QUALITY PERFORMANCE MEASUREMENTS OF AMBULANCE SERVICES IN EAST COAST, MALAYSIA

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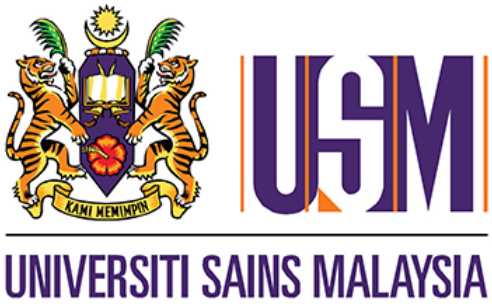
DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF MEDICINE (EMERGENCY MEDICINE)



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LIST OF ABBREVIATIONS

ACV	Ambulance call volume
AHA	American Heart Association
ALS	Advanced Life Support
AMO	Assistant medical officer
CPR	Cardiopulmonary resuscitation
EAS	Emergency Ambulance Services
EMS	Emergency Medical System
EMSPM	Emergency Medical System Performance Measurement
EMT	Emergency Medical Technician
EP	Emergency physician
HKB	Hospital Kota Bharu
IOM	Institute of Medicine
JKN	Jabatan Kesihatan Negeri
JPAM	Jabatan Perkhidmatan Awam Malaysia
KPI	Key Performance Indicator
MECC	Medical Emergency Coordination Centre
MMUCC	Model Minimum Uniform Crash Criteria
MOH	Ministry of Health
NEMSIS	National EMS Information System
NHTSA	National Health Traffic and Safety Administration
OR	Odds Ratio

QI	Quality Indicators
SOP	Standard Operating Procedure
SPSS	Statistical Packages for Social Science
UFR	Unavailable for response
UK	United Kingdom
USA	United States of America

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ABSTRAK

KAJIAN MENGENAI PENGUKURAN PRESTASI KUALITI PERKHIDMATAN AMBULANS DI PANTAI TIMUR , MALAYSIA

PENGENALAN

Negeri-negeri di wilayah Pantai Timur Malaysia terdiri daripada Kelantan, Terengganu dan Pahang. Sama dengan negeri-negeri lain di Malaysia, perkhidmatan ambulans di rantau ini kebanyakannya disediakan oleh kerajaan di bawah Kementerian Kesihatan Malaysia (KKM) dan Kementerian Pelajaran Malaysia (KPM) dalam sistem perubatan kecemasan di hospital (EMS). Perkhidmatan ini memainkan peranan penting di khalayak ramai untuk menyediakan perkhidmatan penjagaan kesihatan yang pantas dan cekap di lapangan serta di dalam ambulans. Oleh itu, kualiti perkhidmatan yang perlu dicapai mengikut standard antarabangsa. Kajian ini memberi tumpuan kepada penilaian prestasi semasa perkhidmatan ambulans di Pantai Timur Malaysia, berasaskan kepada masa tindak balas ambulans, kemalangan ambulans dan aduan pesakit serta mengenal pasti faktor-faktor yang mempengaruhi masa tindak balas ambulans dan juga kemalangan ambulans.

KAEDAH

Kajian ini adalah satu kajian keratan rentas untuk menilai ukuran prestasi kualiti perkhidmatan ambulans di Wilayah Pantai Timur, Malaysia dari Januari 2014 hingga Disember 2014. Data diperolehi daripada borang soal selidik yang telah diedarkan kepada semua hospital kerajaan di Kelantan , Terengganu dan Pahang. Siri wawancara bersama paramedik yang bertanggungjawab bagi perkhidmatan ambulans telah dilakukan di hospital tertentu untuk mengenal pasti faktor-faktor yang menyumbang kepada prestasi tersebut. Ia telah dijalankan dari November 2014 hingga Mac 2015. Analisis statistik dilakukan menggunakan perisian SPSS versi 22.0 . Regresi linear mudah dan berganda telah digunakan untuk menentukan faktor-faktor yang berkaitan yang mempengaruhi masa tindak balas ambulans manakala regresi logistik mudah digunakan untuk mencari faktor-faktor yang mempengaruhi kemalangan ambulans.

