on patient civil ID numbers and/or names. The matching process took two weeks. The researcher divided the OHCA cases into six sub-groups according to province (Al-Asimah, Hawali, Al-Farwanya, Al-Ahmedi, Mubarak Al-Kabeer and Al-Jahra) and wrote the data report over a period of two weeks, compiling monthly incidence and 30-day survival rates for OHCA patients. Results for the pre-intervention group and control group one are discussed in detail in Chapter 5, p.138-139. It is important to note that although the death registry is a primary source of data, it has less accurate data than the hospital medical records for OHCA survival to 30 days. When the retrospective nature of the pre-intervention groups' (2016) data is added in, one cannot eliminate reporting bias for the pre-intervention group's data.

All of the independent and dependent variables for the pre-intervention group were analysed individually and compared to the during-DACPR-implementation group and the post-intervention group. The dependent variables were the 30-day OHCA survival rate, ROSC, rate of bystander CPR, OHCA recognition rate and CPR instruction rate; the independent variable was DACPR implementation (absent in pre-intervention study groups).

4.7.2 *Intervention implementation (19 February to 31 May 2017)*

Before implementation of the DACPR, a meeting was held with the OUD, who was asked to nominate the dispatch instructors to be involved in the DACPR programme, determine the number of current call takers and specify the number and names of call takers to receive the one-day intensive DACPR training programme for implementing DACPR. The OUD nominated one instructor and eight call takers, asserting that this should ensure the presence of an interventional call taker on each shift. The OUD also announced the date of the new standard operating procedure (SOP) for cardiac arrest symptom-related calls for all call takers in the Emergency Unit (19 February 2017). The new SOP stated that 'every cardiac arrest symptom-related call (unresponsive/not breathing normally) in Hawali province should be transferred to the interventional call taker on the shift within less than 1 minute of receiving the call'. A second meeting was held the next day with the dispatch instructor to discuss the DACPR protocol and training programme. The initial training programme was conducted just before the during-implementation and post-intervention periods (21 February–30 May2017 and 1 June-31 December 2017). However, soon after this training programme, the initial quality assurance and improvement measures revealed that the initial implementation strategy had no effect. These findings led to amendments at the organisational and research levels.

- Organisational level: Organisational feedback was obtained in meetings with the dispatch chief, dispatch co-chief and dispatch instructor to discuss the reasons for the poor OHCA recognition rate, management and outcomes. In a meeting, it was decided to train the maximum number of call takers and to continue monitoring the DACPR implementation. Subsequently, the one-day intensive DACPR training programme was repeated 10 times on the following dates: 20 February 2017, 17-20 May 2017 and 20-24 August 2017. In this manner the group of eight interventional call takers was increased to a group of 70 interventional call takers. All of the interventional call takers received one day of intensive DACPR training in the form of a lecture, a workshop and the recommended Save Heart in Arizona Registry and Education (SHARE) e-learning course (Birkenes, 2015). All interventional call takers were certified by SHARE at the end of the course. The researcher distributed the DACPR protocol to all call takers. The call takers were instructed to follow the protocol starting the next day. The run-on period was cancelled owing to the limited timeframe available to the researcher.

- Research level: DACPR was reviewed as a complex tool.

  The complex context of the Kuwaiti EMS and culture had a role in hindering DACPR implementation and obliged the researcher to acquire a new strategy for implementing DACPR in a pilot region of Kuwait. A process of implementation, evaluation and development was followed. The value of repeated evaluations of an intervention lies in the ability to assess the quality of the implementation, clarify causal mechanisms and identify contextual factors associated with variations in outcomes (Moore, 2015). The utilized implementation-evaluation-feasibility and development process is shown in Figure 4.4 and Table 4.5. This process includes strategies to overcome the novel range of complex challenges in DACPR implementation in Kuwait; these novel challenges are listed in Section 4.7.6 of this chapter. On the same vein, the implementation, evaluation, feasibility and development key phases were carried initially over a 2-month period. However, the investigator realised the need for closer observation periods soon after the July 2017 monthly implementation, initiating evaluation, feasibility and development cycles on a monthly basis after this time.

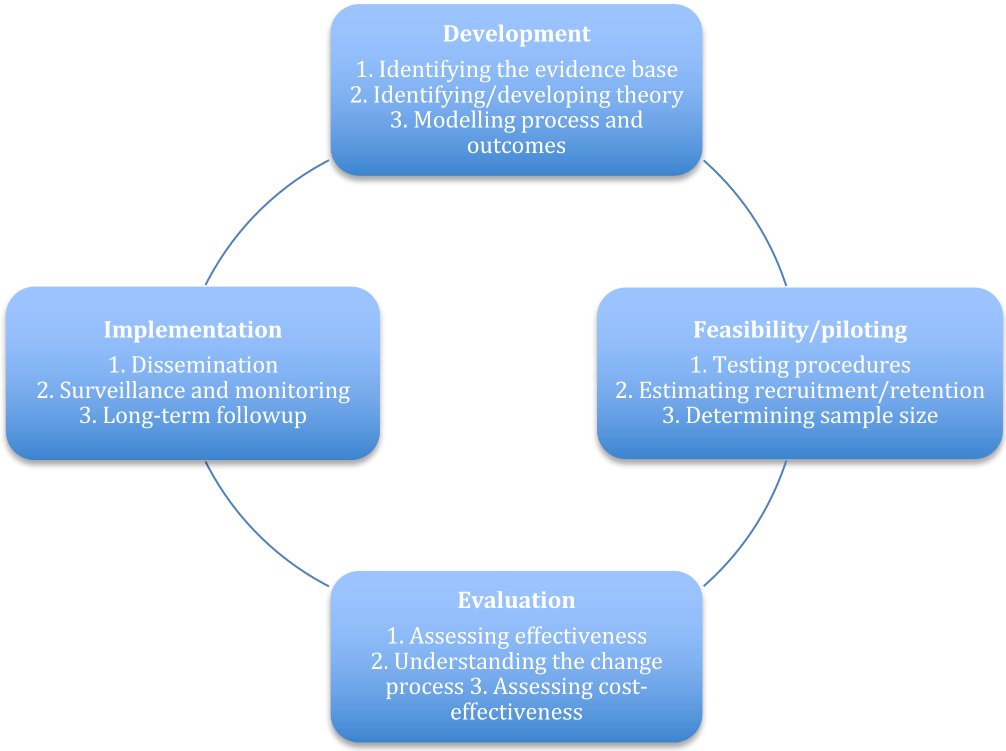

Figure 4.4. Key phases in the implementation, evaluation and development of a complex intervention. Source: Medical Research Council, 2006.

Table 4.5. DACPR implementation processes, outcomes and consequent adapted strategies during the DACPR implementation and post-intervention periods.

<table>
<tr><th rowspan="2">Implementation</th><th colspan="2">Evaluation</th><th rowspan="2">Feasibility</th><th rowspan="2">Development</th></tr>
<tr><th>Observation period</th><th>Outcome</th></tr>
<tr><td>a. <u>DACPR implementation</u>:
One day of intensive training for eight interventional call takers + new protocol
b. <u>DACPR data-sheet collection</u>:
Interventional call takers submitted two DACPR sheets
c. <u>Monitoring</u>:
Computer cross-checking + random audio recording review + retrospective monitoring</td><td>20 February to 31 May, 2017;
N = 48 cases.</td><td>*OHCA recognition Rate = 2%
CPR instruction rate = 0%
*BCPR rate = 14% (7)
*ROSC rate = 6.3% (3)
Survival to 30 days = 2% (1)

Barriers = 2% (1): personal barrier (non-cooperative caller)</td><td><u>DACPR not feasible because</u>:
<u>DACPR implementation</u>: Eight interventional call takers + new protocol is a poor technique
<u>Monitoring</u>: Retrospective sampling: most calls were taken by non-interventional call takers and misdiagnosed
<u>Conclusion</u>: Initial call takers lack the skills to recognise OHCA and are not transferring the calls to interventional call takers</td><td>1. Starting organisational feedback and reviewing DACPR as a complex intervention
2. Following organisational feedback, the researcher and co-chief agreed to:
i. Give DACPR training from 17 May to 20 May, 2017 to another 32 call takers. This ensured 10 interventional call takers were present on each shift
ii. Use of reminder signposts to encourage call takers to transfer calls to interventional call takers and recognise OHCA
iii. Continue monitoring OHCA call processes from the intervention region and add call-taker work-assessment sheets</td></tr>
<tr><td>a. <u>DACPR implementation</u>:
40 interventional call takers + new protocol + reminder sign posts
b. <u>DACPR sheet collection</u>: Two DACPR sheets were submitted
c. <u>Monitoring</u>:
Computer system cross-checking + retrospective monitoring + audio records + call takers' work assessment sheets + organisational feedback</td><td>1 June to 31 July, 2017;
N = 35</td><td>OHCA recognition rate = 14% (5)
CPR instruction rate = 15% (5)
BCPR rate =11 % (4)
ROSC rate = 0% (0)
Survival to 30 days = 0%</td><td><u>DACPR can be feasible</u>:
<u>DACPR implementation</u>: better, but OHCA recognition rate is low

Reminder signposts remain at call takers' desks

<u>Monitoring</u>:
1. Retrospective sampling: increased the number of missed OHCA cases
2. Audio recording review is a key monitoring tool; it shows call takers' level of adherence to protocol, but what percentage of review is needed?
3. Call takers' work assessment sheets are</td><td>Meeting with the dispatch chief identified the need to:
- Give DACPR training to another 30 people to train more call takers, resulting in 70 interventional call takers. Training course offered on 20–24 August, 2017. This ensured that 17 interventional call takers would be present every 24 hours.

- Continue monitoring and adding shift supervisor monitoring sheets</td></tr>
</table>

Implementation	Evaluation		Feasibility	Development
	Observation period	Outcome		
			another key tool: most calls were taken by non-interventional call takers 4. Organisational feedback is another essential tool in launching interventions	
a. DACPR implementation: 70 interventional call takers b. DACPR sheet collection: Two DACPR sheets c. Monitoring: Retrospective monitoring + computer system cross-checking audio recording review + call taker worksheet + supervisor monitoring sheet	1 August to 31 August, 2017; *N* = 18	OHCA recognition rate = 5% (1) CPR instruction rate = 0% BCPR rate = 8% (2) ROSC rate = 0% Survival to 30 days = 0%	DACPR is not feasible: DACPR implementation: OHCA recognition rate decreased. Monitoring: 1. Audio recording review: revealed call takers' poor ethics 2. Call takers' performance sheets: less call taking by non-interventional call takers 3. Supervisor monitoring sheet: only two supervisors were committed to following up the OHCA incidences on their shifts 4. Organisational feedback is another essential tool in launching interventions	Meeting with the dispatch chief declared: - Continue monitoring and give personnel feedback to supervisors and call takers - Increase the audio recording review rate
a. DACPR implementation: 70 interventional call takers + new protocol b. DACPR sheet collection: Two DACPR sheets c. Monitoring: Retrospective monitoring + computer system cross-checking audio recording review + call-taker	1 September to 30 September, 2017; *N* = 23	OHCA recognition rate = 8% (2) CPR instruction rate = 8% (2) BCPR rate = 8% (2) ROSC rate = 4% (1) Survival to 30 days = 0	DACPR can be feasible: DACPR implementation: No substantial improvement of OHCA recognition rate Monitoring: 1. Audio-recording review: call takers continue to show poor ethics and protocol adherence 2. Call takers' performance sheets: less call taking by non-interventional call takers	Meeting with the dispatch chief identified the need to: - Continue to stress that malpractice in OHCA call taking will cause the call taker to be questioned by the Ministry of Health - Increase the audio recording review rate to 50%

Implementation	Evaluation		Feasibility	Development
	Observation period	Outcome		
worksheet + supervisor + personnel feedback			3. Supervisor monitoring sheet: not submitted 4. Personal feedback: special attention was withdrawn regarding caller terminology. Callers tended to use certain words to describe loss of consciousness, e.g., 'syncope', 'not well', 'fell down' Accurate use of coding also was stressed to most call takers. The researcher named the outstanding call takers and potential call takers in her debriefing	
a. DACPR implementation: 70 interventional call takers b. DACPR sheet collection: 0 DACPR sheets c. Monitoring: Retrospective monitoring + computer system cross-checking audio recording review + call taker worksheet + supervisor + personnel feedback	1 October to 31 October, 2017; *N* = 14	OHCA recognition rate = 7% (1) CPR instruction rate = 0% BCPR rate = 12% (2) ROSC rate = 0% Survival to 30 days = 0%	DACPR not feasible: DACPR implementation: No improvement in OHCA recognition rate. Monitoring: 1. Audio-recording review: continued to show call takers' poor ethics and protocol adherence 2. Call takers' performance sheets: less call taking by non-interventional call takers 3. Supervisor monitoring sheet: not submitted 4. Personal feedback: no improvement 4. Ministry of Health investigator: one call taker was investigated and three given violation warnings	Meeting with the dispatch chief identified the need to: - Continue the same processes, but increase the audio recording review to 100%.
a. DACPR implementation: 70 interventional call	1 November to 30	OHCA recognition. rate = 21% (4)	DACPR can be feasible:	Meeting with the dispatch chief identified the need to: - Continue with the same processes

Implementation	Evaluation		Feasibility	Development
	Observation period	Outcome		
takers + new protocol b. DACPR sheet collection: Two DACPR sheets c. Monitoring: Retrospective monitoring + computer system cross-checking audio-recording review + call taker worksheet	November, 2017; *N* = 19	CPR instruction rate = 15% (3) BCPR rate =21 % (4) ROSC rate = 0% Survival to 30 days = 0	DACPR implementation: OHCA recognition rate improved Monitoring: 1. Audio-recording review: poor call taker adherence to protocol 2. Call takers' performance sheets: more call taking by interventional call takers 3. Supervisor monitoring sheet: not submitted 4. Ministry of Health investigator: four call takers given violation warnings	
	1 December to 31 December, 2017; *N* = 19	OHCA recognition rate = 15% (3) CPR instruction rate = 15% (3) BCPR rate = 10% (2) ROSC rate = 0% Survival to 30 days = 5% (1)	DACPR can be feasible: DACPR implementation: Same OHCA recognition rate Monitoring: 1. Audio-recording review: poor call taker adherence to protocol 2. Call takers' performance sheets: new call-taker patch 3. Supervisor monitoring sheet: not submitted 4. Ministry of Health investigator: one call taker given violation warning	End of the post-intervention observation period.

**Note: DACPR = dispatcher-assisted CPR, BCPR = bystander CPR, ROSC = return of spontaneous circulation.*

4.7.3 During implementation study period (21 February -31 May 2017)

The run-on period was initiated just after the training programme, and DACPR was implemented according to the pre-set protocol (see Appendix IV). DACPR was then used in every OHCA case transferred from the initial call taker to an interventional call taker. For every OHCA call received, the interventional call taker completed a DACPR data sheet (see Appendix I). The expected workload was less than seven cardiac arrests per week (Kuwait EMS internal Audit Report, 2013). Dispatch instructors supervised DACPR implementation throughout the data collection periods during daily rounds but without coaching the call takers further. Dispatch instructors and interventional call takers had continuous access to the DACPR protocol (see Appendix. IV). DACPR data sheets and dispatch electronic records were collected at the end of each month by the researcher. Recognized OHCA cases from Hawali Province were filtered and compared to patient report forms. A patient report form was completed by the Hawali EMS ambulance crew after the assessment and management of each OHCA case. The patient report from is based on the Utstein data reporting template (see Appendix II). A comparison between the DACPR data sheet and dispatch electronic records from the dispatch unit and the patient report form from EMS audit department disclosed the number of OHCA cases recognised, missed and incorrectly recognised by call takers. Correctly recognised and missed OHCA cases were matched with Mubarak Al-Kabeer Hospital and Al-Farwanya hospital records to determine the OHCA 30-day survival rate. The secondary outcome (bystander CPR rate) data was obtained from the DACPR data form and compared with the patient report form. The other secondary outcome (ROSC data) was extracted from the patient report form.

During the implementation period, the dependent variables were OHCA recognition rate, CPR instruction rate, 30-day survival rate, ROSC and rate of bystander CPR. The independent variable was DACPR programme implementation. Data for the during-implementation period were collected and analysed on a monthly basis to meet the limited PhD timeframe.

4.7.4 Post-intervention study period (1 June –31 December 2017)

Data for the post-intervention groups were collected using similar extraction processes to collect OHCA cases as those used during the implementation period. The researcher again matched the DACPR data sheet and dispatch electronic records from the dispatch unit with the patient report form from the EMS audit department and the hospital records from Mubarak Alkabeer and Al-Farwanya hospitals manually every month.

In the post-intervention study period, the dependent variables were OHCA recognition rate, CPR instruction rate, 30-day survival rate, ROSC and rate of bystander CPR. The independent variable was DACPR programme implementation. Data for post intervention period were collected and analysed on a monthly basis to meet the limited PhD timeframe.

The personnel involved in this procedure include the EMS director, OUD, Audit and Training Unit Director, dispatch chief, dispatch co-chief, shift supervisors, call takers, ambulance dispatchers, the Hawali province ambulance crew, as well as the researcher and (from Mubarak Al-Kabeer Hospital) the Registry Department Director, Accident and Emergency (A&E) Head Nurse, Intensive Care Unit (ICU) Head Nurse and Cardiac Care Unit (CCU) Head Nurse. There was also a professional relationship between the researcher and the OUD; as an emergency medicine teaching assistant in the Public Authority of Applied Education and Training (PAAET), the researcher had previously worked with the OUD to specify the objectives of a new Communication module for the Emergency Medical Technician Diploma programme at PAAET.

4.7.5 Normalization process model and DACPR implementation challenges

One of the AHA (2016) recommended DACPR performance metrics is to identify the percentage of OHCA cases that were not recognised because of complicating factors (e.g., language barriers, caller hang-ups, CPR already in progress). The proposed study has identified all of the OHCA cases that were not recognised by the Kuwaiti EMS call takers in the intervention and control regions. The method of obtaining the number of unrecognised OHCA calls was discussed earlier in Section 4.6, p.99. Furthermore, this research identified reasons for not recognising OHCA calls without complicating factors and addresses them as novel challenges. This is because these reasons have not been discussed before in the literature. Novel challenges include the following:

a) The behaviours of those delivering DACPR.
b) The high number of organisational levels targeted by the intervention.
c) Limited flexibility or tailoring of the intervention due to the structure of Kuwaiti EMS resources.

Moreover, the current study applied the normalisation process model to overcome these novel challenges. This is because the researcher needed to integrate the complex DACPR intervention into the Kuwaiti EMS dispatch system in order to examine DACPR's impact on OHCA outcomes. Subsequently, each novel challenge was evaluated through the four normalisation model factors, namely interactional workability, relational integration, skill-set workability and contextual integration (May, 2007). The use of the normalisation model to overcome DACPR novel challenges is new to the literature. A detailed discussion of the application of the normalisation model framework to the study's novel challenges is presented later in Chapter 6, p.159.

In terms of the DACPR challenges, the researcher also identified the percentage of predefined DACPR challenges in procedures, CPR knowledge and personal factors in a fashion similar to that used by others in the recent literature (Ho, 2016; Langlais, 2017; Bray, 2017 and Nuño, 2017). In this study, the predefined challenges were retrieved from two instruments: the audio recording review and call taker side notes on electronic records.

4.8 Sample

4.8.1 Sample size

No previous studies evaluated DACPR impact on OHCA patients' outcomes are present in the region. Therefore, sample size was estimated using population proportion formula. Where the standard normal deviate usually set at 1.96 (which corresponds to the 95% confidence level) . the proportion in the target population to have a specific characteristic have no estimate available, set at 50% (or 0.50). and the absolute precision or accuracy set at 0.05. n =384.

Because OHCA cases are unpredictable, convenience sampling was used for the purposes of this study. Effort to reduce selection bias was made. The population of Hawali province was taken to be representative of Kuwait's wider population. Additionally, the researcher collected eleven months of prospective data (February–December 2017) and potentially up to ten months of retrospective data (January–October 2016). This time period (February–December) was selected for three reasons, the first of which was to reduce seasonal effects on data collection, i.e., higher rates of travel in the summer months can result in fewer OHCAs, leading, in turn, to a lower interventional effect (Conroy, 1999). In contrast, the higher OHCA incidence in the winter may result in a higher interventional effect (Hayashi, 2015). Second, the PhD timeframe confined data collection to this period. Third, this period permitted follow-up for prospective data. The sample size was determined by the comparison of the historical control group (pre-intervention group) and post-intervention group OHCA survival to 30-days. This comparison was made because survival to 30 days is the primary outcome of this study and the latest recommended core long-term survival outcome for the Core Cardiac Arrest Outcomes of the International Liaison Committee on Resuscitation (Haywood, 2018).

4.8.2 Statistical considerations

Using Excel and the Statistical Package for the Social Sciences (SPSS version 22), a comparison of OHCA 30-day survival rates was performed for the intervention groups in the three periods, i.e. the pre-intervention, during-implementation and post-intervention study periods, in terms of bystander demographics, patient demographics and EMS resuscitation practice. Additionally, a chi-square test was conducted to study the impact of DACPR on the OHCA 30-day survival rate, as this is a binary outcome and DACPR's impact on the OHCA 30-day survival rate for the pilot region can only be established by comparing the difference in OHCA 30-day survival rate between the three groups (pre-intervention, during-implementation and post-implementation). The secondary end points, i.e., the OHCA recognition rate, CPR instruction rate, return of spontaneous circulation and bystander CPR rate, were calculated using the same statistical methods. ANOVA was used to estimate response time as a continuous variable. This was followed by a multivariate regression analysis of each output. Here, the researcher examined the impact of each variable on each outcome.

Another comparison between the intervention and control groups was made during the period of 21 February to 31 December 2017 using the chi-square test for patient demographics, which are categorical variables, and the ANOVA test for response time, which is a continuous variable. For the OHCA patient outcomes of these intervention and control groups during 21 February-31 December 2017, binary logistic regression was used and the statistical significance was stated for a p-value of less than .05 and 95% confidence interval. The primary outcome was the OHCA 30-day survival rate, and the secondary outcomes were the OHCA recognition rate, return of spontaneous circulation and bystander CPR rate. The goodness of fit of the model was calculated to examine the model fit, where values greater than .2 are indicative of models with excellent fit (Louviere, 2000).

4.9 Instruments

The following instruments were used to collect the data.

4.9.1 DACPR data sheet

This data sheet was completed by the call taker assigned to OHCA cases on each shift. The call taker filled in the sheet after each cardiac arrest symptom-related call. The sheet was based on the AHA and UK resuscitation guidelines (2015) and on the latest recommendations for DACPR (Deakin, 2015) (see Appendix I). The researcher collected the following data:

- Independent variable: DACPR.
- Dependent variables: OHCA 30-day survival rate, ROSC, rate of bystander CPR, OHCA recognition and CPR instruction.

Confounding factors: patient location, patient identification, demographics, first monitored rhythm, EMS management, EMS response time, bystander demographics, time of call and challenges for DACPR.

4.9.2 Patient report form:

This data form was completed by the Hawali EMS ambulance crew following assessment and management of all OHCA cases. The patient report form was based on the Utstein data reporting template (see Appendix II). The researcher collected the following data from this form:

- Independent variables: patient identification, cardiac risk factors, demographics, treatment, first monitored rhythm, reasons for not initiating CPR and bystander demographics
- Dependent variables: ROSC, bystander CPR rate and time metrics (including crew arrival time, scene time and hospital arrival time)

4.9.3 Emergency Medical Priority Dispatch system electronic record

The researcher searched through Kuwait's EMS Emergency Medical Priority Dispatch system electronic records (See Appendix. III) using OHCA case serial numbers. The researcher collected the following data from this system:

- Independent variable: bystander demographics and reported DACPR challenges
- Dependent variable: OHCA recognition rate

4.9.4 Hospital medical records

The researcher searched through patient medical records in the Registry Department and the A&E, ICU and CCU ledgers of Mubarak Al-Kabeer Hospital to obtain the following data:

- Dependent variables: patient mortality and survival to 30 days.

4.9.5 Death Registry records:

The Death Registry was searched when archival data could not be obtained from Mubarak Al-Kabeer Hospital records. The following data was collected:

- Dependent variables: patient mortality and survival to 30 days

4.9.6 Outcome measurements

Primary outcome: OHCA survival rate to 30 days. The OHCA survival rate to 30 days was collected from patient medical records in the Registry, A&E, CCU and ICU Departments of Mubarak Al-Kabeer Hospital and from the Death Registry and described as a percentage.

Secondary outcomes

- OHCA recognition rate: This information was collected from a number of sources, i.e., the dispatch electronic files, DACPR sheets, patient's report forms and audio recording reviews.
- CPR instruction rate: This information was collection form dispatch electronic files, DACPR sheets, patient's report forms and audio recording reviews.
- Return of spontaneous circulation: This information was collected from patient report sheets, the Audit Department, EMS and the Ministry of Health and was also described as a percentage.
- Bystander CPR rate: This information was collected from the DACPR data sheets and patient report forms. Bystander CPR rate was also described as a percentage.

4.10 Data Collection and Analysis

4.10.1 Data storage and management

All collected data were entered by the researcher into Excel spread sheets as a final trial data set. Table 4.6 shows patient demographic data, resuscitation-related variables and cardiac arrest outcomes retrieved from the pre- and post-intervention periods.

Table 4.6. Patient demographic data, resuscitation-related variables and cardiac arrest outcomes retrieved from the pre- and post-intervention periods.

1. Patient demographics	Pre-intervention	During implementation	Post-intervention
a. Age (category)	X	X	X

b. Gender	X	X	X
i. Male	X	X	X
ii. Female	X	X	X
c. Nationality	X	X	X
i. Kuwaiti	X	X	X
ii. Non-Kuwaiti	X	X	X
d. Cardiovascular risk factor	X	X	X
i. One cardiovascular risk factor	X	X	X
ii. More than one cardiovascular risk factor	X	X	X
e. Location:	X	X	X
i. Home	X	X	X
ii. Public	X	X	X
2. Resuscitation-related factors	X	X	X
a. Cardiac arrest:	X	X	X
i. Witnessed	X	X	X
ii. Non-witnessed	X	X	X
b. ECG rhythm:	X	X	X
i. Shockable	X	X	X
ii. Non-shockable	X	X	X
c. Bystander knowledge of CPR:			X
i. Previous knowledge		X	X
ii. No previous knowledge		X	X
d. DACPR:		X	X
i. Caller demographics	X	X	X
ii. Cardiac arrest recognition rate	X	X	X

iii. CPR instruction Rate	X	X	X
iv. Percentage of cardiac arrests that received CPR instructions	X	X	X
v. Non-recognized cardiac arrests	X	X	X
vi. Incorrect OHCA recognition	X	X	X
e. Management:	X	X	
i. BLS (CPR + defibrillation)	X	X	X
ii. ALS (CPR + defibrillation + adrenaline)	X	X	X
iii. Response time (mean)	X	X	X
3. Outcomes	X	X	X
a. Bystander CPR rate	X	X	X
b. ROSC	X	X	X
c. Survival rate to 30 days	X	X	X

Data quality measures included queries to identify missing data, outliers and discrepancies. Only the researcher has access to protected health information. Civil ID numbers and Case numbers assigned to each study participant were used following recruitment. These IDs were linked to patient DACPR data sheets, patient report forms and patient medical records and were stored on the researcher's password-protected computer. All computers used in this research were password protected and encrypted as per university policy, and the researcher ensured that anonymity was maintained. Patients will not be identified by name in any reports related to this study. The researcher had access to the final trial data set; a consulting biostatistician also had access to the final trial data set in a de-identified state.

4.10.2 Process measures

1. Call takers in the training modules were evaluated through their presence at the training sessions.

2. Dispatch instructors randomly reviewed call records to ensure intervention implementation and to record any DACPR implementation challenges during the implementation and post-intervention data collection periods.

3. The researcher conducted retrospective sample monitoring every month by collecting OHCA case data from the on-site EMS personnel and Mubarak Al-Kabeer Hospital and Al-Farwanya hospital records and then matching these with dispatch unit electronic records. This retrospective checking revealed recognised and unrecognised OHCA cases on the part of call takers.

4.10.3 Balancing measures

DACPR barriers are defined as caller hung up, caller refused, caller could not move the patient, a language barrier, phone call not clear, EMS arrived before CPR was initiated, cardiac arrest was non-cardiogenic and other reasons.

4.10.4 Other changes occurring in Emergency Unit, Dispatch Centre EMS and Ministry of Health during study period

All events (such as leadership changes and protocol modifications) occurring during the study period that might have interacted with the intervention or the study results were recorded in a logbook.

4.10.5 Blinding

Given the nature of the intervention and illness, healthcare providers and the researcher were not blinded to the intervention phase. Furthermore, assignment was non-random, as all OHCA patients who activated EMS because of cardiac-arrest-related symptoms and who met the inclusion criteria were enrolled. It would not be ethical to randomly allocate OHCA patients to the DACPR programme and to omit others, as omitting OHCA patients from DACPR would be a form of withholding CPR (Mancini, 2015).

4.11 Ethical Issues

Ethical approval was granted by the Ministry of Health, State of Kuwait on 26 August 2016 (see Appendix VI) and by the Ethics and Research Governance Online, University of Southampton on 18 February 2017 after highlighting the following issues.

4.11.1 Social and clinical value

The DACPR programme has been a widespread practice in the United States and European Emergency Medical Services centres of excellence since the 1970s (Gardett, 2016); thus, it is an impartial process for EMS development. Moreover, White's prospective observational study (2010) concluded that a DACPR programme was associated with as low as a 2% frequency of serious injuries among non-cardiac-arrest patients. When coupled with the established benefits of bystander CPR among those with cardiac arrest, these results support an assertive programme of DACPR.

Therefore, the proposed DACPR programme will be assertively implemented by the investigator. The investigator will also ensure that the DACPR programme is of high integrity and quality and in line with the latest international resuscitation stakeholders' recommendations.

4.11.2 Scientific validity

The study method is valid and feasible. A before-and-after study which includes a control group is not new to research and has been structured according to clear and accepted principles in the proposed study. Of important consideration when using a before and after scenario with consideration of a control group are: adequate selection of the control group and sufficient detail about data collection procedures (O'Connor, *n.d.*). The intervention is also reliable, as the practice of DACPR is not only cost-effective (Rea, 2003 and Vaillancourt, 2007), but has also been in the emergency medical services arena for more than four decades.

4.11.3 Patient anonymity

Patient names will not be included in the analysis. A patient identification number and case number will be recorded once a citizen activates the call. The patient identification number and case number will be used on the dispatch sheet, the patient information sheet, and in hospital records. However, following analysis of the data, all patient information will be anonymised. No patient-identifying information will be recorded on subsequent reports or publications.

4.11.4 Patient privacy

No information regarding patients' behaviour, social status or physical status is allowed to be shared or discussed by research members outside the context of the research.

4.11.5 Patient confidentiality

Patients' names will remain anonymous during the study and no information regarding patient treatment will be discussed outside the research context.
All of the data will be stored on a password-protected computer for 10 years, according to the University of Southampton's data protection policy and the Data Protection Act. Files will be locked at all times when not in use.

1. Personal data shall be processed fairly and lawfully.

2. Personal data shall be obtained only for one or more specified and lawful purposes, and shall not be further processed in any manner incompatible with that purpose or those purposes.
3. Personal data shall be adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed.
4. Personal data shall be accurate and, where necessary, kept up to date.
5. Personal data processed for any purpose or purposes shall not be kept for longer than is necessary for that purpose or those purposes.
6. Personal data shall be processed in accordance with the rights of data subjects under this Act.
7. Appropriate technical and organisational measures shall be taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of, or damage to, personal data.

4.11.6 Favourable risk: benefit ratio

DACPR will be implemented with a caution about minor risks to call takers and patients.

a. Potential physical discomfort (patients):

Putting a DACPR protocol in place, as in this study, reduces the number of incorrectly diagnosed cardiac arrest by 37% (Hallstrom, 2000). Moreover, a patient who receives unnecessary chest compressions will be identified after matching the DACPR data sheet and Pro QA cross-checking with the patient report form and medical records. Hence, DACPR is not a life threatening or disabling intervention (White, 2010).

Furthermore, the researcher will deal with misdiagnosed cases through the quality assurance monthly reports, in which reasons for misdiagnosing patients will be identified and highlighted to call takers at dispatcher instructor monthly debriefing sessions.

b . Call takers' risks of psychological distress:

According to Pierce (2012), taking distressing calls involving death can be stressful on 10% of emergency call takers. Therefore, to provide psychological support, a dispatch instructor debriefing will take place after each observational segment.

4.11.7 Informed consent

Informed consent will not be sought from patients participating in this study. Out-of-hospital cardiac arrest is an urgent, unpredictable event; it will not be known who will arrest and when. Therefore, consent cannot be obtained before the study initiation or from patients who survive to 30 days. However, written consent will be sought from the call takers who will take part in implementing DACPR. The call takers be asked fill out the consent form prior to the commencement of the introductory lecture.

4.11.8 Inclusion/exclusion criteria

Late-pregnancy cardiac arrests

None of the reviewed studies disclosed late-pregnancy women's inclusion or exclusion. Only Rea's (2012) randomized clinical trial determined the impact of hands-only dispatcher-assisted CPR versus the now out-dated 30 compressions:2 breaths, which clearly resulted in the exclusion of pregnant women from this study. The reason for excluding late-pregnancy women from the study is the risk of inferior vena cava injury during chest compression CPR. Morris (2003) explains chest compression for late-pregnancy women in the supine position and that all attempts at resuscitation will be futile unless the compression of the inferior vena cava by the gravid uterus is relieved. This is achieved either by placing the patient in an inclined lateral position by using a wedge or by displacing the uterus manually.

Non-cardiogenic arrests

Non-cardiogenic arrests include cardiac arrests due to intoxication, drowning, suicide or electrocution. Although the latest Utstein template does not recommend the exclusion of non-cardiogenic arrests from data analysis, Carter's (2017) systematic review stressed that different proportions of cardiac versus non-cardiac pathogenesis in an OHCA sample could result in an entirely different interpretation of the data. Furthermore, reviewed studies adopted variable inclusion-exclusion criteria for non-cardiogenic arrests. In fact, most studies were unclear about non-cardiogenic arrest status, as shown in Table 4.7. In the present study, non-cardiogenic arrests were excluded from the data analysis. However, non-cardiogenic arrests are not excluded from resuscitation and are resuscitated in the form of 2 breaths: 30 chest compressions. Resuscitation is used because these arrests are more likely to have respiratory rather than cardiac origins. The call takers were instructed to provide instruction for 2 breaths: 30 chest compressions in these cases and to highlight non-cardiogenic causes in the DACPR data sheet. This is to ensure that this group of patients receives proper treatment while allowing for their exclusion from data analysis. The reasons for excluding non-cardiogenic cardiac arrests are as follows:

1. Out-of-hospital cardiac arrest from a respiratory cause has a poorer survival outcome than OHCA from a cardiac cause in adults (Orban, 2018).

2. The 2 breaths:30 chest compressions form of CPR has different outcomes than hands-only CPR (Bray, 2011).

Table 4.7. Non-cardiogenic arrest: status in the literature.

Study	Year	Author	Non-cardiogenic arrest	Status
Implementation of a regional TCPR and outcomes after OHCA	2016	Bobrow	Mentioned	Included
DACPR in a metropolitan city: A before-after population-based study	2014	Song	Mentioned	Excluded
A before-and-after interventional trial of DACPR for OHCA in Singapore	2016	Harjanto	Not mentioned	Not clear
Effect of introduction of a standardized protocol in DACPR	2016	Plodr	Not mentioned	Included
Changing EMS DACPR to 400 compressions before mouth to mouth improved BCPR rates	2011	Bray	Not mentioned	Not clear
The continuous quality improvement project for TCPR increased the incidence of BCPR and improved OHCA outcomes	2012	Tanaka	Mentioned	Excluded
Importance of the first link: description and recognition of an OHCA in an emergency call	2009	Berdowski	Not mentioned	Not clear
Emergency medical services treated OHCA: Identification of weak links in the chain of survival through epidemiological study	2015	Sanson	Not mentioned	Not clear
Emergency dispatch processes and patient outcomes in bystander-witnessed OHCA	2015	Hiltunen	Not mentioned	Not clear

Dispatch codes of OHCA should be diagnosis related rather than symptom related	2010	Axelsson	Mentioned	Included
In patients with OHCA, does provision of DACPR versus no instruction improve outcome: A systematic review	2011	Bohm	Not mentioned	Not clear
Are regional variations in activity of DACPR associated with OHCA outcomes? A nation-wide population-based cohort study	2016	Nishi	Not mentioned	Not clear
Total excluded	2			

*OHCA: out-of-hospital cardiac arrests, DACPR: dispatcher-assisted CPR, BCPR: bystander CPR.

4.11.9 Do Not Resuscitate (DNR)

None of the reviewed studies discussed DNR except Harjanto's (2016) before-and-after study in Singapore. As Kuwait's cultural context prohibits refusal of resuscitation by the patient or his/her family member (as noted earlier), the study does not discuss DNR cases.

4.11.10 Control group

The control group was subject to regular EMS processes in OHCA cases. This included OHCA recognition according to ProQA, emergency medical dispatch and sending the nearest ambulance to the patient's address. The control group received resuscitation as per Kuwait's EMS standard protocol and not according to the proposed study protocol.

4.11.11 Independent review

As stated earlier, the study protocol went through the ethical approval process in the State of Kuwait. The submission of the study protocol to the Ministry of Health, State of Kuwait was followed by a review of the study protocol by an ethics committee. The ethics committee consisted of a cardiologist, a Health Ministry research member, and the Allied Health Department Director. The ethics committee rendered a decision after six weeks (see Appendix VI).

4.11.12 Dissemination of results

The study results will be disseminated through scientific media, the policymakers in the Kuwait Ministry of Health and the community. The researcher will take the lead in providing copies of this study and an executive summary to peer-reviewed publications and rolling emergency health services conferences. Acknowledgements will include the Ministry of Health EMS director and staff, Mubarak Al-Kabeer Hospital Registry Department staff and the Death Registry director and staff.

Chapter Five: Results

5.1 Introduction

This chapter reports on the results of DACPR implementation in a pilot region of Kuwait and its impact on the outcomes for OHCA patients. The chapter discusses the results of the comparisons made among the different groups sampled in this study. The first comparison was made among the three OHCA patients' groups in the intervention region during the study periods. The purpose of this comparison was to demonstrate the effects of DACPR on the outcomes of OHCA patients before and after its implementation in the pilot region of Kuwait. The second comparison was made between the results of the intervention and control groups from 21 February - 31 December 2017.

5.2 Illustrations through comparisons

A total of 664 OHCA cases from 2016 and 2017 were extracted from the Kuwaiti EMS archived data. A total of 287 cases of non-cardiogenic aetiology, missing data, evident death, unknown identity and paediatric patients were excluded from the final data set. Only 377 OHCA cases met the inclusion criteria for the study periods 1 February – 31 October 2016, 1 February – 31 May, and 1 June – December 2017. There were 80 cases in the pre-intervention period, 78 cases in the implementation period and 219 cases the post-intervention period. Figure 5.1 shows the selection of patients for inclusion in the study and their subsequent classification into the three study periods. Each patient group was subdivided into an intervention patient group and a control patient group. In this section, we conduct multiple comparisons between the illustrated patient groups; one comparison to identify whether the selection of Al-Farwanya Province as the control arm was appropriate; and two comparisons to highlight the effects of DACPR on the OHCA patients' outcomes.

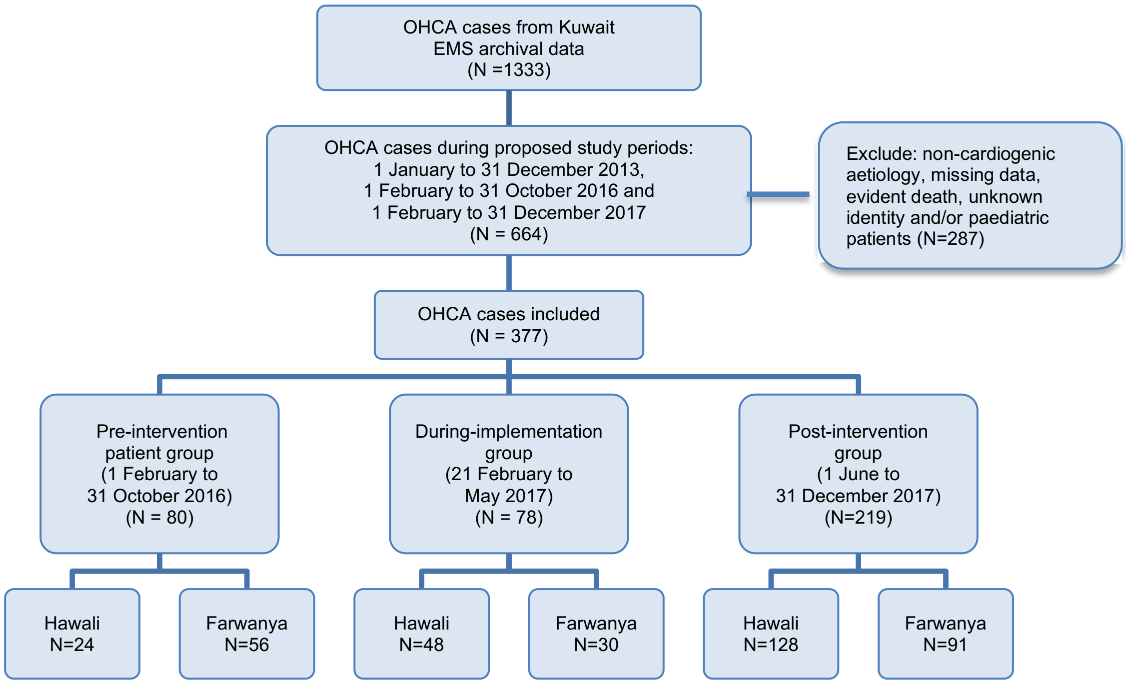

Figure 5.1 Selection of patients for inclusion in the study and their subsequent classification into three study periods

5.2.1 *Comparison between intervention groups before, during and after DACPR implementation*

An initial comparison was conducted in the pilot region, Hawali Province, using a chi-square test among the following groups: the pre-intervention group (1 February to 31 October 2016), intervention group (21February – 31 May 2017), and the post-intervention group (1 June – 31 December 2017). The results demonstrated the effects of the DACPR development, evaluation and implementation process on OHCA outcomes before and after DACPR implementation in the pilot region of Kuwait. These results are shown in Table 5.1.

Table 5.1 Comparison between intervention groups in the pilot region, Hawali Province.