KEPUTUSAN

Sebanyak 22 hospital daripada 26 telah terlibat dalam kajian ini dengan 8 buah hospital dari Pahang, 8 buah hospital dari Kelantan dan 6 buah hospital dari Terengganu. Majoriti ambulans berada dalam seliaan penolong pegawai perubatan tahap U32 dan ke atas. Antara parameter yang digunakan untuk mengukur indeks prestasi utama, masa tindak balas ambulans telah yang tertinggi (95.5%). Masa tindak balas purata pada tahun 2014 untuk semua hospital di Pantai Timur, Malaysia 16.90 minit dengan (SD) 5.94. Min kemalangan ambulans adalah 0.77 dan median adalah 1.00. Majoriti hospital tiada / aduan yang tidak diketahui mengenai perkhidmatan ambulans di hospital mereka (59.1%). Sebanyak 40.9%

mempunyai kurang daripada 10 aduan rasmi. Daripada kajian ini, analisis regresi linear univariat menunjukkan bahawa tidak ada faktor-faktor penting mempengaruhi masa tindak balas ambulans. Untuk kemalangan ambulans, hasil dari analisis regresi logistik mudah menunjukkan tiada faktor yang signifikan mempengaruhi kemalangan ambulans

KESIMPULAN

Berdasarkan kajian itu, kami membuat kesimpulan bahawa kualiti perkhidmatan ambulans di Pantai Timur , Malaysia masih tidak mencapai standard antarabangsa. Tidak ada faktor-faktor penting yang mempengaruhi masa tindak balas ambulans dan juga kemalangan ambulans telah dikenalpasti.

ABSTRACT

QUALITY PERFORMANCE MEASUREMENTS OF AMBULANCE SERVICES IN EAST COAST, MALAYSIA

INTRODUCTION

East Coast Region states in Malaysia consists of Kelantan, Terengganu and Pahang. Similar with other states in Malaysia, ambulance services in this region are mainly provided by the government under Ministry of Health (MOH) and Ministry of Education (MOE) in the hospital-based emergency medical system (EMS). The service plays a significant role in public to provide fast and efficient healthcare services in the field as well as inside the ambulance. Therefore, the quality of services must be achieved according to international standard. This study is focused on evaluating the current performance of ambulance service in East Coast, Malaysia based on ambulance response time, ambulance crash and patients complaints as well as identifying the factors affecting the ambulance response time and also ambulance crash.

METHODOLOGY

This study was a cross-sectional study to evaluate the quality performance measurements of ambulance service in East Coast Region, Malaysia from January 2014 to

December 2014. The data was obtained from questionnaires which was distributed to all the government hospitals in Kelantan, Terengganu and Pahang. Series of interviews with paramedics in-charged of ambulance services was done in selected hospitals to identify the factors contributed to its performance. It was conducted from November 2014 to March 2015. Statistical analysis was done using SPSS software version 22.0. Simple linear regression was used to determine the associated factors influencing the ambulance response time whereas simple logistic regression was used to determine factors associated with ambulance crash incident.

RESULTS

Total of 22 hospitals out of 26 were involved in this study with 8 hospitals from Pahang, 8 hospitals from Kelantan and 6 hospitals from Terengganu. Majority ambulances were in charged by assistant medical officer (pembantu pegawai perubatan) level U32 and above. Among parameters used to measure the key performance index, the ambulance response time had been the highest (95.5%). The mean response time in 2014 for all hospitals in East Coast, Malaysia was 16.90 minutes (SD) of 5.94. The mean ambulance crash was 0.77 and the median was 1.00. Majority hospitals had none /unknown complaints regarding ambulance services in their centres (59.1%). Otherwise, 40.9% had less that 10 formal complaints.

From this study, univariate linear regression analysis showed that there were no significant factors influenced the ambulance response time and univariate logistic regression showed that there were no factors significantly associated with ambulance crash.

CONCLUSION

Based on the study, we concluded that the quality of ambulance services in East Coast, Malaysia still not achieving the international standard. There were no significant factors which influenced ambulance response time and ambulance crash.