Domains (core elements)		Group: Pre-intervention (1 January- 31 October 2016) N=24	During intervention 21 Februaruy-31 May 2017 N=48	Post-intervention 1 June- 31 December 2017 N=128			
1.System							
		Two-tiered EMS system					
2.bystander demographics							
		N	N	N	Chi-square	df	Sig.
Caller:	Civilian	24 (100)	47 (97.9)	124 (96.9)	1.619	4	.805[a,b]
	Others	0 (0)	1 (2.1)	4 (3.2)			
Caller Nationality	Kuwaiti	24 (100)	15 (31.9)	79 (61.7)	31.386	2	<.001
	Non-Kuwaiti	0 (0)	32 (68.1)	49 (38.3)			
Caller gender	Male	17 (70.8)	35 (74.5)	91(71.1)	0.208	2	0.901
	Female	7 (29.2)	12 (25.5)	37 (28.9)			
3.Patient variables							
LOCATION	Home	23 (95.8)	26 (68.4)	83 (84.7)	9.675	4	**.046**
	Public	1(4.2)	12 (31.6)	15 (15.3)			
AGE	16-30	0 (0)	4 (8.3)	4(3.1)	12.306	6	.055
	30-50	1 (4.3)	12 (25)	21(16.4)			
	50-70	8 (34.8)	19 (39.6)	45 (35.2)			
	70	14 (60.9)	13 (27.1)	58 (45.3)			
Gender	Male	15 (62.5)	35 (72.9)	79 (61.7)	1.959	2	0.375
	Female	9 (37.5)	13 (27.1)	49 (38.3)			
Medical history	None	1 (5.9)	23 (54.8)	72 (63.2)	20.621	4	. <.001
	One cardiovascular risk	5 (29.4)	8 (19.0)	17 (14.9)			
	More than one cardiovascular risk	11 (64.7)	11 (26.2)	25 (21.9)			
Nationality	Kuwaiti	21 (87.5)	10 (20.8)	63 (49.2)	29.250	2	<.001
	Non-Kuwaiti	3 (12.5)	38 (79.2)	65 (50.8)			
4. Resuscitation							
Basic Life Support		24 (100)	48 (100)	122 (95.3)	3.479	2	.176

Advanced Life Support	0 (0.0)	1 (2.1)	7 (5.5)	2.178	2	.337
Response time in minutes (mean)	8	8	9			*ANOVA test* *p* = .566
5.Outcomes						
OHCA recognition rate	5 (20.8)	1 (2.1)	16 (12.9)		2	.037
CPR instruction rate	3 (12.5)	0 (0.0)	13 (10.4)	5.729	2	.057
% recognised arrests received CPR instructions	60	0	81			
Bystander CPR	3 (12.5)	7 (14.6)	15 (12.0)	0.210	2	0.900
ROSC	1 (4.2)	3 (6.3)	2 (1.6)	2.728	2	.256
Survival-to 30 days	7 (29.2)	1 (2.1)	1 (0.8)	38.751	2	<.001

The results showed no significant differences in bystander demographics in the three observational periods: pre-intervention, during implementation and post-intervention, with the exception of bystander nationality.

In relation to the patient variables, in the three observation periods in pilot region, OHCA incidences were increasing among healthy middle-aged, non Kuwaiti individuals. No cardiovascular risk factor was reported in 5.9% of the pre-intervention period, 54.8% of the intervention period and 63.2% during the post-intervention period (p-value <.001). The incidences of OHCA in non-Kuwaitis were as follows: 12.5% in the pre-intervention period, 79.2% in the intervention period and 50.8% in the post-intervention period (p-value <.001).
Another observation in patient variables is the increasing OHCA incidence in young adults (30-50) and decreasing/increasing (variable) OHCA incidence in the geriatric population (70+).

Regarding EMS resuscitation efforts, there were no significant changes in EMS processes between 2016 and 2017 in the pilot region, including in basic life support, advanced life support and response time.

The OHCA outcomes in the pilot region showed favourable changes in OHCA recognition rates and survival-to 30 days after the implementation of DACPR in the Kuwaiti EMS.

Regarding other outcomes of OHCA in the pilot region, there were no significant variations in bystander CPR rates or in ROSC rates among the three observational groups (pre-intervention, during implementation and post-implementation).

A multivariate regression analysis was conducted to ensure that the factors did not have any effect on the study outcomes. This statistical test examined separately the impact of all factors on each outcome. These results are shown in the tables below.

Table 5.2 Factors' impacts on OHCA recognition rate in the pilot region, Hawali Province.

Dependent Variable		B	Std. Error	T	P-value	95% Confidence Interval	
						Lower Bound	Upper Bound
OHCA recognition rate	Intercept	0.245	0.563	0.436	0.664	-0.863	1.353
	Response Time	-0.007	0.004	-1.574	0.117	-0.016	0.002
	Caller [Civilian]	-0.063	0.159	-0.397	0.692	-0.375	0.249
	Caller [Health professional]	-0.238	0.256	-0.932	0.352	-0.742	0.265
	[Caller nationality]	0.019	0.055	0.343	0.732	-0.090	0.128
	[Caller gender]	0.027	0.053	0.508	0.612	-0.077	0.130
	[LOCATION] Home	-0.165	0.408	-0.405	0.686	-0.969	0.638
	[LOCATION] Public	-0.170	0.411	-0.414	0.679	-0.980	0.639
	[AGE=30-50]	-0.104	0.149	-0.698	0.486	-0.396	0.189
	[AGE=50-70]	0.032	0.065	0.495	0.621	-0.096	0.161
	[AGE=70+]	0.004	0.052	0.081	0.936	-0.097	0.106
	[Gender]	-0.063	0.050	-1.260	0.209	-0.161	0.035
	No medical history	0.104	0.366	0.285	0.776	-0.617	0.826
	One cardiovascular risk factor	0.038	0.364	0.104	0.917	-0.680	0.756
	More than one cardiovascular risk factor	0.200	0.366	0.548	0.584	-0.520	0.920
	Nationality	-0.045	0.058	-0.766	0.444	-0.159	0.070
	Basic Life support	-0.021	0.254	-0.082	0.935	-0.520	0.479
	Advanced Life Support	0.064	0.102	0.629	0.530	-0.136	0.264

None of the factor had an impact on the OHCA recognition rate.

Table 5.3 Factors' impacts on CPR instruction rate in the pilot region, Hawali Province.

Dependent Variable		B	Std. Error	t	P-value	95% Confidence Interval Lower Bound	Upper Bound
CPR instruction given	Intercept	0.002	0.396	0.005	0.996	-0.778	0.782
	Response time	-0.008	0.003	-2.427	0.016	-0.014	-0.001
	Caller [Civilian]	0.063	0.112	0.568	0.571	-0.156	0.283
	Caller [Health professional]	-0.010	0.180	-0.056	0.955	-0.364	0.344
	[Caller nationality]	0.008	0.039	0.203	0.839	-0.069	0.085
	[Caller gender]	0.014	0.037	0.381	0.703	-0.059	0.087
	[LOCATION] Home	-0.002	0.287	-0.006	0.995	-0.567	0.564
	[LOCATION] Public	-0.049	0.289	-0.169	0.866	-0.619	0.521
	[AGE=30-50]	-0.076	0.105	-0.722	0.471	-0.282	0.131
	[AGE=50-70]	0.026	0.046	0.576	0.565	-0.064	0.117
	[AGE=70+]	0.006	0.036	0.172	0.863	-0.065	0.078
	[Gender]	-0.010	0.035	-0.292	0.771	-0.080	0.059
	No medical history	0.020	0.258	0.077	0.939	-0.488	0.528
	One cardiovascular risk factor	-0.007	0.257	-0.028	0.978	-0.512	0.498
	More than one cardiovascular risk factor	0.040	0.257	0.156	0.876	-0.467	0.547
	Nationality	-0.028	0.041	-0.677	0.499	-0.109	0.053
	Basic Life support	0.017	0.179	0.094	0.925	-0.335	0.369
	Advanced Life Support	0.069	0.072	0.965	0.335	-0.072	0.210

Table 5.4 Factors' impacts on Bystander CPR rate in the pilot region, Hawali Province.

Dependent Variable		B	Std. Error	t.	P-value	95% Confidence Interval Lower border	Upper border
Bystander CPR rate	Intercept	-0.135	0.452	-0.298	0.766	-1.025	0.756
	Response Time	-0.005	0.004	-1.464	0.144	-0.012	0.002
	Caller [Civilian]	0.106	0.127	0.829	0.408	-0.145	0.357
	Caller [Health professional]	0.058	0.206	0.281	0.779	-0.347	0.462
	[Caller nationality]	-0.056	0.044	-1.260	0.209	-0.143	0.032
	[Caller gender]	-0.011	0.042	-0.256	0.798	-0.094	0.073
	[LOCATION] Home	0.218	0.328	0.663	0.508	-0.428	0.863
	[LOCATION] Public	0.251	0.330	0.759	0.449	-0.400	0.901
	[AGE=30-50]	-0.087	0.119	-0.730	0.466	-0.322	0.148
	[AGE=50-70]	0.106	0.052	2.016	0.045	0.002	0.209
	[AGE=70+]	0.023	0.041	0.546	0.586	-0.059	0.104
	[Gender]	-0.044	0.040	-1.083	0.280	-0.123	0.036
	No medical history	0.050	0.294	0.171	0.864	-0.529	0.630
	One cardiovascular risk factor	0.110	0.293	0.375	0.708	-0.467	0.687
	More than one cardiovascular risk factor	0.044	0.294	0.150	0.881	-0.535	0.623
	Nationality	0.110	0.047	2.342	0.020	0.017	0.202
	Basic Life support	-0.103	0.204	-0.504	0.615	-0.504	0.299
	Advanced Life Support	-0.068	0.082	-0.829	0.408	-0.229	0.093

Table 5.5 Factors' impacts on the return of spontaneous circulation (ROSC) rate in the pilot region, Hawali Province.

Dependent Variable	B	Std. Error	t	P- value	95% Confidence Interval Lower Border	Upper Border

ROSC	Intercept	-0.001	0.258	-0.002	0.998	-0.509	0.508
	Response Time	0.002	0.002	0.908	0.365	-0.002	0.006
	Caller [Civilian]	0.033	0.073	0.453	0.651	-0.110	0.176
	Caller [Health professional]	0.020	0.117	0.171	0.864	-0.211	0.251
	[Caller nationality]	0.013	0.025	0.511	0.609	-0.037	0.063
	[Caller gender]	-0.014	0.024	-0.580	0.563	-0.062	0.034
	[LOCATION] Home	-0.010	0.187	-0.051	0.959	-0.379	0.359
	[LOCATION] Public	-0.016	0.189	-0.084	0.933	-0.388	0.356
	[AGE=30-50]	-0.022	0.068	-0.321	0.749	-0.156	0.113
	[AGE=50-70]	-0.023	0.030	-0.753	0.452	-0.082	0.036
	[AGE=70+]	0.008	0.024	0.335	0.738	-0.039	0.055
	[Gender]	-0.040	0.023	-1.740	0.083	-0.085	0.005
	No medical history	-0.002	0.168	-0.010	0.992	-0.333	0.329
	One cardiovascular risk factor	-0.001	0.167	-0.004	0.997	-0.330	0.329
	More than one cardiovascular risk factor	-0.035	0.168	-0.206	0.837	-0.365	0.296
	Nationality	0.013	0.027	0.498	0.619	-0.039	0.066
	Basic Life support	-0.014	0.117	-0.120	0.905	-0.243	0.216
	Advanced Life Support	0.014	0.047	0.310	0.757	-0.077	0.106

Table 5.6 Factors' impacts on the survival to 30 days rate in the pilot region, Hawali Province.

Dependent Variable	B	Std. Error	t	P- value	95% Confidence Interval	
					Lower Border	Upper Border

Survival-to 30 days	Intercept	-0.050	0.385	-0.129	0.897	-0.807	0.708
	Response time	-0.003	0.003	-0.877	0.381	-0.009	0.003
	Caller [Civilian]	0.043	0.108	0.399	0.690	-0.170	0.257
	Caller [Health professional]	-0.033	0.175	-0.191	0.849	-0.378	0.311
	[Caller nationality]	0.056	0.038	1.488	0.138	-0.018	0.131
	[Caller gender]	-0.021	0.036	-0.580	0.562	-0.092	0.050
	[LOCATION] Home	-0.065	0.279	-0.231	0.817	-0.614	0.485
	[LOCATION] Public	-0.099	0.281	-0.351	0.726	-0.652	0.455
	[AGE=30-50]	0.134	0.102	1.317	0.189	-0.066	0.334
	[AGE=50-70]	-0.027	0.045	-0.604	0.546	-0.115	0.061
	[AGE=70+]	-0.053	0.035	-1.489	0.138	-0.122	0.017
	[Gender]	0.031	0.034	0.910	0.364	-0.036	0.098
	No medical history	0.261	0.250	1.041	0.299	-0.232	0.754
	One cardiovascular risk factor	0.256	0.249	1.029	0.305	-0.234	0.747
	More than one cardiovascular risk factor	0.285	0.250	1.140	0.255	-0.207	0.777
	Nationality	-0.012	0.040	-0.298	0.766	-0.090	0.067
	Basic Life support	-0.092	0.174	-0.532	0.595	-0.434	0.249
	Advanced Life Support	-0.161	0.070	-2.316	0.021	-0.298	-0.024

5.2.2 *Comparison between intervention and control groups during 21 February to 31 December 2017*

A comparison was made between the intervention groups and control groups during the period from 21 February – 31 December 2017 to ensure that the recorded effects of DACPR on OHCA outcomes were factual and not due to other changes in the Kuwaiti EMS during 2017.

After statistical consultation, the researcher used a binary logistic regression model to conduct the comparison between the OHCA patients' demographics in the intervention and control groups (see Table 5.7).

Table 5.7 Comparison between OHCA patients' demographics in intervention and control regions during the period 21 February-31 December 2017 using a chi-square test

Domains		Study groups: Control (21 February-31 December 2017) (N= 121)	Study groups: Intervention (21 February-31 December 2017) (N= 176)	P-value
System		Two-tiered EMS system		
Crude annual incidence		10.3 per 100,000	18.7 per 100,000	
Caller:	Civilian	114 (94.2)	171 (97.2)	.378
	Others	7 (5.8)	5 (2.8)	
Caller nationality	Kuwaiti	69 (57)	94 (53.7)	0.574
	Non-Kuwaiti	52 (43)	81 (46.3)	
Caller gender	Male	102 (84.3)	126 (72)	.013*
	Female	19 (15.7)	49 (28)	
LOCATION	Home	89 (77.4)	109 (80.1)	.529
	Public	26 (22.6)	27 (19.8)	
Witness	Witness	14 (11)	19 (10.7)	
AGE (categorical)	16-30	2 (1.7)	8 (4.5)	0.144
	30-50	22 (18.2)	33 (18.8)	
	50-70	58 (47.9)	64 (36.4)	
	70+	39 (32.2)	71 (40.3)	
Patient gender	Male	85 (70.2)	114 (64.8)	0.324
	Female	36 (29.8)	62 (35.2)	
Medical history	None	70 (66.7)	95 (60.9)	0.135
	Cardiovascular risk	35 (33.3)	61(39.1)	
Nationality	Kuwaiti	45 (37.5)	73 (41.5)	0.493
	Non-Kuwaiti	75 (62.5)	103 (58.5)	
Basic Life Support		120 (99.2)	170 (96.6)	.149
Advanced Life Support		4 (3.3)	8 (4.5)	.594

Response time in minutes (mean)	9	8	.863

Table 5.8. Comparison between intervention and control OHCA patient outcomes during 21 February – 31 December 2017 using binary logistic regression model.

OHCA patients outcomes	Control	Intervention	Intervention *versus* control		Odds ratio
			P-value	(95%CI)	
OHCA recognition rate	19 (15.7)	17 (9.9)	.001	[-3.43, -0.89]	0.13
CPR instruction rate	3 (2.5)	13 (7.5)	.007	[0.78, 4.62]	13.26
Number of recognised OHCAs that received CPR instructions	3 (6.3)	13 (76)			
Incorrectly diagnosed (false positive)	2 (2.4)	3 (1.6)			
Positive predictive value	19 (86)	17 (85)			
Bystander CPR rate	5 (4.1)	22 (12.7)	.053	[0.06, 2.59]	3.40
ROSC	5 (4.1)	5 (2.9)	.779	[-2.14, 1.66]	0.77
Survival to 30 days	2 (1.7)	2 (1.1)	.954	[-2.62, 3.07]	0.93

The OHCA recognition rates were higher in the control group (15.7%) than in the intervention group (9.9%) from 21 February – 31 December 2017 (p-value = .001). The close examination of the OHCA recognition pattern for the intervention and control groups revealed that, in 2017, there was an association between the timing of the DACPR training course and the rates of OHCA recognition in both groups (intervention and control group). This association is demonstrated in Figure 5.2. The DACPR training course is associated with better OHCA recognition.

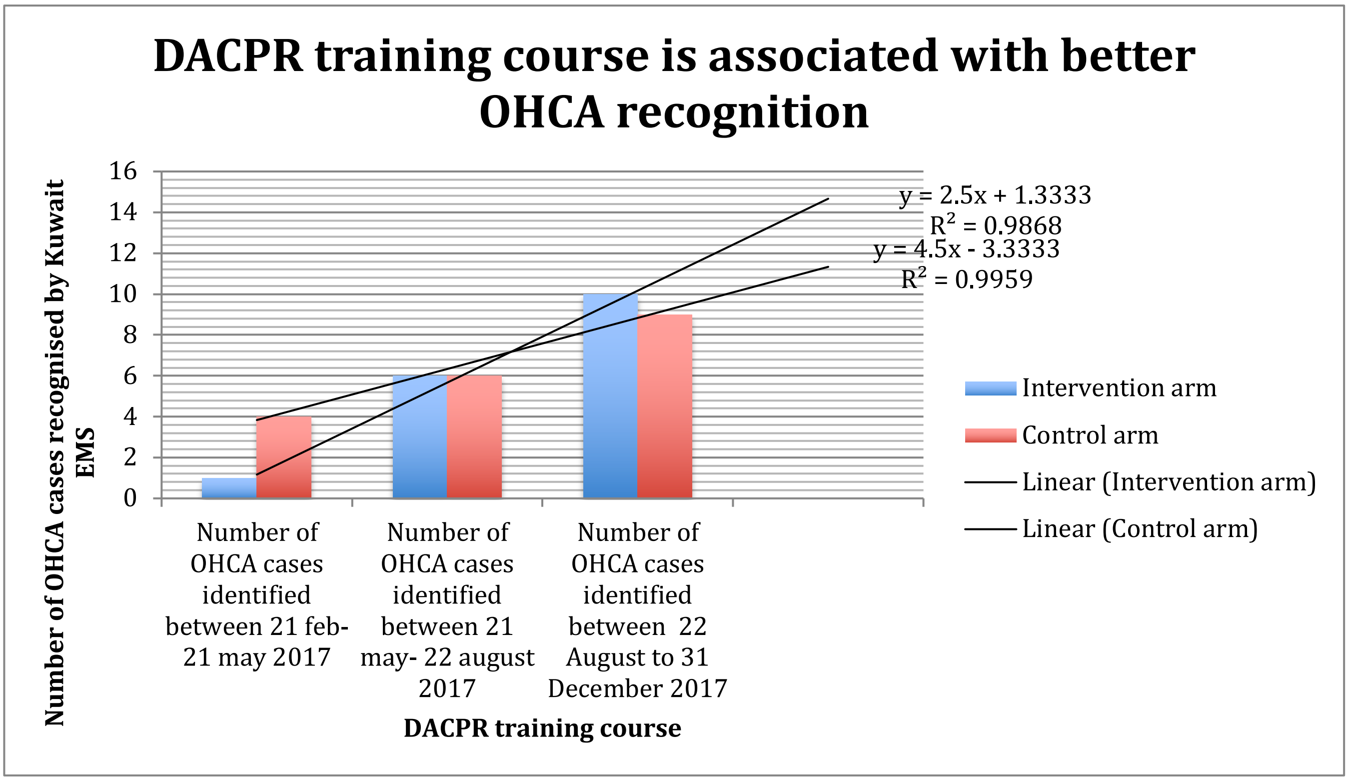

Figure 5.2. **The** DACPR training course is associated with better OHCA recognition rates in both the post-intervention group and the control three group in 2017

The next study outcome is CPR instruction rate, which showed a certain trend towards significance. In the pilot region, the CPR instruction rate (7.5%) is higher than in the control region (2.5%), and the p-vale=. 061. A full 76% of the recognised OHCAs received CPR instructions in the pilot region versus 6.3% of recognised OHCAs receiving CPR instructions in the control region.

The CPR instruction rate increased in the pilot region and subsequently increased the bystander CPR rates instruction rate. Bystander CPR rates were significantly higher in the pilot region (12.7%) than in the control group (4.1%) during the period from 21 February – 31 December 2017 (*p-value* = .012).

Chapter Six: Discussion

6.1 Introduction

This chapter discusses the study's results in the context of the current literature. The first section establishes the implemented DACPR's effects on the pilot region's OHCA outcomes, namely the OHCA recognition rate, CPR instruction rate, bystander CPR rate, ROSC and survival to 30 days. The third section of the chapter considers the DACPR intervention in the Kuwaiti EMS, as well as the methods employed and the level of DACPR implementation. In this section, the investigator discusses the stages that the introduction of DACPR passed through to reach full implementation in Kuwait's EMS and the originality of the implementation method. DACPR's challenges are then discussed in the following section and categorised into predefined and novel DACPR challenges. While the predefined challenges are related to the current literature, the novel challenges are disclosed in the context of the normalisation process model, which is new to the literature.
Given that this study is the first to describe OHCA in Kuwait, the researcher provides an overview of the pilot region's OHCA baseline and relates it to regional and international OHCA baselines. It highlights the pilot OHCA incidence, patient variables and EMS resuscitation in Kuwait. In the last section, the researcher highlights the study's limitations.

6.2 Pilot region OHCA patient outcomes

Recently, a considerable amount of literature has focused on DACPR and OHCA outcomes (Ro, 2017; Huang, 2017; Fukushima, 2017; Hardeland, 2017; Viereck, 2017; Shah, 2018; Wu, 2017; Park, 2018 and Masoud, 2018). This indicates that research on DACPR's effects on OHCA outcomes is an ongoing process. Most of the published studies examined reputable DACPR methods, i.e., DACPR bundles, DACPR as a sole tool and partial DACPR, as well as its impact on OHCA outcomes. This study evaluates the impact of DACPR implemented through implementation-evaluation-feasibility and development key phases on OHCA patients' outcomes. All OHCA patient outcomes are considered in this section.

6.2.1. OHCA recognition rates

There is growing evidence that the OHCA recognition rate should be one of the key DACPR implementation outcomes (Hardeland, 2017; Nuno, 2017; Biancardi, 2017; Tsunoyama, 2017 and Shah, 2018). This study reviewed the existing literature and identified the OHCA recognition rate according to the latest definition of 'recognised OHCA arrest':

- ‘Recognised OHCAs should be defined as cases in which the caller or the call taker expressed the presence of ‘OHCA’, or the need for ‘CPR’ or an ‘AED’
- Recognition should be assessed by evaluating emergency call recordings
- The following cases should be excluded: EMS-witnessed, missing/corrupted emergency call recordings; cases where the patient was obviously alive during the call; cases where bystander CPR was initiated prior to the emergency call; and cases where the caller was unable to assess the patient
- Data collection should include incidence, sensitivity and positive predictive value,[4] if possible’ (Viereck, 2017).

Using this definition, it was determined that there were 9.9% recognised, 90.1% false-negative (not recognised) and 1.6% false-positive (incorrectly recognised) OHCA cases in the pilot region of Kuwait in the 21 February-31 December, 2017 study period. This established DACPR’s high specificity and positive predictive value, with few false positives, resulting in low sensitivity for OHCA cases in the EMS. The study’s false-positive rate was lower than the published false-positive rate of 61.9% (Numi, 2006). Numi’s observational study (2016) assessed the effect of DACPR protocol compliance on the accuracy of cardiac arrest (CA) identification; the high false-positive rate could be due to study-protocol inadequacies (Hallstrom, 2003) because the false positives were significantly higher when the protocol was adhered to in Numi (2006).

Furthermore, implementing the DACPR protocol ‘*Is the patient unconscious?*’ and ‘*Is the patient breathing abnormally?*’ is known to have a sensitivity of 38.0%-96.9% and a specificity exceeding 97% (Ng, 2017). But, due to the poor definition of OHCA recognition in most DACPR studies in existing literature, which caused the inclusion of myriad non-cardiac cases and, subsequently, high sensitivity (Viereck, 2017), complete reliance on these figures of sensitivity and specificity is no longer acceptable (Viereck, 2017). This study differs from the existing literature by reporting a more transparent evaluation of DACPR accuracy in recognising OHCA cases (sensitivity and specificity). The investigator used a clear, up-to-date, ‘recognised OHCA’ definition and provided explicit results on call takers’ OHCA recognition rates. This research also contains the first reference to the Middle East’s OHCA recognition rate.

The implemented DACPR did not achieve the designated 75% success benchmark for the study (see Chapter 4, p.99), nor did it reach the established, optimal, 95% DACPR recognition rate for OHCA cases, as reported by the Resuscitation Academy (2017), Viereck (2017) and Moller (2017). The study’s OHCA rate did not fall within the published DACPR OHCA recognition-rate

[4] Positive predictive value: ‘the amount of cases dispatched as OHCA, that were confirmed as clinical OHCA’ (Viereck, 2017). PPV= a (true positive) / a+b (true positive + false positive).

range of 82% (Shah, 2018) to 14.1% (Sanson, 2015). The reasons for the low OHCA recognition rate are discussed in Section 6.4.

The study's multiple group comparison in the intervention region-demonstrated a significant before (20.8%, five), during (2%, one) and after (12.9%, 16) difference in the OHCA recognition rate in favour of the pre-intervention group, which used the standard EMS protocol (AMPD, Version 12.1). However, close analysis of 2017 OHCA recognition rate revealed a steadier OHCA recognition rate in 2017 than during the 2016 observation period. One reason for the falsely inflated OHCA recognition rate in the pre-intervention group is the smaller OHCA patient group used in 2016 (24) compared to the post-intervention OHCA group (218). Fewer OHCA patients in the pre-intervention group gave an inflated OHCA recognition ratio, favouring the pre-intervention group. Another possible explanation is instrumentation, which is a possible threat to the study's internal validity. A sudden decrease in OHCA recognition rates in May 2017 was observed during the monthly analysis of the OHCA rate, which can be attributed to a new batch of approximately 25 critical-care nurses joining the emergency dispatch room in April 2017. The new batch did not receive any training on OHCA case call-taking (neither AMPD nor DACPR). The investigator recognised this and picked up on those confounders through the call takers' work-assessment sheets. The dispatch co-chief did not inform the researcher about the arrival of the new, non-trained critical care nurses. However, the high number of new non-interventional call takers on the call takers' worksheet assessment and the decrease in the OHCA recognition rate that month highlighted a problem to the researcher, who consequently explored the dispatch-room status for that month. The strategy adapted to overcome this challenge is discussed in Section 6.4.

Returning to DACPR, it resulted in better OHCA recognition rates during the prospective study period (February-December 2017) than the standard EMS protocol (AMD) achieved during February-December 2016. These findings are in line with Clawson's (2007) retrospective study findings, which showed that AMPD can be inaccurate when a patient or situation, such as cardiac arrest, requires more resources than the AMPD's structured interrogation process allows. Recognizing cardiac arrest is difficult over the phone and is made more difficult considering that the caller usually is distressed, alone and scared (UK Resuscitation Council, 2018). The medical dispatch system should provide call takers with wording flexibility to clarify the meaning to and from callers during OHCA incidents. Rigorous or too flexible medical-dispatch systems can cause ambiguity (UK Resuscitation Council, 2018 and Eisenberg, 2017).

To confirm that the documented OHCA recognition rate was due to DACPR and not to other factors occurring in the dispatch room in 2017, a comparison with a control group was performed. There was no differences in OHCA recognition rates between the two groups, but there was an unexpected increase in the OHCA recognition rate in the control group, *p-value*=.01, OR= .13.

There are two possible explanations for this, namely, the introduction of the DACPR training course and signposts. After each DACPR training course, the OHCA recognition rate increased in the intervention and control groups simultaneously. The intervention call takers and control call takers were at one site (dispatch room), and it was impossible to segregate them. The only way to ensure interventional call takers follow DACPR call-taking processes, at the pilot region; and non-interventional call takers ,at the control region, follow Kuwait EMS standard protocol is to have a clear DACPR protocol. DACPR protocol have clearly specified the areas that belong to Hawali province and stated that DACPR protocol application should be restricted to these areas only. Any other area should follow the standard EMS call taking process. However, the researcher noticed that after every DACPR training course, awareness of OHCA symptoms increased. Nevertheless, because the control call takers did not attend the training course, they did not know how to provide CPR instructions for the identified OHCA cases. This was clearly illustrated when the intervention group's percentage of recognised OHCA cases who received CPR instructions (76%) was compared with that of the control group (6.3%). Thus, during the post-intervention period, the control call takers recognised the OHCA cases from the control region, but they did not provide CPR instructions. In contrast, the interventional call takers recognised the OHCA cases from the pilot region and provided CPR instructions.

Another possible explanation for the increase in the OHCA recognition rate in the control group was the OHCA recognition signposts on call takers' desks, which were part of the key development-evaluation and implementation phases during the post-intervention period (see Appendix XVII). Again, the OHCA signposts only included key questions for recognising cardiac arrest and excluded CPR instructions. The sign posts were placed on 1 June 2017, soon after the discovery of low OHCA recognition rates during the implementation period (21 February-31 May 2017). During this period, the acknowledged cause for the low OHCA-recognition rate was a lack of non-interventional call taker skills in recognising OHCA symptoms and the subsequent low passing rate of OHCA calls from non-interventional call takers to interventional call takers. This situation provides the reason for including only key OHCA recognition questions on the reminder signposts.

It may be concluded that the signposts and DACPR training course had a positive effect on OHCA recognition rates. The latter is supported by Morrison's (2017) controlled, randomised simulation-study results. Morrison (2017) concluded that as the number of call takers with simulated DACPR training increased, the call taker' OHCA recognition and CPR instruction improved. Signposts' positive impact on OHCA recognition rates should be validated in future studies.

Another identified factor that improved OHCA recognition in this study was bystanders' previous knowledge of CPR; three OHCA cases were associated with better OHCA recognition rates. All of the bystanders with previous knowledge of CPR followed the interventional call takers' instructions. However, the small number of OHCA patients with bystanders who had previous knowledge of CPR means that a tight association of OHCA recognition with bystanders' previous CPR knowledge cannot be claimed and that CPR public awareness is low. In relation to the existing literature, Berdowski's observational study (2012) reported the rate of callers with previous knowledge of CPR, but did not assess the impact of their CPR knowledge on OHCA recognition rates. To the researcher's knowledge, no other studies have reported or correlated callers' previous knowledge of CPR with OHCA recognition.

Factors associated with low OHCA recognition rates in the Kuwaiti EMS included: callers' poor terminology in describing OHCA as 'syncope', 'unwell' and 'fell down'; interventional call takers' behaviour (such as poor protocol compliance); and the absence of a prioritising system in the Kuwaiti EMS dispatch unit (see Section 6.4). These factors were all viewed as possible reasons for the low OHCA recognition rates recorded.

Overall, the introduction of DACPR improved the OHCA recognition rate in the pilot region. However, it is still below the DACPR programme's success benchmark (Resuscitation Academy, 2017 and Viereck, 2017). DACPR can be enhanced with training and signposts or hindered by callers' poor terminology in describing OHCA, interventional call takers' behaviour and the absence of a prioritising system within Kuwait's EMS dispatch network.

6.2.2 CPR instruction rate

Like the OHCA recognition rate, the CPR instruction rate is a newly established DACPR outcome in existing literature (Hardeland, 2017; Nuno, 2017; Biancardi, 2017; Tsunoyama, 2017 and Shah, 2018). Therefore, it was included as one of the present study's outcomes.

In relation to the implemented DACPR in the pilot region of Kuwait, the initial comparison between the before (12.5%, 3), during (0%, 0) and after (10.9%, 13) CPR instruction rates showed higher rates in the pre-intervention group. However, when the investigator compared the percentages of recognised OHCA cases that received CPR instruction between the three observational periods (60% before, 0% during and 81% after the intervention), the recorded CPR instruction rates for the recognised OHCA cases (81%) in the post-intervention group indicated an improvement in DACPR rates. The intervention accomplished the pre-set DACPR success benchmark of >75%, as outlined by the AHA (2016).

When the present study's results are compared within the Middle East, the resultant CPR instruction rate for the recognised OHCA cases from this study was better than those in the latest Middle Eastern Gulf States studies, e.g., 69.6% in the Northern Emirates (Batt, 2016). The present study's CPR instruction rates for recognised OHCA by call takers are comparable to recent international EMS studies (97.5%-24.2%) (See Table 6.1). To confirm that these changes in CPR instruction rate were due to the introduction of DACPR, the researcher utilised the control region to detect the effects of the intervention and control for confounders and seasonal trends. Consequently, a comparison between the pilot and control region during the 21 February-31 December 2017 period was performed. The comparison showed overall higher CPR instruction rate in the pilot region (pilot region, 7.5%, 13; control region, 2.5%, 3; *p-value*=.007, OR=13.26). This can serve in showing direct causal inference of DACPR on the CPR instruction rate. In terms of factors that influenced the rate, the multivariate regression analysis revealed none, with the *p-value* of all confounders greater than .05.

Table 6.1. Percentage of recognised arrests that received CPR instruction in recent studies.

	Author	Year	Title	Region	Percentage of recognised arrests that received CPR instructions
1	Bray	2017	Barriers to bystander cardiopulmonary resuscitation (CPR) in a dispatcher CPR system: A qualitative review of emergency calls	Melbourne, Australia	26%
2	Viereck	2017	Recognising out-of-hospital cardiac arrest during emergency calls increases bystander cardiopulmonary resuscitation and survival	Capital Region of Denmark	97.50%
3	Herdeland	2017	Targeted simulation and education to improve cardiac-arrest recognition and phone-assisted CPR in an emergency medical communication centre	Oslo, Norway	83%

4	Shah	2018	Evaluating dispatch-assisted CPR using the CARES Registry	Eight states in the United States	73.70%
5	Huang	2017	Validation of a Dispatch Protocol with Continuous Quality Control for Cardiac Arrest: A Before-and-After Study at a City Fire Department-Based Dispatch Center	Taiwan	62%
6	Tsunoyama	2017	Effectiveness of dispatcher training in increasing bystander chest compression for out-of-hospital cardiac arrest patients in Japan	Japan	52%
7	Bobrow	2016	Implementation of regional TCPR program and outcomes after out of hospital cardiac arrests.	Arizona, United States	52%
8	Song	2014	Dispatcher-assisted bystander cardiopulmonary resuscitation in a metropolitan city: A before-and-after population-based study	Korea	24.2%
9	Berdowski	2012	Importance of the first link description and recognition of an out-of-hospital cardiac arrest in an emergency call	Amsterdam, Netherlands	37%

In sum, DACPR made positive impacts on the CPR instruction rate, with implemented DACPR achieving the targeted CPR instruction rate (81%) for recognised cardiac arrests, comparable with recent existing literature (97.5%-24.2%).

6.2.3 Bystander CPR rates

In the context of the revised OHCA chain of survival, the bystander CPR rate should be used to reflect the effectiveness of the early CPR link (Deakin, 2018). However, due to the persistent reporting of in-the-field EMS personnel as the initial CPR givers in OHCA patients, the EMS CPR rate has been used to estimate the effectiveness of early CPR links. And, although it is not being used as an early CPR link effectiveness estimator, the bystander CPR rate remains the most important modifiable factor for improving OHCA survival (Bray, 2011; O'Keeffe, 2011; Vaillancourt, 2008 and Sasson, 2012). The two different elements acknowledged by the literature to improve bystander CPR rates are public campaigns and DACPR. DACPR doubles the bystander CPR rate (Culley, 1991 and Vaillancourt, 2003), and, due to bystander CPR's level of significance in the survival chain, the bystander CPR rate is an important outcome by which to measure the success of DACPR implementation.

As in the existing literature, this study set the bystander CPR rate as one DACPR outcome. However, unlike in the literature, the researcher deployed implementation-evaluation-feasibility and development key phases to implement DACPR in the Kuwaiti EMS pilot region, which tripled the bystander CPR rates in the pilot region (12.7%, 22) in period 21 February-31 December 2017 compared with the control group (4.1%, 5) (*p-value*=.053, OR=3.40). This impact is higher than what has been reported in the literature, except in the case of Viereck (2017). Furthermore, given that the pilot region of Kuwait is new territory (i.e., with an unknown level of public awareness of OHCA symptoms and no recent CPR public campaigns), DACPR's competence was demonstrated in this regard.

The recorded bystander CPR rates in this study remain lower than the regional (20-30%) (Batt, 2016; Irfan, 2016; Bin Salleeh, 2015), European (50%) (Gräsner, 2016) and U.S. rates (46.1%) (American Heart Association, 2016). However, the improved bystander CPR rate over a relatively short period of time in this study (post-intervention period was equal to six months) suggest that higher bystander CPR rates can result from longer periods of DACPR implementation. This is founded on Viereck's (2017) one-year observational study on DACPR's documented five- to eight-fold increase in the bystander rate among all OHCA patients.

Turning to another observation related to bystander CPR rates in this research, in the pilot region before, during and after multivariate regression analysis, the investigator noted two factors affecting bystander CPR rates: middle age (ages 50-70) and nationality. These factors carried cultural significance and can be corrected through a national public-awareness campaign.

In sum, the introduction of DACPR tripled the bystander CPR rate in the pilot region. There was also variability present in the profiles of patients who received CPR, which requires further investigation.

6.2.4 Return of spontaneous circulation (ROSC)

ROSC is one of the core OHCA outcomes, and it has been used repeatedly as a DACPR outcome in the existing literature (Wu, 2017; Tanaka, 2017; Viereck, 2017; Shah, 2018 and Huang, 2017). There is also a recent trend of estimating ROSC regularly as an EMS quality indicator in EMS systems internationally (National Health Services of England, 2018) because ROSC reflects the whole EMS chain of survival (Chen, 2015). Furthermore, the ROSC rate has been used recently to estimate the effectiveness of post-resuscitation care (Deakin, 2018). The present study evaluated ROSC for two aforementioned purposes, i.e., as a DACPR outcome and a baseline for the Kuwaiti EMS' overall quality.

In terms of ROSC as a DACPR outcome, the investigator found the results in this study inconclusive in terms of whether DACPR impacted ROSC. As a Kuwaiti EMS quality indicator, the estimated ROSC rate reflected the quality of the Kuwaiti EMS. The ROSC rate in the pilot region of Kuwait was 2.9% (five) during the prospective study period (21 February-31 December 2017), which was lower than regional levels (3.1-13%) (Irfan, 2016; Batt, 2016; Binsalleeh, 2015 and Conoray, 1999) and substantially lower than the Arizona Health Services' EMS Center of Excellence (29.8%) level (Bobrow, 2016).

6.2.5 Survival to 30 days

Like ROSC, survival to 30 days is a recognised outcome for DACPR and the quality of an EMS system. In the context of DACPR outcomes, there was a high survival-to-30-days rate (29.2%, seven) in the pre-intervention group (1 February-31 October 2016). Two explanations can be provided for this result: First, the survival rate in 2016 was estimated by matching EMS patient report sheets with death registry files, which could have introduced inaccuracy to the survival-to-30-day rates in this group and therefore the possibility of reporting bias cannot be completely eliminated. Second, the small patient group (24) showed higher rates of survival.

In the during-implementation group (21 February-31 May 2017; 2.1%, one) and post-intervention group (1 June-31 December, 2017; 0.8%, one), the introduction of DACPR was associated with a decline in OHCA survival to 30 days in the pilot region of Kuwait. These observations are consistent with Moriwaki's (2016) observational study and Hardeland's (2017) more recently published before-and- after study, the latter of which demonstrated a decline in OHCA survival to 30 days after the introduction of DACPR training in the Oslo EMS system (from 18% to 14%). Shah's (2018) evaluation of DACPR using the CARES Registry in U.S. regions also concluded that DACPR was not associated with improvements in OHCA survival to 30 days. As in Huang(2017), the authors' (2017) before-and- after interventional study in a region of Taiwan documented that DACPR was not associated with improvement in survival to hospital discharge. In contrast, Viereck's (2017) before-and-after study on DACPR concluded that DACPR improved the survival to discharge in only one group of OHCA patients: those with witnessed OHCA incidents. The current study was no different from recent existing literature; it established that the introduction of DACPR as a sole tool was associated negatively with OHCA survival to 30 days in the pilot region of Kuwait. Collectively, the present study contributed to the unresolved conflict around DACPR effects on survival to 30 days. Thus, the study highlighted the importance of a fully active chain of survival in terms of improving OHCA survival. It is not enough to activate DACPR and subsequently improve bystander CPR rates to record improvements in OHCA survival to 30 days; other links in the chain of survival should be competent and active, including early defibrillation, post-resuscitation care and after care. This is confirmed by two studies: Song's (2014) double pre-test, single post-test interventional study and Kim's (2017) before-and-after interventional study. Song (2014) said that the reason for the OHCA survival to hospital discharge's significant improvement (from 7.1% to 9.4%) in the post-test DACPR implementation group was the EMS personnel performance improvements in defibrillation rates, post-resuscitation care, transport to high levels of emergency departments and after care. When EMS personnel hear pre-arrival CPR instructions while driving to a scene at which patients are receiving CPR, their performance improves, causing the survival-to-hospital-discharge rate to rise (9.4%) (Song, 2014). Moreover, Kim's (2017) before-and-after interventional study evaluated the impact of activating all OHCA survival links during a ten-year period. The author and his colleagues used reporting OHCA outcomes to the public, obligatory CPR education, DACPR, an EMS quality assurance programme and a national OHCA registry to double the OHCA rate of survival to hospital discharge (from 3% percent in 2006 to 6.1% in 2015). As a result, the current study does not deny DACPR's role as an element in early OHCA recognition and early CPR due to the poor survival-to-30-days rate, but stresses that the chain of survival needs to be intact.

In the same vein, DACPR's negative association with survival to 30 days as a lone tool may lead one to question the appropriateness of DACPR's application to an EMS system. The researcher found instances of DACPR providing positive changes to OHCA survival to 30 days when applied in a bundle format (Tanaka, 2012; Bobrow, 2016 and Hasselqvist-Ax, 2018) or in communities with high OHCA and CPR awareness (Wu, 2018). For instance, Tanaka (2012) targeted high schools for CPR campaigns during DACPR implementation. He reported improvements in OHCA survival to one year (from 16% to 27%). Concurring with Bobrow (2016), public CPR campaigns, along with DACPR applications, recorded improvements in OHCA survival to hospital discharge (from 9% to 12%). Hasselqvist-Ax's (2018) interventional study reported OHCA survival to 30 days improvement (from 7.7% to 9.5%) through the provision of dual dispatch (BLS-trained police and firefighters, plus the EMS system). On the other hand, Wu's (2018) observational study in Arizona, a community with bystander CPR awareness >40% (Shams, 2016), reported significantly higher survival to 30 days among OHCA patients who received DACPR as a lone tool. These findings further indicate that DACPR is only effective when provided in a bundle format with joint tool(s) (such as a public CPR campaign or first-responder system) or in communities with high public awareness of OHCA and CPR.

In the current study, DACPR was implemented as a lone tool in a community with relatively low public awareness of OHCA and CPR. The pilot region's low public awareness is based on low bystander rates in the three study periods (12%). This setting (DACPR as a lone tool, plus low public awareness) had an unfavourable impact on OHCA survival to 30 days, which confirmed that DACPR must be applied in a bundle format, or in coordination with high CPR public awareness, in order to have a favourable impact on OHCA survival to 30 days.

A possible reason for this is that DACPR, as a lone tool, improved the quantity of bystander CPR in the community, but not the quality of CPR. Although CPR quality was not measured, there is a high possibility that bystander CPR delivered through the DACPR study was of poor quality and almost equal to no CPR. OHCA patients must receive high-quality CPR to survive. High-quality, chest-compression-only CPR parameters include: 100 to 120 compressions/min and compression depth between 5 and 6 cm, minimum chest-compression interruption, correct hand position and allowing full chest recoil (Harris, 2018). As part of the present DACPR study protocol, interventional call takers should count with callers to ensure CPR rate achievement and provide instructions on hand position and depth. However, the caller factor could not be eliminated. The possibility of poor caller performance due to lack of CPR training exists. In fact, long chest-compression interruption was observed in some audio recordings. Collectively, there is a high likelihood that the implemented DACPR provided poor-quality bystander CPR that led to negative impacts on OHCA survival to 30 days.

These findings are consistent with the factors raised by Harjnato's (2016) before-and-after interventional study in Singapore. Harjnato (2016) concluded that DACPR implementation accompanied by the DARE campaign (a campaign to increase public awareness and encourage calling EMS during OHCA symptoms) failed to improve OHCA survival to 30 days. Furthermore, the DACPR group and no-CPR group made equal impacts on OHCA survival to 30 days (Harjnato, 2016). In addition, more recent observational research in a region of Japan compared bystander CPR rate and the quality between two groups: the DACPR group and spontaneously-initiated CPR group. The author concluded that good-quality CPR was only found among the spontaneously-initiated CPR group. DACPR improved the rate of bystander CPR, but not the quality of CPR (Fukushima, 2017). Moreover, three other small simulation studies examined the quality of CPR during DACPR and found less-than-optimal chest compression depth, hand positioning and chest-compression pausing (Asai, 2017; Savastano, 2017 and Van, 2017).

In sum, DACPR, as a lone tool, had a negative impact on pilot region survival to 30 days. This has two explanations: First, DACPR increased the bystander CPR rate, but did not provide high-quality bystander CPR. Poor bystander CPR quality is due to lack of caller training in CPR. Methods of establishing DACPR with high-quality CPR and subsequently better impacts on OHCA survival include: DACPR in a bundle (e.g., accompanied by a public campaign or first-responder system) or DACPR in a community with high bystander CPR rates. The second reason that poor DACPR impacts on survival to 30 days is that EMS systems need a fully active chain of survival to improve OHCA survival to 30 days. Both elements were missing in the pilot region: high public awareness of CPR and a fully active chain of survival.

In relation to the entire EMS system's quality, the present study established an OHCA survival to 30 days baseline in the pilot region of Kuwait of 1.1% (2; 21 February-31 December 2017), which reflected the challenges within the Kuwaiti EMS system in the pilot region of Kuwait for the first time. It was found that the pilot region's survival rate to 30 days is lower than that for the region (3-8.1%) (Irfan, 2016; Batt, 2016; Binsalleeh, 2015 and Conoray, 1999) and the Arizona Health Services Center of Excellence (12%) (Bobrow, 2016).

In terms of factors influencing the survival to 30 days in this study, none of the recognised OHCA cases in the study survived to 30 days, unlike in the recent observational study by Viereck (2017) in which OHCA recognition was associated with a 10.9% rate of survival to 30 days. The reason for the non-parallel results is the absence of a fully active OHCA chain of survival in the pilot region of Kuwait.

Ultimately, DACPR improved the OHCA recognition rate, CPR instruction rate, percentage of recognised OHCA cases that received CPR instructions and bystander CPR rate. The introduction of DACPR was negatively associated with survival to 30 days. These findings are in line with recently published literature (Hardeland, 2017; Viereck 2017 and Shah, 2018). DACPR can have positive impacts on OHCA survival if implemented in communities with high CPR public awareness or when applied in bundle fashion, namely, in conjunction with public campaigns or first-responder systems (Tanaka, 2012; Bobrow, 2016; Hasselqvist-Ax, 2018 and Wu, 2018).

6.3 DACPR in Kuwait's Emergency Medical Services

Prior to this study, Kuwait's EMS had not fully implemented evidence-based practice in relation to OHCA. In fact, OHCA recognition and management were not included as a quality measurement indicator for monitoring Kuwaiti's EMS performance. Furthermore, although Kuwaiti EMS leaders were familiar with the OHCA chain of survival, they appeared unaware of each call taker's significance in enhancing the early links of the chain (early recognition, early hands-only CPR and early defibrillation).

In the Emergency Dispatch Unit, the standard EMS protocol (pre-installed Advanced Medical Priority Dispatch [AMPD], version 12.0) was believed to be appropriate and highly sensitive to all emergency cases, including OHCA cases. Once the investigator disclosed the standard EMS protocol's lack of recognition and low sensitivity to OHCA cases (only five OHCA cases were recognised, and three of the recognised OHCA cases received CPR instructions in Hawali province during the pre-intervention period), the EMS leaders expressed an organisational need to introduce DACPR.

6.3.1 Method of implementation

Upon recognition of the organisational need, efforts to launch an up-to-date, customised DACPR system were put in place. This was accomplished initially through 8 of the 175 interventional call takers by changing the Kuwaiti EMS protocol for OHCA calls, along with quality assurance measures, between 21 February and 31 May 2017. The plan was for non-interventional call takers to pass OHCA calls on to the eight interventional call takers. However, this initial strategy did not result in DACPR implementation in the Kuwaiti EMS. The quality assurance measures were put in place as a result of poor OHCA recognition and CPR instruction rates in the initial phases, which resulted in the researcher increasing the number of interventional call takers to 70 and reconsidering the DACPR implementation method and the need to review DACPR as a more complex intervention than previously identified. A complex intervention commonly is defined as comprising multiple interacting components (Medical Research Council, 2006). In previous studies, DACPR was viewed as a simple, straightforward, call-taking process and method of measurement (Troung, 2015), as there are no sharp boundaries between simple and complex interventions (Craig 2008) and all reviewed studies in the literature were conducted in developed countries with developed EMS systems. In this study, DACPR was replicated in different contexts (distinct cultural contexts and EMS systems). These components interacted with the DACPR implementation and complicated its launch process, although the researcher had become familiar with Kuwait's EMS resources while developing the study intervention (a DACPR tool in the form of an intensive training course, new DACPR protocol, and quality assurance and improvement measures) and initiating the feasibility assessment, as described in Chapter 4, p. 98.

The identification of these issues resulted in the researcher applying new techniques for launching DACPR in the Kuwaiti EMS. This involved DACPR implementation, followed by evaluating the outcomes and assessing the feasibility and the consequential development of new strategies. This process comprises the key phases of a complex intervention development, evaluation and implementation (Moore, 2015).

The Medical Research Council (2015) recognised the value of repeated evaluations of an intervention, stating: 'It can be used to assess the quality of implementation, clarify causal mechanisms and identify contextual factors associated with variation in outcomes' (Moore, 2015). The development, evaluation and implementation model of this study is shown in Figure 6.1. This model took into consideration the novel range of complex challenges in DACPR implementation in Kuwait, including the following:

d) The behaviours of those delivering DACPR.
e) The large number of organisational levels targeted by the intervention.
f) Limited flexibility or tailoring of the intervention due to the structure of Kuwaiti EMS resources.

Figure 6.1 The implementation , evaluation, feasibility and development model of this study

DACPR implemntation Process	Intervention region	Control region
• Plan	• Identify center resources,operational processes and current outcomes(operational and clinical). • Set data source for each outcome. • Set overall targeted operational and clinical goals with clear defintions. • Set evaluation time frame(monthly).	• Identify center resources,operational processes and current outcomes(operational and clinical). • Set data source for each outcome. • Set overall targeted operational and clinical goals with clear defintions. • Set evaluation time frame(monthly).
• Implementation	• Ensure DACPR installation by interventional call takers by providing: • -One day intensive course (train minmum 50% of staff using lectures+workshops and online course). • -Preset protocol. • -Number of quality assurance tools:(audio recording review+ organisational feedback+ PRO-QA cross checking+ retrospective sample collection).	• Standard EMS protocol for OHCA calls processes by all call takers. • Number of quality assurance tools: audio recording review+ organisational feedback+PRO-QA cross checking+ retrospective sample collection.
• Evaluation	• Assess operational outcomes(correctly recognised, missed and incorrectly recognised OHCA calls/ CPR insturction rate and actual CPR rate preformed by calls under call taker guidance)and clinical outcomes and rate of improvement.	• Assess operational outcomes (correctly recognised, missed and incorrectly recognised OHCA calls/ CPR insturction rate and actual CPR rate preformed by calls under call taker guidance) and clinical outcomes and rate of improvement.
• Feasibility	• Weight correctly recognised OHCA calls rate and correct CPR insturction rate and preformed chest compression rates.verusus the targeted. • Identify areas of improvement. a-Feasible? operational outcomes are improving. b-Not feasible? Operational outcomes are not improving Why? address each challenge and apply normalisation model four facotrs to it.	• Weight correctly recognised OHCA calls rate and correct CPR insturction rte and preformed chest compression rates.verusus the targeted. • perform root cause analysis for all results: improvement/decline and sustainability of operational outcomes.
• Development	• Develop new implementation plan based on outcomes ,challenges and normalisation model findings.	• Continue recording operational and clinical outcomes of stanard EMS call taking processes of OHCA calls.
• Restart the cycle until operational outcomes target are acheived.		

6.3.2 Originality of DACPR implementation method

EMS centres of excellence, such as King County and Arizona Health Services in the United States, achieve their evidence-based practices by customising their early links and applying them to suit their communities, followed by periodic performance measurements and strategy amendments (Resuscitation Academy, 2017 and Bobrow, 2016). Following best practices related to EMS centres of excellence, the present study's investigator applied this concept to one element of the chain of survival: DACPR. There are no existing studies that support the strategy of a continuous process of development, evaluation and implementation for DACPR in EMS systems. The AMA's (2018) recent scientific statement on out-of-hospital cardiac arrest resuscitation care recognised the significance of DACPR as a novel aspect of the resuscitation system that should be measured, compared with benchmarks, and improved as needed. It was only in 2017, as the study was being conducted, that the Resuscitation Academy (a joint training programme of Seattle Medic One and the King County EMS in the United States) discovered the need for periodic performance measurements and strategy amendments for DACPR to ensure its proper implementation in EMS systems (Resuscitation Academy, 2017). Prior to this, in 2013, the Resuscitation Academy acknowledged the structure of DACPR and its success benchmarks in its e-book, *10 Steps to Improve OHCA Survival* (Resuscitation Academy, 2013). However, it was only in 2017 that the Resuscitation Academy applied the mantra 'Measure, improve, measure' to DACPR and published a special guide for call takers, elucidating the mantra's role in improving OHCA survival (Resuscitation Academy, 2017). The guide specifically outlined DACPR implementation in the following steps: quality improvement (QI) process development, measurement, training, deploying the QI programme and analysing the QI process. These steps were applied in the implementation of the DACPR method in this study, i.e., implementation, evaluation, feasibility and development. This was found to be not only appropriate in implementing the DACPR method in a complex EMS system in Kuwait, but also demonstrates that the present study is pioneering in drawing on recent best practices in implementing the optimal strategy for DACPR in EMS systems (McCarthy, 2018).

The study contributed to existing literature in that it provided a transparent overview of a DACPR implementation method and results. The study's DACPR method included original practical steps, as follows: establishing the call taker's commitment significance in DACPR implementation; establishing the infrastructure for a successful DACPR programme; co-chiefs (monitoring), shift supervisors (feedback) and call takers (implementation); and identifying the timing of the implementation feedback and monitoring cycle as every month.

In summary, DACPR is a complex intervention that was implemented in the Kuwaiti EMS by applying key implementation, evaluation and development phases; this is the first study to use this approach. This DACPR implementation method recently was confirmed by the Resuscitation Academy, a joint training programme of Seattle Medic One and King County EMS, a centre of excellence.

6.3.3 Level of implementation

The American Heart Association recommendation on DACPR (2018) gave clear outlines for DACPR benchmarking schemes. However, the American Heart Association recommendation did not pinpoint what parameters should be used to assess DACPR implementation levels. Modern authors have been using the percentage of recognised OHCA that received CPR instructions to estimate the DACPR implementation level in their systems (Bobrow, 2016; Huang, 2017; Viereck, 2017 and Shah, 2018), with the exception of Hardeland (2017), who used the CPR instruction rate to reflect the DACPR implementation level.

In this section, the investigator will use the percentage of recognised OHCAs that received CPR instructions and discuss the resultant intervention benchmarks. This is to demonstrate the extent of the improvement in the pilot's region EMS's operational outcomes.

The strategy initially did not result in DACPR implementation in the Kuwaiti EMS. The quality assurance measures revealed the following issues related to the poor initial implementation of the initiative: the OHCA recognition rate dropped from 20.8% (5) in the pre-intervention study period in 2016 to 2.1% (1) during the implementation period in the pilot region of Kuwait. Moreover, the CPR instruction rate dropped from 12.5% (3) in the pre-intervention period to 0% during the implementation period. In addition, there was a fall in the percentage of recognised OHCA cases that received CPR instructions from 60% in the pre-intervention period to 0% during the implementation period. Taking these findings together, it was found that that the level of DACPR implementation was practically non-existent between February and May 2017.

A change was made, and DACPR was then viewed as a complex intervention during the post-intervention period (1 June-31 December 2017). This altered the DACPR launch processes and enhanced quality assurance measures, resulting in OHCA recognition increasing to 9.9%, while the CPR instruction rate increased to 10.4% and the percentage of recognised OHCA that received instructions was 81%.

The evidence concerning DACPR implementation in the pilot region is supported by the presence of discrepancies in the OHCA recognition and CPR instruction rates between the intervention and control groups (see Chapter 5, p. 137), which were enhanced through the introduction of quality assurance measures. The discrepancies indicated different call-taking processes for OHCA cases in the pilot and control regions – DACPR in the pilot region and the standard EMS protocol for OHCA calls in the control region.

It should be noted that quality assurance measures are vital for assessing the DACPR implementation level. Using quality assurance measures, the researcher differentiated between the level of implementation in the initial phases of the study (during implementation) and the level of implementation in the post-intervention period, as well as DACPR implementation in the pilot region and its absence in the control region. The researcher's methods differ here from the existing literature, although several authors mentioned their use of quality assurance measures, they did not explain clearly the impact of these methods (see Table 6.2). Thus, it is relevant to highlight the quality assurance measures used in this research and to show their impacts.

The researcher used up-to-date DACPR implementation quality assurance and improvement tools, including the DACPR protocol, a one-day training course, monthly organisational/personal feedback and audio-recording reviews, all of which were used by the researcher (Huang, 2017) before and after the study. The investigator also used call taker work assessment sheets (Appendix XXI), OHCA recognition signposts and supervisor monitoring sheets, which represent innovative DACPR implementation quality assurance and improvement tools. Table 6.2 illustrates all of the quality improvement and assurance measures utilised in this study.

Table 6.2. Quality improvement and assurance measures utilised in the post-intervention study periods

Quality assurance tool	**Advantages**	**Disadvantages**	**Conclusion**
Audio-recording review	Objective and accurate tool in identifying: -Caller terminology -DACPR barriers -Level of call taker adherence to protocols -Elements of CPR quality: rate, chest compression interruption.	-Time consuming -For complete call assessment, there is a need to ensure retrieval of all records of one call -Need to assign one EMS employee or quality agency to complete this process	100% audio recording is the most objective and accurate tool for DACPR quality improvement and assurance; however, it is time consuming and requires assigned EMS personnel

Quality assurance tool	Advantages	Disadvantages	Conclusion
Call takers' work assessment sheets	Objective tool for identifying: -Interventional call-taker workload and performance -Number of active non-interventional call takers and performance -Useful in giving supervisors and call takers feedback	Can be inaccurate: Call takers may use each other's login names and take each other's calls	Can give a holistic view of DACPR implementation by interventional and non-interventional call takers
Shift supervisor's monitoring sheet	Objective tool for: - Ensuring interventional call taker presence at all times - Keeping records of OHCA calls at all times - Ensuring DACPR completion	Completely relies on shift supervisor's co-operation and enthusiasm	Useful tool for engaging shift supervisors in the quality assurance programme but demands co-operative shift supervisors
Retrospective sample collection	Key tool in identifying correctly diagnosed and misdiagnosed OHCA cases; helps in identifying the codes used by call takers to describe OHCA	-Time consuming	Only useful in underdeveloped EMS systems; systems with cardiac registries do not need it
Computer cross-checking	Key tool in identifying incorrectly diagnosed OHCA cases and the effect of performing DACPR when it is not indicated	-------	Computer cross-checking is helpful in assessing the impact of performing DACPR when it is not indicated
Feedback	Organisational feedback is a key tool for developing a feasible DACPR in EMS systems	Assigned EMS personnel need to give shift supervisor and call takers feedback; time consuming	Organisational feedback is essential for quality improvement

Quality assurance tool	Advantages	Disadvantages	Conclusion
Usage of OHCA case recognition and management as an assessment tool for call-taker performance (Ministry of Health investigation and violation warnings)	Preventing unwanted occurrences; improving work ethic	Call takers can become stressed at work	Ministry of Health investigation and violation warnings can be used as a last resource to improve DACPR feasibility

Conclusively, during the assessment of the level of DACPR implementation in the pilot region of Kuwait, the researcher used quality assurance and improvement measures to detect a lack of DACPR implementation in the early phases of the study, followed by full DACPR implementation. Thus, the results reflect full DACPR implementation in the pilot region of Kuwait. The most substantial quality assurance and improvement measures used in this investigation to evaluate the level of DACPR implementation were as follows: retrospective sampling, organisational feedback, audio-recording review and call taker work assessment sheets.

In addition, while the mentioned quality assurance and improvement measures were competent tools with which to detect the DACPR implementation level, they have also served in identifying DACPR implementation challenges. The next section discusses DACPR challenges in the Kuwaiti EMS.

6.4 Challenges

In this section, the investigator explores common and novel DACPR challenges. Common DACPR challenges are those that have been pre-defined in the existing literature. Novel challenges include the identified complex dimensions of DACPR, which have only been noted during DACPR implementation in the Kuwaiti EMS.

6.4.1 Common DACPR challenges

Common DACPR challenges include procedural barriers, CPR knowledge and personal factors (Bray, 2017). These challenges were discussed in Chapter 3 on page 67. In the context of common, pre-identified challenges, there was an overall low incidence of common challenges before and after DACPR implementation in the Kuwaiti EMS due to more recent studies reporting higher OHCA incidences with pre-defined challenges (26%) (Langalis, 2017). Moreover, the current study reported a reduction in the rate of common, pre-identified challenges after DACPR implementation by 50%. In the pre-intervention group, the rate of common challenges (uncooperative caller, panicking caller or a caller not physically at the scene) was 18%, and in the post-intervention group, this rate (caller physically not at the scene, call details from the Ministry of Interior directory, uncooperative caller or panicking caller) was 9%.

An uncooperative caller was one of the most common DACPR challenges prior to DACPR implementation. The reduction in such incidents after DACPR implementation reflected DACPR's competency in improving call-taker skills during OHCA call handling. Furthermore, the low overall rate of uncooperative callers indicates high public readiness to perform CPR.

The most common DACPR challenge in Kuwait was the caller not being physically on the scene, representing a procedural barrier (3.4%). The audio-recording reviews of these calls revealed interventional call takers interrogating these callers to confirm the cardiac arrest. Callers, in response, answered the OHCA confirmation questions, but when the interventional call takers started giving them instructions, the callers stated that 'they are not with the OHCA patient right now, and the OHCA patient is at home'. Fukushima (2016) reported a similar DACPR challenge, i.e., callers not physically on the scene in public places (11.8%) and in homes (Fukushima, 2016).

However, Fukushima (2016) and other authors confirmed changing patient positions, a personal factor, as the most common DACPR challenge (Ho, 2016 and Langlais, 2017). Lower incidences of this challenge (changing patient positions) in Kuwait could be due to bystander demographics. The bystanders in Kuwait were predominantly Kuwaiti civilian males. In contrast, in Langlais' (2017) study, the bystanders were mostly females (88%).

Furthermore, language barriers are another pre-defined DACPR challenge. However, although Kuwait has a heterogeneous population, there was a low rate of language barriers (0.5%). One reason may be that most non-native residents of the pilot region are Arabic language speakers.

6.4.2 Novel challenges

During DACPR implementation, a novel range of complex challenges was discovered. These challenges were the reason for the low OHCA recognition rate in the pilot region of Kuwait. In this section, each novel challenge is discussed within the framework of the previously discussed normalisation model (May, 2007).

6.4.2.1 Difficult behaviours from those delivering DACPR and their negative effects on DACPR implementation

The present study discovered that it was not enough to have a well-structured DACPR protocol for implementing DACPR in an EMS system. Rather, an intervention is effective when the call takers apply a well-structured DACPR protocol. When they do not adhere to the protocol, an efficient intervention cannot be implemented (Breitenstein, 2010). Thus, the effect of difficult call takers' behaviour is significant in DACPR implementation. Only one author introduced behaviour modifications for call takers while implementing DACPR in the EMS system (Tanaka, 2012). Yet, Tanaka (2012) did not disclose the reasons for introducing behaviour modifications, nor did that study mention the types of call-taker behaviours that required modifications in order to implement DACPR. Tanaka mentioned that a psychologist was called in to introduce behavioural changes, but he did not specify what methods were used to modify DACPR interventional call-taker behaviours or the significance of call takers' behaviours in implementing DACPR.

More recently, Hardeland's (2017) before-and after-study in the Oslo EMS concluded that the most common causes of a lack of OHCA recognition were agonal breathing and poor adherence to the DACPR protocol. The author introduced a DACPR intervention in the form of lectures, simulated scenarios, web-based learning and personal feedback. Introducing a new DACPR intervention reduced deviation from the protocol from 4% to 0% (Hardeland, 2017). In the present study, a similar DACPR intervention was used (lecture, workshop and a SHARE e-learning course); however, poor protocol compliance persisted, making DACPR's initial implementation difficult. The present study is the first to explore such a complex dimension of DACPR, and this issue necessitated the application of the normalisation model. The investigator evaluated this challenge repeatedly and applied new techniques for overcoming interventional call takers' difficult behaviour to permit DACPR implementation in the Kuwaiti EMS.

The current study also differs from the Resuscitation Academy (2017) clarification on the AHA's (2016) No. 1 recommendation: 'DACPR commitment'. The Resuscitation Academy (2017) equalised 'DACPR commitment' to 'dispatch-centre director commitment'. The Resuscitation Academy (2017) further explained that dispatch-centre directors should show leadership and hold their staffs accountable for DACPR implementation. The researcher concluded that, in 'DACPR commitment', the commitment is most wanted from interventional call takers.

Returning to the investigator strategy for overcome difficult behaviours of those delivering DACPR, collective actions were taken over time in setting up Kuwait's EMS, along with the evaluation of the following four principles that can interact with implementation processes. This implementation strategy is known as the normalisation model (May, 2007)

a. Interactional workability

While exploring why interventional call takers did not adhere to the DACPR protocol, two possibilities arose. The first was the presence of DACPR barriers, such as the caller's terminology or uncooperative callers. The second possibility was call takers' reliance on old practices during OHCA call-taking. Examining the first possibility, most callers were calm and cooperative in the reviewed audio records for the prospective study period (21 February-31 December 2017). However, during the callers' terminology assessment, callers used uncommon terms to describe OHCA symptoms, such as 'not well', 'fell down', 'syncoped', 'not breathing' and 'not responding'. Few studies on caller terminology cover cardiac arrest. Berdowski's (2012) retrospective study listed callers' terminologies for describing OHCA cases: While 'fell down' (24.9%) and 'not breathing' (35%) were used regularly, callers rarely used 'not well' (17%) and 'syncope' (3.5%) to describe OHCA cases. As part of the normalisation process, the researcher considered this challenge during DACPR implementation in the Kuwaiti EMS. The identified caller terminologies were highlighted for interventional call takers during supervisor and personal feedback in September 2017 (see Appendix XIX).

Looking at the other aforementioned possibility, call taker reluctance to change an old practice, a script of an interventional call taker taking an OHCA call from a layperson was appraised (case No. 274 on 25 April 2017).

Call taker: Ambulance. How can I help?

Caller: Hello.

Call taker: Hello.

Caller: Please, I need an ambulance now! I am living in (an area of Kuwait).

Call taker: What case do you have?

Caller: He fell suddenly…not conscious, and he can't breathe.

Call taker: Where in (the area)? Which block?

Caller: (Caller provides address.)

Call taker: Behind what?

Caller: xx Market, xx Building.

Call taker: OK, behind 'xx' Market. What is the number of your building?

Caller: Building xx. xx floor. Flat number xx.

Call taker: Building xx. xx floor. Flat number xx?

Caller: Yes.

Call taker: OK. Are there any other shops on the ground floor of your building?

Caller: Yes. There is xx hairdresser.

Call taker: There is xx hairdresser.

Caller: Or the xx shop.

Call taker: There is xx hairdresser or xx shop.

Caller: Yes.

Call taker: OK. They are on the way. Your name?

Caller: [Redacted].

Call taker: OK. They are on the way.

The audio-recording script showed the call taker's adherence to an old practice (taking the primary complaint/request, phone number and address). This reluctance to shed old practices has been recognised recently as an existing challenge to improving EMS recognition and management of OHCA incidences (McCarthy, 2018). The AHA's new scientific statement (2018) listed a 'lack of desire among individuals, including health professionals from EMS, to make changes' as one of the key barriers to implementing successful cardiac-resuscitation systems of care (McCarthy, 2018).

Having said that, there could be an operational barrier that prevents call takers from following the new DACPR protocol, i.e., that all Kuwaiti EMS calls are high priority. As such, all calls should receive an ambulance in the shortest time possible. Hence, call takers focus on sending the ambulance in the shortest time possible to all callers, rather than focusing on caller integrations to identify who needs CPR instructions. Although this challenge was identified, the researcher found that little could be done to overcome it. Following a discussion with the dispatch instructor, it was noted that switching the dispatch system to a prioritised system, which should enhance call takers' interrogation skills and normalise DACPR in Kuwait's EMS, would require a substantial amount of training on the dispatch-priority system for call takers and EMS personnel in the field.

a. *Relational integration (trust and confidence)*

According to the normalisation model, relational integration means determining the impact of relationships and existing knowledge on complex intervention implementation (May 2007).

Initially, the dispatch chief and co-chief were confident that their staff were performing DACPR as part of the AMPD instructions and that there was no need to go through a research intervention. This 'lack of understanding that change is needed' is a newly defined challenge, according to an AHA scientific statement (McCarthy, 2018). To overcome this obstacle and normalise DACPR implementation in the pilot region of Kuwait's EMS, the investigator disclosed the initial findings of poor DACPR implementation and its outcomes to the dispatch chief and co-chief. The poor findings encouraged them to implement the key phases of complex intervention – development, evaluation and implementation -- to improve their EMS system. Moreover, the dispatch chief and co-chief were committed to introducing DACPR to the pilot region of Kuwait EMS; however, this enthusiasm was not observed among call takers. The dispatch chief and co-chief were confident in the researcher's knowledge and approach, while the call takers were not. However, further research is required to support this conclusion.

c. Skill-set workability

Skill-set workability concerns which tasks are performed and by whom and how these decisions are made. This principle also includes staff performance, staff competence, needed staff training and policies (May, 2007).

A viable element of the implementation process was personal feedback, which was not part of the initially developed intervention, but is part of the Resuscitation Academy's (2017) latest recommendation (#3). In addition, its presence has been part of the DACPR intervention in many recent studies (Hardeland, 2017; Ro, 2017 and Huang, 2017), which encouraged the researcher to introduce it during the implementation-evaluation-development process as a tool for improving call takers' adherence to the protocol.

During personal feedback, the researcher and dispatch instructor met with the four shift supervisors to discuss the study's significance, their overall shift performance and the performance of each call taker on their shift. The dispatch instructor and researcher used the call taker work assessment sheet to assess each call taker's performance, then encouraged each shift supervisor to hold five-minute meetings with each call taker regarding his or her performance. Not all shift supervisors cooperated. As such, not all call takers received personal feedback. At times, skill-set workability was problematic from the perspective of some shift supervisors.

To overcome this challenge, the dispatch chief was involved, and he permitted the dispatch instructor to play relevant OHCA audio records for each shift supervisor. This engaged the shift supervisors with the DACPR implementation process and normalised the personal feedback process.

d. Contextual integration

As the Normalisation Process Model proposes, 'a complex intervention will affect the mechanisms that link work to existing structures and procedures, allocating and organising resources for them' (May, 2007). With the absence of a cardiac registry in Kuwait, a retrospective sample collection was the only tool for identifying correctly diagnosed and misdiagnosed OHCA cases in this study, and subsequently, for identifying the outcomes of call taker adherence to the DACPR protocol. The researcher performed this key step manually by matching patient report forms (collected from the EMS audit department) to operation unit electronic files and audio-recording reviews. Limited Kuwaiti EMS resources resulted in long matching procedures and could have affected ensuring call takers' adherence to the protocol.

6.4.2.2 Number of organisational levels targeted by the intervention

Although the intervention was implemented in the emergency rooms, dispatch units and operations departments associated with the Kuwaiti EMS, its implementation, evaluation and development targeted many departments of the Kuwait EMS, Mubarak Al-Kabeer Hospital and Al-Farwanya Hospital. Figure 6.2 illustrates all of the departments involved in the process. Installing DACPR in the Kuwaiti EMS required training call takers and changing the protocol regarding OHCA calls. The training centre was contacted repeatedly to reserve a training room. Subsequently, the researcher depended on training centre availability to improve the DACPR intervention. In contrast, the IT department was involved in the prospective and retrospective monitoring processes. Prospectively, DACPR sheet collection and cardiac-arrest cases that activated the EMS were cross-checked in the IT Pro QA system (see Chapter 4, p.99). In addition, for information on retrospective sampling collection, see Chapter 4 (p. 99). To establish the outcome, the investigator went through many departments at Mubarak Al-Kabeer Hospital and Al-Farwanya Hospital, namely Accident and Emergency (A&E), the Cardiac Care Unit (CCU), the Intensive Care Unit (ICU) and the registry. Specifically, for the present study, the A&E department created a special file to keep a record of all cardiac cases that their department received. The investigator collected data from this file every month and followed patient outcomes in the CCU ledger, ICU ledger and computerised registry. This was done to establish survival to 30 days.

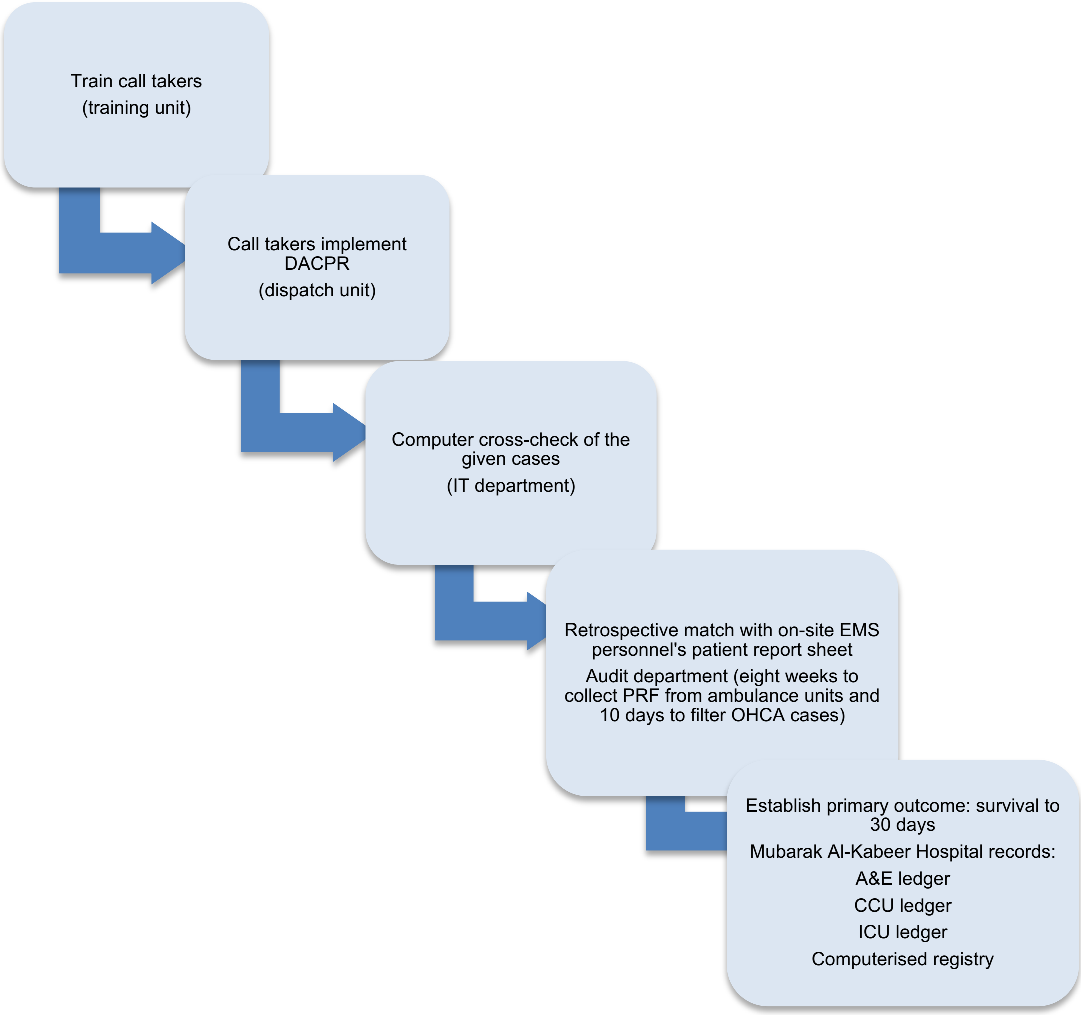

Figure 6.2. All departments involved in the DACPR implementation process.

Hence, the DACPR implementation targeted many organisational levels:

a) EMS: dispatch unit, training unit, and the IT and audit departments
b) Hospital: A&E, CCU, ICU and the registry

Although many developed countries cannot relate to this challenge due to a lack of cardiac registries, this challenge needed to be uncovered for many underdeveloped and developing countries. Below, the Normalisation Process Model is applied to this complex dimension of DACPR to further understand the workability and DACPR interventions in our study settings.

a. Interactional workability

In this principle, the normalisation model proposes 'How does complex intervention implementation affect interaction between people and practices?' (May, 2007)

DACPR training was the cornerstone of this DACPR implementation. The Resuscitation Academy's recent (2017) 'DACPR Programme Recommendation No. 2' stated that initial training is necessary for 100% of call takers and dispatchers (see Chapter 3, p. 46). The dispatch room staff consisted of 175 call takers. Although the Resuscitation Academy (2017) emphasised that all call takers should be trained (175 call takers) to implement DACPR, this was not feasible for the researcher due to the Kuwaiti EMS training centres' limited resources; hence, only 70 call takers were trained overall. The training centre only had one room with four stationary computers. Thus, the training course was carried out repeatedly (12 times) to train 70 interventional call takers. This poor interactional workability could have been why the Kuwaiti EMS had an inadequate DACPR launch process. This is one of the newly identified key barriers to implementing cardiac resuscitation systems cited by the AHA: 'resource limitations, which force organisations to change allocations of resources' (McCarthy, 2018). Although the investigator did not overcome this challenge during the study, in future studies, EMS systems with limited resources could benefit from this observation by training their interventional call takers months ahead of the intervention implementation.

b. Relational integration (trust and confidence)

Again the normalisation model emphasises exploration of the impact of those enacting the complex intervention knowledge and confidence on implementing the complex intervention in the real setting (May, 2007). All of the involved organisational members, except call takers, cooperated with the researcher. This indicated the organisations' confidence and trust in the research processes and the researcher. However, qualitative data are required to support this conclusion.

b. Skill-set workability

This principle sheds further light on the performance and allocation of resources in facilitating DACPR implementation in Kuwait's EMS setting.
During the retrospective sample collection, the monthly manual retrieval of OHCA cases (8,000-12,000 patient report forms stored in boxes) via the Kuwaiti EMS' audit department was highly susceptible to inaccuracies and delays. Some OHCA cases could have been missed, and the collection process was lengthy. Again, this was due to the absence of a cardiac registry. Thus, the

skill-set workability of the Audit department could have contributed to the unsatisfactory results of launching DACPR in the Kuwaiti EMS.

c. Contextual integration

Here, the normalisation model mandates that the investigator examine the practicality of integrating the complex intervention in the real setting.

During the OHCA's outcome retrieval from the A&E department (Mubarak Al-Kabeer Hospital and Farwanya Hospital), the researcher had to go through the nurses' notes ledger, as unsuccessfully resuscitated OHCA patients are not registered in the hospital records. The manual retrieval of OHCA patients' information from the nurses' notes ledger was essential in determining patients' survival to 30 days. The DACPR outcome retrieval processes lasted six hours at both hospitals every month. The hospitals are 20 km apart. To maintain similar processes, it should be stressed that a cardiac registry is essential when involving A&E nurses in recording these findings. Hence, involving A&E departments can complicate the integration of DACPR interventions in the Kuwaiti EMS.

6.4.2.3 Degree of flexibility or tailoring of intervention permitted

Soon after the feasibility assessment (Chapter 4, p. 99), DACPR was initiated in the Kuwaiti EMS in the form of eight interventional call takers, specifically tailoring the call-intake process for non-interventional call takers. This DACPR adjustment did not exhibit DACPR feasibility in the Kuwaiti EMS for the pilot region. Therefore, repeated tailoring in the form of 40 interventional call takers in May 2017, followed by 70 interventional call takers in August 2017, was a substantial endeavour taken to observe DACPR's effects. This indicates that DACPR is not flexible when it comes to the number of interventional call takers. There is a minimum number of interventional call takers required to facilitate DACPR effects.

a. Interactional workability

The normalisation model stresses the inclusion of human and non-human factors in the setting that affects intervention implementation (May, 2007). DACPR implementation relied fully on active interventional call taker practice of DACPR, which represents a human factor.

In the present study, there was a need for a repeated increase in the number of interventional call takers because they often took leave soon after their training. The researcher tried to keep track of the interventional call takers' leaves through their work assessment sheet, on which any call takers with low OHCA call rates had their leave checked. However, there were only two call takers who took a long leave after their training. Nevertheless, leave can affect the number of active interventional call takers, indicating DACPR inflexibility.

b. Relational integration (trust and confidence)

As stated earlier, knowledge and confidence can interact with intervention implementation in real settings (May, 2007). The lack of researcher confidence in interventional call takers in the OHCA call-taking processes and coding system led to repeatedly increasing the audio-recording review frequency from a random audio-recording review rate of 10% to 100% of calls. This relational integration may demonstrate that DACPR is an inflexible intervention and that DACPR implementation should be assessed only by evaluating all audio recordings.

b. Skill-set workability

Once more, the normalisation model encourages the investigator to examine allocation and performance as part of normalising this complex dimension of DACPR.

As discussed in Section 6.3.1.1, in April 2017, a new batch of 25 call takers began work in the dispatch room – intensive-care nurses without any dispatch background. The low skill-set workability of this batch and the need to run a training course to improve their call-taking skills could have contributed to the repeated need to increase the number of interventional call takers, demonstrating DACPR inflexibility. To overcome this barrier and implement DACPR in Kuwaiti EMS settings, the investigator and co-chief involved most of the intensive care nurses in the DACPR training course on 17 May 2017.

d. Contextual integration

The DACPR sheets were used to collect the prospective sample. This instrument is widely used to collect dispatches from OHCA patients (Ho, 2016; Tanaka, 2017 and Resuscitation Academy, 2017) However, it was evident during the study that there was a low rate of DACPR sheet use. Therefore, the use of this data-collection instrument was not reliable, demonstrating that DACPR lacked flexibility in data-collection instruments. More reliable tools for collecting prospective samples would include an electronic DACPR registry, as used in Ro's (2017) retrospective study, in which every 'cardiac arrest'-coded case necessitated electronic filing and automated storage of the audio recording for review. Hence, the low contextual integration of manual DACPR sheets could have a role in demonstrating DACPR's inflexibility.

6.5 Effects of DACPR implementation

6.5.1 Kuwait's Emergency Medical Services in pilot region

DACPR impacted the EMS within a region of Kuwait, and the study had a role in establishing the quality of the system in this major region of the nation.

The EMS systems' quality is verified by evaluating EMS response times and EMS clinical outcomes. EMS clinical outcomes are subdivided into the ROSC rate, OHCA survival to 30 days, ST-elevation myocardial infarction and stroke (National Health Services of England, 2018).

The EMS' mean response time was eight minutes in the pilot region and nine minutes in the control region in the prospective study period (21 February-31 December 2017). Although the reported response times were not equal to the high-quality EMS target (<8 minutes) (National Health Services of England, 2018), one can conclude that the DACPR implementation did not have a negative impact on EMS response time in the pilot region of Kuwait.

As for clinical outcomes, poor ROSC and poor OHCA survival to 30 days were detected, indicating challenges to EMS quality in the pilot region. However, other clinical outcomes, i.e., stroke and ST-elevation myocardial infarction, were not evaluated. The research served only as an overall estimate of EMS quality within a region, and it is not an evaluation of the overall Kuwaiti EMS quality.

Turning to the effects of DACPR in the pilot region, DACPR introduced constructive changes to the pilot region's EMS, as described below:

i. Pilot region emergency dispatch system

a. DACPR initiated evidence-based practices by using OHCA outcomes as EMS performance measures and setting a success benchmark to estimate any dispatch system competence in detecting OHCA patients (50%).
b. It identified the peak time of OHCA calls, 8:00 to 11:59, and the predicted workload of OHCA calls, which was approximately five cases per week.
c. It increased the percentage of recognised patients who received CPR instructions from 60% to 81%.

d. It initiated the early links of the OHCA chain of survival in the pilot region of Kuwait at a low cost. This is evident from the results of repeated cost evaluations during the three study periods. This confirms DACPR's ability to initiate the OHCA chain of survival in EMS systems with limited resources (Ng, 2017 and Resuscitation Academy, 2017).
e. It initiated a quality-assurance random check for all calls for all of Kuwait provinces (see Appendix XXIII).
f. It initiated call-taker performance annual evaluations based on OHCA recognition and CPR instruction rates.
g. It initiated a monthly electronic match between the dispatcher coded 'cardiac arrests' and EMS personnel's field diagnoses.

ii. Pilot region EMS audit department

In the audit department, DACPR implementation resulted in monthly data collection and analysis of OHCA cases from all the provinces in Kuwait; this was done to establish annual OHCA measurements and outcomes. DACPR also activated a follow-up system of inaccurate patient report sheets, which were tracked, and EMS personnel were identified and retrained to improve their competence level in filling out patient report forms.

6.5.2 Establishing OHCA baseline and incidence in the pilot region of Kuwait

This study established an OHCA baseline and incidence rate in the pilot region of Kuwait. This is the first study to describe OHCA in any region of Kuwait. current OHCA annual incidence in Hawali province is approximately 18.72 per 100,000 (as of 2017). A much lower OHCA incidence was documented in 2016. A possible explanation for this difference is 2016 reporting bias of the OHCA data. In 2016, data were collected and matched retrospectively using two instruments only: patient report forms and death registry records. However, in 2017, using the researchers' improved method of data collection, OHCA cases were collected and matched using three instruments: dispatch electronic files, patient report forms and hospitals' A&E departmental records. This data collection method is more accurate compared to 2016's data collection methods. Collectively, one cannot confirm that there was a spontaneous increase in OHCA incidence in the pilot region of Kuwait over one year. However, the reader can be confident that the 2017 OHCA incidence data are accurate. Furthermore, in relation to the Gulf States in the Middle East and Europe, the pilot region's OHCA crude annual incidence remains less than Qatar's (23.5 per 100,000) and Europe's (84 per 100,000) (Irfan, 2016 and Grasner, 2016).

In the pilot region, a pattern of decreasing OHCA incidence in the elderly population (70+ years), steady OHCA incidence in the middle-age population (50-70 years) and increasing OHCA rates in young adults (30-50 years) was observed in the before, during and after chi-square age analysis. Moreover, in terms of the OHCA patient demographics, OHCA patients were predominantly non-Kuwaiti (58.5%%), male (64.8%) and had no previous medical history or cardiovascular risk factors (61%) during the prospective study period of 21 February-31 December 2017 in the pilot region.

Comparing pilot region's patient demographic to the Gulf States in the Middle East, Qatar reported similar results, with high rates of OHCA in non-national, middle-age males, i.e., non-Qataris (80%) and males (80%) with a mean age of 51 years (Irfan, 2016). In North Carolina in the United States, comparable patient variables were found; most OHCA patients were men with a mean age of 53 (Lewis, 2016). Hypertension and dyslipidaemia were common in men and women who experienced OHCA. However, OHCA incidence with no cardiovascular risks was overrepresented in a specific race and gender cohort internationally (African-American women, see Lewis, 2016).

OHCA was generally the first sign of coronary artery disease and cardiovascular risk (McCarthy, 2018). In the pilot region, the majority of the OHCA patients did not have a previous medical history or cardiovascular risk factor. One possible reason for OHCA occurrence among this patient group is their genetic composition. The pilot region was mostly populated by immigrant males (see Chapter 2, p.30), and Kuwait has a restrictive policy for health insurance and health screenings for new immigrants (Kuwait Government, 2018). Hence, the absence of a previous medical history or cardiovascular risk factor from OHCA patients' medical records confirms that sudden OHCA can be associated with specific cohorts of residents in the region, which resembles Lewis' (2016) observational study findings. The overrepresented OHCA incidence with no cardiovascular risks in the pilot region is an important matter for future research.

Looking at other patient variables, the current study reported different findings from those of Qatar in terms of location and witness rate. The pilot region had a higher OHCA occurrence at home (80%), but a lower witness rate (10.7%) than Qatar (home, 63%; witness rate, 38%) (Irfan, 2016). The results of the present study resemble those from North Carolina in the United States. Lewis (2016) reported the OHCA occurrence at home as 87%, with a witness rate of 6%. Lewis (2016) reasoned that the low witness rate was due to the low marriage rate among OHCA patients in North Carolina. Although the present study did not investigate OHCA patients' marital status, the fact that most of the OHCA patients were non-Kuwaiti increased the likelihood that they were single at the time of cardiac arrest. Non-Kuwaiti individuals living in Kuwait predominantly are single men in the workforce, and immigration regulations impose tight restrictions on family immigration (Ministry of Interior, 2018). These results also are in line with those of Akahane (2012) and Herlitz (2002), who found that OHCAs at home are less likely to be witnessed and are associated with poor OHCA outcomes. However, in the present study, OHCA outcomes were not influenced by OHCA location, which was viewed as a confounder, and its effect on each OHCA outcome was evaluated through a multivariate regression analysis.

Moving on to Kuwait's overall EMS resuscitation practice during the study period, the Kuwaiti EMS resuscitation of OHCA incidence remained relatively unchanged across two successive years (2016 and 2017), except for a slight increase in the advanced life support (ALS) rate at the end of 2017. Again, compared with Qatar's advanced EMS system, in which OHCA patients are resuscitated with ALS and mechanical chest-compression devices by critical-care paramedics (Irfan, 2016), Kuwait's EMS was not as advanced in resuscitation practice.

Although the Kuwait EMS was not as advanced as others in the region, the system was open to change as evinced through the implementation of DACPR. Kuwait's EMS leaders permitted a DACPR feasibility assessment to be conducted for the EMS system, with the result that DACPR was tailored to meet the EMS's available resources and Kuwait's distinct culture. This paved the way for data collection in different EMS departments and, most importantly, repeated DACPR implementation-evaluation-feasibility and development processes.

In sum, the population characteristics in Hawali province are representative of the population in the rest of Kuwait. Non-Kuwaiti males with variable age patterns and no known cardiovascular disease risk factors were more likely to experience OHCA. Unlike in the published literature, the OHCA location (e.g., home, public place) did not affect the study's outcome.

6.6 Limitations

This study was subjected to several limitations. It compared OHCA outcomes before and after DACPR with a control. Consequently, it did not have a randomised, controlled design. Thus, the possibility that the associations identified were related to other factors linked to both the intervention and outcome could not be fully eliminated. However, with the use of multivariate regression analysis, the evaluation of other factors' impacts on each OHCA outcome was feasible. Another limitation is the small sample size, which might increase the likelihood of a Type II error. Yet the study sample size is comparable to regional studies' sample sizes (ranging between 447 and 96 participants, see Irfan, 2016; Batt, 2016; Bin Salleeh, 2015; Yadgir, 2014 and Conroy, 1999). It should also be noted that the retrospective nature of the pre-intervention groups data could have contributed to the inflated OHCA survival to 30 days rate in the pre-intervention group. The pre-intervention group sample was smaller and had a less accurate primary data source (Death Registry) when compared to the other observational groups (during-implementation and post-intervention groups), which had larger sample sizes and a more accurate primary data source (hospital medical records).

Another limitation is that this study tested short-term effects; therefore, it is not known whether the improvements observed are sustainable over a longer time frame. Thus, further longitudinal research is required. Again, the study's short time period is equivalent to those used in recent studies (Huang, 2017 and Ro, 2017). Moreover, the threat of maturation cannot be ruled out. The increased recognition and instruction rates in the pilot region of Kuwait over the study period may be due to the call takers' skill improvements or maturation. This may reduce the study's internal validity. Another internal validity threat is design contamination. The use of signposts during DACPR implementation may be associated with positive effects on the control call taker OHCA recognition rate. The researcher could not eliminate this factor during the study because the control and interventional call takers shared the same site. The final internal validity threat is selection bias from the manual matching process. Manual matching is susceptible to missing data, which can cause selection bias.

Another limitation of this study is that the researcher did not examine the median time for OHCA recognition or the median time for first chest compression, which represent recent AHA (2016) requirements for assessing DACPR performance metrics. The reason for excluding these metrics was the lack of audio recording availability for all OHCA cases in the analysis. Moreover, there are no public automated external defibrillators in Kuwait; thus, the study's DACPR instruction did not include AED use. Hence, the study's results reflect only hands-based CPR instructions. The last limitation of this study was that the investigator could not ensure caller performance of high-quality CPR, as the callers were limited to giving clear CPR instructions. Any poor-quality caller CPR performed during DACPR may gave misrepresenting results for DACPR's impacts on OHCA outcomes.

Chapter Seven: Recommendations and Conclusion

7.1 Introduction

In this chapter, the researcher provides a structured list of recommendations for all Kuwaiti EMS members involved in the DACPR-implementation process, namely call takers, dispatch unit directors and EMS policymakers. These recommendations are grounded in this study's findings. The chapter also include the study's overall conclusion.

7.2 Recommendations

Following this evaluation's findings, several recommendations are outlined below for the future development of Kuwaiti EMS policymakers, dispatch unit directors and call takers:

7.2.1 Call takers

In addition to the training manuals for DACPR, several areas need to be highlighted which specifically concern the Kuwaiti system.

i. <u>Call taker role:</u> 'DACPR implementation requires commitment'. It is only through call taker commitment that DACPR can be implemented in the Kuwaiti EMS system. Call takers first should be informed about their roles as the initial activators of the early links in the chain of survival: OHCA recognition and early CPR. Second, call takers must be informed about their role in improving OHCA outcomes and public awareness of OHCA recognition and CPR.

ii. <u>Call takers' expected OHCA workload:</u> The peak time for OHCA calls from the Kuwaiti pilot region in the dispatch centre is 8:00 to 11:59, and the predicted OHCA workload is approximately five cases per week. OHCA calls are not straightforward case scenarios (Eisenberg, 2017). However, there are some words that callers commonly use to describe OHCA, such as 'syncoped', 'fell down' and 'unwell'. These terms must trigger call takers' suspicions concerning OHCA. In giving CPR instructions, call takers should know that most callers in the pilot region of Kuwait are cooperative and willing to follow call takers' instructions. Nevertheless, one possible challenge in giving CPR instructions occurs when the caller is physically not on the scene. One way to handle this situation is to get the phone number of a bystander on the scene and give CPR instructions to that person.

iii. <u>Call-taker action items:</u> Call takers' adherence to the DACPR protocol for all OHCA calls in Kuwait ensures DACPR implementation in the Kuwaiti EMS. Call takers need to focus on interrogating each caller to reach a proper diagnosis rather than on getting extensive details about the address. Interrogation must include asking about the patient's consciousness level and breathing patterns as part of every call-taking routine to recognise an OHCA case. This should be followed by giving CPR instructions that include certain CPR metrics. Doing so will allow the delivery of high-quality bystander CPR. In addition, a metronome could be used to ensure a 100-120 chest-compressions-per-minute rate while asking the caller to compress the centre of the patient's chest 5-6 cm in depth and allow full chest recoil. Call takers also should encourage callers to minimise chest-compression interruptions.

These practises should include OHCA calls from primary-care clinics by training nurses on how to rule out OHCA and give CPR instructions when OHCA is recognised.

iv. <u>Call taker goals:</u> Adequate recognition and management of OHCA calls are major goals for EMS systems (Resuscitation Academy, 2017), and, as staff members of the EMS system, call takers should have similar goals. Call takers must keep a record of their own performance, aim to recognise all OHCA cases and give CPR instructions to 75% of callers in OHCA cases. One tool shown to aid call taker progress is constructive personal feedback. Call takers can benefit from personal feedback if they accept it with a sporting spirit.

7.2.2 Dispatch unit director

After establishing that DACPR must be applied in a bundle fashion in Kuwait to make an impact on OHCA outcomes and survival to 30 days, the dispatch unit director must refer to DACPR protocol and focus on areas that need to be stressed specifically within the Kuwaiti system.

I. <u>Establish organisational baseline and goals:</u> Keeping a record of DACPR operational and clinical outcome baselines and rates of change is essential for guiding organisational accomplishments. For instance, the present study helped the dispatch unit to introduce changes to operational outcomes, including CPR instruction rates (doubled), percentage of recognised OHCAs that received CPR instructions (quadrupled), bystander CPR rate (tripled) but reduced the clinical outcome of survival to 30 days (reduced 20-fold). These changes established the organisation's (dispatch unit's) success in improving operational outcomes and its need for a tool to improve clinical outcomes.

As for organisational goals, they include targeting response times to be <8 minutes, as well as clinical outcomes (ROSC, OHCA survival to 30 days, ST-elevation myocardial infarction and stroke) and DACPR operational outcomes (targeted OHCA recognition rate, targeted CPR instruction rates, percentage of recognised OHCAs that receive CPR instructions and bystander CPR rate). When a dispatch unit director selects a certain goal, they must introduce the organisational goal to all dispatch system members, including the dispatch co-chief, dispatch instructor, shift supervisors and call takers. This helps strengthen the dispatch organisation members' commitments prior to implementation. Moreover, goals should be examined in pre-set periodic time frames (monthly).

iii. Implement a customised DACPR: DACPR is not a one-size-fits-all intervention; however, it has minimal requirements, including *training of approximately 50% of call takers and tight monitoring of call taker training via worksheets and audio-recording reviews.* Skill-set workability is the cornerstone of implementing DACPR in any EMS system. It can be achieved by assigning a role for each EMS employee prior to DACPR implementation:

-Members for monitoring processes (co-chief, dispatch instructor)

-Members to give constructive feedback (shift supervisors)

-Members to implement DACPR (interventional call takers)

iv. DACPR-quality assurance and improvement: High-quality DACPR requires monthly organisational feedback carried out by DACPR monitors (co-chief, dispatch instructor) during the initial phases of the DACPR launch process. This helps detect areas that need improvement. Furthermore, the best-quality assurance tools for the Kuwaiti EMS include audio-recording review, call taker worksheet assessment and subjecting non-compliant call takers to Ministry of Health investigations. The best DACPR improvement tools include OHCA recognition signposts and DACPR training programmes.

v. Address challenges: DACPR's contextual integration into the Kuwaiti EMS was poor due to the Kuwaiti EMS' limited resources, which caused DACPR outcomes to depend on lengthy manual matching, repeated DACPR training and slow DACPR protocol adherence. Manual matching can be overcome by creating a cardiac registry that involves the following: dispatch data, on-site EMS personnel data, A&E data, CCU data and ICU data. Repeated training can be resolved by creating a dispatch training centre or ensuring training centre availability before launching DACPR . at least 50 % of call-takers of the dispatch unit should be trained on DACPR.

DACPR protocol adherence can be improved by activating a dispatch priority system, which should encourage call takers to interrogate callers to establish diagnoses.

7.2.3 EMS policymakers

Aside from the DACPR protocol in the dispatch unit, EMS policymakers must consider the following recommendations.

i. Evidence-based practices: Evidence-based practices must be initiated in all Kuwaiti EMS divisions, first by acknowledging predefined EMS-quality indicators, such as response time (<8 minutes) and clinical outcomes, namely ROSC, OHCA, survival to 30 days, ST-elevation myocardial infarction and stroke, and, second, by focusing initially on OHCA outcome measurements as tools to measure and compare EMS systems' quality and effectiveness. OHCA incidences test the integrity of an EMS system, as they are time-sensitive and can reflect the performances of all of the elements of a system, including call takers, EMS personnel in the field, system logistics, readiness of equipment and reporting. Finally, EMS policymakers should research the following dimensions: causes of idiopathic OHCA incidences, qualitative research on DACPR facilitators and obstacles, the ultimate tool for DACPR to improve OHCA outcomes and OHCA rhythms in Kuwait – all of which can contribute to installing a customised OHCA chain of survival.

ii. Kuwait EMS OHCA baseline: The low OHCA outcome baseline in the pilot region of Kuwait, which exhibited a 12.7% bystander CPR rate, 2.9% ROSC and 1.1% survival to 30 days, should be used as a reference for Kuwait's OHCA baseline.

7.3 Conclusion

The rationale behind examining DACPR's effects on OHCA outcomes in a pilot region of Kuwait is to participate in enhancing the OHCA chain of survival at the national and international levels. DACPR is one of the elements in the OHCA chain of survival. The latest trend in the OHCA chain of survival entails enhancing early links, which is the most effective approach for improving OHCA survival. DACPR is an element of the early links, which include early OHCA recognition and early CPR. This explains international stakeholders' recommendations to use DACPR in practice. However, to date, these recommendations have been based entirely on DACPR's ability to increase bystander CPR rates, with benefits outweighing risks and cost effectiveness and no clear evidence of DACPR's effect on survival to 30 days. This led to DACPR being evaluated repeatedly in the existing literature. More than 30 studies on DACPR were published in 2017 alone.

The existing literature is scarce on not only DACPR impacts on OHCA outcomes, but also on DACPR implementation methods. The AMA (2016) published general guidelines for DACPR implementation for EMS systems without clearly stating the optimal method of implementation.

One more knowledge gap in the literature was validating DACPR programme outcomes. The lack of transparency in EMS reporting and the vague definition of 'recognised OHCA' were the two main obstacles for measuring DACPR outcomes. Hence, various DACPR quality assurance and improvement methods have emerged, including audio-recording reviews, personal and organisational feedback, and assigning specially trained employees to be call takers. The effects of using DACPR quality assurance tools had not been established, and optimal quality assurance and improvement tools had not been identified.

The investigator filled the knowledge gaps described above, first by concluding what impacts DACPR had on OHCA outcomes. DACPR as a solo tool had a negative association with OHCA survival to 30 days; nevertheless, it had a positive association with OHCA recognition, CPR instruction rates and bystander CPR rates. These results demonstrate that DACPR's capacity is limited to improving early-OHCA recognition and early CPR and that it cannot act as a replacement for a fully active OHCA survival chain to improve OHCA outcomes, namely survival to 30 days. In the pilot region of Kuwait, DACPR raised the bystander CPR rate three-fold, but the lack of CPR public awareness, early defibrillation and post-resuscitation care, resulted in low OHCA survival to 30 days.

DACPR's negative relationship with OHCA survival to 30 days in the pilot region of Kuwait can also be explained by DACPR not providing high-quality bystander CPR. To have effective bystander CPR care, CPR metrics should be met. In this study, aside from providing clear CPR instructions, it was difficult to ensure that callers performed high-quality CPR on OHCA patients. The fact that callers were lay people who did not receive CPR training confirmed the possibility of poor-quality bystander CPR. This is an area for future research. Furthermore, these study findings developed the need to identify a modality of DACPR that ensures high-quality caller performance of CPR and, subsequently, better impacts on OHCA survival.

Subsequently, DACPR is only a tool that can improve early OHCA recognition and early CPR. In EMS systems that look to improve these two links, DACPR is the ultimate choice. This research outlines all of the relevant information regarding the complexities of DACPR implementation.

First, the best modality of DACPR (DACPR protocol and training) is followed by implementation through the key phases of development, evaluation, feasibility and implementation. Second, DACPR is a complex intervention due to DACPR's predefined common and novel challenges that are unique to every EMS system. EMS system leaders can identify their DACPR implementation challenges in their EMS systems via quality assurance tools, and the best way to overcome DACPR implementation challenges is through the use of the normalisation model.

Third, the study also identifies DACPR programme outcome validation for EMS system leaders. Evaluating the OHCA recognition rate was a practical validation process in the pilot region of Kuwait. It requires a clear definition of 'recognised OHCA' and clear inclusion and exclusion criteria. The inclusion criteria should comprise at least one of the following: submitted manual or electronic DACPR sheets, dispatched electronic files coded as 'cardiac arrest' or 'suspicion of death' and a reviewed audio record showing that the call taker recognised cardiac arrest or gave CPR instructions. The exclusion criteria should include the following: EMS-witnessed patient care, patient pronounced dead on the scene and patient found to be alive during the call or by on-site EMS personnel (misdiagnosed OHCA cases). The researcher also disclosed the results using this DACPR programme validating process on Kuwait's EMS system for a pilot region, in which DACPR was found to be highly specific and relatively insensitive as an OHCA recognition tool. Research is lacking in existing literature regarding DACPR validation process usage and results.
Fourth, the research in this thesis highlighted the ultimate DACPR quality assurance and improvement measures: call taker work assessment sheets, organisational feedback, audio-recording reviews, signposts and DACPR training courses.

Turning to the national contribution to examining DACPR's effects on OHCA outcomes in a pilot region of Kuwait, cardiac-related mortality is high in this country, but little had been done to register or improve the data for OHCA cases. The present study served these purposes by establishing an OHCA incidence baseline in the pilot region of Kuwait. This research represents the first evidence-based practice for the Kuwaiti EMS, established by capturing OHCA characteristics and using OHCA as an evaluative tool to assess the EMS system's quality.

Moreover, following recent international resuscitation practices in developing a customised OHCA chain of survival, DACPR was a form of initiating the early links of OHCA survival in a pilot region in Kuwait. In effect, DACPR had a positive impact on early recognition and early CPR in the pilot region in Kuwait because DACPR improved the Kuwaiti EMS' OHCA recognition rates, the percentage of OHCA cases that received CPR instructions and the bystander CPR rate quickly and at low cost. DACPR is a competent tool to initiate the OHCA chain of survival's early links in EMS systems with limited resources.

The evaluation also served the purpose of identifying problems with the DACPR programme in developing EMS systems and how future DACPR could be improved. DACPR in Kuwait's EMS faced novel challenges, and the normalisation model was one way to overcome them.

This research also identified the level of activity in the OHCA chain of survival early links (public awareness and readiness, early recognition, early CPR) in the pilot region of Kuwait as a low level of public awareness and a high level of readiness. The identification of a low rate of callers with previous knowledge of CPR and a low incidence of uncooperative callers provided insight into the public level of awareness and readiness in this study. The subsequent links' (early recognition and early CPR) level of activity improved through DACPR. These findings were based on the increase in the OHCA recognition and bystander CPR rates in the pilot region. However, due to the small scale of this study, repeating this research on a larger scale is warranted.

This study provides evidence that in the current climate of promoting DACPR implementation in EMS systems to improve OHCA outcomes, DACPR influenced early OHCA recognition and early CPR only. DACPR was found to be competent for these purposes. DACPR implementation should not be viewed as straightforward due to its complex launch process. It requires comprehensive phases of implementation, evaluation, feasibility and development to be initiated into EMS systems.

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Appendix

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XXV. **Diploma of International academy of Emergency Medical Dispatch**

Appendix I. DACPR data sheet

Dispatcher –Assisted CPR Data Sheet

Call number: Date:__/___/___ Time:_ _:_ _

Patient civil ID number: _ _ _ _ _ _ _ _ _ _ _ _ _

Gender: ☐ M ☐ F Nationality: Kuwaiti /Non-Kuwaiti

Primary complaint: ☐ Unresponsive ☐ Apnea

☐ Agonal breathing ☐ Discoloration

Others: ______________________________

Location: ☐ Home ☐ Public Province: ___________

Caller:

Gender: ☐ M ☐ F Nationality: Kuwaiti /Non-Kuwaiti

Previous knowledge of CPR:	Yes	No
Witnessed Cardiac arrest [5]:	Yes	No
Cardiac arrest is recognized?	Yes	No
Because:	Unresponsive	Not breathing normally
Instructions for positioning the patient are given?	Yes	No
Hands only CPR instructions are given?	Yes	No
Chest compression preformed?	Yes	No
Barriers to CPR?	-Caller hung up. -Could not move the patient. -The phone call was not clear. -Cardiac arrest is due to non- cardiogenic *reason____________________. Others:______________________.	-Caller refused. -Language barrier. -EMS arrived before CPR instruction.

Time metrics for dispatcher:

-Time of OHCA recognized:	_ _/_ _	A.M.	P.M.
-Time of first CPR instruction given:	_ _/_ _	A.M.	P.M.
-Time of first Chest compression:	_ _/_ _	A.M.	P.M.

Total time of the call:

[5] Witnessed cardiac arrest: the arrest was heard or seen by the bystander.

Call taker serial number:____

Signature: ____

استبيان حالة توقف القلب خدمة الإنعاش القلبي بمساعدة مرسل الطوارئ

رقم البلاغ: -- --

التاريخ: -- / --/ -- . الوقت:- -:- - صباحاً/ مساءً.

اسم المريض:________________________________

رقم البطاقة المدنية للمريض: _ _ _ _ _ _ _ _ _ _ _ _

المنطقة: ________________ الموقع: المنزل/ مكان عام

شكوى الرئيسية: توقف التنفس / لا يستجيب/ التنفس احتضاري/ شكوى أخرى____________.

تأكيد حالة توقف القلب نعم لا الوقت:_ _ :_ _ صباحا/ مساء

بيانات المتصل:

جنسية المتصل: كويتي / غير كويتي. جنس المتصل: ذكر /أنثى .

عمر المتصل: 18-30 30-50 50-70 70+

شهود المتصل للحدث: نعم لا

معرفة المتصل السابقة لعملية الإنعاش القلبي: نعم لا

إعطاء التعليمات

تم إعطاء تعليمات تغيير وضعية المريض ؟ نعم لا

تم إعطاء تعليمات الأنعاش القلبي؟ نعم لا

تم الضغط على الصدر؟ نعم لا

هناك حواجز تحول دون تطبيق الانعاش القلبي ؟ نعم لا

- رفض المتصل
- انقطاع المكالمة-
- وصول طاقم الإسعاف
- عدم القدرة على تحريك المريض
- حاجز لغوي
- توقف القلب بسبب:غرق،جرعة زائدة،صدمة كهربائية،جراحي)
- المكالمة غيرواضحة
- أخرى: ______________________________

- مقاييس الوقت لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ ":
  - وقت المكالمة: _ _ / _ _ صباحا مساء.
  - وقت التأكد من حالة توقف القلب: _ _ / _ _ صباحا مساء.
  - وقت اعطاء التعليمات للإنعاش القلبي: _ _ /_ _ صباحا مساء.
  - وقت اول ضغطة على الصدر: _ _ / _ _ صباحا مساء.
  - الوقت الكلي للمكالمة: _ _ / _ _ صباحا مساء.
- التسلسل الرقمي لمتلقي المكالمة : _ _ _ _
- التوقيع لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ؛________________

Appendix II. Patient report form (Cardiac Arrest Form)

Cardiac arrest form

Case Number: ________________ **Date**:_____/_______/_____

Age ☐ 16-30 ☐ 30-50 ☐ 50-70 ☐ 70+

Gender ☐ M ☐ F

Nationality ☐ Kuwaiti ☐ Non-Kuwaiti

Location ☐ Home ☐ Public

Risk factor ☐ IHD ☐DM ☐HTN ☐smoking ☐ FHX

Arrest information		
Witnessed arrest	☐ **Yes**	☐ **No**
Recognition ☐Unresponsive ☐ no Breathing ☐ Snoring ☐ Pulseless		
Cause ☐Unknown ☐ Drowning ☐Trauma ☐ Electrical fault ☐ Suicide ☐Intoxication ☐ Others		
Resuscitation information		
Bystander CPR	☐ **Yes**	☐ **No**
Time to CPR*		
Initial rhythm: ☐ Shoackable ☐ non shockable ☐ Not attained		
Initial rhythm was recorded = or < 4 minutes	☐ **Yes**	☐ **No**
Time to defibrillation*		
Defibrillation ☐Manual ☐ AED Number of shock attempts: ______________		
Prehospital care outcome		
ROSC** ☐ On scene ☐During retrieval ☐Not achieved Time:		
Resuccitation terminated: ☐ On scene ☐ During retrieval ☐ Not achieved Time		
Pronounced Death:		

☐ On scene ☐ During retrieval ☐ ED ☐ Hospital	

*from dispatch time and should be documents in minutes
**ROSC return of spontaneous circulation pulse / breathing /consciousness

(Appendix. III) Emergency Medical Priority Dispatch system electronic records

Report Preview

SAP CRYSTAL REPORTS®

Main Report

2/27/2017
10:51:28
Page 1 of 5

نتيجة البحث عن العاجلة عن حادث رقم : 93

Search Result For Emergency Event No.: 93

Event Info — **معلومات الحدث**

رقم البلاغ Event ID	93	اليوم Day	Sunday
التاريخ Date	2/5/2017 8:39:56	النوبة Shift	
نوع الحالة Case Type	توقف القلب-Cardiac Arrest/الجهاز الدوري-Circulatory System		
نوع الحادث Event type			
تفاصيل العنوان Address details	المطار, قطعه 1, شارع المطار قطعة 1		

Caller Information — **معلومات المبلغ**

إسم المبلغ Notified by	كريم هلاريا	هاتف المبلغ Notifier's phone	24768999
مبلغ الجهة الرسمية Official Site Notifier		هاتف بديل Alternate Number	
رقم البلاغ بلاغ الداخلية MOI Case Number		بواسطة Through	Radio
ساعة البلاغ Time of notification	2/5/2017 8:39:56 AM	اسم متلقي البلاغ Calltaker's name	.كريم ~~هلاريا أبو بكر~~
الجهة Site	اسعاف رقم 304		

Additional Information — **معلومات إضافية**

حجمه Size of accident		عدد الأشخاص No. of Peoples	
العدد التقريبي للاصابات Approximate number of injuries		سببه Caused by	
افضل مدخل للموقع Best location entrance		نوعية الاصابات Type of injuries	
الأخطار المتعلقة بالحادث Accident related hazards		وضع البلاغ Event Category	
حالة الموقع عن الوصول Situation Found		الجهاز المكون للبلاغ Terminal Name	$304
عاجل الأولوية Event Priority	1		

Current Page No.: 1 Total Page No.: 5 Zoom Factor: 100%

Appendix IV. DACPR protocol

Alhasan D

Content

<u>Emergency Medical Services</u>

<u>Operation unit</u>

<u>Emergency calls division</u>

<u>Dispatch assisted CPR Program</u>

Why?

Emergency Medical Services (EMS) efficacy is measured and compared internationally by the number of people who experience Out of Hospital Cardiac Arrest (OHCA), activate the EMS system and survive to hospital discharge (*Resuscitation Academy, 2010)*. This is because OHCA is time sensitive and can reflect the performance of different EMS departments; EMS logistics, dispatch Center, Ambulance centers staff skills and equipments, management department, audit department and quality department (Rahman, 2015).

And although Kuwait EMS OHCA survival to 30 days have never been measured in Kuwait. There fore Kuwait EMS level if efficacy is not known. In keeping with international EMS practices, Kuwait EMS should measure and improve OHCA survival to 30 days.

The most famous management strategy for OHCA recognition and management is :OHCA chain of survival. The application of the survival chain require the activation of: early OHCA recognition, Early CPR, Early Defibrillation and Post resuscitation Care links *(*Kronick,2015*)* . Each link consists of many elements. One Element that over lap between the early links of the survival Chain is Dispatcher assisted CPR (*Scottish Government, 2015)*. Dispatcher assisted CPR can be capable of initiating the early recognition and early CPR and even early defibrillation links (*Scottish Government, 2015)*. And although all the survival chain links are significant, current research have placed great emphasis on activating the early links (boborow, 2016). DACPR is implemented in an EMS system, when the call taker deliver simple questions to recognize cardiac arrest and giving simple instructions to initiate hands-only CPR.

Given Kuwait EMS urgent need to initiate OHCA chain of survival, implementing DACPR seems like an appropriate strategy. DACPR is cost effective and it’s benefits out weight it risks

(Vaillancourt , 2007 and Rea, 2003).

In sum, this study obtains OHCA outcome, OHCA survival to 30 days in pilot region of Kuwait, which is a wanted evaluative figure to Kuwait EMS efficacy. The study also implements DACPR, which will activate the early OHCA chain links: early recognition and early CPR.

Objectives:

- ✓ To install an internationally accepted DA CPR program that recognize Cardiac arrest within 1 minute and initiate chest compression within 2 minutes of EMS activation.
- ✓ To provide 50% of all cardiac arrest that activate Kuwait EMS with DA CPR.
- ✓ Provide CPR instructions for 75% of the recognized OHCA cases.
- ✓ To examine DA CPR ability as an cost effective tool that improves OHCA survival in the state of Kuwait.

Expected workload:

In a heavily populated metropolitan area is approximately 7 cardiac arrests per week. Nationally and based on OHCA survivals in Kuwait ,2013 study expected workload is average 10 cardiac arrests/ week. (Max. December 20/wk – Min July 1.75/wk)

Expected Training:

Expected Training will be conducted over one day in the form of (Lecture, Work shop and Save hear Arizona Registry and education (SHARE)-Online course) for nominated call takers.

Lectures :

Lecture 1 : Basics of cardiac system and Why hands only CPR?

Lecture 2 : Dispatch assisted CPR program

Lecture 3 : How to perform Dispatch Assisted CPR(Call taker, Supervisor)?

Lecture 4: Obstacles of DA CPR

Workshop: on DA CPR

Work shop: will be the form of case scenario; each call taker will preform 2 script scenarios: in one scenario he is the caller and in the other he is the call taker. Feedback will be given for all performers.

Reference:

Kronick S and Kruz M 2016 'Part 4: Systems of care and continuous quality improvement; 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care'. Available from: http://www.cercp.org/images/stories/recursos/Guias%202015/Guidelines-RCP-AHA-2015-Full.pdf

Rahman, N and Tanaka, H 'Emergency medical services key performance measurement in Asian cities' international journal of emegecnt medicine.8(2015)12.

Resuscitation Academy (2010) "Dispatch assisted CPR toolkit" [Online] available at: http://www.resuscitationacademy.com/downloads/DACPRToolkit1010.pdf.last *accessed on 4/3/2015.*

Rea, T and Eisenberg, M, 'Clinical investigation and reports temporal trends in sudden cardiac arrest: A 25-year emergency medical services perspective', *Circulation*, 107(2003), pp. 2780-2785.

Scottish Government 2015, 'OUT-OF-HOSPITAL CARDIAC ARREST: A strategy for Scotland'. Available from: <http://www.gov.scot/Resource/0047/00474154.pdf>.

Vaillancourt,C and Verma, A (2007) 'Evaluating the effectiveness of dispatch-assisted cardiopulmonary resuscitation instructions' Academic Emergency Medicine.14;877-883.

Dispatch assisted CPR at Emergency Medical Services State of Kuwait

Operation unit Instruction

Emergency calls division

- This protocol is part of an interventional research and should be applied by call takers as soon as the training course is complete.
- Interventional call takers should complete all the elements of the training to be categorized as trained (SHARE online course, Lecture and Work shop).
- There is a persistent access to this protocol. Copies have been provided to all of the following: Dispatch chief, Dispatch Co-chief, Dispatch instructor, Shift supervisor and interventional call takers.

- The leading investigator is Dalal Alhasan and her Contact details are;

  Dr.dalal.alhasan@gmail.com

Standard procedure (SOP):

- Call taking process are applied to all OHCA calls from Hawali province areas only. These include: Meshrif, Hawali, Bayan, Jabrya, Salmya, Surra, Rumaithya, Anjefa, Salwa and Mubarak Al-Abdullah,,Subah ALsalem, ALbede'e, Alnegrah and Maidan Hawali .
- OHCA calls from other provinces should follow Kuwait EMS standard protocol.
- There has to be at least **one** interventional call taker at each shift.
- If the interventional call taker on the shift is occupied with another case, the shift supervisor should take the OHCA call.
- There are number of OHCA calls from Hawali province that should not follow this Standard of procedure, these include:
  - Age less than 16 years old.
  - Pregnant women.
  - Non cardiogenic OHCA: intoxication, drowning ,traumatic , elctricusion, drug overdose or suicide.
  - Death is imminent: the caller volunteer tells you that he is charred or stiff "rigor mortis.

- Reason for excluding these cases is; this SOP encourages Hands only CPR and eliminates instructions for ventilations. Thus the aforementioned patients should receive Kuwait EMS standard protocol for OHCA calls.
- Do not apply this protocol if there was a senior professional on site: doctor or Nurse.

- This SOP should be only be provided by trained can takers. Untrained call takers who receive OHCA call from Hawaii province should transfer the call to trained call taker on the shift.
- This SOP should be applied as soon after Case Entry and sending the ambulance to the patient.
- The implementation of this SOP involves filling a DACPR sheet for each OHCA case.
- DACPR sheets are found at shift supervisor desks. And once filled should be placed back at collection envelope (also found at shift supervisor desk).
- DACPR sheets can be filled during or after the call.
- A call is categorized as an OHCA call when the caller states: the patient is "unresponsive" and or "not breathing normally".
- The call taker has to confirm caller witness of the OHCA at each call. By simply asking" did you see him or hear him collapse?"
- There are elements of the DACPR sheet that should be completed with out asking the patient direct questions these include:
    - Date
    - Call number
    - Bystander; gender, age bystander nationality.
- Call taker should confirm OHCA by asking the caller clear questions assertively as:

  ‘’ IS the patient is responsive?"

  "IS the patient breathing normally?"
- Call takers should ask the caller the question twice only.
- There are different modalities of these questions that you can use; use each twice only. If the patient state I don't know for these questions consider his answer as a yes and proceed to giving CPR instructions.

➢ Modality of is the patient responsive? Question:

- "Call him/her loudly by his name does he answer you?"
- "Put me on speaker, shake his shoulder, does he response to you?"

➢ Modality of "is he breathing normally question?"

- "Place the palm of your hand on his chest, does his chest move at all?"
- "Does he breath like you?"

- Agonal breathing(snoring or interrupted breathing sound should not be considered as normal breathing)
- Do not take longer than1 minute to identify the arrest.

- During time metrics for OHCA recognition calculation, the beginning point is the start of the call (before case entry).
- Once the arrest is confirmed by the answer of "yes" or " I don't know". Confirm of the patient have any previous knowdlege of CPR by asking:
  "Have you ever did CPR before?" Yes/ No. Then move to CPR instruction step.
- CPR instructions:
  - The ambulance has been sent to you and now it is on its
  - I want you to start doing CPR. This is important.
  - Put me on speaker.
  - Listen carefully,I will tell you what to do now:
  - Where is the patient? Place the patient on a hard surface on his back.
  - Set on your knees next to the patient trunk.
  - Place the palm of your right hand on the center of the patient chest.
  - Place your other hand on top of it.
  - Now straighten your elbows and push hard down for 5 cm.
  - Continue pushing, I will count with you one, two,three…….
  - You are doing very well. The ambulance is on the way and I am staying on the line with you.
  - The target is 100 chest compression/minute. I am with you and wont leave you until the ambulance crew arrive.
  - Is any body with you?
  - Can you ask him to open the door? The ambulance crew arrived.
- CPR instruction target is to preform the first chest compression with in 2 minutes from the call /100 compression per minute / 5 cm depth and keep chest compression interruption to the minimum.
- Do not confirm the OHCA or give instructions to a bystander less than 11 years old. Instead ask the child to call an adult to speak to.
- Do not allow the caller to stop chest compression unless some body is taking over or he is too exhausted.
- Stop giving instructions immediately; if the patient speaks or move.
- Possible barriers: (Changing patient position/caller is not on scene/ panicking caller.)
  1.Changing patient position:

- Patient sitting on sofa but too heavy to be brought on the floor=> check if any one was there to help if not, ask the caller to place on flat on his back on the sofa and the give CPR instructions.
- Patient is heavy but flat on his back on the bed=> Give CPR instructions.

2. Panicking caller:

- “Shouting wont help! You need to help the patient.”
- “Stop shouting and help the patient’
- “Is there is someone else in the room I can speak to?”

3.caller not on scene:

- Take the phone number of a bystander on scene?

- If the caller is a bystander in a public place , you can ask him to send some one to check if automated electrical defibrillator is available.

DACPR Quality measures:

The following are monthly evaluations and they include:

- To ensure DACPR quality 10% of the OHCA calls audio recordings will be reviewed b dispatch instructors.
- There is also the following matching process done by researcher, to identify the exact number of the recognized Arrests:

  {Recognized arrest: coded as “Heart”, “Cardiac arrest”/or received CPR instructions. That matched patient report form and A&E records as cardiac arrest of unknown origin.}

- Incorrectly recognized cases are:

  {Labeled as cardiac arrest or Receive CPR instruction but they are not cardiac arrests according to matching process: patient report form and A&E records.}

- Missed OHCA cases;

  {Coded in different codes other than “Heart”, “Cardiac arrest” and reported to be cardiac arrest according to patient report form and A&E records.

Script for OHCA recognition and CPR instruction for call takers

- Your call is divided to four sections: Case entry/OHCA confirmation/CPR instruction/Case exist;

a. ***<u>Case entry:</u>***

- What is your address?
- What is your phone number? (if not appearing on screen only)
- Tell me what happened exactly? (Unresponsive, unconscious, not breathing, gasping) => confirm an OHCA.

b. <u>Cardiac arrest recognition:</u>

-*Screening questions:*

- Is the patient responsive *(awake)?*
- Is the patient breathing normally?

If the answer is No to both => give Hands only CPR instruction

If the answer is no not awake and there is a “little”, “sometimes” or “I’m not sure” or “I think so.” for breathing =>give hands only CPR instruction

c. <u>CPR Instruction:</u>

-Hands-only CPR (chest compression CPR):

1. Help is coming on the way.
2. Get the phone next to a person. Put me on speaker
3. Listen carefully I will tell you what to do:
    a) Get the patient flat on their back on the floor
    b) Kneel by the side of the patient trunk
    c) Put the heel of your hand at the center of the patinet’s chest.
    d) Put your other hands on top of that hand
    e) Interlock your hands
    f) Straighten your elbow
    g) Push hard (5cm depth)
    h) Count load1, 2,3,4,5,
    i) You are doing well, help is on the way and I will stay online.
    j) The goal is 100 chest compression per minute.

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d. <u>Case Exist:</u>

-(Once the caller confirms the ambulance crew arrival). State the following;

- **'**Let some one open the door……. Continue chest compression'.
- If the caller is alone he can open the door him self.

<u>Reference:</u>

AHA(n.d.) "hands only CPR;learn more" [online] available at :http://www.heart.org/HEARTORG/CPRAndECC/HandsOnlyCPR/LearnMore/Learn-More_UCM_440810_FAQ.jsp. last accessed on 27/4/2014.

AHA(2012) " 2012 Hands-OnlyTM CPR Fact Sheet" [online] available at : http://www.heart.org/idc/groups/heart-public/@wcm/@ecc/documents/downloadable/ucm_441302.pdf . last accessed on 27/4/2014.

Dispatcher –Assisted CPR Data Sheet

Call number: Date: / / Time:_ _:_ _

Patient civil ID number: _ _ _ _ _ _ _ _ _ _ _ _

Gender: M F Nationality: Kuwaiti /Non-Kuwaiti

Primary complaint: Unresponsive Apnea

Agonal breathing Discoloration

Others: ____________________

Location: Home Public Province: __________

Caller:

Gender: M F Nationality: Kuwaiti /Non-Kuwaiti

Previous knowledge of CPR: Yes No

Witnessed Cardiac arrest [6]: Yes No

Cardiac arrest is recognized? Yes No

Because: Unresponsive Not breathing normally

Instructions for positioning the patient are given? Yes No

6 Witnessed cardiac arrest: the arrest was heard or seen by the bystander.

Hands only CPR instructions
are given? Yes No

Chest compression preformed? Yes No

Barriers to CPR? -Caller hung up.-Caller refused.

-Could not move the patient. -Language barrier.

-The phone call was not clear. -EMS arrived before CPR instruction.

-Cardiac arrest is due to non- cardiogenic
*reason____________________.

Others:______________________.

Time metrics for calltaker:

-Time of OHCA recognized: _ _/_ _ A.M. P.M.

-Time of first CPR instruction given: _ _/_ _ A.M. P.M.

-Time of first Chest compression: _ _/_ _ A.M. P.M.

Total time of the call:

Call taker serial number:____

Signature: ____

<u>Dispatch assisted CPR at Emergency Medical Services State of Kuwait</u>

<u>Operation unit</u>

<u>Emergency calls division</u>

<u>Quality assurance</u>

Audio recording review:

-OHCA call taking processes should be evaluated, by Dispatch instructor as follows:

Call taker evaluation	Performance
Did the call taker recognize the cardiac arrest?	Yes No
Did the call taker recognize the cardiac arrest in1 minute?	Yes No
Were agonal respirations *(if present)* recognized?	Yes No
Did the call taker give the instructions per protocol?	Yes No
First compression started within two minutes?	Yes No
Difficult case	Yes No
Why was considered difficult? (not recognized or instructed)	Language barrier Drowning Traumatic cardiac arrest Hypothermia Electrocution Strangulation Patient on ventilator the citizen was too emotional the phone call was disconnected the phone call was unclear others:______________________________

How can he/she do it better?

Supervisor name: Supervisor signature :

برتوكول الإنعاش القلبي بمساعدة مرسل الطوارئ الطبية

لماذا؟

يتم قياس و مقارنة كفاءة الطوارئ الطبية دوليا بإحصاء عدد الأشخاص الذين بقوا على قيد الحياة بعد أصابتهم بتوقف القلب و قد تمت معالجتهم من قبل الطوارئ الطبية و خرجوا أحياءً من المستشفى. ولم يتم هذا الإحصاء في دولة الكويت من قبل , على رغم من إرتفاع معدلات أمراض القلب و الدورة الدموية في دولة الكويت على حسب احصائيات منظمة الصحة العالمية.

و بما يختص في الطوارئ الطبية, قسم العمليات يستقبل ما يقارب 90244 مكالمة سنوياً,بما فيهم 9427 حالات قلب و الدورة الدموية. حالات القلب و الدورة الدموية من أكثر الحالات إتصالاً في وحدة الطوارئ ,حسب إحصائيات قسم العمايت لعام 2013. وتمثل هذه الحالات 21% فقط من مجموع حالات توقف القلب في دولة الكويت. و ترجع هذه النتائج لدراسة دكتور الحبيب الذي أضاف أيضاً قلة إستخدام خدمات الطوارئ الطبية لنقل حالات توقف القلب في المجتمع الكويتي. و علل ذلك بإستخدام المركبات الخاصة من قبل الأهل لنقل حالات توقف القلب إلى المستشفى.

و لم تتباطء الطوارئ الطبية في تطوير رعاية حالات توقف القلب في دولة الكويت. و قد قامت بحملة تدريب 10% من المجتمع الكويتي على عملية الإنعاش القلبي في عام 2014. وذلك لعلمها المسبق بأهمية الإنعاش القلبي لحالات توقف القلب. حيث تمكن الانعاش القلبي من قبل الشهود على رفع معدلات النجاة من الموت بمعدل الضعف عالمياً و كل دقيقة تمر على المريض دون الانعاش القلبي تقلل من نسبة الحياة بمعدل 10%. و من الجهود السماية للطوارئ الطبية في هذا المجال هو تفعيل توزيع جهاز الصدمة في الاماكن العامة في عام 2016 . و من منطلق الإستمرار في تطوير خدمات الطوارئ الطبية لحالات توقف القلب لابد أيضاً من تفعيل الإنعاش القلبي بمساعدة مرسل الطوارئ .

و يمكن تعريف الإنعاش القلبي بمساعدة مرسل الطوارئ ب "توجيه أسئلة بسيطة من قبل متلقي الإتصال لمكالمة توقف القلب ,وذلك للتأكد من الحالة و إعطاء التعليمات البسيطة للمتصل للقيام بعملية الإنعاش القلبي قبل وصول طاقم الإسعاف".

ومن مميزات الانعاش القلبي بمساعدة مرسل الاسعاف هي:رفع معدلات المتدربين على الإنعاش القلبي في دولة الكويت , تقديم إنعاش قلبي عالي الجودة, رفع معدلات استخدام جهاز الصدمة في الاماكن العامة و إنشاء إحصائية لحالات توقف القلب في دولة الكويت.

ومن خلال هذا البحث ستتمكن الطوارئ الطبية , وحدة العمليات من تطبيق "الإنعاش القلبي بمساعدة مرسل الطوارئ "على منطقة حولي الصحية.

يتمحور هذا البحث حول مقارنة نسبة العيش إلى الخروج من المستشفى بعد الإصابة بتوقف القلب بين مجموعتين من المصابين: المجموعة الاولى قبل تفعيل خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ " و المجموعة الثانية بعد تفعيل هذه الخدمة. تتمثل المجموعة الاولى من البالغين المصابين بتوقف القلب خلال شهر يناير وفبراير ومارس و ابريل لعامي 2013 و 2016 . بينما تتألف المجموعة الثانية من المصابين بحالة توقف القلب خلال شهر يناير و فبراير و مارس و إبريل لعام 2017. على أن يتم تفعيل خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ " خلال شهر ديسمبر عام 2016. و بتحديد فارق النسبة المعيشية بين المجموعتين سيتسنى للباحث من التعرف على دور "الإنعاش القلبي بمساعدة مرسل الطوارئ " في تحسين النسب المعيشية لمرضى توقف القلب في منطقة حولي الصحية.

الأهداف:

- ✓ تفعيل خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ " بكفاءة مقبوله عالمياً.و ذلك من خلال التعرف على حالة توقف القلب هاتفياً خلال دقيقة واحدة و إعطاء تعليمات الإنعاش القلبي خلال دقيقتين من الاتصال في منطقة حولي الصحيه.
- ✓ التعرف على مكالمة توقف القلب و إعطاء تعليمات الإنعاش القلبي لما يقرب 50% من حالات توقف القلب في منطقة حولي الصحية.
- ✓ تحديد قدرة "الإنعاش القلبي بمساعدة مرسل الطوارئ " كأداة عالية الكفاءة و قليلة التكلفة في رفع معدلات العيش إلى الخروج من المستشفى في حالات توقف القلب.
- ✓ مشاركة متلقيين الاتصالات في وحدة العمليات في إسعاف حالات توقف القلب.

عدد الحالات المحتملة:

تقدر عدد حالات توقف القلب في المنطقة المدنية المكتظة سكانياً ب 7 حالات اسبوعياً تقريبا. و بناءاً على إحصائية محلية لعام 2013, عدد الحالات المتوقعة 10 حالات أسبوعياً تقريباً.

فريق العمل:

فريق العمل	الأعمال المطلوبة
مدير وحدة العمليات	- ترشيح و تحديد عدد أسماء مدربين الإتصالات و متلقي مكالمات توقف القلب القادرين على اتمام مهام البحث. - تفعيل التعميمات المتعلقة بالبحث العلمي: كموعد بداية و نهاية البرنامج التدريبي و بداية ونهاية خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ ". - دعم خطة البرنامج التدريبي و البحث العلمي.
الباحثة	- تزويد فريق العمل ببرتوكول خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ " باللغتين العربية و الإنجليزية. - تزويد مدربي الاتصالات بالمواد العلمية للبرنا مج التدريبي. - تحديد مهام المدربين الإتصالات و متلقي مكالمات. - إلقاء محاضرات البرنامج التدريبي. - الإشراف على ورش العمل. - جمع نسخ مم الشهادات الإلكترونية لخدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ " من فريق العمل. - الإشراف على آلية ضمان الجودة. - تزويد مدربين الإتصالات و متلقي مكالمات توقف القلب بإستبيان المكالمات. - تحصيل ورقة البيانات شهرياً من متلقي مكالمات توقف القلب. - تحصيل تقارير مرضى توقف القلب شهرياً من قسم التدقيق.

	- متابعة بيانات مرضى توقف القلب في سجلات مستشفى مبارك الكبير.
مدربي الأتصالات	- تحصيل الشهادة الإلكترونية لخدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ ".على الرابط التالي: http://cprlinktolife.com/language - القيام بورش العمل. - متابعة جودة خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ ". عن طريق سماع بعض المكالمات عشوائياً و تعبئة ورقة بيانات ضمان الجودة. ملاحظة: يرجى إرسال نسخة من الشهادة الإلكتروبية إلى الباحثة.[dr.dalal.alhasan@gmail.com]
متلقي مكالمات توقف القلب	- حضور البرنامج التدريبي لخدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ ". - تحصيل الشهادة الإلكترونية لخدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ ". - تلقي مكالمات توقف القلب حسب البرتوكول. - تعبئة استبان لكل مكالمة يتم تلقيها. ملاحظة: يرجى إرسال نسخة من الشهادة الإلكتروبية إلى الباحثة. [dr.dalal.alhasan@gmail.com]

البروتوكول خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ:

- على جميع المدربين و متلقي الاتصالات المرشحين لإتمام البحث العلمي الحصول على الشهادة الإلكترونية لخدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ ".
- لابد من خوض فترة تجريبية قبل تفعيل الفترة الزمنية الاولى خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ "
- لابد من وجود على الأقل متلقي مكالمات مدرب 1 في كل مناوبه.
- يستقبل متلقي مكالمات مدرب جميع حالات توقف القلب وفقاً لهذا البرتوكول.
- في حال إنشغال أو عدم تواجد متلقي المكالمة المدرب على "الإنعاش القلبي بمساعدة مرسل الطوارئ ",على مساعد المشرف الإستجابة لحالة توقف القلب و تطبيق هذا البرتوكول.
- يطبق البوتوكول على مكالمات توقف القلب من منطقة حولي الصحية و بذلك يندرج كل من منطقة: بيان, الرميثية, الزهراء,حطين, حولي, السالمية, مشرف, ضاحية مبارك الجابر, الجابرية, ضاحية صباح السالم, سلوى, ميدان حولي,النقرة , الشعب, البدع.
- يطبق البرتوكول على البالغين فقط.
- يستثنى من تطبيق البرتوكول:
  - الأرضع و الأطفال
  - المرأة الحامل
  - توقف القلب ل جرعة زائدة, إصابة, نزيف, صعقة كهربائية, غرق و الإنتحار.
  - حالات الوفاة المؤكدة: التخشب الموتي , الزرقاء الرمية وانفصال الجسد عن الجسم و التفحم.

- لابد على متلقي المكالمة إدخال بيانات الموقع و الهاتف (Case Entry)قبل الشروع في اخذ بيانات الشكوى و اعطاء اي توجيهات.
- يطبق البرتوكول على اي شكوى من شكاوي المتصل الآتية: عدم استجابة, توقف التنفس الطبيعي,التنفس الإحتضاري,فقدان الوعي.
- على متلقي مكالمة توقف القلب ان يرسل "Red Code" و تفاصيل المكالمة لمرسلي الإسعاف بمجرد كتابة الشكوى الأساسية و قبل تاكيد الحالة أو إعطاء اي توجيهات للإنعاش القلبي. و بذلك تضمن الطوارئ الطبية عدم تعارض البحث مع الخدمات اليومية المقدمة للعامة.
- يؤكد متلقي الإتصال حالة توقف القلب من المتصل في حالة عدم تأكده و بتوجيه السؤالين الآتيين:
  - "هل توجد اي إجابة استجابة من المريض؟" / "إذا ناديته بصوت عالي اجاوبك او يتحرك؟" => نعم / لا
  - "هل المريض يتنفس بشكل طبيعي؟" / "حط ايدك على صدره يرتفع صدره لي فوق؟.اتنفس؟" / " هل مريض يتنفس نفسك؟" نعم / لا أو وجود التنفس الإحتضاري : و هو صوت شخير.

    *يتم تغيير طريقة السؤال في حالة عدم ادراك المتصل من معنى السؤال

    * يمكن تكرار اي وجه من الاسئلة مرتان فقط.
  - إذا كانت الإجابة ب "لأ" لاي من السؤالين => يحدد وقت التعرف على الحالة _ _: _ _ و يشرع في إعطاء تعليمات الإنعاش القلبي.
- على متلقي المكالمة المختص ب " الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" أن يؤكد حالة توقف القلب خلال دقيقة واحدة من تلقي المكالمة.
- يتم تدوين الفترة الزمنية للمكالمة من بداية الإتصال الى لحظة تحديد حالة توقف القلب من فبل متلقي المكالمة المختص ب " الانعاش القلبي بمساعدة مرسل الطوارئ الطبية"
- يتعين على متلقي المكالمة المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" اعطاء الشروع في اعطاء التعليمات بمجرد التأكد من حالة توقف القلب.
- لا يعطي متلقي المكالمة المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" المتصل مجالاً لرفض تطبيق الإنعاش القلبي.
- الهدف الزمني لأول ضغطة صدر هو دقيقتان من المكالمة.
- في حالة وجود صعوبة في تحريك المريض للوضعية المناسبةز يمكن اعطاء التعليمات و المريض مستلقياً على ظهره إما السرير أو الأريكة فقط.

- يملي متلقي المكالمة المختص ب " الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" استبيان خدمة الإنعاش القلبي بمساعدة مرسل الإسعاف لكل مكالمة توقف القلب يتلقاها حتى في حالات التطبيق الجزئي.

- في حالة عدم نعاون المتصل مع تعليمات متلقي المكالمة المختص ب " الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" يمكن متلقي المكالمة المختص ان يقول "أحتاجك إلى ان تهدأ والبدء في الضغط على صدر المريض أو" سيدتي توقفي عن الصراخ و بدئي بمساعدة المريض"أو "سيدتي الصراخ لن يعود بالنفع الآن. اريدك ان تبدئي بالضغط على الصدر ".

  يتوقف عن إعطاء التعليمات في الحالت التالية:تحدث المريض - تحرك المريض - تنفس المريض بشكل طبيعي- وصول طاقم الإسعاف.

آلية تلقي المكالمة

- يدخل متلقي المكالمة بيانات الموقع و الهاتف (Case Entry) طبقاً لبرنامج ال Pro QA و برتوكول International Academy of Emergency Dispatch version 12.1 - 13 طبقا لإجراءات شعبة الطوارئ قبل الشروع في اخذ بيانات الشكوى و اعطاء اي توجيهات.
- يرسل متلقي مكالمة توقف القلب "Echo" "Red Code" و تفاصيل المكالمة لمرسلي الإسعاف بمجرد كتابة الشكوى الأساسية و قبل تاكيد الحالة أو إعطاء اي توجيهات للإنعاش القلبي.

- في حالة انتماء المكالمة إلى منطقة حولي الصحية و وجود شكوة: عدم استجابة, توقف تنفس, تنفس احتضاري, فقدان الوعي على متلقي المكالمة الأنتقال للخطوة التالية.
- يتم تحويل المكالمة لمتلقي المكالمات المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية"
- في حالة انشغال متلقي المكالمات المختص تحول المكالمة إلى مساعد المشرف المدرب على "الانعاش القلبي بمساعدة مرسل الطوارئ الطبية".
- يأكد متلقي الإتصال المختص حالة توقف القلب من المتصل في حالة عدم تأكده وذلك بتوجيه أحد السؤالين الآتيين او كلاهما:
  - "هل توجد اي إجابة استجابة من المريض؟" / "إذا ناديته بصوت عالي اجاوبك او يتحرك؟" => نعم / لا
  - "هل المريض يتنفس بشكل طبيعي؟" / "حط ايدك على صدره يرتفع صدره لي فوق؟ اتنفس؟" / " هل مريض يتنفس نفسك؟" نعم / لا أو وجود التنفس الإحتضاري : و هو صوت شخير.
- يؤكد متلقي الاتصال المختص من شهود المتصل للحدث اما بشكل مرئي أو سمعي
  - هل كنت متواجد اثناء حدوث الحدث؟/هل سمعت أو رأيت المريض يفقد وعية؟ نعم/ لا
- و بذلك يتمكن متلقي المكالمة المختص ب " الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" من ملئ البيانات التالية من استبيان خدمة الإنعاش القلبي بمساعدة مرسل الإسعاف:
  - ✓ رقم البلاغ.
  - ✓ التاريخ: / / .
  - ✓ الوقت.
  - ✓ اسم المريض.
  - ✓ عمر المتصل. (بشكل تقربي دون توجيه سؤال مباشر)
  - ✓ رقم البطاقة المدنية للمريض. (إن أمكن)
  - ✓ جنسية المتصل: كويتي / غير كويتي. (بشكل تقربي دون توجيه سؤال مباشر)
  - ✓ جنس المتصل: ذكر /أنثى . (بشكل تقربي دون توجيه سؤال مباشر)
  - ✓ شهود المتصل للحدث: نعم/ لا
  - ✓ تأكيد حالة توقف القلب لثبوت شكوى الرئيسية: توقف التنفس / لا يستجيب/ التنفس احتضارية/ شكوى أخرى_______________.
  - ✓ المنطقة.
  - ✓ الموقع :عامة /المنزل.
- يتوجب على متلقي المكالمة المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" الشروع في اعطاء التعليمات في حالة التأكد من توقف القلب للبالغ من منطقة حولي الصحية .
- اعطاء التعليمات للإنعاش القلبي:
- يستفسر متلقي المكالمة المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" عن معرفة المتصل المسبقة بعملية الإنعاش القلبي.
  - هل قمت بإنعاش قلبي من قبل؟/ سويتCPR من قبل؟
- يعطي متلقي المكالمة المختص ب " الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" تعليمات الإنعاش القلبي بحزم لأي فئة عمرية.
- 1. "تم ارسال الإسعاف إليك و هي في الطريق الآن".
- 2. " أريد منك القيام ب الانعاش القلبي الآن. هذا مهم.
- 3. "اترك الهاتف بجانب المريض" أو "وضعني على مكبر الصوت للهاتف".
- 4. إستمع بعناية وسوف اقول لك ما يجب القيام به:

أ) أين المريض الآن؟ ضع المريض على الارض مستلقيا على ظهره.

*في حالة وجود صعوبة في تحريك المريض, يمكن ترك المريض مستلقي على ظهره في الفراش او على الاريكة.

ب) اجلس على ركبتيك بجانب صدر المريض.

ج) ضع راحة احدى يديك في وسط صدر المريض.

د) وضع يدك الأخرى فوق تلك اليد.

ه) افرد كوع يديك و اضغط على الصدر بشده إلى الأسفل .

و) اضغط بشدة و لمسافة خمسة سنتيمتر

ز) استمر في الضغط و سأعد معك واحد اثنان ثلاثة.........

ط) أنت تبلي بلاء حسنا، والمساعدة على الطريق وسأبقى على الهاتف معك.
ي) هدف ل100 ضغط / دقيقة. لن اتركك حتى يأتي طاقم الإسعاف.

- يبقى متلقي المكالمة المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" *حتى قدوم طاقم الإسعاف ثم يغلق الهاتف.*
- *يملي* متلقي المكالمة المختص ب" الانعاش القلبي بمساعدة مرسل الطوارئ الطبية" البيانات التالية:
-
- معرفة المتصل السابقة لعملية الإنعاش القلبي: نعم /لا.
- تم إعطاء تعليمات تغيير وضعية المريض ؟ نعم /لا.
- تم إعطاء تعليمات الأنعاش القلبي؟ نعم /لا.
- تم الضغط على الصدر؟ نعم /لا.
- الحواجز التي تحول دون تطبيق الانعاش القلبي ؟ (رفض المتصل- انقطاع المكالمة- عدم القدرة على تحريك المريض- حاجز لغوي- وصول طاقم الإسعاف- توقف القلب بسبب: غرق,جرعة زائدة,صدمة كهربائية,جراحي- المكالمة غيرواضحة- أخرى).
- مقاييس الوقت لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ ":
  - وقت المكالمة: __ / __ صباحا مساء.
  - وقت التأكد من حالة توقف القلب: __ / __ صباحا مساء.
  - وقت اعطاء التعليمات للإنعاش القلبي: __ / __ صباحا مساء.
  - وقت اول ضغطة على الصدر: __ / __ صباحا مساء.
  - الوقت الكلي للمكالمة: __ / __ صباحا مساء.

- التسلسل الرقمي لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ " _ _ _ _

- التوقيع لمتلقي المالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ.

- في حال عدم وجود المتصل بمشهد الحدث. يمكنك طلب هاتف مشهد الحدث.و توجيه التعليمات لشاهد العيان.

<u>نص متلقي المكالمة المدرب على الإنعاش القلبي بمساعدة مرسل الإسعاف لحالات توقف القلب في منطقة حولي الصحية</u>

Case Entry

متلقي المكالمة:خدمة الإسعاف. تفضل.
المتصل:.............
متلقي المكالمة: هل ممكن أن تعطيني عنوان الحالة الطارئ؟ (منطقة حولي الصحية)
المتصل:............
متلقي المكالمة:ممكن أن تعطيني رقم الهاتف؟(فقط إن لم يكن ظاهراً)
المتصل:.............
متلقي المكالمة:قل لي ما الذي حدث بالضبط؟
المتصل: فقدان وعي؟ عدم إستجابة؟ توقف التنفس ؟ التنفس الإحتضاري؟
متلقي المكالمة: ("Echo" "Red Code" و تفاصيل المكالمة لمرسلي الإسعاف بمجرد كتابة الشكوى الأساسية)

تم التأكد من
توقف القلب للبالغ

من منطقة حولي
الصحية

الوقت:__:__.

(الهدف 1 دقيقة)

متلقي المكالمة: هل توجد اي إجابة استجابة من المريض؟" / "إذا ناديته بصوت عالي اجاويك او يتحرك؟" * => نعم / لا (لا أدري تصنف ب لا)

المتصل: لا أ دري.

متلقي المكالمة: هل المريض يتنفس بشكل طبيعي؟" / "حط ايدك على صدره
يرتفع صدره لي فوق؟.اتنفس؟" / " هل مريض يتنفس
نفسك؟"=> نعم / لا (لا أدري تصنف ب لا)
أو يتنفس بشكل غريب *
(وجود التنفس الإحتضاري : و هو صوت شخير)

المتصل: لاأدري.

متلقي المكالمة:هل كنت متواجد اثناء حدوث الحدث؟/هل سمعت أو رأيت المريض يفقد وعية؟
=> نعم/ لا *

المتصل: نعم .

اعطاء التعليمات للإنعاش القلبي

الوقت لأول ضغطة:__:__.

(الهدف 2 دقيقة)

متلقي المكالمة: هل قمت بإنعاش قلبي من قبل؟/ سويتCPR من قبل؟

المتصل: لا

متلقي المكالمة: تم ارسال الإسعاف إليك و هي في الطريق الآن. أريد منك القيام ب الانعاش القلبي الآن. هذا مهم.

المتصل: هه كيف؟

متلقي المكالمة: اترك الهاتف بجانب المريض" أو "وضعني على مكبر الصوت للهاتف

المتصل : حسناً.

متلقي المكالمة: إستمع بعناية وسوف اقول لك ما يجب القيام به. أين المريض الآن؟

المتصل : على الأرض.

متلقي المكالمة: ضع المريض على الارض مستلقيا على ظهره.*

المتصل : حسناً.

متلقي المكالمة: اجلس على ركبتيك بجانب صدر المريض.

المتصل : حسناً.

متلقي المكالمة: ضع راحة احدى يديك في وسط صدر المريض.

المتصل : حسناً.

متلقي المكالمة: وضع يدك الأخرى فوق تلك اليد.

المتصل : حسناً.

متلقي المكالمة: افرد كوع يديك و اضغط على الصدر بشده إلى الأسفل .

المتصل : حسناً.

متلقي المكالمة: اضغط بشدة و لمسافة خمسة سنتيمتر. استمر في الضغط و سأعد معك واحد اثنان ثلاثة.........

متلقي المكالمة: أنت تبلي بلاء حسناء، والمساعدة على الطريق وسأبقى على الهاتف معك.

متلقي المكالمة: إستمر.. الهدف ل100 ضغط / دقيقة. لن اتركك حتى يأتي طاقم الإسعاف.

Case Exit

المتصل : جرس الباب...... لابد أنه طاقم الإسعاف.

متلقي الإتصال: دع أحداً يفتح الباب. و إستمر حتى يأتي طاقم الإسعاف عندك.

المتصل : إنهم هنا.

الملاحظات:

1. يمكنك اللجوء إلى الآتي في حالة عدم تعاون المتصل:
- "أحتاجك إلى أن تهدأ والبدء في الضغط على صدر المريض أو
- " سيدتي توقفي عن الصراخ و بدني بمساعدة المريض"أو
- "سيدتي الصراخ لن يعود بالنفع الآن. اريدك ان تبدئي بالضغط على الصدر ".

2. كما هو الحال في النسخة الثالثة عشر لبرنامج ال إي. أم.دي. تلجأ إلى إستخدام الصيغة المرادفة في حال عدم فهم المتصل للصيغة الأولى.
3. لا يكرر السؤال الواحد أكثر من مرتين.
4. لا يعد صوت الشخير تنفساً.
5. في حالة وجود صعوبة في تحريك المريض, يمكن ترك المريض مستلقي على ظهره في الفراش او على الاريكة.
6. يتوجب عليك إعطاء تعليمات الإنعاش القلبي بحزم.
7. تدخل البيانات التالية في الإستبيان بشكل تقريبي و دون سؤال المتصل: جنس المتصل + عمر المتصل+ جنسية المتصل(كويتي أو غير كويتي) .
8. في حال عدم وجود المتصل بمشهد الحدث. يمكنك طلب هاتف مشهد الحدث.و توجيه التعليمات لشاهد العيان .
9. يمنكك إعطاء التوجيهات لاي فئه عمرية.
10. في حال حدوث الحدث في مكان عام يمكن الطلب من المتصل أن يدعو شخص لإحضار جهاز الصدم, تشغيلة ثم إتباع تعليمات الجهاز.

آلية ضمان جودة خدمة "الإنعاش القلبي بمساعدة مرسل الطوارئ :

- على الباحثة و مدربي الأتصالات الإشراف على "الإنعاش القلبي بمساعدة مرسل الطوارئ" في الفترة التجريبية و مناقشة أي صعوبات في تفعيل الخدمة.
- على متلقي مكالمة المختصين في خدمة الإنعاش القلبي بمساعدة مرسل الطوارئ ايداع الإستبيانات في الظرف المخصص في شعبة الطوارئ لكل مكالمة يومياً.
- تجمع الباحثة الإستبيانات الإنعاش القلبي بمساعدة مرسل الطوارئ المودعة في الظرف المخصص في شعبة الطوارئ بشكل شهري .
- على مدربي الإتصالات الإستماع لبعض المكالمات عشوائياً و تعبئة ورقة بيانات ضمان الجودة التالية في كل شهر بعد تفعيل "الإنعاش القلبي بمساعدة مرسل الطوارئ" .
- على مدربي الاتصال تسليم استبيانات ضمان الجودة للباحثة بشكل شهري.

إستبيان ضمان الجودة

تقييم متلقي المكالمة المختص في خدمة الإنعاش القلبي بمساعدة مرسل الطوارئ	الأداء	
هل تمكن من التعرف و تأكيد حالة توقف القلب؟	نعم	لا
هل تمكن من التعرف على حالة توقف القلب خلال دقيقة واحدة؟	نعم	لا
هل تمكن من التعرف على التنفس الإحتضاري(إن وجد) ؟	نعم	لا
هل تمكن من إعطاء التعليمات حسب البرتوكول؟	نعم	لا
هل تمكن من إعطاء التعليمات خلال دقيقتين من المكالمة.	نعم	لا
الحالة صعبة	نعم	لا
لماذا تم تقييم الحالة على أنها صعبة؟(لم يتمكن من التعرف على توقف القلب او إعطاء التعليمات)	و ذلك لوجود: o حاجز اللغة o غرق o السكتة القلبية الصدمة o انخفاض حرارة الجسم o القتل بالكهرباء o الخنق o المريض على جهاز التنفس الصناعي o وكان المواطن العاطفي جدا o تم قطع المكالمة الهاتفية o كانت مكالمة هاتفية غير واضحة o آخرى: ______	

- كيف يمكن من تحسين اداء متلقي المكالمة المتخصص في خدمة الإنعاش القلبي بمساعدة مرسل الطوارئ ؟

____

____

____

- التسلسل الرقمي للمكالمة : _ _ _ _

- التوقيع مدرب الاتصالات: ______________________

استبيان حالة توقف القلب خدمة الإنعاش القلبي بمساعدة مرسل الطوارئ

رقم البلاغ: _ _

التاريخ: _ / _ / _ . الوقت:- -:- - صباحاً/ مساءً.

اسم المريض:________________________

رقم البطاقة المدنية للمريض: _ _ _ _ _ _ _ _ _ _ _ _

المنطقة: ______________ الموقع: المنزل/ مكان عام

شكوى الرئيسية: توقف التنفس / لا يستجيب/ التنفس احتضاري/ شكوى أخرى_____________.

تأكيد حالة توقف القلب نعم لا الوقت:_ _ :_ _ صباحا/ مساء

بيانات المتصل:

جنسية المتصل: كويتي / غير كويتي. جنس المتصل: ذكر /أنثى .

عمر المتصل: 18-30 30-50 50-70 70+

شهود المتصل للحدث: نعم لا

معرفة المتصل السابقة لعملية الإنعاش القلبي: نعم لا

إعطاء التعليمات

تم إعطاء تعليمات تغيير وضعية المريض ؟ نعم لا

تم إعطاء تعليمات الأنعاش القلبي؟ نعم لا

تم الضغط على الصدر؟ نعم لا

هناك حواجز تحول دون تطبيق الانعاش القلبي ؟ نعم لا

- o رفض المتصل
- o انقطاع المكالمة.
- o وصول طاقم الإسعاف
- o عدم القدرة على تحريك المريض
- o حاجز لغوي
- o توقف القلب بسبب:غرق,جرعة زائدة,صدمة كهربائية,جراحي)
- o المكالمة غيرواضحة
- o أخرى:____________________

- مقاييس الوقت لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ ":
  - وقت المكالمة: _ _ / _ _ صباحا مساء.
  - وقت التأكد من حالة توقف القلب: _ _ / _ _ صباحا مساء.
  - وقت اعطاء التعليمات للإنعاش القلبي: _ _ / _ _ صباحا مساء.
  - وقت اول ضغطة على الصدر: _ _ / _ _ صباحا مساء.
  - الوقت الكلي للمكالمة: _ _ / _ _ صباحا مساء.

- التسلسل الرقمي لمتلقي المكالمة : _ _ _ _

- التوقيع لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ؛________________

(Appendix. V) One day- DACPR Intensive course material.

المرفقات:

الإقرار المستنير

المحاضرات

ورش العمل

إقرار مستنير

Informed consent

(للمرضي / للبالغين / كاملي الاهلية / 21 سنة فأكثر)

عنوان الدراسة:

اسم الباحث:

أهداف الدراسة:

- **لك كامل الحرية في المشاركة أو عدم المشاركة في هذا البحث لأن المشاركة اختيارية وليست اجبارية**
- **في حالة الموافقة تتعهد الباحثة بالمحافظة علي الخصوصية وسرية المعلومات وعدم تدوولها خارج إطار البحث ولن يتم كتابة أسماء المشاركين أو ماقد يدل علي شخصياتهم بالبحث.**
- **في حالة الموافقة يمكنك الانسحاب من الدراسة في أي وقت دون إبداء الأسباب.**
- **في حالة الانسحاب من الدراسة أو عدم الموافقة فانة لا يوجد أي ضرر وظيفي عليك.**
- **لا يتضمن هذا البحث أي تجارب طبية او إعطاء ادوية او أخذ عينات حيوية أو إجراء مقابلات او فحوصات للمرضي.**

▪ في حالة الموافقة لا توجد أي مخاطر من المشـــاركين في هذا البحث لأنه مجرد اســـتبيان يتكون من سـؤال وتكون من الإجابة علية حوالي دقيقه وذلك بعد المشاركة في برنامج تدريب لمدة يومياً ولايوجد تسجيل أو تصوير بالبرنامج التدريبي وسيتم الحصول عل بعض الاحصـائيات من سـجلات الاختبارية بإدارة الطوارئ الطبية والســجل المركزي والمعلومات الصــحية قبل وبعد البرنامج التدريبي ودون كتابة أسماء المرضي أو قد يدل علي شخصياتهم.

وترحب الباحثة باي استفسارات قبل وأثناء مشاركتك في البحث.

▪ وضع علامة (√) بالمكان المناسب وكتابة الاسم والتوقيع :

☐ موافق الاسم / التوقيع /

☐ غير موافق الاسم / التوقيع /

كيف سنطبق الإنعاش القلبي بمساعدة مرسل في شعبة الطوارئ؟

متلقي المكالمة: هل قمت بإنعاش قلبي [illegible] (CPR) من قبل؟
المتصل: لا
متلقي المكالمة: تم إرسال الإسعاف إليك و هي في الطريق الآن. أريد منك القيام ب الإنعاش القلبي الآن. [illegible]
المتصل: نعم كيف؟
متلقي المكالمة: أترك الهاتف بجانب المريض" أو "وضعني على مكبر الصوت للهاتف
المتصل: حسناً.
متلقي المكالمة: إستمع بعناية وسوف أقول لك ما يجب القيام به. أين المريض الآن؟
المتصل: على الأرض.
متلقي المكالمة: ضع المريض على الأرض مستلقيا على ظهره.
المتصل: حسناً.
متلقي المكالمة: اجلس على ركبتيك بجانب صدر المريض.
المتصل: حسناً.
متلقي المكالمة: ضع راحة احدى يديك في وسط صدر المريض.
المتصل: حسناً.
متلقي المكالمة: وضع يدك الأخرى فوق تلك اليد.
المتصل: حسناً.
متلقي المكالمة: افرد ذراعيك و اضغط على الصدر بشدة إلى الأسفل.
المتصل: حسناً.
متلقي المكالمة: اضغط بشدة و بسرعة خمسة سنتيمتر [illegible] في الضغط
و ساعد معك واحد اثنان ثلاثة ......
متلقي المكالمة: أنت تبلي بلاءً حسناً والمساعدة على الطريق وسأبقى على الهاتف معك.
متلقي المكالمة: إستمر... الهدف ل100 ضغطة / دقيقة. أن تواصل حتى يأتي طاقم الإسعاف.

إعطاء التعليمات للإنعاش القلبي
الوقت لأول ضغطتين [illegible]
(الهدف 2 دقائق)

كيف سنطبق الإنعاش القلبي بمساعدة مرسل في شعبة الطوارئ؟

متلقي المكالمة: هل توجد اي إجابة استجابة من المريض؟" / "إذا ناديته بصوت عالي اجاوبك او يتحرك؟" *
=> نعم / لا (لا أدري تصنف ب لا)
المتصل: لا أدري.
متلقي المكالمة: هل المريض يتنفس بشكل طبيعي؟" / "حط اذنك على صدره ويرتفع صدره لفي فوق؟
إتنفس؟" / " هل مريض يتنفس نفسك؟" => نعم / لا (لا أدري تصنف ب لا)
أو يتنفس بشكل غريب (وجود التنفس الإحتضاري : و هو صوت شخير)
المتصل: لاأدري.
متلقي المكالمة: هل كنت متواجد اثناء حدوث الحدث؟/هل سمعت أو رأيت المريض يفقد وعية؟ => نعم/ لا
المتصل: نعم.

تم التأكد من حالة توقف القلب
الهدف دقيقة

متى نتوقف عن تطبيق الإنعاش القلبي بمساعدة مرسل؟

- تحدث المريض - تحرك المريض - تنفس المريض بشكل طبيعي- وصول طاقم الإسعاف- تواجد شخص من الطاقم الطبي(طبيب أو ممرض).
- العلم بوجود مسبب لتوقف القلب مثل: جرعة زائدة, إصابة, نزيف, صعقة كهربائية, غرق و الإنتحار.
- دلائل على الوفاة المؤكده مثل الرمية الزرقاء أو التخشب.

كيف سنطبق الإنعاش القلبي بمساعدة مرسل في شعبة الطوارئ؟

المتصل : جرس الباب.... لابد أنه طاقم الإسعاف.
متلقي الإتصال: دع أحداً يفتح الباب. و إستمر حتى يأتي طاقم الإسعاف عندك. Case Exit
المتصل : إنهم هنا.

آلية ضمان الجودة

سيتم الإستماع لبعض المكالمات عشوائياً و تعبئة ورقة بيانات ضمان الجودة في كل شهر بعد تفعيل "الإنعاش القلبي بمساعدة مرسل الطوارئ" .

الصعوبات المتوقعة

ممكن أن تتواجد صعوبات في 37% من الحالات فقط

حواجز :
رفض المتصل للتعليمات (6.3%)
ذعر المتصل (6.3%)
تغيير وضعية المصاب (~ 30% الأكثر شيوعاً)
حاجز لغوي. (الأقل شيوعاً)
بعد المتصل عن المصاب(أكثر حدوثاً في حالات الأماكن العامة)
مشكلة في الأتصال (انقطاع الخط ... إلخ)

كيف سنطبق الإنعاش القلبي بمساعدة مرسل في شعبة الطوارئ؟

متلقي المكالمة: هل توجد اي إجابة استجابة من المريض؟" / "إذا ناديته بصوت عالي اجاوبك او يتحرك؟" "
=> نعم / لا (لا أدري تصنف ب لا)
المتصل: لا أدري.
متلقي المكالمة: هل المريض يتنفس بشكل طبيعي؟" / "حط ايدك على صدره ويرتفع صدره لي فوق؟
إتنفس؟" / " هل مريض يتنفس نفسك؟" => نعم / لا (لا أدري تصنف ب لا)
أو يتنفس بشكل غريب (وجود التنفس الإحتضاري : و هو صوت شخير)
المتصل: لاأدري.
متلقي المكالمة: هل كنت متواجد اثناء حدوث الحدث؟/هل سمعت أو رأيت المريض يفقد وعية؟ => نعم/ لا
المتصل: نعم.

كيف سنطبق الإنعاش القلبي بمساعدة مرسل في شعبة الطوارئ؟

كيف سنطبق الإنعاش القلبي بمساعدة مرسل في شعبة الطوارئ؟

المتصل : جرس الباب..... لابد أنه طاقم الإسعاف.
متلقي الإتصال: دع أحداً يفتح الباب. و إستمر حتى يأتي طاقم الإسعاف عندك. Case Exit
المتصل : إنهم هنا.

متى نتوقف عن تطبيق الإنعاش القلبي بمساعدة مرسل؟

- تحدث المريض - تحرك المريض - تنفس المريض بشكل طبيعي- وصول طاقم الإسعاف- تواجد شخص من الطاقم الطبي(طبيب أو ممرض).
- العلم بوجود مسبب لتوقف القلب مثل: جرعة زائدة, إصابة, نزيف, صعقة كهربائية, غرق و الإنتحار.
- دلائل على الوفاة المؤكده مثل الرمية الزرقاء أو التخشب.

الصعوبات المتوقعة

ممكن أن تتواجد صعوبات في 37% من الحالات أشطر حواجز :

رفض المتصل للتعليمات (6.3%)
ذعر المتصل (6.3%)
تغيير وضعية المصاب (~ 30% الأكثر شيوعاً)
حاجز لغوي. (الأقل شيوعاً)
بعد المتصل عن المصاب(أكثر حدوثاً في حالات الأماكن العامة)
مشكلة في الأتصال (انقطاع الخط ... إلخ)

آلية ضمان الجودة

سيتم الإستماع لبعض المكالمات عشوائياً و تعبئة ورقة بيانات ضمان الجودة في كل شهر بعد تفعيل "الإنعاش القلبي بمساعدة مرسل الطوارئ" .

الإنعاش القلبي بمساعدة مرسل الطوارئ الطبية
شعبة الطوارئ
وحدة العمليات
الطوارئ الطبية
وزارة الصحة , الكويت
2017 -2016

التعرف على حالة توقف القلب
ورشة عمل:1
الموقع: غرفة الكمبيوتر

يرجى فتح الرابط التالي:

1. التعرف على حالة توقف القلب:

https://depts.washington.edu/survive/audio/identify-cardiac-arrest.wav

https://www.youtube.com/watch?v=NGNL9LEyuYE&feature=youtu.be

2. التعرف على التنفس الإحتضاري:

https://www.youtube.com/watch?v=wtE3nG_IqMM&feature=youtu.be

https://www.youtube.com/watch?v=nqi_PpJwf38&feature=youtu.be

3. إعطاء تعليمات الإنعش القلبي:

https://depts.washington.edu/survive/audio/chest-compressions.wav

االفترة الزمني: ساعة واحدة فقط.

رابط الشهادة الإلكترونية:

http://www.cprlinktolife.com/language

- يرجى إنهاء المحاضرة الإلكترونية و إرسال الشهادة الإلكترونية في حال الحصول عليها إلى البريد الإلكتروني التالي:
Dr.dalal.alhasan@gmail.com
- يحتاج الرابط: المسمى الوظيفي / مكان العمل/ البريد الإلكتروني.
- الفترة الزمنية: ساعتين.

المتدرب أ:

سيناريو 1:أنت الإبن لرجل يبلغ من العمر 67 سنة سقط على الأرض بشكل مفاجئ. إتصلت ب 211 . -

دور الإبن:

الابن: والدي سقط على الأرض بشكل مفاجئ. هل يمكنك ارسال سيارة الإسعاف؟
المرسل: ما هو العنوان ؟
الابن: السالمية، قطعة 4 شارع بن المغيرة مبنى 25 شقة 5.
المرسل: ما هو رقم الهاتف الذي تتحدث منه؟
الابن: 35262823
المرسل: قل لي بالضبط ماذا حدث؟
الابن: والدي إدخل للتو غرفة المعيشة ثم سقط على الأرض.
على المرسل (إرسال رمز إيكو ونقل تفاصيل المكالمة إلى مرسل الإسعاف): سيارة الإسعاف قادمة. هل يستجيب أبيك لك؟
الابن: ماذا تقصد انه انهار؟
المرسل: إذا قمت بمناداته بإسمه بصوت مرتفع. هل يقول شيئا أو يفتح عينيه؟
الابن: يا أبي، يا أبي لا !!
المرسل: هل يتنفس ؟
الابن: لا !!
المرسل (يسجل المرسل وقت التعرف على حالة توقف القلب) واطلب ما يلي: "هل كمنت متواجداً عندما سقط أباك؟"
الابن: نعم.
المرسل: هل قمت بعملية الإنعاش القلبي من قبل؟
الابن: لا
المرسل: "المساعدة قادمة في الطريق." "أنا أريد منك أن تبدأ عملية الإنعاش القلبي. هذا مهم. "
الابن: ماذا؟ كيف؟
المرسل: "استمع بعناية وسوف اقول لك ما يجب القيام به:"
ضع أباك مستلقياً على ظهره على الأرض.
الابن: طيب هو على الأرض بالفعل،مستلقياً على ظهره.
المرسل: اجلس على ركبتيك بجانب صدر المصاب.
الابن: طيب.

المرسل: ضع راحة يدك في وسط الصدر.
الابن: فعلت ذلك!
المرسل: وضع اليد الأخرى الخاصة بك على تلك اليد.
الابن: طيب.
المرسل : افرد كوع يديك و اضغط على الصدر بشده إلى الأسفل .
الابن: طيب
المرسل: اضغط بشدة و لمسافة خمسة سنتيمتر (يسجل المرسل تسجيل وقت أول ضغطة على الصدر)

الابن: طيب
المرسل :استمر في الضغط و سأعد معك واحد اثنان ثلاثة.........
أنت تبلي بلاء حسنا، والمساعدة على الطريق وسأبقى على الهاتف معك.
الهدف 100 ضغط / دقيقة. لن اتركك حتى يأتي طاقم الإسعاف.

الابن: جرس الباب يرن: لابد أنه طاقم الإسعاف.
المرسل: أرسل احداً لفتح الباب وواصل عملية الإنعاش القلبي.
الابن:أمي تفتح الباب. شكرا لك طاقم الإسعاف هنا.

المتدرب ب:
يستخدم المتدرب (دور متلقي الإتصال) بروتوكول و يملي إستبيان الإنعاش القلبي بمساعدة المرسل.

الفترة الزمنية:
البداية: __ / __
النهاية: __ / __
الزمن الكلي: __ / __

- التسلسل الرقمي لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ" ____

- التوقيع لمتلقي المكالمة المختص ب"الإنعاش القلبي بمساعدة مرسل الطوارئ:____________________

(Appendix. VI) Ethical approval process in the State of Kuwait

STATE OF KUWAIT
MINISTRY OF HEALTH
Asst. Undersecretary
for Medical Service

دولـــة الكويـــت
وزارة الـصحـــــة
الوكيل المساعد لشئون
الخدمات الطبية المساندة

التاريخ : 28-8-2016
الرقـــم : 448

To Whom it May Concern

From: *Ministry of Health – Kuwait*

The Standing Committee for Coordination of Medical Research

To *: :* Dalal Al-Hassan

Study title: Can Dispatcher – Assisted Cardiopulmonary Resuscitation improve Out of Hospital Cardiac Arrest Patients' Outcomes in a Region of Kuwait(#446/2016)

University College **Southampton University / United Kingdom**

The above mentioned Proposal was given an ethical approval by the Committee on its meeting held on Ougust 4,2016

The research will be conducted in Directorate of Emergency Medical Services *and, Kuwait Ministry of Health Hospitals.*

Dr.Jamal M. Al – Harbi
Asst. Undersecretary for
Assistanace Medical Service Affairs
Head, Standing Committee for Coordination of Medical Research

Ministry of Health – State Of Kuwait

Jamal M. Al-Harbi
Asst. Undersecretary for Assistance
Medical Service Affair

P.O.Box : (5) Safat, 13001, State of Kuwait
Fax:(965) 24864325 - Tel.: (965) 24860205

ص.ب: (٥) الصفاة، الرمز البريدي ١٣٠٠١، دولة الكويت
فاكس: ٢٤٨٦٤٣٢٥ – تلفون ٢٤٨٦٠٢٠٥

(Appendix VII) 2013 descriptive analysis (1st February to 31st December 2013)

2013 descriptive analysis (1st February to 31st December 2013)

OHCA cases from the year of 2013 were included because the data were available to the researcher as part of OHCA internal audit Kuwait EMS, audit department.(see table **VII**.1)

Table VII.1. Final internal audit summary for OHCA cases using Kuwait's EMS in 2013.

Data analysis of 357 cardiogenic OHCA cases that activated Kuwait EMS Crude annual incidence	Discussion 8.5 per 100,000
1.Non-modifiable metrics ➢ Most common provinces: Hawali and Al-Asimah. ➢ Mean age: 57 years ➢ Gender: Male ➢ Nationality: Non-Kuwaiti ➢ Medical history: Healthy ➢ Month: December, November	Lower survival among females No recorded data for 39% of PRF
2.Modifiable metrics a. Time metrics - Bystander CPR: 3%	Highest in Hawali Did not improve survival rate but better management of EMS personnel

-Response time: Average = 12 min; mode = 9 min. - Scene time: Average = 34 min; mode = 11 min. b. Interventional metrics -CPR: 51% -Defibrillation: 1.9% - Adrenaline: 1.4% c. Diagnostic metrics - MCL1 device: 8.5%	Despite reasonable time, many cases were reported as rigor mortis (77), and 64 patients died before EMS personnel arrival. 32% cases were managed within 11 min.; correlated to bystander CPR and ECG rhythm. 11% of patients should have received CPR but did not, and 3% received CPR but were in rigor mortis (both in Hawali). In Al-Asimah, 1 of 7 patients lived beyond 24 h. Correct use; asystole (4:5). Use of MCL1 device did not change EMS management plan.
3. Survival Beyond 24 h: .024% Day 0 (1.6%–7.9%) Day 1 (1.1%–2.6%) Day 7 (0.5%–1%) Day 28 (0–0.5%) Day 365 (0%)	There was no statistically significant difference in survival rate between Kuwaitis and non-Kuwaitis.
4.Mortality	

Death on scene: 159 During EMS resuscitation: 106 Within 24 h: 57 Within 1 week: 3 Within 1 month: 1 Within 1 year: 1 Unmatched: 16	Rigor mortis: 77 Dead before EMS personnel arrival: 64 Lividity: 4 Declared dead by doctor on scene: 13 Did not achieve ROSC on scene or at hospital arrival so were considered dead
Conclusion:	The probability of surviving an OHCA in Kuwait is low (2.4%), and this pathology affects Kuwaitis and non-Kuwaitis alike. Kuwait's modifiable metrics are similar to international metrics: male, middle-aged and time of year (except for high occurrence among healthy people). Kuwait's modifiable metrics (e.g. time, intervention and diagnostics) can be enhanced on the basis of this study's recommendations, beginning with those provinces with the highest OHCA rates (i.e. Hawali and Al-Asimah). This should prove highly effective in improving OHCA survival rates.
Recommendation	➢ Create cardiac registry ➢ Augment BLS through refresher course and monitoring ➢ Start with Hawali and then proceed to Al-Asimah. ➢ Commence dispatch-assisted CPR.

Collectively 86 OHCA cases were identified during (2013): 56 from the Hawali province, intervention and 30 from the Farwanya province, control .

Utstein standardized template for reporting outcomes of out-of-hospital cardiac arrest of 2013

Population served	655,516
EMS system	Two-tiered system
OHCA	56

Dispatch	
OHCA recognized	Unknown
CPR instruction given	Unknown

Mean response time	20 min
Resuscitation attempts	42

Exclusion reason	Number of Cases
Non-cardiogenic aetiology	17
Dead before arrival of EMS personnel	34 (rigor mortis)
Pronounced dead on scene	21 (declared dead by General Practitioner on scene)
Unknown	8
Poor documentation (area not written)	26
Paediatric population (<18 years)	0
Total number of cases excluded from the analysis	109

Nationality			
Kuwaiti	48% (27)		
Non-Kuwaiti	51% (29)		
Gender			
Male	75 % (42)		
Female	25% (14)		
Age category	70+ years (std.= .897)		
Pathogenesis	No known primary cause		
Comorbidities	Yes 33% (19)	No 26%(15)	Unknown 39%(22)
Defibrillation time	N/A		

Location	
Home/Public	N/A
Witnessed (public)	N/A
Witnessed	N/A
Bystander CPR	
No	93 %(52)

Targeted temperature manageme nt (TTM)	N/A
BLS/ALS	
ALS	1.8% (1)
BLS	73% (41)

Initial rhythm	
Shockable	0
Non-shockable	16.2% (9)
Unobtainable	83.8% (47)

Patients	ROSC at hospital transfer			Survived events	Survival to 30 days			Neurological outcome at 30 days		
Shockable rhythm witnessed	Yes	No	Unknown 0		Yes	No	Unknown 0	Yes	No	Unknown 0
All EMS-treated arrests			56		12.5 % (7)	87.5%(49)				12.5 % (7)

Figure VII.1 Utstein standardized template for reporting outcomes of out-of-hospital cardiac arrest of-intervention group. OHCA cases in the Hawali province during the observational period of 1 February to 31 December 2013.

Population served	818,571
EMS system	Two-tiered system
OHCA	30

Mean response time	7 min
Resuscitation attempts	29

Initial rhythm	
Shockable	0
Non-shockable	7% (2)
Unobtainable	93% (28)

Location	
Home/Public	Unknown
Witnessed (public)	Unknown
Witnessed	Unknown
Bystander CPR	
No	97.7(29)
Yes	3.3% (1)

Exclusion reason	Number of Cases
Non-cardiogenic aetiology	14
Dead before arrival of EMS personnel	11 (rigor mortis)
Pronounced dead on scene	13 (declared dead by General Practitioner on scene)
Unknown	9
Poor documentation (area not written)	4
Paediatric population (<18 years)	0
Total number of cases excluded from the analysis	51

Nationality	
Kuwaiti	50% (15)
Non-Kuwaiti	50% (15)
Gender	
Male	63.4% (17)
Female	36.6% (11)
Age category	50-70 years in 38%
Pathogenesis	No known primary cause
Comorbidities	Yes 9
Defibrillation time	No
Targeted temperature management (TTM)	Unknown
BLS/ALS	

ALS	0
BLS	29

Outcome

Patients	ROSC at hospital transfer			Survived events	Survival to 30 days			Neurological outcome at 30 days		
Shockable rhythm witnessed	Yes	No	Unknown 0		Yes	No	Unknown 0	Yes	No	Unknown 0
All EMS-treated arrests			30		13% (4)	26				13% (4)

Figure VII. 2 Utstein standardized template for reporting outcomes of out-of-hospital cardiac arrest of control group. OHCA cases in the Farwanya province during the observational period of 1 February to 31 October 2013.

Table VII.2 Out-of-hospital cardiac arrest cases of pre-intervention group. OHCA cases in the Hawali province during the observational period of 1 February to 31 December 2013.

SN	LOCATION Home=1 Public=2 clinic=3	AREA	AGE	SEX Male=1 female=2	MH None=0 one illness=1 more than one=2	Nationality Kw=1 non Kw=2	Dispatch time	RT	Initial rhythm 1=Non shock 2=Shockable	Witnessed witnessed=1 non-witnessed=0	TIME	BLS yes=1 no=0	ALS yes=1 no=0	OUT 1 OHCA recognised yes=1 No=0	OUT2 CPR instruction given yes=1 No=0	OUT3 BCPR yes=1 No=0	OUT 4 ROSC yes=1 No=0	OUT 5 Survival to 30 days yes=1 No=0	DACPR
1	.	1	3	1	.	2	21.13	15	.	.	.	1	0	.	.	0	.	0	0
2	.	2	4	1	.	2	22.58	43	.	.	.	0	0	.	.	0	.	0	0
3	.	1	3	1	.	2	3.53	52	.	.	.	0	0	.	.	0	.	0	0
4	.	3	3	1	0	1	14.07	7	.	.	.	1	0	.	.	0	.	0	0
5	.	4	2	1	.	1	9.32	10	.	.	.	1	0	.	.	0	.	0	0
6	.	2	0	1	0	2	19.08	10	.	.	.	1	0	.	.	0	.	0	0
7	.	5	4	1	2	1	15.3	7	.	.	.	1	0	.	.	0	.	1	0
8	.	1	3	1	2	2	19.33	17	.	.	.	1	0	.	.	0	.	0	0
9	.	1	2	1	.	2	17.52	1.07	.	.	.	1	0	.	.	0	.	0	0
10	.	6	4	1	.	1	12.5	6	.	.	.	1	0	.	.	0	.	0	0
11	.	7	4	2	.	1	9.51	50	.	.	.	0	0	.	.	0	.	0	0
12	.	1	3	1	.	2	10.41	7	.	.	.	1	0	.	.	0	.	1	0
13	.	7	4	1	1	1	17.27	9	1	.	.	1	0	.	.	1	.	0	0
14	.	2	2	2	.	1	10.04	50	.	.	.	0	0	.	.	0	.	0	0
15	.	2	3	1	1	2	7.19	7	1	.	.	1	0	.	.	0	.	0	0
16	.	3	4	2	0	2	2.51	9	1	.	.	1	0	.	.	0	.	0	0
17	.	1	3	2	1	1	13.39	6	.	.	.	0	0	.	.	0	.	0	0
18	.	7	2	1	.	1	16.34	9	.	.	.	0	0	.	.	0	.	0	0
19	.	1	3	1	1	2	7.57	50	.	.	.	0	0	.	.	0	.	0	0
20	.	1	3	1	.	1	0.11	14	.	.	.	1	0	.	.	0	.	0	0
21	.	1	3	1	1	2	11.15	10	1	.	.	0	0	.	.	0	.	0	0
22	.	8	4	1	.	1	3.5	48	.	.	.	1	0	.	.	0	.	0	0
23	.	6	2	1	.	1	19.46	9	.	.	.	1	0	.	.	0	.	0	0
24	.	5	3	1	.	1	18.51	12	.	.	.	0	0	.	.	0	.	0	0
25	.	5	4	1	2	1	21.47	51	.	.	.	1	0	.	.	0	.	0	0
26	.	2	4	1	2	2	14.51	57	.	.	.	1	0	.	.	0	.	0	0

27	.	7	4	1	0	1	5.57	4	.	.	.	0	0	.	.	0	.	0	0
28	.	1	1	1	0	2	0.55	1	.	.	.	1	0	.	.	0	.	1	0
29	.	2	2	1	1	2	20.18	48	.	.	.	1	0	.	.	0	.	1	0
30	.	7	4	1	.	1	5.5	47	.	.	.	0	0	.	.	0	.	0	0
31	.	1	2	1	0	2	16.4	27	.	.	.	1	0	.	.	0	.	0	0
32	.	5	3	2	0	1	14.24	9	.	.	.	0	0	.	.	0	.	0	0
33	.	7	2	1	0	1	1.19	4	.	.	.	1	0	.	.	0	.	0	0
34	.	2	4	1	2	2	7.33	5	1	.	.	1	0	.	.	0	.	0	0
35	.	6	2	1	.	1	3	17	1	.	.	0	0	.	.	0	.	0	0
36	.	5	4	1	1	1	9.49	27	.	.	.	1	0	.	.	0	.	0	0
37	.	7	4	2	2	1	17.28	53	.	.	.	1	0	.	.	0	.	1	0
38	.	9	3	2	1	1	14.47	9	1	.	.	1	0	.	.	0	.	0	0
39	.	2	4	2	.	2	17.16	5	.	.	.	1	0	.	.	0	.	1	0
40	.	2	4	2	0	1	1.32	10	.	.	.	1	0	.	.	0	.	1	0
41	.	2	3	2	0	2	7.4	15	.	.	.	1	0	.	.	0	.	0	0
4	.	5	3	1	2	2	13.52	53	.	.	.	1	0	.	.	0	.	0	0
43	.	6	4	1	0	1	10.12	6	.	.	.	0	0	.	.	0	.	0	0
44	.	3	4	1	.	2	0.29	4	.	.	.	1	0	.	.	0	.	0	0
45	.	10	3	1	1	2	0.58	51	.	.	.	1	0	.	.	0	.	0	0
46	.	2	3	1	0	2	9.4	7	.	.	.	1	0	.	.	0	.	0	0
47	.	11	3	2	2	1	13.53	53	.	.	.	1	0	.	.	0	.	0	0
48	.	2	3	1	0	2	4.49	4	.	.	.	0	0	.	.	0	.	0	0
49	.	3	4	2	2	2	13.43	15	.	.	.	1	0	.	.	0	.	0	0
50	.	3	4	1	0	2	0.48	9	1	.	.	1	1	.	.	0	.	0	0
51	.	2	3	1	0	2	1.33	19	.	.	.	1	0	.	.	0	.	0	0
52	.	10	4	1	.	1	20.24	27	.	.	.	1	0	.	.	0	.	0	0
53	.	2	4	1	.	2	10.1	12	.	.	.	1	0	.	.	0	.	0	0
54	.	1	3	1	.	2	13.38	23	.	.	.	1	0	.	.	1	.	0	0
55	.	7	4	2	.	2	6.19	1	1	.	.	1	0	.	.	1	.	0	0
56	.	10	4	2	2	1	14.33	12	.	.	.	1	0	.	.	1	.	0	0

Moreover, 109 cases were excluded from the analysis. A review of the causes of exclusion revealed poor documentation (26 cases), non-cardiogenic aetiology (17 cases), death before arrival of EMS personnel (34 cases), death on scene (21 cases) and unknown (9 cases).

The Farwanya province had a population of 818,571 in 2013 (Kuwait Central Statistical Bureau 2013; Annual Population Report 2014). There were 81 OHCA incidents in the Farwanya province in 2013, of which 30 were of cardiogenic aetiology. Thus, the incidents of OHCA in the Farwanya province is ~3 cases per month and 1cases per week. Resuscitation attempts were identified in 28 cases, reasons for not resuscitating two OHCA case is not reported. Table **VII**.3 shows the details of each OHCA case.

Table VII.3 out-of-hospital cardiac arrest cases of control group. OHCA cases in the Farwanya province during the observational period of 1 February to 31 October 2013.

SN	LOCATION Home=1 Public=2 clinic=3	AREA	AGE	SEX Male=1 female=2	MH None=0 one illness=1 more than one=2	Nationality Kw=1 non Kw=2	Dispatch time	RT	Initial rhythm 1=Non shock 2=Shockable	Witnessed witnessed=1 non-witnessed=0	TIME	BLS yes=1 no=0	ALS yes=1 no=0	OUT1 OHCA recognised yes=1 No=0	OUT2 CPR instruction given yes=1 No=0	OUT3 BCPR yes=1 No=0	OUT4 ROSC yes=1 No=0	OUT5 Survival to 30 days yes=1 No=0	DA CPR
1	.	2	3	2	2	1	0.45	9	0	.	.	1	0	.	.	0	.	0	0
2	.	2	4	2	.	1	11.55	7	0	.	.	1	0	.	.	0	.	1	0
3	.	21	4	2	1	1	11.52	8	0	.	.	1	0	.	.	0	.	0	0
4	.	2	4	2	.	1	18.18	12	0	.	.	1	0	.	.	0	.	0	0
5	.	2	4	2	.	1	15.38	8	0	.	.	1	0	.	.	0	.	0	0
6	.	2	4	2	0	1	12.49	10	0	.	.	1	0	.	.	0	.	0	0
7	.	2	3	2	0	2	8.21	7	0	.	.	1	0	.	.	0	.	0	0
8	.	1	1	2	0	2	0.45	4	0	.	.	1	0	.	.	0	.	0	0
9	.	1	2	2	1	2	8.42	8	0	.	.	1	0	.	.	0	.	1	0
10	.	1	2	2	0	2	14.15	7	0	.	.	1	0	.	.	0	.	0	0
11	.	2	3	2	.	2	0.15	4	0	.	.	1	0	.	.	0	.	0	0
12	.	10	3	1	0	1	1.55	5	0	.	.	1	0	.	.	0	.	0	0
13	.	2	4	1	2	1	8.32	11	0	.	.	1	0	.	.	0	.	0	0
14	.	8	3	1	.	1	6.05	10	0	.	.	1	0	.	.	0	.	0	0
15	.	5	2	1	.	1	11.46	4	0	.	.	1	0	.	.	0	.	0	0
16	.	5	3	1	2	1	1.16	9	1	.	.	1	0	.	.	0	.	0	0
17	.	8	4	1	0	1	16.41	8	0	.	.	1	0	.	.	0	.	0	0
18	.	5	4	1	2	1	7.45	7	0	.	.	1	0	.	.	0	.	0	0
19	.	10	4	1	2	1	13.16	5	0	.	.	1	0	.	.	0	.	0	0
20	.	1	3	1	.	2	2.32	7	0	.	.	1	0	.	.	0	.	0	0

21	.	2	3	1	.	2	21	9	0	.	.	0	0	.	.	0	.	0	0
22	.	1	3	1	1	2	9.15	6	0	.	.	1	0	.	.	0	.	1	0
23	.	20	3	1	.	2	22.39	2	1	.	.	1	0	.	.	0	.	0	0
24	.	22	3	1	.	2	18.28	10	0	.	.	1	0	.	.	0	.	0	0
25	.	1	2	1	.	2	22.05	1	0	.	.	1	0	.	.	0	.	0	0
26	.	1	.	1	0	2	2.3	8	0	.	.	1	0	.	.	0	.	0	0
27	.	2	2	1	2	2	22.1	9	0	.	.	1	0	.	.	1	.	0	0
28	.	2	2	1	2	2	0.12	2	0	.	.	1	0	.	.	0	.	1	0
29	.	20	2	1	0	1	23.06	7	0	.	.	1	0	.	.	0	.	0	0
30	.	1	2	1	0	2	9.15	7	0	.	.	1	0	.	.	0	.	0	0

Appendix VIII. Out-of-hospital cardiac arrest cases of the retrospective period, pre-intervention group one. OHCA cases in the Hawali province during the observational period of 1 February to 31 October 2016.

Table of Out-of-hospital cardiac arrest cases of the second retrospective period, pre-intervention group one. OHCA cases in the Hawali province during the observational period of 1st January to 31 October 2016.

SN	CODE	caller: Civilian =1 Health professional=2 others =3	Caller Nationality Kw =1 NonKw =2	caller gender Male=1 Female=2	LOCATION Home=1 Public=2 clinic =3	AREA	AGE	SEX Male =1 female =2	MH None =0 one illness =1 more than one =2	Nationality Kw =1 nonKw =2	Dispatch time	RT	Initial rhythm 1= Non shock 2= Shockable	Witnessed witnessed =1 non-witnessed =0	TIME	BLS yes =1 no =0	ALS yes =1 no =0	OUT1 OHCA recognised yes=1 No =0	OUT2 CPR instruction given yes=1 No=0	OUT3 BCPR yes =1 No =0	OUT4 ROSC yes =1 No =0	OUT5 Survival to 30 days yes =1 No =0	DACPR
1	2	1	1	2	1	12	4	1	1	1	18.1	9	1	0	.	1	0	1	0	0	0	0	0
2	1	1	1	1	1	13	4	1	.	1	7.72	4	.	0	4	1	0	0	0	0	0	0	0
3	5	1	1	2	1	5	2	1	0	1	5.15	9	.	1	10	1	0	0	0	0	0	0	0
4	5	1	1	1	1	5	3	2	2	1	18.13	7	.	0	.	1	0	0	0	0	0	1	0
5	5	1	1	2	1	5	4	2	2	2	15.25	13	.	0	15	1	0	0	0	0	0	0	0
6	37	1	1	1	2	7	3	1	1	1	21.37	9	1	.	10	1	0	0	0	0	0	0	0
7	1	1	1	1	1	7	3	2	2	1	9.45	5	.	1	7	1	0	0	0	1	0	0	0
8	6	1	1	1	1	12	.	2	1	1	3.16	15	.	0	.	1	0	0	0	0	0	0	0
9	9	1	1	1	1	7	4	1	.	1	20.3	10	1	0	9	1	0	1	1	0	0	0	0

10	1	1	1	1	1	7	3	1	.	2	13.06	8	.	0	.	1	0	0	0	0	0	0	0
11	5	1	1	2	1	5	4	1	.	1	14.14	10	.	0	10	1	0	0	0	0	0	0	0
12	3	1	1	1	1	7	4	1	2	1	2.06	8	.	0	8	1	0	0	0	0	0	0	0
13	22	1	1	2	1	7	3	1	2	1	19.52	10	.	0	8	1	0	0	0	0	0	0	0
14	5	1	1	2	1	7	4	2	2	2	22.37	10	.	0	.	1	0	0	0	0	0	1	0
15	10	1	1	1	1	7	4	1	.	1	18.26	5	.	.	.	1	0	1	1	0	0	0	0
16	22	1	1	1	1	5	4	1	.	1	12.19	9	.	0	.	1	0	0	0	0	0	0	0
17	1	1	1	1	1	12	3	2	2	1	14.21	7	.	0	7	1	0	1	1	0	0	0	0
18	1	1	1	1	1	7	4	1	.	1	23.34	6	.	.	.	1	0	0	0	0	0	1	0
19	3	1	1	1	1	9	3	1	1	1	1.08	12	.	.	12	1	0	0	0	0	0	1	0
20	3	1	1	1	1	9	4	2	2	1	12.08	9	1	1	.	1	0	1	0	0	1	0	0
21	5	1	1	1	1	7	4	1	2	1	18.36	8	.	1	.	1	0	0	0	1	0	1	0
22	1	1	1	1	1	5	4	2	2	1	23.49	9	1	0	.	1	0	0	0	0	0	1	0
23	3	1	1	2	1	7	4	1	2	1	13.4	11	.	0	.	1	0	0	0	1	0	1	0
24	1	1	1	1	1	3	3	2	1	1	13.02	8	.	0	8	1	0	0	0	0	0	0	0

(Appendix IX.) Table of OHCA cases of the second retrospective period, control group one. OHCA cases in the Farwanya province during the observational period of 1 February to 31 October 2016.

Table of OHCA cases of pre-intervention period, control group one. OHCA cases in the Farwanya province during the observational period of 1st January to 31 October 2016.

SN	CODE	caller: Civilian=1 Health professional=2 others=3	Caller Nationality Kw=1 Non Kw=2	caller gender Male=1 Female=2	LOCATION Home=1 Public=2 clinic=3	AREA	AGE	SEX Male=1 female=2	MH None=0 one illness=1 more than one=2	Nationality Kw=1 nonKw=2	Dispatch time	RT	Initial rhythm 1=Non shockable 2=Shockable	Witnessed witnessed=1 non-witnessed=0	TIME	BLS yes=1 no=0	ALS yes=1 no=0	OUT1 OHCA recognised yes=1 No=0	OUT2 CPR instruction given yes=1 No=0	OUT3 BCPR yes=1 No=0	OUT4 ROSC yes=1 No=0	OUT5 Survival to 30 days yes=1 No=0	DACPR
1	5	1	2	1	1	3	2	1	0	2	22.14	6	1	0	7	1	0	0	0	0	0	0	0
2	2	1	2	1	2	3	3	1	2	2	16.47	7	1	0	.	1	0	1	0	0	0	0	0
3	3	1	1	1	1	4	4	2	.	1	12.5	2	1	0	0	1	0	1	0	1	0	0	0
4	11	1	2	1	1	1	3	1	.	2	9.37	9	1	0	.	1	0	0	0	0	0	0	0
5	3	1	1	2	1	14	4	2	0	1	20.41	5	.	0	5	1	0	1	1	0	0	1	0
6	5	1	2	1	1	2	3	1	1	2	17.53	5	1	0	6	1	0	0	0	0	0	0	0
7	1	1	1	2	1	8	3	1	1	1	1.31	9	1	0	.	1	0	0	0	0	0	0	0
8	5	1	2	1	1	1	2	1	2	2	0.28	10	1	0	.	1	0	0	0	0	0	0	0
9	1	1	2	.	1	1	2	1	1	2	12.4	8	.	0	9	1	0	0	0	0	0	1	0

19	5	1	1	1	1	5	3	1	2	1	15.45	6	.	0	7	1	0	1	1	0	0	0	0
11	5	1	1	1	1	2	4	1	1	1	10.5	6	1	1	.	1	0	0	0	0	0	1	0
12	1				2	8	2	1	.	2	13.24	4	1	.	.	1	1	0	0	0	0	0	0
13	5	1	1	2	1	2	4	2	2	1	0.53	7	.	0	.	1	0	0	0	0	0	0	0
14	5	1	1	2	1	2	3	1	2	2	4.42	5	.	0	5	1	1	0	0	0	0	1	0
15	1	1	1	1	1	1	2	1	1	2	8.11	4	.	1	.	1	1	0	0	0	0	1	0
16	5	1	2	1	1	1	2	1	0	2	5.4	9	.	0	.	1	1	0	0	0	0	1	0
17	5	1	2	1	1	4	3	1	0	2	21.19	4	1	0	4	1	0	0	0	0	0	0	0
18	2	1	1	1	1	1	3	1	0	2	8.48	8	.	0	.	1	0	1	0	0	0	1	0
19	3	1	1	1	1	2	4	1	2	2	3.26	6	1	0	.	1	0	1	1	0	0	0	0
20	5	1	1	1	2	1	3	1	0	2	17.15	1	.	0	1	1	0	0	0	0	0	0	0
21	3	1	2	1	1	1	3	1	0	2	2.29	8	.	0	8	1	0	1	1	0	0	0	0
22	5	1	2	1	1	1	3	1	0	2	3.09	9	.	0	.	1	0	0	0	0	0	0	0
23	5	1	2	1	1	1	4	1	3	2	16.08	7	1	0	8	1	1	0	0	0	0	0	0
24	22	1	1	2	1	13	2	1	2	1	0.08	12	.	0	9	1	0	0	0	0	0	0	0
25	5	1	1	1	1	13	4	1	0	2	2.12	19	.	0	20	1	0	0	0	0	0	1	0
26	1	1	2	1	1	2	2	1	.	2	22.05	10	1	0	11	1	0	0	0	0	0	0	0
27	5	1	2	1	1	2	2	1	1	2	0.39	7	.	0	46	1	0	0	0	0	0	0	0
28	7	1	2	1	1	1	2	1	.	2	5.57	13	.	0	13	1	0	1	0	1	0	1	0

29	5	1	2	1	1	1	3	1	1	2	15.3	8	1	1	.	1	1	0	0	0	0	0	0
30	5	1	2	1	1	2	4	1	2	2	21.21	9	1	.	10	1	0	0	0	0	0	0	0
31	5	1	2	1	1	1	2	1	.	2	21.16	12	1	0	13	1	0	0	0	0	0	0	0
32	1	1	2	1	1	3	2	1	1	2	7.13	20	.	0	22	1	0	0	0	0	0	0	0
33	22	1	2	2	1	1	2	1	1	2	7.21	18	.	0	18	1	0	0	0	0	0	0	0
34	8	1	1	1	1	3	3	1	.	2	1.16	5	.	0	5	1	0	0	0	0	0	0	0
35	5	1	2	1	1	3	2	1	.	2	13.46	4	.	0	.	1	0	0	0	0	0	0	0
36	5	1	2	1	1	3	3	1	1	2	18.15	20	.	0	.	1	1	0	0	0	0	0	0
37	4	1	1	1	1	14	4	2	2	1	19.15	9	.	0	10	1	0	0	0	0	0	0	0
38	21	1	2	1	1	3	3	1	.	2	19.28	20	.	0	21	1	0	0	0	0	0	0	0
39	24	1	2	2	2	5	3	1	0	2	9.12	10	.	0	.	1	0	0	0	0	0	0	0
40	25	1	2	1	1	3	3	1	.	2	22.48	24	.	0	24	1	0	0	0	0	0	0	0
41	5	1	2	1	1	1	2	1	1	2	1.22	7	.	0	.	1	0	0	0	0	0	0	0
42	5	1	2	1	2	3	2	1	1	2	0.38	6	.	0	.	1	0	0	0	1	0	1	0
43	5	1	2	1	1	2	2	1	.	2	23.49	13	1	1	14	1	0	0	0	0	0	0	0
44	9	1	1	1	1	3	3	1	.	2	2.23	15	.	0	17	1	0	1	1	0	0	0	0
45	5	1	1	1	1	1	4	2	2	1	9.51	3	.	0	4	1	0	0	0	0	0	0	0
46	7	1	2	2	1	2	4	1	1	2	8.17	4	1	0	0	1	0	1	1	1	0	0	0

47	9	1	2	1	2	17	2	1	0	2	6.13	5	1	0	.	1	0	1	1	0	0	0	0
48	5	1	2	1	2	3	2	1	0	2	6	8	.	0	8	1	0	0	0	0	0	0	0
49	11	1	2	1	1	18	3	1	1	2	6.03	8	.	1	.	1	0	0	0	0	1	0	0
50	11	1	1	1	2	1	2	2	.	1	13	7	.	1	.	1	0	0	0	0	0	0	0
51	4	1	1	2	1	13	4	2	2	1	23.03	9	.	0	.	1	0	0	0	0	0	0	0
52	1	1	1	1	1	13	4	2	1	1	8.41	9	.	1	9	1	0	0	0	0	0	0	0
53	2	1	1	1	2	19	2	1	0	2	6.02	4	1	0	.	1	0	1	0	0	0	0	0
54	3	1	2	1	1	2	2	2	1	2	2.37	8	.	0	.	1	0	0	0	0	0	0	0
55	1	1	2	1	1	6	0	2	.	1	1.24	8	.	0	8	1	0	0	0	0	0	0	0
56	1	1	1	1	1	6	4	1	2	1	12.42	13	1	0	.	1	1	0	0	0	0	0	0

Appendix X. descriptive analysis of the pre-intervention period: pre-intervention group and control group one (1 January – 31 April 2017)

Descriptive analysis of the pre-intervention period: pre-intervention group and control group one (1 January – 31 April 2017)

In the pre-intervention period from 1 January to 31 October 2016, 80 OHCA cases were identified: 24 in Hawali Province represented the pre-intervention group one, and 56 in Al-Farwanya Province represented control group one. These cases were retrieved from the archival data in the EMS Audit Department and then matched with the registry's record of deaths during the period from 1 January to 31 April 2017**.** The methods used to extract the data for this period are discussed in Chapter 4, p.100-101.

X.2.1 Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest

Figure X.1 shows the number of OHCA cases in Hawali Province during the observational period from 1 January to 31 October 2016. Figure 5.2 shows the number of OHCA cases in Al-Farwanya Province during the observational period from 1 January to 31 October 2016.

Population served	939,507
EMS system	Two-tiered system
OHCA	24

Dispatch	
OHCA recognised	20% (5)
CPR instruction	12% (3)

Mean response time	8 min
Resuscitation attempts	24

Location	
Home/Public	Home 96% (23) Public 4.2% (1)

Witnessed (public)	
Witnessed	16.7% (4)
No	66% (16)
Bystander CPR	
No	87% (21)
Yes	12% (3)

Initial rhythm	
Shockable	0
Non-shockable	21% (5)
Unobtainable	79% (19)

Exclusion reason	Number of Cases
Non-cardiogenic aetiology	2
Dead before arrival of EMS personnel	6 (rigor mortis)
Pronounced dead on scene	5 (declared dead by General Practitioner on scene)
Unknown	0
Poor documentation (area not written)	0
Paediatric population (<16 years)	0
Total number of OHCA cases excluded from the analysis	13

Nationality	
Kuwaiti	87.5% (21)
Non-Kuwaiti	12.5% (3)
Gender	
Male	63% (15)
Female	38% (9)

Age	70+ years (58%)		
Pathogenesis	No known primary cause		
Comorbidities	Yes 16	No 1	Unknown 7
Defibrillation time	No		
Targeted temperature management (TTM)	Unknown		
BLS/ALS			
ALS	0		
BLS	24		

Patients	ROSC at hospital transfer			Survived events	Survival-to 30 days			Neurological outcome to 30 days		
Shockable rhythm witnessed	Yes	No	Unknown 0		Yes	No	Unknown 0	Yes	No	Unknown 0
All EMS-treated arrests	4.2 % (1)	0		4.2% (1)		71% (17)	29% (7)			29% (7)

Outcome

Figure X.1 Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest of the retrospective period, pre-intervention group one. OHCA cases in the Hawali Province during the observational period of 1 January to 31 October 2016.

Population served	1,169,302
EMS system	Two-tiered system
Out of Hospital Cardiac arrest	56

Dispatch	
OHCA recognised	21% (12)
CPR instruction given	13% (7)

Mean response time	8 min
Resuscitation attempts	56

Location	
Home/ Public	Home 84% (47) Public 16% (9)

Initial rhythm	
Shockable	0
Non-shockable	37% (21)
Unobtainable	63% (35)

Witnessed Non-witnessed	13%(7) 87%(47)
Bystander CPR	
No	93%(52)
Yes	7% (4)

Exclusion reason	Number
Non-cardiogenic aetiology	0
Dead before arrival of EMS personnel	4 (rigor mortis)
Pronounced dead on scene	12 (declared dead by General Practitioner on scene)
Unknown	1
Poor documentation (area not written)	0
Paediatric population (<16 years)	0
Total number of OHCA cases excluded from the analysis	17

Nationality	
Kuwaiti	25% (14)
Non-Kuwaiti	75% (42)
Gender	
Male	82% (46)
Female	18 % (10)
Age category	30–50 years (39%) 50-70 years (34%)
Pathogenesis	No known primary cause
Comorbidities	Yes 53%
Defibrillation time	No
Targeted temperature management (TTM)	Unknown
BLS/ALS	
ALS	14.3% (8)
BLS	100% (56)

Patients	ROSC at hospital transfer			Survived events	Survival-to 30 days			Neurological outcome to 30 days		
Shockable rhythm witnessed	Yes	No	Unknown 0		Yes	No	Unknown 0	Yes	No	Unknown 0
All EMS-treated arrests	1.8% (1)	55			17.9 % (10)	46				17.9% (10)

Figure X.2 Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest in the retrospective period, control group one. OHCA cases in Al-Farwanya Province during the observational period of 1 January – 31 October 2016.

Table X.1. Summary of the results of pre-intervention period: pre-intervention group and control group one (1 February to 31October 2016)

Domains (elements) 2016	**Hawali pre-intervention group 1Jan – 31 Oct 2016**	**Al-Farwanya control group one 1 Jan – 31 Oct 2016**
1.System		
Population served	939,507	1,169,302
EMS system	Two-tiered system	Two-tiered system
Total number of OHCAs	37	73
OHCA incidence per month	3	6
Excluded	13	17
Included	24	56
Resuscitation attempts	24	56
Area with highest incidence of OHCA	Subah Al-salem	Al-Farwanya
Peak time of OHCA	12.00-15.59 hrs	0.00-3.59 hrs
2. Dispatch-assisted CPR:		
a. OHCA Recognition Rate (%)	5 (20.5)	12 (21)
b. CPR instruction Rate(%)	3 (12)	7(13)
c.Percentage of recognised OHCA's that received CPR instructions	60%	58%
d. Bystander Demographic		
i. Caller	100% civilians	98% civilians
ii. Gender	78% males	80% males
ii. Nationality	100% Kuwaiti	40% Kuwaiti's
3. Patient variables		
a. Age (category)	70+ years (58%)	30-50 years (39%)
b. Gender(%)		
i. Male	15 (63)	46(82)
ii. Female	9 (37)	10(18)
c. Nationality(%)		

Domains (elements) 2016	Hawali pre-intervention group 1Jan – 31 Oct 2016	Al-Farwanya control group one 1 Jan – 31 Oct 2016
i. Kuwaiti	21(87.5)	14(25)
ii. Non-Kuwaiti	3 12.5)	42(75)
d. Comorbidities(%)	16(62)	30(53)
e. Location (%)		
i. Home	23(96)	47(84)
ii. Public	1(4.2)	9(16)
f. Witnessed	4(17)	7(13)
ii. Non-witnessed	16 (66)	47(87)
g. ECG rhythm (%)		
i. Shockable	0	0
ii. Non-shockable	5 (21)	21 (37)
iii. Unobtainable	19 (79)	63% (35)
4.Resuscitation Factors		
a. Response Time (mean)	8 min	8min
c. Defibrillation time	N/A	N/A
d. BLS (CPR+ defibrillation) (%)	24 (100)	56(100)
e. ALS (CPR+ defibrillation adrenaline) (%)	0	8 (14.3)
f. Targeted temperature management (TTM)	N/A	N/A
4. Outcomes		
a. Bystander CPR rate (%)	3(12)	4(7)
b. Return of spontaneous circulation (%)	1(4.2)	1(1.7)
c. Survival event (%)	1(4.2)	1(1.7)
d. Survival-to 30 days(%)	7 (29)	10 (21)

X.1 Dispatch during 2016

In 2016, Kuwait's EMS implemented Emergency Medical Priority Dispatch Version 12.1 was revised to include all call-taking processes. The call takers did not take any specific training except that required for the Emergency Medical Dispatch (EMD) licence. Pre-intervention OHCA dispatch electronic records were collected for the retrospective period (1 January – 31 October 2016) to identify the following:

i. OHCA recognition

The results for the pre-intervention group were as follows: the recognised OHCA cases were (5), not recognised OHCA cases (19), incorrectly recognised OHCAs could not be estimated. This makes the overall all pre-intervention group OHCA recognition rate 20% (5) (95% CI ; .03-.38), std. error = .085, the false negative =79% .

The results for control group one were as follows: the recognised OHCA cases were (12), not recognised OHCA cases (44), incorrectly recognised OHCAs could not be estimated. This makes the overall all control group one OHCA recognition rate= 21% (12) (95% CI; .1-.33), std. error = .055, the negative false=78%.

In relation of OHCA recognition impact on survival during the period of (1 January- 31 October) None of the recognised OHCAs survived to 30 days in pre-intervention group, whereas 3.5% (2) of the recognised OHCAs in control group one survived to 30 days.

ii. CPR instruction

The percentage of recognised OHCA cases that received CPR instructions in the pre-intervention group, 60% and in the control group, 56%. Both rates are below AHA recommendations, >75% (American Heart Association, 2016).

Collectively, the percentage of recognised OHCA cases that receive CPR instructions in Kuwait EMS needs further improvement.

iii. Common OHCA codes

In Kuwait culture there are different terminologies to describe loss of consciousness. 'Syncope' describes loss of conscious from any position but 'falling in' is to describe loss of consciousness from standing position. One common dispatch code for OHCA in the pre-intervention group was, "falling in" 29% (7). Where "syncopy" was the commonest dispatch codes for describing OHCA in control group one, 43% (24).

Call taker OHCA mal-recognition codes. "falling in" and "syncopy" were the most commonly used by call takers during 2016, a finding that is new to the literature and therefore warrants further investigation.

iv. Bystander Demographic

Caller demographics that activated the EMS to report OHCA cases in the pilot region were; Kuwaiti civilians = 100% and males = 78%, respectively. Finally, caller's knowledge of CPR could not be assessed during this period. And the caller demographics in the control region were as follows:

Kuwaiti = 40%, civilians = 98% and males = 80%. Finally, caller's knowledge of CPR could not be assessed during this period.

v. Challenges

Another important finding was the incidence and the categories of challenges reported by call takers that prevented them from recognising the OHCA case or giving CPR instructions, during this period. (See table X..2) (18%) of the OHCA calls experienced predefined challenges. The most common predefined challenges were: Non-cooperative caller (33%) and caller physically not at the scene (33%). The researcher collected the data on these challenges by reviewing call taker's written notes on OHCA cases electronic files.

TableX.2 Common predefined challenges during pre-intervention period (1 February to 31October 2016) in the intervention region,Hawali province.

Barriers	Number of Cases.
1. Personal barrier	
a. Non-cooperative caller	5
b. Panicking caller	2
c. Positioning difficulty	
2. Procedural	
a. Language barrier	1
b. Caller physically not at the scene	5
c. Technicality	1
d. Call details from the directory of Ministry of the Interior	1
3. CPR knowledge	
a. Breathing	
Total	15

vi. Cost

There were no financial expenses of collecting the data of pre-intervention group and control group one during (1 January – 31 April 2017).

(Appendix . XI) Table of out-of-hospital cardiac arrest cases of during DACPR implementation period, during intervention group. OHCA cases in the Hawali province during the observational period of 21st February to 31st May 2017.

Table of out-of-hospital cardiac arrest cases of during DACPR implementation period, during intervention group. OHCA cases in the Hawali province during the observational period of 21st February to 31st May 2017.

SN	CODE	caller: Civilian =1 Health professional=2 others =3	Caller Nationality Kw =1 Non Kw =2	caller gender Male= 1 Female= 2	LOCATION Home =1 Public= 2 clinic =3	AREA	AGE	SEX Male = 1 female = 2	MH None = 0 one illness = 1 more than one = 2	Nationality Kw =1 nonKw =2	Dispatch time	RT	Initial rhythm 1= Non shock 2= Shockable	Witnessed witnessed =1 non-witnessed =0	TIME	BLS yes = 1 no = 0	ALS yes = 1 no = 0	OUT1 OHCA recognised yes= 1 No =0	OUT2 CPR instruction given yes= 1 No= 0	OUT3 BCPR yes = 1 No = 0	OUT4 ROSC yes = 1 No = 0	OUT5 Survival to 30 days yes = 1 No = 0	DACPR
1	3	1	2	1	1	1	3	1	0	2	19.07	12	1	0	.	1	0	0	0	0	0	0	1
2	1	1	2	1	1	2	4	1	1	2	6.02	10	1	0	13	1	0	0	0	0	0	0	1
3	5	1	1	1	.	10	2	2	0	1	21.06	2	.	.	.	1	0	0	0	0	0	0	1
4	5	1	1	1	.	2	2	1	.	2	0.16	10	.	.	0	1	0	0	0	0	1	0	1
5	31	1	1	1	2	10	2	1	0	2	20.42	5	.	.	.	1	0	0	0	0	0	0	1
6	3	1	2	2	.	2	3	1	0	2	3.14	8	1	0	.	1	0	0	0	1	0	0	1
7	5	1	2	1	1	1	4	1	0	2	0	10	1	0	.	1	0	0	0	0	0	0	1
8	5	1	2	1	1	1	3	1	0	2	11.02	7	.	0	.	1	0	0	0	0	0	0	1
9	5	1	2	2	2	2	3	1	0	2	19.23	14	.	0	.	1	0	0	0	0	0	0	1
10	5	1	1	2	1	3	4	1	2	1	9.54	6	.	.	8	1	0	0	0	0	0	0	1
11	5	1	1	1	1	2	4	1	1	2	19.53	19	1	0	.	1	0	0	0	0	0	0	1

12	3	1	1	2	1	9	4	2	0	1	2.39	8	1	0	.	1	0	0	0	1	1	1	1
13	5	1	1	1	2	1	3	1	0	1	14.02	1	.	.	.	1	0	0	0	0	0	0	1
14	5	1	2	2	1	3	4	2	0	1	13.01	10	1	0	.	1	No	0	0	0	0	0	1
15	5	1	1	1	1	10	1	2	1	1	6.19	7	.	0	7	1	0	0	0	0	0	0	1
16	5	1	2	1	2	1	4	1	2	2	19.2	40	.	.	42	1	0	0	0	0	0	0	1
17	5	1	2	2	2	1	2	2	0	2	18.52	4	.	.	.	1	0	0	0	0	0	0	1
18	5	1	2	1	2	2	3	1	2	2	23.4	7	.	.	.	1	0	0	0	0	0	0	1
19	5	1	2	2	1	3	1	2	0	2	3.48	13	.	1	.	1	0	0	0	0	0	0	1
20	12	1	2	1	1	2	3	2	0	2	3.56	9	1	0	10	1	0	0	0	0	0	0	1
21	30	1	2	1	1	1	4	1	2	2	1.47	7	.	.	.	1	0	0	0	0	0	0	1
22	.	1	.	.	.	1	1	1	0	2	7.21	8	.	.	.	1	0	0	0	1	0	0	1
23	3	1	2	1	2	10	2	1	1	2	1.36	4	1	1	6	1	0	0	0	1	0	0	1
24	3	1	2	1	1	2	2	1	0	2	1.15	10	1	1	1	1	0	0	0	1	0	0	1
25	5	1	1	1	1	3	3	1	0	1	10.53	7	.	0	.	1	0	0	0	0	0	0	1
26	5	1	2	1	2	2	2	1	1	2	3.31	8	1	.	8	1	0	0	0	0	0	0	1
27	5	1	2	1	2	2	3	1	0	2	7.16	5	1	0	5	1	0	0	0	0	0	0	1
28	3	1	2	2	.	2	3	1	.	2	9.58	28	1	0	29	1	0	0	0	0	0	0	1
29	5	1	2	2	1	2	3	1	1	2	18.3	7	1	1	5	1	1	0	0	1	0	0	1
30	29	1	1	1	2	6	3	1	1	2	18.35	13	1	1	14	1	0	0	0	0	0	0	1
31	27	1	2	1	1	2	4	1	2	2	7.1	10	1	0	11	1	0	0	0	0	0	0	1
32	2	1	2	2	1	2	3	1	2	2	14.07	9	1	0	16	1	0	1	0	0	0	0	1
33	5	1	1	1	2	1	4	1	2	2		10	.	.	.	1	0	0	0	0	0	0	1
34	5	1	2	1	.	1	3	1	0	2	11.06	6	.	.	.	1	0	0	0	0	0	0	1
35	28	1	2	1	1	2	2	1	.	1	10.14	9	.	.	.	1	0	0	0	0	0	0	1
36	13	1	2	1	1	1	2	1	.	2	4.4	8	.	.	.	1	0	0	0	0	0	0	1

37	3	1	1	2	1	14	4	2	2	1	9.48	9	1	0	.	1	0	0	0	0	0	0	1
38	5	1	1	1	1	3	1	1	0	2	5.46	12	.	.	0	1	0	0	0	0	0	0	1
39	27	1	1	1	1	3	4	2	1	1	4.59	6	1	0	.	1	0	0	0	0	0	0	1
40	5	3	1	1	1	2	3	1	0	2	14.3	11	1	0	.	1	0	0	0	0	0	0	1
41	1	1	2	1	1	1	3	1	2	2	6	14	.	0	.	1	0	0	0	0	0	0	1
42	1	1	2	2	1	2	4	2	2	2	10.15	10	.	0	1	1	0	0	0	0	0	0	1
43	3	1	2	1	1	2	3	2	2	2	18.45	9	2	0	1	1	0	0	0	0	0	0	1
44	3	1	2	1	2	2	3	1	0	2	6.56	21	1	0	.	1	0	0	0	0	0	0	1
45	1	1	2	1	.	1	2	2	.	2	21.05	6	.	0	.	1	0	0	0	0	0	0	1
46	1	1	2	1	.	1	2	1	.	2	5.5	12	1	.	.	1	0	0	0	1	0	0	1
47	5	1	2	1	.	2	2	2	0	2	7.55	8	.	.	.	1	0	0	0	0	1	0	1
48	29	1	2	1	.	2	3	1	0	2	3.35	4	.	.	.	1	0	0	0	0	0	0	1

(Appendix. XII) Table of OHCA cases of the during DACPR implementation period, control group two. OHCA cases in the Farwanya province during the observational period of 21st February to 31st May 2017.

Table of OHCA cases of the during-DACPR implementation period, control group two. OHCA cases in the Farwanya province during the observational period of 21 February to 31 May 2017.

SN	CODE	caller: Civilian=1 Health professional=2 others=3	Caller Nationality Kw=1 NonKw=2	caller gender Male=1 Female=2	LOCATION Home=1 Public=2 clinic=3	AREA	AGE	SEX Male=1 female=2	MHNone=0 one illness=1 more than one=2	Nationality Kw=1 nonKw=2	Dispatch time	RT	Initial rhythm 1=Non shock 2=Shockable	Witnessed witnessed=1 non-witnessed=0	TIME	BLS yes=1 no=0	ALS yes=1 no=0	OUT1 OHCA recognised yes=1 No=0	OUT2 CPR instruction given yes=1 No=0	OUT3 BCPR yes=1 No=0	OUT4 ROSC yes=1 No=0	OUT5 Survival to 30 days yes=1 No=0	DACPR
1	5	1	2	1	1	1	3	1	.	2	20.22	14	.	1	.	1	0	0	0	0	0	0	0
2	5	1	2	1	1	2	3	2	2	2	14.21	9	.	1	1	1	0	0	0	0	0	0	0
3	5	1	1	2	.	4	3	1	.	1	16.43	4	.	.	.	1	0	0	0	0	0	0	0
4	7	1	1	1	.	6	4	2	.	2	8.24	10	1	.	.	1	0	1	0	0	0	0	0
5	5	1	1	1	2	12	3	1	.	1	20.58	34	2	.	.	1	0	0	0	1	0	0	0
6	1	1	1	1	1	6	4	2	1	1	20.08		.	.	.	1	0	0	0	0	0	0	0
7	1	1	2	1	1	3	2	2	.	2	15.18	13	.	.	1	1	0	0	0	0	1	1	0
8	5	1	1	1	1	13	3	1	.	1	10.46	9	.	.	9	1	0	0	0	0	0	0	0

9	5	1	1	1	1	6	4	1	.	1	16.36	5	.	.	.	1	0	0	0	0	0	0	0
10	3	1	2	1	1	1	3	1	.	2	0.09	21	.	.	.	1	0	0	0	0	0	0	0
11	5	1	1	2	1	4	4	2	1	1	12.01	15	.	.	.	1	0	0	0	0	0	0	0
12	7	1	1	1	.	5	1	2	.	1	17.18	11	.	.	.	1	0	1	0	0	0	0	0
13	5	2	1	1	2	.	3	1	.	2	14.28	2	.	.	.	1	0	0	0	0	0	0	0
14	5	1	1	1	2	4	2	1	.	2	4.58	2	.	.	.	1	0	0	0	0	0	0	0
15	5	3	1	1	.	12	3	1	2	.	23.37	4	1	.	.	1	0	0	0	0	0	0	0
16	7	1	2	1	1	3	2	1	2	1	3.18	4	.	0	.	1	0	1	0	0	0	0	0
17	5	1	1	1	1	13	3	1	2	2	19.54	9	.	.	.	1	0	0	0	0	0	0	0
18	26	1	1	2	1	3	4	2	0	2	20.35	7	.	.	.	1	0	0	0	0	0	0	0
19	1	1	2	1	1	1	4	1	0	2	10.08	7	.	.	.	1	0	0	0	0	0	0	0
20	4	1	1	1	1	11	3	1	0	1	16.07	8	.	0	1	1	0	0	0	0	0	0	0
21	5	1	2	1	2	1	3	1	1	2	11.05	5	.	1	.	1	1	0	0	0	0	0	0
22	2	1	2	1	1	3	3	1	0	2	11.34	7	.	0	.	1	0	1	0	0	0	0	0
23	1	1	2	1	2	3	2	1	0	2	14.05	7	.	0	0	1	0	0	0	0	0	0	0
24	1	1	1	1	2	13	2	1	0	2	16.49	13	1	0	3	1	0	0	0	0	0	0	0

25	5	1	1	2	1	10	3	1	2	1	0.11	8	1	1	.	1	0	0	0	0	0	0	0
26	3	1	2	1	1	1	3	1	0	2	19.16	6	1	.	.	1	0	0	0	0	0	0	0
27	1	1	2	1	1	1	4	2	1	2	3.12	14	1	1	.	1	0	0	0	0	0	0	0
28	5	1	2	1	1	3	3	1	0	2	15.59	6	1	0	8	1	0	0	0	0	0	0	0
29	5	1	2	1	1	1	3	1	0	2	9.26	7	1	1	.	1	0	0	0	0	0	0	0
30	5	1	1	1	1	6	3	1	0	1	18.51	8	.	0	8	1	0	0	0	0	0	0	0

Appendix. XIII Descriptive analysis of the implementation period for the intervention group and control group (19 February to 30 May 2017)

Descriptive analysis of the implementation period for the intervention group and control group (19 February to 30 May 2017)

Population served	939,507
EMS system	Two-tiered system
OHCA	48

Dispatch	
OHCA recognised	2% (1)
CPR instruction given	0% (0)

Mean response time	8 min
Resuscitation attempts	48

Witnessed (public)	
Witnessed	10% (5)
Bystander CPR	
No	85% (41)
Yes	14% (7)

Location	
Home/Public	Home 54% (26) Public 25% (12)

Initial rhythm	
Shockable	2%(1)
Non-shockable	45% (22)
Unobtainable	52% (25)

Nationality	
Kuwaiti	21% (10)
Non-Kuwaiti	79% (38)

Reason for exclusion	Number
Non-cardiogenic aetiology	11
Dead before arrival of EMS personnel	28 (rigour mortis)
Pronounced dead on scene	5 (declared dead by General Practitioner on scene)
Unknown	0
Poor documentation (area not written)	1
Paediatric population (<16 years)	1
Total number of OHCA cases excluded from the analysis	46

Gender	
Male	73% (35)
Female	27% (13)

Age category	50-70 40% (std.=		
Pathogenesis	No known primary cause		
Comorbidities	Yes 40 % (19)	No 8	Unknown 21
Defibrillation time	No		
Targeted temperature management (TTM)	Unknown		
BLS/ALS			
ALS	2 % (1)		
BLS	100% (48)		

Outcomes

Patients	ROSC at hospital transfer			Survived events	Survival-to 30 days			Neurological outcome to 30 days		
Shockable rhythm witnessed	Yes	No 2	Unknown		Yes	No 2	Unknown	Yes	No	Unknow n
All EMS-treated arrests	6.3 % (3)	45		6.3% (3)	2% (1)	47				2% (1)

Figure XIII.1 Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest during DACPR implementation period, intervention group. OHCA cases in Hawali Province during the observational period from 21 February to 31 May 2017

Population served	1,169,302,
EMS system	Two-tiered system
OHCA	30

Dispatch	
OHCA recognised	13% (4)
CPR instruction given	0% (0)

Mean response time	8 min
Resuscitation attempts	30

Location	
Home/Public	Home 66% (20) Public 20% (6)

Witnessed (public)	
Witnessed	20% (6)
Bystander CPR	
No	97% (29)
Yes	3% (1)

Initial rhythm	
Shockable	3%(1)
Non-shockable	27% (8)
Unobtainable	70% (21)

Reasons for exclusion	Number
Non-cardiogenic aetiology	14
Dead before arrival of EMS personnel	24(rigour mortis)
Pronounced dead on scene	14(declared dead by General Practitioner on scene)
Unknown	0
Poor documentation (area not written)	0
Paediatric population (<16 years)	0
Total number of cases excluded from the analysis	62

Nationality	
Kuwaiti	36% (11)
Non-Kuwaiti	64% (19)

Gender	
Male	73% (22)
Female	27% (8)

Age	50-70 years 56%		
Pathogenesis	No known primary cause		
Comorbidities	Yes 9	No 10	Unknown 11
Defibrillation time	No		
Targeted temperature management (TTM)	Unknown		
BLS/ALS			
ALS	3% (1)		
BLS	100% (30)		

Patients	ROSC at hospital transfer			Survived events	Survival-to 30 days			Neurological outcome to 30 days		
Shockable rhythm witnessed	Yes 0	No	Unknown		Yes	No	Unknown	Yes	No	Unknown
All EMS-treated arrests	3% (1)	29		3% (1)		100 % (30)				

Outcome

Figure XIII.2 Utstein standardised template of OHCA during the DACPR implementation period, control group two. OHCA cases in Al-Farwanya Province during the observational period from 21 February to 31 May 2017

Table XIII.1. Summary of the results for the DACPR implementation period (21 February – 1 May 2017)

Domains (elements) (21 February – 31 May 2017)	**Hawali During DACPR intervention group (21 February – 31 May 2017)**	**Al-Farwanya control group (21 February – 31 May 2017)**
1.System		
Population served	939,507	1,169,302
EMS system	Two-tiered system	
Total number of OHCAs	94	92
OHCA incidence per month	12	8
Excluded	46	62
Included	48	30
Resuscitation attempts	48	30
Area with highest incidence of OHCA	Salmya	Al-Farwanya
Peak time of OHCA	12.00-15.59 hrs	16.00-19.59 hrs
2. Dispatch-assisted CPR:		
a. OHCA Recognition Rate (%)	2% (1)	13% (4)
b. CPR instruction Rate (%)	0 (0)	0 (0)
C % of recognised OHCA's that received CPR instructions	0%	0%
d. Bystander Demographic		
i. Caller	98% civilians	93% civilians
ii. Gender	73% males	86% males
ii. Nationality	31% Kuwaiti	56% Kuwaiti's
3. Patient variables		
a. Age (category)	50-70 years (40%)	50-70 years (56%)

Domains (elements) (21 February – 31 May 2017)	Hawali During DACPR intervention group (21 February – 31 May 2017)	Al-Farwanya control group (21 February – 31 May 2017)
b. Gender(%)		
i. Male	35(73)	22(73)
ii. Female	13(27)	8(27)
c. Nationality (%)		
i. Kuwaiti	10(21)	11(36)
ii. Non-Kuwaiti	38(79)	19(64)
d. Comorbidities (%)	19(40)	9(30)
e. Location (%)		
i. Home	26(54)	20(66)
ii. Public	3(25)	6(20)
f. Witnessed	5(10)	6(20)
ii. Non-witnessed	24(50)	24(80)
g. ECG rhythm (%)		
i. Shockable	1 (2)	1(3)
ii. Non-shockable	22(46)	8(27)
iii. Unobtainable	25(52)	21(70)
4.Resuscitation Factors		
a. Response Time (mean)	8 min	8 min
c. Defibrillation time	N/A	N/A
d. BLS (CPR+ defibrillation) (%)	48(100)	30(100)
e. ALS (CPR+ defibrillation adrenaline) (%)	1(2)	1(3)
f. Targeted temperature management (TTM)	N/A	N/A
4. Outcomes		
a. Bystander CPR rate (%)	7(14)	1 (3)
b. Return of spontaneous circulation (%)	3(6.3)	1(3)
c. Survival event (%)	1(6.3)	1(3)
d. Survival-to 3o days (%)	1 (2)	1(3)

Dispatch from 21 February to 31 May 2017

Following the interventional call-taker training (8 call takers) on 20 February 2017, the researcher collected DACPR sheets and OHCA dispatch electronic records for DACPR implementation period (21 February – 31 October 2016).

i. OHCA recognition

In the intervention group, number of recognised OHCA cases (1), not recognised (47) and incorrectly recognised (1). This make the overall OHCA recognition rate of the intervention group,

2% (1), the false positive=2% (1) and false negative=98% (47). There was a 10-fold drop in OHCA recognition rates compared to 2016 and a low false positive rate =2%.
In control group two, recognised OHCA cases (4), not recognised (26) and incorrectly recognised (0). Hence, control two OHCA recognition rate was 13% (4), false positive=0% (0) and false negative=86% (26). There were similar drop in OHCA recognition rate from 2016 in control group two. In assessing the impacts of OHCA recognition on survival to 30 days, none of the recognised cases survived in the control group two.

ii. CPR instruction

CPR instruction rate was 0% in both groups. Subsequently the percentage of recognised that received CPR instructions was 0%.

iii. Common OHCA codes

The analysis revealed that the number of mal recognition codes “syncopy” increased. The incidence of “syncopy” was 48% (23) in intervention group and 53% (16) in control group two during the DACPR implementation period. In 2016, this code was used less than in the implementation period in 2017. The reasons for these results are discussed in section 5.4.3, quality assurance and improvement measures.

iv. Bystander Demographic

None of the callers had previous knowledge of CPR.

v. Challenges

Turing to DACPR challenges, only one intervention call taker reported a personnel barrier (i.e. a non-cooperative caller) during the period from 21 February – 31 May 2017.

vi. Cost

There were minimal financial costs, mostly spent on printing protocol and course material paper during this study period.

Overall, the EMS call-taking process and the OHCA outcomes did not show improvement in the initial DACPR implementation strategy. A root cause analysis of this outcome was initiated through the quality improvement and assurance measures. The following section discusses the results of quality improvement and assurance measures. This result is shown in Table XIII.2.

Table XIII2 Initial findings of quality assurance and improvement measures during the DA-CPR implementation period in the intervention group, Hawali Province.

Observation period	Number of cases	DA-CPR sheet submitted	Incidence of correct diagnosis	Incidence of misdiagnosis	Most common misdiagnosis
February	12	0	0	100% (11)	syncope 54% (6)
March	12	0	0	100% (12)	Syncope 58% (7).
April	12	1	8% (1)	92% (11)	Syncope 41% (5)
May	12	2	0	100%	Syncope 50% (6)

(Appendix XVI) Table OHCA cases in the post intervention period, post-intervention group. OHCA cases in the Hawali province during the observational period of 1st June to 31st December 2017.

Table of OHCA cases in the post intervention period, post-intervention group. OHCA cases in the Hawali province during the observational period of 1st June to 31st December 2017.

SN	CODE	caller: Civilian=1 Health professional=2 others=3	Caller Nationality Kw=1 NonKw=2	caller gender Male=1 Female=2	LOCATION Home=1 Public=2 clinic=3	AREA	AGE	SEX Male=1 female=2	MH None=0 one illness=1 more than one=2	Nationality Kw=1 nonKw=2	Dispatch time	RT	Initial rhythm 1=Non shock 2=Shockable	Witnessed witnessed=1 non-witnessed=0	TIME	BLS yes=1 no=0	ALS yes=1 no=0	OUT1 OHCA recognised yes=1 No=0	OUT2 CPR instruction given yes=1 No=0	OUT3 BCPR yes=1 No=0	OUT4 ROSC yes=1 No=0	OUT5 Survival to 30 days yes=1 No=0	DACPR
1	3	1	1	2	.	5	4	1	0	1	10.27	10	.	.	.	1	0	0	0	0	0	0	1
2	5	1	1	1	.	9	3	2	0	1	5.39	13	.	.	.	1	0	0	0	0	0	0	1
3	1	1	2	1	.	1	2	1	0	2	5.16	9	.	.	0	0	0	0	0	0	0	0	1
4	5	1	2	1	.	1	3	1	2	2	20.24	8	1	.	.	1	0	0	0	0	0	0	1
5	3	1	1	1	.	1	2	1	0	2	22.26	12	.	.	.	1	0	0	0	0	0	0	1
6	5	1	1	1	.	10	4	2	0	1	13.54	5	.	.	.	1	0	0	0	0	0	0	1
7	3	1	2	2	.	10	2	1	0	2	15.19	9	.	.	.	1	0	0	0	0	0	0	1
8	1	1	1	1	.	10	4	2	.	1	10.31	10	.	.	.	1	0	0	0	0	0	0	1
9	5	1	1	2	.	6	4	1	.	2	2.15	3	.	.	.	1	0	0	0	0	0	0	1
10	5	1	2	1	.	2	4	1	.	2	16.42	6	1	.	.	1	0	1	1	0	0	0	1
11	5	1	2	1	.	2	4	2	1	2	4.08	9	.	.	.	1	0	0	0	0	0	0	1
12	5	1	1	1	.	7	4	1	0	1	6.37	6	.	.	.	1	0	0	0	0	0	0	1
13	5	1	1	1	.	7	3	2	0	1	18.52	7	.	.	.	1	0	0	0	0	0	0	1
14	10	1	1	1	.	6	2	1	0	2	21.54	4	.	.	.	1	0	1	1	1	0	0	1
15	5	1	2	2	.	2	4	2	0	1	9.36	14	.	.	.	1	0	0	0	0	0	0	1
16	1	1	1	1	.	7	3	1	0	1	2.48	7	.	.	.	1	0	0	0	0	0	0	1

17	5	1	1	1	.	6	4	2	0	1	13.07	5	1	.	.	1	0	0	0	0	0	0	1
18	5	1	1	2	.	3	3	1	2	1	12.1	5	.	.	.	1	0	0	0	0	0	0	1
19	1	1	1	1	1	12	4	1	0	1	8.31	13	1	.	.	1	0	0	0	0	0	0	1
20	5	2	2	1	.	14	2	1	0	1	5.37	8	.	.	.	1	0	0	0	0	1	0	1
21	5	1	1	1	1	10	2	1	1	2	8.2	8	.	.	.	1	0	1	1	0	0	0	1
22	1	1	1	2	1	15	4	1	2	1	11.17	16	1	.	.	1	0	0	0	0	0	0	1
23	5	1	2	1	1	1	3	1	0	2	21.36	11	1	.	.	1	0	0	0	0	0	0	1
24	1	1	2	1	1	3	3	1	0	2	22.24	11	.	.	.	1	0	0	0	0	0	0	1
25	5	1	2	1	1	2	1	1	0	2	23.32	10	1	.	.	1	0	0	0	0	0	0	1
26	10	1	2	1	2	1	2	1	0	2	19.38	3	1	.	.	1	0	1	1	1	0	0	1
27	5	1	1	1	2	5	4	2	.	1	22.42	4	.	.	.	1	1	0	0	0	0	0	1
28	23	1	1	2	1	8	4	2	.	1	2.54	4	1	.	.	1	1	0	0	0	0	0	1
29	33	1	1	2	1	15	4	1	.	1	13.2	4	.	.	.	1	1	0	0	0	0	0	1
30	9	1	1	1	1	3	3	1	0	1	7.39	2	.	.	.	1	0	1	1	1	0	0	1
31	1	1	1	1	1	6	3	1	0	1	16.18	3	1	0	.	1	0	0	0	0	0	0	1
32	5	1	1	1	1	2	4	1	.	1	9.44	9	.	0	1	1	0	0	0	0	0	0	1
33	5	1	2	1	.	2	3	1	0	1	10.54	3	.	.	.	1	0	0	0	0	0	0	1
34	23	1	1	1	.	7	4	2	2	2	19.41	11	1	.	.	1	1	0	0	0	0	0	1
35	10	1	1	1	.	6	4	2	.	2	16.34	3	.	.	.	0	0	0	0	0	0	0	1
36	36	1	1	2	1	3	2	2	1	2	22.59	11	.	.	0	1	0	0	0	0	0	0	1
37	3	1	2	1	1	2	3	1	1	2	10.24	7	.	1	4	1	0	0	0	1	0	0	1
38	29	1	1	1	1	10	4	2	1	1	8.09	11	.	0	1	1	0	0	0	0	0	0	1
39	5	1	1	1	1	5	4	2	2	1	9.35	10	1	0	.	1	0	0	0	0	0	0	1
40	1	1	1	1	1	5	3	1	2	1	11.21	6	1	0	1	1	1	0	0	0	0	0	1
41	5	1	1	1	2	1	3	1	0	2	12.36	3	.	.	.	1	0	0	0	0	0	0	1
42	5	1	1	1	2	1	3	1	.	2	11.11	1	.	.	.	1	0	0	0	…	0	0	1
43	5	1	1	1	1	5	4	2	.	1	18.38	23	1	.	.	1	0	0	0	0	0	0	1

44	14	1	1	2	1	5	3	2	0	1	3.13	14	.	.	.	1	0	0	0	0	0	0	1
45	5	1	1	1	1	5	4	1	0	1	9.16	12	.	.	.	1	0	0	0	0	0	0	1
46	3	1	1	1	1	5	4	2	0	1	14.37	7	1	.	.	1	0	0	0	0	0	0	1
47	18	2	2	1	3	6	4	1	1	1	16.58	4	.	1	0	1	0	0	0	0	0	0	1
48	3	1	1	2	1	15	1	2	1	1	0.27	13	.	.	0	1	0	0	0	…	0	0	1
49	5	1	1	1	1	9	4	2	0	1	3.28	12	.	.	.	1	0	0	0	…	0	0	1
50	1	1	1	2	1	7	4	2	.	1	8.49	13	.	.	.	1	0	0	0	0	0	0	1
51	4	1	1	2	1	5	4	1	2	1	18.27	10	.	.	.	1	0	0	0	0	0	0	1
52	5	1	1	1	1	5	4	2	2	1	13.08	13	.	.	.	1	0	1	0	0	0	0	1
53	8	1	2	1	2	2	3	1	0	2	7	9	1	0	0	1	0	0	0	1	0	0	1
54	5	1	1	1	1	2	3	1	0	2	13.51	24	2	0	1	1	0	0	0	0	1	0	1
55	5	1	2	1	1	1	2	1	0	2	14.28	1	.	.	.	1	0	0	0	0	0	0	1
56	5	1	1	2	1	6	3	2	2	1	5.06	6	.	.	.	1	0	0	0	0	0	0	1
57	1	1	2	1	1	2	4	2	0	2	18.37	14	1	0	0	1	0	0	0	0	0	0	1
58	5	1	1	1	2	14	3	1	0	2	18.18	9	1	0	.	1	0	0	0	0	0	0	1
59	35	1	2	1	1	3	3	2	1	1	14.22	9	1	.	.	1	0	0	0	0	0	0	1
60	5	1	1	1	1	3	2	2	0	2	1.22	10	1	0	.	1	1	0	0	0	0	0	1
61	1	1	2	2	1	2	4	2	1	2	21.59	12	1	1	0	1	0	0	0	0	0	0	1
62	5	1	2	1	1	2	3	1	2	2	9.33	12	.	.	0	1	0	0	0	0	0	0	1
63	3	1	2	2	1	2	4	1	2	2	18.3	6	1	.	.	1	0	0	0	0	0	0	1
64	5	1	2	1	1	1	3	2	1	2	6.11	9	.	.	.	1	0	0	0	0	0	0	1
65	5	1	2	1	.	1	2	1	0	2	8.25	6	.	.	.	1	0	0	0	0	0	0	1
66	5	1	2	1	1	3	3	2	2	1	11.13	7	.	1	.	1	0	1	1	1	0	0	1
67	5	1	2	1	1	2	2	1	0	2	16.1	9	.	.	.	1	0	0	0	0	0	0	1
68	27	1	2	1	1	2	3	1	0	2	4.57	5	.	1	1	1	0	0	0	0	0	0	1
69	5	1	1	2	1	6	3	1	2	1	12.18	9	.	0	.	1	0	0	0	0	0	0	1
70	5	1	1	1	2	6	3	1	0	1	21.31	6	1	1	0	1	0	0	0	1	0	0	1
71	2	1	2	1	.	2	1	1	.	2	3.13	13	.	.	.	1	0	1	1	0	0	0	1

72	1	1	1	2	.	13	3	1	0	2	15.56	5	1	.	.	1	0	0	0	0	0	0	1
73	5	1	2	1	.	1	3	1	0	2	5.03	11	.	.	.	1	0	0	0	0	0	0	1
74	5	1	1	2	1	5	3	1	0	1	10.16	9	.	.	.	1	0	0	0	0	0	0	1
75	1	1	1	1	1	2	2	1	0	2	17.27	13	1	.	.	1	0	0	0	0	0	0	1
76	5	1	1	2	1	5	3	2	0	2	22.21	6	.	.	.	1	0	0	0	0	0	0	1
77*	5	1	2	1	1	11	4	2	0	1	15.47	9	1	.	.	1	0	0	0	0	0	0	1
78	5	1	1	2	1	5	4	1	0	2	9.18	10	1	.	.	1	0	0	0	0	0	0	1
79*	5	1	1	1	1	7	4	1	2	1	7.03	13	.	0	1	1	0	1	0	0	0	0	1
80	8	3	1	1	2	6	4	1	0	1	8.47	4	.	1	5	1	0	0	0	0	0	0	1
81	5	1	2	1	1	10	3	2	0	2	10.15	6	.	0	0	1	0	0	0	0	0	0	1
82	34	1	1	2	1	14	4	2	0	1	21.54	6	.	.	.	1	0	0	0	0	0	0	1
*83	26	1	1	1	1	7	4	1	0	1	13.17	20	.	0	1	1	0	0	0	0	0	0	1
*84	1	1	1	2	1	3	3	1	0	1	4.58	9	1	.	.	1	0	0	0	0	0	0	1
85	5	1	2	1	1	6	2	1	0	2	8	3	.	1	.	1	0	0	0	0	0	0	1
*86	8	1	2	1	1	1	4	1	0	2	4.19	4	.	.	.	1	0	0	0	0	0	0	1
*87	8	1	1	1	1	16	2	2	1	1	12.16	20	.	0	.	1	0	0	0	1	0	0	1
88	5	1	2	1	1	3	2	1	0	2	15.37	9	.	0	.	1	0	0	0	1	0	0	1
89	4	1	2	1	1	2	3	1	0	2	8.14	8	1	0	.	1	0	0	0	0	0	0	1
90	5	1	2	1	2	1	4	1	0	2	19.38	14	.	.	.	0	0	0	0	0	0	0	1
91	25	1	2	1	.	2	3	1	0	2	3.37	7	.	0	.	1	0	0	0	0	0	0	1
92	3	1	1	1	1	3	2	1	1	1	22.41	7	1	1	.	1	1	0	0	1	0	0	1
93	1	1	1	1	1	1	4	1	1	2	8.2	16	.	.	.	1	0	0	0	0	0	0	1
94	11	1	1	2	1	5	4	2	0	1	17.21	24	.	0	.	1	0	0	0	0	0	0	1
95	1	1	1	1	2	10	3	2	0	2	16.3	5	.	.	.	1	0	0	0	0	0	0	1
96	5	1	1	1	.	2	4	2	2	1	4.16	8	.	.	.	1	0	1	1	1	0	0	1
97	33	1	2	1	1	1	4	1	1	2	14.3	15	.	1	20	1	0	0	0	0	0	0	1
98	3	1	1	2	1	5	4	2	2	1	18.06	15	1	1	.	1	0	0	0	0	0	0	1

99	3	1	1	2	1	5	4	2	2	1	5.29	8	.	.	.	1	0			0	0	0	1
100	1	1	2	1	.	1	4	1	2	2	11.04	13	.	0	.	0	0			0	?	0	1
101	1	1	2	2	1	7	2	2	2	1	3.34	12	.	.	.	1	0	0	0	0	0	0	1
102	5	1	1	2	1	7	4	2	2	1	11.36	9	.	.	.	1	0	1	0	0	0	0	1
103	5	1	1	2	1	5	2	2	0	2	19.29	7	.	.	.	1	0	1	1	1	0	0	1
104	32	1	1	1	.	1	2	1	0	2	20.08	10	.	.	.	0	0	0	0	0	0	0	1
105	5	1	1	2	1	5	4	2	2	1	21.32	8	.	.	.	1	0	1	1	1	0	0	1
106	5	1	1	1	2	1	3	2	.	2	19.16	10	1	.	.	1	0	0	0	0	0	0	1
107	16	1	2	1	1	1	3	2	1	2	16.57	5	.	.	.	1	0			0	0	0	1
108	5	1	1	2	1	7	4	2	0	1	16.3	19	.	0	20	1	0	0	0	0	0	0	1
109	1	1	1	2	1	9	4	1	0	2	3.45	9	1	.	.	1	0	0	0	0	0	0	1
110	5	1	2	1	2	7	3	1	0	2	7.22	11	.	.	.	1	0	0	0	0	0	0	1
111	38	1	1	1	1	3	4	2	0	1	19.38	10	1	0	0	1	0	0	0	1	0	0	1
112	27	1	2	1	1	6	1	1	0	2	12.23	4	1	1	.	1	0	0	0	0	0	1	1
113	5	1	2	1	1	2	3	1	1	2	9	7	.	0	.	1	0	0	0	0	0	0	1
114	5	1	2	2	1	2	3	1	0	2	1.36	6	.	.	0	1	0		0	1	0	0	1
115	1	1	1	1	1	6	4	2	0	2	8.05	9	.	0	.	1	0	0	0	0	?	0	1
116	10	1	1	1	1	3	4	1	0	2	23.54	9	.	0	.	1	0	1	1	0	0	0	1
*117	5	1	2	1	1	2	4	2	0	2	4.12	6	1	0	.	1	0	0	0	0	0	0	1
118	5	1	2	1	1	2	3	1	0	2	16.17	5	1	0	.	1	0	1	1	0	0	0	1
*119	14	1	2	2	1	2	3	1	2	2	20.09	11	.	1	11	1	0	0	0	0	0	0	1
*120	5	1	2	1	2	17	3	1	0	2	21.33	2	.	.	.	1	0	0	0	0	0	0	1
123	5	1	2	1	2	2	2	1	0	2	7.09	11	1	.	.	1	0	1	0	0	0	0	1

124	39	1	1	2	1	18	4	1	.	1	9.5	14	.	.	.	0	0	0	0	0	0	0	1
125	5	1	1	1	1	9	4	1	1	1	15.12	8	.	.	.	1	0	0	0	0	0	0	1
126	5	3	1	1	1	8	3	2	2	1	5.35	6	.	.	.	1	0	0	0	0	0	0	1
127	1	1	1	2	1	19	4	1	0	1	14.45	8	.	1	.	1	0	0	0	0	0	0	1
128	5	1	1	1	1	7	3	1	0	1	14.16	17	.	0	.	1	0	0	0	0	0	0	1
129	5	1	1	2	1	12	4	1	2	1	11.18	9	.	0	.	1	0	0	0	0	0	0	1
130	5	1	1	1	1	7	4	1	2	1	37	10	.	.	.	1	0	0	0	0	0	0	1

(Appendix. XV) Table of out-of-hospital cardiac arrest of post intervention period, control group three. OHCA cases in the Farwanya province during the observational period of 1st June to 31st December 2017.

Table of out-of-hospital cardiac arrest of post intervention period, control group three. OHCA cases in the Farwanya province during the observational period of 1st June to 31st December 2017.

SN	caller: Civilian=1 Health professional=2 others=3	Caller Nationality Kw=1 Non Kw=2	caller gender Male=1 Female=2	LOCATION Home=1 Public=2 clinic=3	AGE	SEX Male=1 female=2	MH None=0 one illness=1 more than one=2	Nationality Kw=1 non Kw=2	RT	BLS yes=1 no=0	ALS yes=1 no=0	OUT 1 OHCA recognised yes=1 No=0	OUT 2 CPR instruction given yes=1 No=0	OUT3 BCPR yes=1 No=0	OUT 4 ROSC yes=1 No=0	OUT 5 Survival to 30 days yes=1 No=0	DA CPR
1	1	1	1	2	2	1	0	1	4	1	0	0	0	0	0	0	0
2	1	1	2	1	2	1	0	1	10	1	0	0	0	0	0	0	0
3	1	1	1	2	3	1	2	2	6	1	1	1	0	0	0	0	0
4	1	2	1	2	2	1	0	2	26	1	0	0	0	0	0	0	0
5	1	2	1	1	2	2	1	2	12	1	0	0	0	0	0	0	0
6	1	2	1	1	4	2	0	2	2	1	0	0	0	0	0	0	0
7	1	1	1	1	4	1	2	2	15	1	0	1	0	0	0	0	0
8	1	2	1	1	3	1	1	2	9	1	0	0	0	0	0	0	0
9	2	2	1	2	3	1	0	2	5	1	0	0	0	0	0	0	0
10	1	2	1	1	4	2	2	2	15	1	0	0	0	0	0	0	0
11	1	1	1	1	3	1	0	1	9	1	0	0	0	0	0	0	0
12	1	1	1	1	4	2	0	1	10	1	0	0	0	0	0	0	0
13	1	2	1	2	3	1	0	2	13	1	0	0	0	0	0	0	0
14	1	1	1	1	3	2	0	1	12	1	0	0	0	1	1	0	0
15	1	2	1	2	2	1	0	2	4	1	0	0	0	0	0	0	0
16	1	2	1	1	2	1	0	2	9	1	0	0	0	0	0	0	0
17	1	2	1	1	3	1	0	2	8	1	0	1	1	0	0	0	0
18	1	1	1	1	4	2	1	1	8	1	0	0	0	0	0	0	0
19	1	2	1	2	4	1	0	2	1	1	0	1	0	0	0	0	0
20	1	1	1	1	3	1	0	1	7	1	0	0	0	0	0	0	0
21	1	1	1	1	3	1	0	1	12	1	0	0	0	0	0	0	0

22	1	1	1	1	4	2	1	2	5	1	0	0	0	0	0	0	0
23	1	1	1	1	4	2	0	1	8	1	0	1	0	0	0	0	0
24	1	2	1	1	3	1	0	1	9	1	0	0	0	0	0	0	0
25	1	1	2	1	4	2	0	2	6	1	0	0	0	0	0	0	0
26	1	1	1	1	4	1	0	1	27	1	0	0	0	0	0	0	0
27	1	2	1	1	3	1	0	2	15	1	0	0	0	0	0	0	0
28	1	1	1	1	3	1	0	2	5	1	0	0	0	0	0	0	0
29	1	2	1	2	1	1	0	2	6	1	0	0	0	0	0	0	0
30	1	1	2	1	4	2	1	1	9	1	0	0	0	1	1	0	0
31	1	1	1	2	2	1	0	2	16	1	0	0	0	0	0	0	0
32	1	1	2	1	4	1	0	1	8	1	0	0	0	0	0	0	0
33	1	2	1	1	3	2	0	2	14	1	0	1	0	1	0	0	0
34	1	1	1	1	3	1	0	1	6	1	0	0	0	0	0	0	0
35	1	2	1	2	4	1	0	2	6	1	0	0	0	0	0	0	0
36	1	2	1	2	3	1	0	2	4	1	0	0	0	0	0	0	0
37	1	2	1	1	3	1	0	2	15	1	0	1	0	0	0	0	0
38	1	1	1	2	3	1	1	2	13	1	1	0	0	0	0	0	0
39	1	1	1	1	4	1	0	1	9	1	0	0	0	0	0	0	0
40	2	1	1	1	4	1	1	1	4	1	0	0	0	0	0	0	0
41	1	2	1	2	3	1	0	2	13	1	0	0	0	0	0	0	0
42	1	2	1	2	3	1	0	2	5	1	0	0	0	0	0	0	0
43	1	2	1	1	3	1	2	2	7	1	0	0	0	0	0	0	0
44	1	1	1	1	4	2	0	1	14	1	0	0	0	0	0	0	0
45	1	1	2	1	3	1	0	2	6	1	0	0	0	0	0	0	0
46	1	2	1	1	4	1	0	2	7	1	0	0	0	0	0	0	0
47	1	1	1	1	2	1	0	2	10	1	0	0	0	0	0	0	0
48	1	1	1	1	2	2	0	1	9	1	0	0	0	0	0	0	0
49	1	1	1	1	4	2	0	1	11	1	0	0	0	0	0	0	0
50	1	2	1	1	2	1	0	2	11	1	0	0	0	0	0	0	0

51	3	2	1	2	4	1	0	2	10	1	0	0	0	0	0	0	0
52	1	1	1	1	4	2	0	2	10	1	0	0	0	0	0	0	0
53	1	1	1	.	2	1	0	1	13	1	0	1	1	1	0	0	0
54	1	1	2	1	4	1	2	1	12	1	0	0	0	0	0	0	0
55	1	1	1	2	3	1	0	2	12	1	0	0	0	0	0	0	0
56	1	1	1	1	3	2	1	1	7	1	0	0	0	0	0	0	0
57	1	1	2	1	2	2	0	2	3	1	0	1	0	0	0	0	0
58	1	2	2	1	3	1	1	2	10	0	1	0	0	0	0	0	0
59	2	2	1	1	3	1	2	2	10	1	0	0	0	0	0	0	0
60	1	2	1	1	3	1	1	2	13	1	0	0	0	0	0	0	0
61	1	1	2	1	4	2	2	1	8	1	0	0	0	0	0	0	0
62	1	2	1	1	4	2	0	2	16	1	0	1	1	0	0	0	0
63	1	1	1	2	2	1	0	2	13	1	0	0	0	0	0	0	0
64	1	2	1	1	3	1	1	2	8	1	0	0	0	0	0	0	0
65	1	2	2	1	4	1	0	2	8	1	0	0	0	0	0	0	0
66	1	2	1	1	3	1	0	2	6	1	0	0	0	0	0	0	0
67	1	2	1	1	2	1	0	2	18	1	0	0	0	0	0	0	0
68	1	1	2	1	4	1	0	1	12	1	0	0	0	0	0	1	0
69	1	1	1	1	4	1	1	2	4	1	0	0	0	0	0	0	0
70	1	2	1	1	3	1	.	2	7	1	0	1	0	0	0	0	0
71	1	1	2	1	4	1	0	1	7	1	0	0	0	0	0	0	0
72	1	1	1	1	2	2	0	2	2	1	0	0	0	0	0	0	0
73	1	1	1	1	3	1	1	1	8	1	0	0	0	0	0	0	0
74	1	2	1	2	3	1	1	2	4	1	0	0	0	0	0	0	0
75	1	1	1	1	4	1	0	1	4	1	0	0	0	0	0	0	0
76	1	2	1		3	2	0	2	10	1	0	1	0	0	0	0	0
77	1	2	1	1	3	1	0	2	7	1	0	0	0	0	0	0	0
78	1	1	1	2	2	1	.	2	14	1	0	0	0	0	0	0	0
79	1	2	2	1	3	2	0	2	15	1	0	0	0	0	0	0	0

80	1	1	1	1	3	2	2	1	27	1	0	1	0	0	0	0	0
81	1	1	1	1	4	1	2	1	10	1	0	0	0	0	0	0	0
82	3	1	1	1	4	2	1	1	11	1	0	1	0	0	0	0	0
83	1	1	1	1	3	1	0	1	16	1	0	0	0	0	0	0	0
84	1	1	1	1	3	1	.	2	10	1	0	0	0	0	0	0	0
85	1	1	1	1	3	2	.	1	11	1	0	0	0	0	0	0	0
86	1	2	1	2	2	1	0	2	6	1	0	0	0	0	0	0	0
87	1	1	2	1	4	2	0	1	7	1	0	1	0	0	1	0	0
88	1	1	1	1	3	1	1	2	10	1	0	0	0	0	0	0	0
89	1	1	2	1	3	2	1	1	8	1	0	0	0	0	0	0	0
90	1	1	1	1	4	2	0	2	4	1	0	0	0	0	0	0	0
91	1	2	1	1	3	1	.	2	12	1	0	0	0	0	1	0	0

Appendix. XVI. Descriptive analysis of the post-intervention group and control group during the post-intervention period (1 June to 31 December 2017)

The Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest during the post-intervention period

Population served	939,792
EMS system	Two-tiered system
OHCA	128

Dispatch	
OHCA recognised	12.5% (16)
CPR instruction given	10% (13)

Mean response time	9 min
Resuscitation attempts	128

Location	
Home/Public	Home 65% (83) Public 11% (14)

Initial rhythm	
Shockable	.8%(1)
Non-shockable	30% (38)
Unobtainable	69.9% (89)

Witnessed	11% (14)
Non-Witnessed	23% (29)
Bystander CPR	
No	88% (113)
Yes	12% (15)

Reason for exclusion	Number
Non-cardiogenic aetiology	5
Dead before arrival of EMS personnel	21(rigour mortis)
Pronounced dead on scene	46(declared dead by General Practitioner on scene)
Unknown	7
Poor documentation (area not written)	0
Health professional witnessed	5
Paediatric population (<16 years)	2
Total number of OHCA cases excluded from the analysis	89

Nationality	
Kuwaiti	49% (64)
Non-Kuwaiti	51%% (65)

Gender	
Male	62% (79)
Female	38% (49)

Age category	70+ 45% (std.=.834)		
Pathogenesis	No known primary cause		
Comorbidities	Yes 42	No 72	Unknown 14
Defibrillation time	No		
Targeted temperature management (TTM)	Unknown		
BLS/ALS			
ALS	5.5 % (7)		
BLS	100% (128)		

Outcome

Patients	ROSC at hospital transfer			Survived events	Survival-to 30 days			Neurological outcome to 30 days		
Shockable rhythm witnessed	Yes .8% (1)	No	Unknown		Yes	No .8 % (1)	Unknown	Yes	No	Unknown
All EMS-treated arrests	1.6 % (2)				.8% (1)	127				.8% 1

FigureXVI.1 Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest during the post-intervention period in the post-intervention group. OHCA cases in Hawali Province during the observational period from 1 June – to 31 December 2017.

Population served	1,169,321
EMS system	Two-tiered system
OHCA	91

Dispatch	
OHCA recognised	15.5% (15)
CPR instruction given	3% (3)

Mean response time	9 min
Resuscitation attempts	91

Location	
Home/Public	Home 76% (69) Public 22% (20)

Initial rhythm	
Shockable	0
Non-shockable	19% (17)
Unobtainable	81% (74)

Witnessed	9% (8)
Non-Witnessed	38% (35)
Bystander CPR	
No	96% (87)
Yes	4% (4)

Reason for exclusion	Number
Non-cardiogenic aetiology	3
Dead before arrival of EMS personnel	18 (rigour mortis)
Pronounced dead on scene	25 (declared dead by General Practitioner on scene)
Unknown	11
Poor documentation (area not written)	1
Paediatric population (<16 years)	2
Total number of OHCA cases excluded from the analysis	60

Nationality	
Kuwaiti	37% (34)
Non-Kuwaiti	63% (57)

Gender	
Male	69% (63)
Female	31% (29)

Age category	50-70 45% (std.=		
Pathogenesis	No known primary cause		
Comorbidities	Yes 26	No 60	Unknown 5
Defibrillation time	No		
Targeted temperature management (TTM)	Unknown		
BLS/ALS			
ALS	3 % (3)		
BLS	100% (91)		

Outcome

Patients	ROSC at hospital transfer			Survived events	Survival-to 30 days			Neurological outcome to 30 days		
Shockable rhythm witnessed	Yes	No	Unknown		Yes	No	Unknow n	Yes	No	Unknown
All EMS-treated arrests	4% (4)	96% (87)		4% (4)	1% (1)	99% (90)				1% (1)

Figure XVI.2 Utstein standardised template for reporting outcomes of out-of-hospital cardiac arrest of post-intervention period, control group OHCA cases in Al-Farwanya Province during the observational period from 1 June – 31 December 2017

Table XVI.1 Summary of the results during the DACPR implementation period (1 June – 31 December 2017).

Domains (elements) (1 June – 31 December 2017)	**Hawali post-intervention group (1 June – 31 December 2017)**	**Al-Farwanya control group (1 June – 31 December 2017)**
1.System		
Population served	939, 792	1,169,321
EMS system	Two-tiered system	Two-tiered system
Total number of OHCAs	217	151
OHCA incidence per month	21	15
Excluded	89	60
Included	128	91
Resuscitation attempts	128	91
Area with highest incidence of OHCA	Salmya	Al-Farwanya and Khitan
Peak time of OHCA	8.00-11.59 hrs	8.00-11.59 hrs
2. Dispatch-assisted CPR:		
a. OHCA Recognition Rate (%)	16(12.5)	15(15.5)
b. CPR instruction Rate(%)	13(10)	3 (3)
c. % of recognised OHCA's that received CPR instructions	81%	20%
c. Bystander Demographic		
i. Caller	97% civilians	95% civilians
ii. Gender	91% males	83% males
ii. Nationality	62% Kuwaiti	57% Kuwaiti's
3. Patient variables		
a. Age (category)	70+ years (45%)	50-70 years (45%)
b. Gender (%)		
i. Male	79 (62)	63 (69)
ii. Female	49 (38)	29 (31)
c. Nationality(%)		
i. Kuwaiti	63(49)	34 (37)
ii. Non-Kuwaiti	65 (51)	57 (63)
d. Comorbidities(%)	19(32)	26(28)
e. Location(%)		
i. Home	83(65)	69(76)
ii. Public	11% (14)	20 (22)
f. Witnessed	14 (11)	8 (9)
ii. Non-witnessed	29 (23)	35 (38)
g. ECG rhythm (%)		
i. Shockable	1(.8)	0
ii. Non-shockable	38 (30)	17(19)
iii. Unobtainable	89 (69)	74 (81)

Domains (elements) (1 June – 31 December 2017)	**Hawali post-intervention group (1 June – 31 December 2017)**	**Al-Farwanya control group (1 June – 31 December 2017)**
4.Resuscitation Factors		
a. Response Time (mean)	9 min	9 min
b. Defibrillation time	N/A	N/A
c. BLS (CPR+ defibrillation) (%)	128(100)	91(100)
d. ALS (CPR+ defibrillation adrenaline) (%)	7(5.5)	3(3)
f. Targeted temperature management (TTM)	N/A	N/A
4. Outcomes		
a. Bystander CPR rate (%)	15(12)	4(4)
b. Return of spontaneous circulation(%)	2 (1.6)	4 (4)
c. Survival event(%)	2 (1.6)	4 (4)
d. Survival-to 3o days (%)	1(.8)	1 (1)

Dispatch during the period from 1 June – 31 December 2017

i. OHCA recognition

In the post-intervention group, the number of correctly recognised OHCA cases were (16), non recognised (112) and the incorrectly recognised were (3). This makes OHCA recognition rates (12.5%), false positive (2.3%) and false negative (87%). None of the recognised OHCA cases survived to 30 days. In relation to the incorrectly diagnosed cardiac arrests (false positive), none of the call taker gave CPR instructions. Thus, the effects of unnecessary DACPR could not be evaluated.

In control group, the number of recognised OHCAs (15), non recognised (76) and incorrectly recognised (2). This makes OHCA recognition rates (15.5%), false positive (2%) and false negative (83%). Again in the incorrectly diagnosed cardiac arrests (false positive), none of the call taker gave CPR instructions. Thus, the effects of unnecessary DACPR could not be evaluated

TableXVI.2 Incorrectly diagnosed OHCA arrests by interventional call takers during the post-intervention period (1 June – 31 December 2017)

Date	Case No,	Code	Caller Nationality	Caller	Caller gender	Area	Location	On field EMS personnel diagnosis	Call taker instructions
13.07.17	69	Cardiac arrest	Kuwaiti	Civilian	Male	Hawali	Home	Pulmonary oedema	None
27.09.17	169	Cardiac arrest	Kuwaiti	Civilian	Male	Jabrya	public	. general weakness	None
28.05.16	244	Cardiac arrest	Non-Kuwaiti	Civilian	Male	Hawali	Public	Convulsion	Patient refuse transfer
21.09.17	39	Cardiac arrest	Kuwaiti	Civilian	Male	Al-Farwanya	Public	Chest pain	None
23.09.17	302	Cardiac arrest	Non-Kuwaiti	Civilian	Male	Khitan	Home	Hysterical	None

ii. <u>Common codes for OHCA</u>

More over Dispatch in the period from 1 June – 31 December 2017, the most commonly used code to describe OHCA was “Syncopy” in the post-intervention group (51%) and control group three (40%).

<u>iii.Bystander Demographic</u>

18% (3) had previous knowledge of CPR.

TableXVI.3 Demographics of callers with previous knowledge of CPR versus OHCA outcomes during the post-intervention period (1 June – 31 December 2017)

Date	Caller	Nationality	Gender	Province	Rhythm	ROSC	Survival
16.11.17	Civilian	Kuwaiti	Female	Hawali	Unobtainable	NO	pronounced dead in A&E
20.11.17	Civilian	Kuwaiti	Male	Hawali	Unobtainable	NO	pronounced dead in A&E

16.12.17	Civilian	Kuwaiti	Male	Hawali	Unobtainable	NO	pronounced dead in A&E

ii. *Challenges*

There were two types of challenges during post intervention period; pre-defined common challenges and novel challenges. Novel challenges have been previously discussed in chapter four, and here we disclose predefined challenges. Only 9% (19) of OHCA cases experienced common challenges during 1 June – 31 December 2017. The researcher collected the data on these challenges by reviewing OHCA cases, audio recording and writing notes on the electronic files of the call takers (see Table XVI48). The most common DACPR challenges were procedural barriers 65% (13): the caller physically not at the scene (6 cases); the call taker took the OHCA call details from the directory of Ministry of the Interior (not from the caller)(5); technical issues (1); and language barrier (1). The instructions regarding handling a caller who is not at the scene were given during the intensive DACPR day course. These instructions include taking the number of the person at the scene and calling him/her. However, the interventional call takers did not follow the study protocol in these cases. Nevertheless, there were only a few challenges in implementing DACPR, which did not explain the low rate of practising DACPR by the interventional call takers.

Table XVI.4 The identified DACPR challenges in Kuwaiti EMS from 1 June – 31 December 2017

Barriers	Number of Cases.
1.Personal barrier	
a. Non-cooperative caller	2
b. Panicking caller	2
c. Positioning difficulty	1
2.Procedural	
a. Language barrier	1
b. Caller physically not at the scene	6
c. Technicality	1
d. Call details from the directory of Ministry of the Interior	5
3.CPR knowledge	
a. Breathing	1
Total	19

iii. *Cost*

Similar to implementation period there was minimal amount of financial cost. Mostly spent on printing protocol and training material.

(Appendix. XVII.) OHCA recognition Signposts

☑ Unresponsive

☑ Not Breathing Normally

🡇

[Cardiac Arrest]

- ✓ عدم إستجابة
- ✓ تنفس بشكل غير طبيعي

[توقف القلب]

(Appendix. XIX.) Personal feedback.

Personal feedback:
(Shift D)

A. (18-trained call taker)
B. 38 OHCA cases. 8 cases were correctly recognised only two received CPR instructions the other audio record need to be reviewed.
C. Review of OHCA cases recognition from Hawali and Farwanya provinces from May to September 2017.

Name	Total number of cases seen	Number of correct cases (Cardiac arrest or death suspicion)	Most frequent Misdiagnosis	Time of training	April	May	June	July	Aug	Sept	Oct	Nov	Area of improvement
XXXX	2			May						Cancerou tumor (180) 13.09.17	Syncopy (332)15.10.17		Case (332) was reported by a nurse from farwanya clinic. Can not be filed for call taker diagnosis.
XXXX	4	0	Syncopy	May		1Hypertension**(36) 25.05.17 syncopy (314) 24.05.17 Resp. distress(304) 24.05.17	0	0	0	asphaxia (62) 30.09.17			You always take the patient primary complaint and address and you do not confirm loss of response or presence of breathing. You have missed 3 cases soon after your training. Be aware of the syncoped terminology. When a caller state that the patient is syncoped ,it mens he is not conscious. You need to check response and precense

													of normal breathing if both absent give hands only CPR instruction per DACPR protocol. September cardiac arrest was asphyxia so I assume it was abnormal breathing. again should be checked for response. No response no normal breathing +> it is an arrest and you should give hands only CPR instruction
XXXX	1			May		syncopy (97) 20.05.17		0					Be aware of the syncoped terminology. When a caller state that the patient is syncoped ,it mens he is not conscious. You need to check response and precense of normal breathing if both absent give hands only CPR instruction per DACPR protocol.
XXXX	5	Pro QA	syncopy	Feb.		Syncopy (221) 20.05.17			1 fall in (327)15.07.17	Syncopy (4) 10.09.17 Pro QA (81) 25.09.17 Syncopy (287)29.09.17	On leave		You have misdiagnosed one case on May: Cardiac arrest (244)** 28.05.17 the patient had convulsion. He is alive and no harm was inflected. You also managed Pro QA (78) 19.07.17 very well. You confirmed the arrest and gave Pro QA instructions. You need to use the cardiac arrest icon instead of Pro QA. September cases Please note that when a caller state that the patient is syncoped, It means that he lost consciousness and you should proceed to checking response

													and normal breathing if not present is n arrest and you should give hands only CPR instruction Excellent recognition please cardiac arrest diagnosis icon.
XXXX				May				0			Chest pain (49) 20.10.2017		The caller clearly stated that his father is “tired”. The call taker only took the address , name. and took the number from the ministry f interior and made up that he complaint from ‘chest Pain’
XXXX	1			Feb.					Upper airway obstruction (326) 13.08.17	0	0		The patient was diagnosed as cardiac arrest. When there is abnormal breathing make sure to check response if the patient is not responsiv e => it is an arrest and give CPR instruction . Even if you though it was chocking the patient is unconciou s so you should give CPR instruction . We expect a lot from you Bader you are one of our excellent

													employees.
XXXX				May				0	0		0		
XXXX ri	5	2 (death suspicion was diagnosed in both)		May		Respiratory distress (336) 24.05.17	Death suspicion (276) 21.06.17	Falling in (355) 27.07.17		Syncopy (131) 09.09.17 Death suspicion (249) 09.09.17	0		Please do not use death suspicion and proceed to confirming the arrest and giving CPR instructions. Also note that when a caller state that the patient is falling in, It means that he lost consciousness and you should proceed to checking response and normal breathing if not present .it is n arrest and you should give hands only CPR instruction. Do not use death suspicion unless one of the next is stated: brain is out,patient is charred, run over, head is de-attached from he rest of the body. Otherwise it is a cardiac arrest and you should give CPR instruction.

XXXX	0			May							0		
XXXX (1 case very poor performance and the other poor performance)	2			May					0		Chest pain (84) 3.10.17 Falling in (39) 12.10.17		Case 84. Took the case detailes and diagnosis from the ministry of interior and did not call or speak to public (bystander) to confirm the arrest or complaint. Case 39. The wife stated her husband fill in the toilet and not responding. You took medical history address and sent an ambulance. No confirming the arrest and not giving CPR instructions.
XXXX	2			Aug					Falling in (302) 08.08.17 respiratory distress (11) 25.08.17		0		You have missed two cases one before the training and one after the training. The case on the 25.08.17 was difficult. The patient was connected to a ventilating machine and bedridden. Do not be thrown off with this complex scenario. Always

													check response in abnormal breathing. If no response or unsure then it cardiac arrest and give hands only CPR instructions on the bed lying supine.
XXXX	2	Cardiac arrest		Aug			Cardiac arrest (177) 17.06.17		0	Shock (329) 05.09.17	0		Welldone! You have recognized one cardiac arrest before the training in farwanya on June and we wish you always proceed to giving CPR instructions. Keep the good work. September field personal diagnosed the case as death on arrival.Call from nurse at farwanya clinic. you are excused for not recognising the arrest. the nurse should have known.
XXXX i	1			May	Falling in (113) 30.04.17	0	0	0	0		0		Missed 1 case before training. note that when a caller state that the patient is falling in, It means that he lost conscious

													ness and you should proceed to checking response and normal breathing if not present .it is n arrest and you should give hands only CPR instruction.
XXXX	2			August	Heart failure (50) 15.04.17				Syncopy (214) 16.08.17		0		You have missed 2 cases before the training. Do not use the heart failure. It needs a physician to diagnose a heart filure. If no response and abnormal breathing => its an arrest and give CPR instructions.
XXXX (warning)	2			Aug			Heart blood vessel trauma (77) 08.06.17		0		Syncopy (319) 15.10.17		OCT 319) The caller tells you fell down in the living room and he has cardiac problem and not breathing and you just took address and send ambulance. No CPR instruction was given
XXXX	2	1	1	Aug					Death Suspicion (336) 24.08.17	Syncopy (159) 29.09.17	0		Good recognition! Please use cardiac arrest diagnosis. and

													proceed to CPR instructions. Audio not reviewed. Please note that when a caller state that the patient is syncoped, It means that he lost consciousness and you should proceed to checking response and normal breathing if not present is n arrest and you should give hands only CPR instruction
XXXX (warning)	5	1		Feb				Cardiac arrest (179) 23.07.17 (farwanya)	Syncopy (294) 04.08.17 falling in (42) 09.08.17	Diabetes millutis(204) 25.09.17	Syncopy (79) 19.10.17		The caller clearly stated my mother “fill down” did not ask about response nor breathing. Took details from ministry of interior employee.
XXXX	4	1 (death suspicion)		Aug					Hypoglycemia (235) 29.08.17 respiratory distress (170) 15.08.17 syncopy (229) 21.08.17	Death suspicion (295) 28.09.17	0		You missed 3 cardiac arrest cases 2 before the training and 1 after the training. We reviewed the audio of case (235) and although it was under your name and Naser al esbee’e took the call not you. This going in your assessment and you need to Please make sure that you log in and out only during your use. Be aware of the caller terminology syncoped mean lost consciousness and you should check normal breathing then give hands only CPR

													instruction .Do not use death suspicion unless one of the next is stated: brain is out,patient is charred, run over, head is de-attached from he rest of the body. Otherwise it is a cardiac arrest and you should give CPR instruction .
XXXX	1			No						Convulsions (86) 06.09.17	0		The onfield EMS personal as Cardiac arrest. Check response and normal breathing for every case.
XXXX	1									Falling in (338) 17.09.17	0		On field EMS personal diagnosed it as cardiac arrest Please note that when a caller state that the patient fill down, It means that he lost consciousness and you should proceed to checking response and normal breathing if not present is n arrest and you should give hands only CPR instruction
XXXX	1			No						Syncpy (330) 17.09.17	0		On field EMS diagnosed the case as cardiac arrest. Please note that when a caller state that the patient is syncoped, It means that he lost consciousness and you should proceed to checking response and normal breathing if not present is n arrest and you should give hands only CPR instruction

Best employee on this shift (based on recognition and workload)
1. XXXX.

Potential employees:
1. XXXX
2. XXXX

3. XXXX

(Appendix. XXI) Call taker work assessment sheet

	Name	Shift	Trained	Feb		March		April		May		June		July		August		Sept		Oct	
	OHCA cases																				
				Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed	Diagnosed	Missed
1	MXXX Axxxx	A	Not trained										Fall in								
2	Axxxx Axxx	C	Not trained						1 (Resp. distress)												
3	Axxxx Axxxx	A	Not trained						1 (syncopy)												
4	Axxxxxx Hxxxxxx	B	Trained						1 (syncopy)		1 (syncopy)										
5	Txxxxx Axxxxxx	C	Trained						1 (syncopy												
6	NxxxxxMxxxxxx	D	Not trained						1 (hypertension)												
7	AxxxxAxxxx	D	Not trained						1 (asphaxia				1 Fall in 1 heart								
8	KxxxxxxAxxxxxx	D	Trained						1(syncopy												
9	AxxxxHxxxx	B	Trained						1 (heart)	1 (RTA)											
10	Axxxxxx Axxxxxx	A	Not trained						3 (Syncopy)		1 (syncopy)										
11	ExxxxxxAxxxxx	A	Not trained						1 (syncopy												
12	Oxxxx Sxxx	B	Not trained						1(syncopy)												
13	MxxxxxAxxxx	B	Trained						1 (syncopy				1 Syncopy								

14	AxxxxxxA XXXX	D	Not trained						1 (respiratory Distress)		1 (fall in)										
15	Mxxxx Axxxxx	B	Not trained						1 (vertigo												
16	Axxxx Axxxxx	D	Not trained						1 (heart & blood vessel trauma												
17	Txxxxxxxx x	C	Trained					1 (Death suspicion)					1 Fall in								
18	AxxxxxAx xxxx	D	Trained								Diagnosed CA but it was convulsion										
19	Axxxx exxx	C	Not trained								2 (syncopy)		2 Syncopy								
20	SxxxxAxxx	A	Not trained								1 (syncopy)										
21	Sxxxxaxxx		Not trained								1 (Resp. Distress)										
22	XXXX	B	Not trained							1 (Death suspicion)	1(syncpoy		2 syncopy								
23	Axxxxxvxx x	B	Not trained								1 (syncopy										
24	Axxx axxxx	B	Not trained								1 (general weakness)										
25	AxxxxxAx xxx	C	Trained								1 Respiratory distress 1 fall in										
26	XXXX	D	Trained								1 (syncopy)										
27	XXX	A	Trained								1(asphaxia)		1 Respiratory distress								
28	XXX	C	Trained								1 Syncopy										

29	XXXX		Not trained								Fall in										
30	XXXXX	D	Not trained								1 Respiratory distress		Syncopy								
31	XXXXX	D	Trained								1 (fallin										
32	XXXXX	D	Trained								1 (syncopy)										
33	XXXXXX	C	Not trained								1 (convulsion)										
34	XXXXXX	B	Not trained								1 (syncopy)		Respiratory distress								
35	XXXXXX		Not trained								1 (syncopy)		1 syncopy								
36	XXXXXX	C	Not trained								1 (change catheter										
37	XXXXXX	D	Trained								3(1Hypertension,1 syncopy,1 Resp. distress)										
38	XXXXX		Trained										1 Syncopy								
39	XXX	A	Trained																		
40	XXXX	A	Trained																		
41	XXXXX	A	Trained										1 Tachycardia								
42	XXX	D	Trained																		
43	XXXXX	A	Trained																		
44	XXXXX	A	Trained																		
45	XXXXX	A	Trained										1 Death suspicion 1 Syncopy								
46	XXXX	B	Trained																		
47	XXXX	B	Trained																		

48	XXXX	B	Trained																		
49	XXXX	B	Trained																		
50	XXXX	B	Trained																		
51	XXXX	D	Trained																		
52	XXXXX	D	Trained																		
53	XXX	D	Trained																		
54	XXXXX	D	Trained																		
55	XXXX	D	Trained																		
56	XXXX	C	Trained																		
57	XXXX	C	Trained																		
58	XXXXX	C	Trained																		
59	XXX	C	Trained																		
60	XXXX	C	Trained																		
61	XXXXX	B	Trained										1 Fall in								
62	xxxxx	C	Trained									1 Cardiac arrest									
63	xxxx		Not trainted										Respiratory Distress								
64	XXX		Not trained										1 Fall in								
65	XXX	A	Not Trained										1 Syncopy								
66	X XX	B	Not trained										1 syncopy								
67	XXX		Not trained										1 Syncopy								

68	XXXX	A	Not Trained										Heart								
69	XXX		Not Trained										1 Syncopy								
70	XXX	A	Not Trained										1 syncopy								
71	XXXX	C	Not trained										1 syncopy 1 Fall in								
72	XXXXX	C	Not Trained										1 syncopy								
73	XXXXX	D	Not trained																		

Notes:
Yellow highlights mean case dates are after DACPR intensive day course and trained call takers(17-20 May2017).
Trained 40 not trained are 33
Not trained are managing most of the calls in May and June 2017

كشف أسماء متلقي البلاغ المتدربين

(دورة تدريبيةالإنعاش القلبي بمساعدة المرسل لشهر فبراير و مايو2017)

-تم تدريب المذكوريين أدناة على دورة تدريبيةالإنعاش القلبي بمساعدة المرسلوفقاً لمقاييس منظمة أريزونا للتسجيل و التعليم لإنقاذ قلب (Save Heart Arizona Registry and Education (SHARE شهر مايو 2017.

-الكشف أدناه يقيس أداء كل متلقي بعد إتمام الدورة.

-تم القياس وتحديد أداء كل متلقي بناءً على بلاغات توقف القلب من محافظتي حولى و الفروانية خلال فترة (21 مايو-31 يوليو 2017).

-أدوات القياس المستخدمة:

1.رصد و مراجعة البلاغات لحالات توقف القلب من قسم العمليات و تقارير حالات المريض من قسم التدقيق.

2.مراجعة المكالمات الصوتية بشكل عشوائي.

-تم إستخدام ثلاث مستويات لتحديد أداء المتلقين :

1. ممتاز: تحقق من حالة توقف القلب و أعطى إرشادات الإنعاش القلبي وفقاً لبرتوكول الدورة.
2. جيد: تعرف على حالة توقف القلب لكن لم يعطي إرشادات الإنعاش القلبي أوشخص الحالة بمسمى مختلف.
3.ضعيف: لم يتعرف على حالة توقف القلب و لم يعطي إرشادات الإنعاش القلبي.

يرجى العلم أن أغلب حالات توقف القلب خلال الفترة(21 مايو-31 يوليو 2017) تم إستلامها من متلقين غير متدربين, وذلك يفسر عدم تلقي الكثير من المذكوريين أدناه لأي حالة توقف قلب.

	الإسم	النوبة	عدد الحالات	تشخيص صحيح	تشخيص غير صحيح	مستوى الأداء	الهاتف/ الإيميل
1	سعود فرحان العنزي	c	1	1(326) 04.06.17		ممتاز	51336333
2	أحمد حسب العوضي	c	1		Syncopy (41) 24.05.17 syncopy (11) 05.06.17	ضعيف	66334509
3	عبدالله الجاهل محمد العنزي	c	0				55551660
4	طلال [illegible] العنزي	C	1		cardiac arrest (333) 2.07.17	ضعيف	55886336
5	موفق محمد أحمد	C	1		Syncopy (155) 27.05.17	ضعيف	66540078
6	خالد وليد مذكور	C	0			لايمكن التحديد	99779116
7	ناصر عقيل الخالدي	C	0			لايمكن التحديد	55161151
8	نايف فزاع العنزي	C	0			لايمكن التحديد	50274554
9	أحمد سالم العنزي	C	0			لايمكن التحديد	19sasuke@gmail.com
10	نواف أحمد جابر	D	0			لايمكن التحديد	Eyes&OB@gmail.com.com
11	أحمد عيد	D	3		Hypertension**(36) 25.05.17 Syncopy (314) 24.05.17 Resp. distress(304)	ضعيف	Ahmadeidd22@gmail.com

		24.05.17					
[illegible].Gmail.com	ضعيف	Syncopy (97) 20.05.17		1	D	إسماعيل [illegible]	12
A[illegible]@gmail.com	ضعيف	Syncopy (221) 20.05.17 Cardiac arrest (244)** 28.05.17 1 fall in (327)15.07.17 Pro QA (78) 19.07.17		4	D	علي أحمد الركب	13
K[illegible]@hotmail.com	ضعيف	Falling from height (153) 27.07.07		1	D	فواز الظفيري	14
Abonaser183@hotmail.com	لايمكن التحديد			0	D	بدر ناصر	15
Alnaemat.[illegible]mmad@yahoo.com	لايمكن التحديد			0	D	[illegible] علي سالم [illegible]	16
[illegible]otmail.com	جيد	Falling in (355) 27.07.17 Respiratory distress (336) 24.05.17	Death suspicion (276) 21.06.17	3	D	[illegible]	17
Fahad Al[illegible]@[illegible]ok.com	لايمكن التحديد			0	D	فهد [illegible]ي	18
Tabualshwarib@ems.gov.kw	لايمكن التحديد			0	D	تيسير [illegible] إبراهيم	19
[illegible].live	ممتاز	Syncopy (29) 16.06.17	**Cardiac arrest	2	B	مؤيد عدنان الرفاعي	20

(Appendix. XXII) Supervisor shift monitoring sheet.

Shift's Supervisor reporting

The following figures are based on Kuwait EMS Audit department Out of hospital cardiac arrest report 2013:

- Expected workload Approximately 10 cases per week. More specifically From Hawali province 1 case a day.

- Time of the day: High peak 1-2 pm and lowest peak 11 pm. Not equally distributed across the day.

- Month: Highest rate in December and the lowest rate in July.

Supervisor Objective.

To ensure that his shift recognize at least 1 OHCA case a day and give Hands- only CPR instruction according to DACPR protocol

Method

At least one of the call takers should submit one DACPR sheet to the shift supervisor. The supervisor should sign in each case in the Dispatch room monitoring table.1 The supervisor should then hand in the DACPR sheets to the Dispatcher chief office. The dispatcher chief will hand it to the researcher and the Dispatch instructor.
The researcher and the Dispatch instructor will assess the outcomes of each submitted OHCA call:
i. Active component (OHCA recognition and Hands only CPR instructions): this is by listening to the audio record of this call and audio record's monitoring sheet.
ii. Correct Diagnosis: Reviewing the outcome of this call via matching its serial number in the computer system.(correct diagnosis, incorrect diagnosis)
iii. Primary and secondary outcomes: on field EMS personal patient report forms and Hospital records.

Date	Shift	Shift Supervisor	Call taker	Signature
	A			
	B			
	C			
	D			
	A			
	B			
	C			

	D			
	A			
	B			

Feedback will be given to Dispatcher chief and Shift supervisors.

كشف توقيع موظفي شعبة العمليات العاملة
لرصد حالات توقف القلب

* عدد الحالات المتوقعة أكثر من 10 حالات أسبوعيا. وبالتحديد حالة توقف قلب يوميا من محافظة حولي الصحية .

* وقت الذروة 6-8 صباحا و 1-2 ظهراً والوقت الأدنى 11 مساءاً .

* الحالات أكثر حدوثا في شهر ديسمبر وأقل حدوثا في شهر يوليو .

لذا يرجى من حضرتكم التأكد من استلام على الأقل استبيان واحد لحالة توقف القلب بشكل يومي ووضع علامة (√) في الجدول التالي :

التاريخ	النوبة	مسئول النوبة مساعد مسئول	متلقي الاتصال	تم استلام استبيان توقف القلب
7/25		عبدالعزيز الحافظ محمد رشيد صلاح عبدالكريم		
7/26		خالد المذكور محمد كابلي مساعد المطيري		
7/27		محمد فاضل حسن الصيدلي عبدالعزيز حاجي		
7/28		ناصر السبيعي خالد المطيري فهد العنزي		
7/29		عبدالعزيز الحافظ محمد رشيد صلاح عبدالكريم		
7/30		خالد المذكور محمد كابلي مساعد المطيري		
7/31		محمد فاضل حسن الصيدلي عبدالعزيز حاجي		

(Appendix. XXIII) Call taker Quality assurance form.

Operation Unit
Emergency call division
Call taker Quality assurance form

Background	ProQA	DACPR course trained	Not trained
Nurse			
EMT			
Paramedic			

Call taker name: _________________ Shift:______

Evaluator Name: _________________ Case No: _____ Date:___/_____/____
Time:________pm/ am

Number of calls taken by this call taker from the

start of the shift to this time(workload) :___________

Evaluative sections		Yes	No	Correctly Yes	Correctly No	*Performance level
1. Proper identification	a. The call taker is logged in with his own username.					
2.Greetings (less than 10 *seconds*)	a. Call taker stated his name and agency.					
	b. Call taker stated “How can I help you?”					
3.Case Entry (less than 40 *seconds*) *Time elapsed from the start of the call: ______________	a. The call taker took the address of the incident.					
	b. The call taker took the name and the phone number caller in a timely fashion.					
4. Role out Cardiac arrest	a. Did the call taker ask if the patient awake?					

(less than 20 *seconds*) Time elapsed from the start of the call: ______ (If it is a case of cardiac arrest skip 5./6. And proceed to 7.1 section please)	b. Did the call taker ask if the patient is breathing normally?					
	c. Did the call taker ask about the patients age?					
5.Cheif complaint selection	a. Did the call taker ask "tell me exactly what happened?"					
	b. Did the call taker select the correct chief complaint?					
6. Key question	a. Did the call taker follow Pro QA key question protocol?					
	b. Did the call taker asked relevant question to the case?					
7. Pre arrival-Instruction section.	a.The instructions are not indicated(dangerous situation to the caller.)					
	Instructions indicated: Did the call taker state' An ambulance is being dispatched, but I					

	need you to stay on the line to help the patient.’					
	The call taker gave instruction per;(Pro QA protocol/ DACPR training course/ no specific guideline.)					
	The call taker selected the right instruction for the case.					
	Comments: ________________ ________________ ________________					
7.1 Cardiac arrest instructions: (awake no, breathing normally no) (Breaths instructions should only be given in: Children drowning, suicide, intoxication and traumatic cardiac arrests (*1st chest compression should be with in 120 seconds from the call)*	a. Correct positioning of patient (lying on the floor on his back).					
	b.The call taker asked the caller to “ place the palm of his right hand on the center of the chest. place his left hand on it. Straighten the elbow and push hard and count 1,2,3……100. *(did the call taker use the momintrome to count)__________					
	c. The call taker asked him if any other bystander is with him to help.					

	d. The call taker is reassuring the caller continuously					
	e. Barriers to instruction exist: caller refused/ language barrier line disconnect/panic caller/ positioning difficulty	Comments:				
8.Customer service section	a. Displays professional manner(speak clearly and listen attentively)					
	b. Controls conversation					
	c.Reassures caller					
	d.Uses calming techniques when appropriate					
	e.Kept the phone call for appropriate period of time.					
	f. kept supporting documents (DACPR protocol or EMD cards)					
9.Cross check on field EMS personal diagnosis in the system (*This step should be done with in 12 hours from the call to ensure data entry*)	The call taker diagnosis matches the on field EMS personal.(label exceed) The call taker diagnosis matches the on field EMS personal to some extent. (label satisfactory) The call taker doss not diagnosis matches the on field EMS personal. (label unsatisfactory)					

*Performance level:
Exceed: complaint with protocol (yes correctly been marked).
Satisfactory: not fully compliant to protocol (yes and incorrectly been marked)
Unsatisfactory: not compliant (no and in correctly been marked)

Over all performance:

1.Count the total number of
Exceed :______ Satisfactory:_______ Unsatisfactory:________

*Notes:
Exceed: 7 evaluative sections are labelled with exceed.
Satisfactory: 4 evaluative sections are labelled with satisfactory and or only 1 unsatisfactory.
Unsatisfactory: if more than 2 evaluative sections are marked with unsatisfactory.

Over all performance of the call	
Total time of the call	
Matched on field EMS personal diagnosis	YES / NO

Reference:

The International Academy EMD Protocol ‘Medical Dispatch Case Evaluation Record’ Emergency medical dispatch version 13. Courses Scenarios. (2016)Ed.25

(Appendix. XXIV.) Monthly Evaluation report

Dispatcher Assisted -CPR (April 2017)

Monthly report

Emergency Unit, Operation Department

Emergency Medical services

Results:

- This report was written 2 months after this observation segment. This is because Patient report sheets collection takes 6 weeks and 1 week to be matched wit operation unit data retrospectively. The trained call takers on DACPR protocol on this period were 8 call takers only. There were no DACPR sheets submitted by the trained call takers at the end of this observational period from Hawaii province to the researcher. Thus the Dispatcher Instructor searched Operation Unit electronic files using the Emergency Medical Priority Dispatch system (EMD) for all OHCA cases that activated the Operation system during April 2017. This is to confirm that all OHCA cases were transferred to the trained call takers. Table 9.Show Emergency Medical Priority Dispatch system crosscheck findings for OHCA cases during the first post-intervention Observational segments (April 2017).

Trial number	Date	Shift	Caller	Caller Nationality	Caller gender	Call Number	Province	Area	Location	Call Time	Dispatch Time	Outcome
EMD	0.3.04.17	A	Nurse	Non-Kuwaiti	M	271	Mubarak Alkabeer	alreqaah	Primary care clinic	18.18	18.2	Correct diagnosis

Table 9.Show Emergency Medical Priority Dispatch system crosscheck for OHCA cases during first post- intervention Observational segment April 2017)

- 1 case was identified and analyzed. It was not from Hawali province.

- Patient report sheets from Hawali province and Mubarak Al-Kabeer hospital medical records have been collected and reviewed. Nineteen cardiogenic OHCA cases have occurred during April 2017. 84% (16 OHCA cases) were misdiagnosed. The most common misdiagnosis is Syncope (52% (10 cases). 15% of the OHCA cases was diagnosed as cardiac related conditions (3 case), yet when Audio records were reviewed, the diagnosis was based on chance. the call takers did not confirm the cardiac arrest. As the caller volunteer the heart related condition and the call taker wrote it down. Methods of Audio records review were random audio review of 5 cases by the researcher and the instructor with the filling of Audio recording monitoring sheet. (See Appendix. A.) despite the reasonable mean response time (10 minutes) of all the cases in April 2017, none of the patients survived.

- There were equal distribution of calls between the shifts calls 26% occurred during shifts D and C and 21 % during shifts A and B. All callers were civilian, males (68%) and 43% were Kuwaitis.
- Outcome; None of the patients achieved ROSC nor survived. All patients died on scene or during retrieval.

Date	Shift	Dispatched as	Caller	Caller Nationality	Caller Gender	Case Number	Response time	Bystander CPR	Outcome
04.04.17	B	Syncopy	Civilian	Kuwaiti	M	154	0.07	No	Pronounced dead during retrieval
08.04.17	A	Syncopy	Civilian	Non Kuwaiti	M	34	0.08	No	Pronounced dead during retrieval
13.04.17	C		Civilian			73	0.05	No	Pronounced dead during retrieval
13.04.17	C	Respiratory distress	Civilian	Unclear	F	124	0.28	No	Resuscitation terminated in ER
25.04.17	C	Syncopy	Civilian	Non Kuwaiti	F	274	0.07	Yes	Pronounced dead in A&E
26.04.17	D	Hypertension	Civilian	Kuwaiti	M	286	0.13	No	Pronounced dead during retrieval
14.04.17	D	Asphyxia	Civilian	Non Kuwaiti	M	65	0.1	No	Pronounced dead during retrieval
19.04.17	D	Syncopy	Civilian	Non Kuwaiti	M	22	0.07	No	Rigor mortis
20.04.17	B	Heart	Civilian	Non Kuwaiti	F	220	0.09	No	Pronounced dead during retrieval
11.04.17	A	Syncopy	Civilian	Non Kuwaiti	F	193	0.12	No	Pronounced dead on scene left for forensic
03.04.17	A	Syncopy	Civilian	Non Kuwaiti	M	205	0.08	No	Pronounced dead on scene left for forensic
04.04.17	B	Syncopy	Civilian	Kuwaiti	M	145	0.09	No	Rigor mortis
04.04.17	B	Syncopy	Civilian	Kuwaiti	M	360	0.1	No	Pronounced dead during retrieval

15.04 .17	A	Syncopy	Civilian	Kuwaiti	M	138	0.08	No	Pronounced dead on scene left for forensic
15.04 .17	A	Syncopy	Civilian	Non Kuwaiti	M	134	0.06	No	Pronounced dead during retrieval
18.04 .17	D	Respiratory distress	Civilian	Kuwaiti	F	323	0.06	No	Rigor mortis
20.04 .17	B	Vertigo	Civilian	Non Kuwaiti	M	380	0.09	No	Pronounced dead during retrieval
23.04 .17	D	Heart blood vessel trauma	Civilian	Non Kuwaiti	M	37	0.08	No	Pronounced dead during retrieval
29.04 .17	C	Death Suspicion	Civilian	Non Kuwaiti	M	84	0.16	No	Rigor mortis

Conclusion:

Only 15% of OHCA cases during April 2017 were identified. Audio records review showed it was due to chance. All the shifts missed the OHCA cases. There is a significant area of improvement in Kuwait EMD system when it comes to OHCA identification. Dispatcher Assisted CPR training course is required for all call takers and took place on 17 May 2017 to include 36 call takers. OHCA cases measurement should continue. The addition of Audio records monitoring improves the accuracy of the results.

Appendix A. Audio recording Monitoring Sheet

<u>Audio recording monitoring sheet</u>

Case Number: _ _ _   Date: _ _/_ _ / _ _

Case of	Incorrectly diagnosed case as OHCA	Correctly diagnosed OHCA.	Missed OHCA case: -----------------------

1.What protocol did the call taker use to identify the Case?

Pro QA	DACPR protocol	Neither

2.Was it an obvious OHCA case?

Unresponsive	Not breathing	Both	Not sure of Both

Time of OHCA recognition:

Less than 1 minute	With in 1 minute	2 minutes	More than 2 minutes

3. Was CPR instructions indicated?

YES	NO

3.Did the call taker give an CPR instructions?

YES	NO	Time: 2 minutes More than 2 Minutes.

4. Did the call taker give Clear CPR instructions?

YES	NO

5.Was there any call barriers:

Panicking caller	
Caller refusal	
Positioning difficulties	
Language barriers	
Line difficulties	
Caller not with the patient	
Others:	

5. What was the outcome of the call?

Harm	
No Harm	
Benefit	

(Appendix. XXV). Diploma of International academy of Emergency Medical Dispatch.

DIPLOMA

INTERNATIONAL ACADEMY of EMERGENCY MEDICAL DISPATCH

Upon recommendation of its Faculty and Fellows, the International Academy hereby attests that

Dalal DA Alhasan

has successfully fulfilled the International Academy's requirements for honoured level of

Certified Advanced Emergency Medical Dispatcher

with all Rights and Responsibilities this 21st day of October, 2016

Interim President of the Academy

Pamela Stewart
Chair, Board of Certification

Board of Trustees

Vicki Mag
Chair, Board of Medical Curriculum

Certification No. 565197

Chair, College of Fellows