BAHAGIAN C

Biodata Abstrak Penyelidikan

QUALITY PERFORMANCE MEASUREMENTS OF AMBULANCE SERVICES IN EAST COAST, MALAYSIA

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Introduction: East Coast Region states in Malaysia consists of Kelantan, Terengganu and Pahang. Similar with other states in Malaysia, ambulance services in this region are mainly provided by the government under Ministry of Health (MOH) and Ministry of Education (MOE) in the hospital-based emergency medical system (EMS). The service plays a significant role in public to provide fast and efficient healthcare services in the field as well as inside the ambulance. Therefore, the quality of services must be achieved according to international standard. This study is focused on evaluating the current performance of ambulance service in East Coast, Malaysia based on ambulance response time, ambulance

crash and patients complaints as well as identifying the factors affecting the ambulance response time and also ambulance crash.

Objectives: The aim of this study were to evaluate the quality performance of ambulance services in government hospital in East Coast Malaysia based on ambulance response time, number of ambulance crash and number of patients' complaint and factors affecting its quality services.

Methods: This study was a cross-sectional study to evaluate the quality performance measurements of ambulance service in East Coast Region, Malaysia from January 2014 to December 2014. The data was obtained from questionnaires which was distributed to all the government hospitals in Kelantan, Terengganu and Pahang. Series of interviews with paramedics in-charged of ambulance services was done in selected hospitals to identify the factors contributed to its performance. It was conducted from November 2014 to March 2015. Statistical analysis was done using SPSS software version 22.0. Simple linear regression was used to determine the associated factors influencing the ambulance response time whereas simple logistic regression was used to determine factors associated with ambulance crash incident.

Results: Total of 22 hospitals out of 26 were involved in this study with 8 hospitals from Pahang, 8 hospitals from Kelantan and 6 hospitals from Terengganu. Majority ambulances were in charged by assistant medical officer (pembantu pegawai perubatan) level U32 and above. Among parameters used to measure the key performance index, the

ambulance response time had been the highest (95.5%). The mean response time in 2014 for all hospitals in East Coast, Malaysia was 16.90 minutes (SD) of 5.94. The mean ambulance crash was 0.77 and the median was 1.00. Majority hospitals had none /unknown complaints regarding ambulance services in their centres (59.1%). Otherwise, 40.9% had less that 10 formal complaints. From this study, univariate linear regression analysis showed that there were no significant factors influenced the ambulance response time and univariate logistic regression showed that there were no factors significantly associated with ambulance crash.

Conclusion: Based on the study, we concluded that the quality of ambulance services in East Coast, Malaysia still not achieving the international standard. There were no significant factors which influenced ambulance response time and ambulance crash.

CHAPTER 1

INTRODUCTION

1.1 East Coast, Malaysia

Generally, Malaysia is a part of South East Asia and consists of Peninsular Malaysia or also known as West Malaysia and part of Borneo or known as East Malaysia. Peninsular Malaysia is further divided into East Coast, Northen Region, Central Region and Southern Region. States in East Coast are Kelantan, Terengganu and Pahang. Majority of the people in East Coast region are Malays with few population of Chinese and Indians (Malaysia, 2010). According to Department of Statistics, the population of Pahang is 1.8 millions whereas in Kelantan and Terengganu, there are 1.6 millions and 1.1 millions of populations respectively. The total land area of the East Coast states is 13,963.86 miles square with Pahang being the largest state among the three (Malaysia, 2010).

Similar with other states in Malaysia, the healthcare facilities are provided by Ministry of Health (MOH) and implements the universal healthcare system which co-exist with private sector (Hisamuddin *et al.*, 2007). However, each state has their own Jabatan Kesihatan Negeri (JKN) and conducting the services based on their own policies. The ambulance services are mainly provided by government in hospital-based emergency medical system (EMS) and supported by Jabatan Perkhidmatan Awam Malaysia (JPAM) as well as non-governmental ambulance service such as St John Ambulance (Hisamuddin *et al.*, 2007).

1.2 Ambulance services

In general, ambulance is often defined as a vehicle to transport sick or injured patient to the healthcare facility to be treated accordingly (Alan, 1949). The term *'ambulance'* itself derived from a Latin word which means to *walk or move about* (Fraunhofer *et al*.),(Barkley, 1978). However, ambulance service has many other pivotal roles and is considered one of the most fundamental services in healthcare arena all over the world. It is a part of emergency medical services (EMS) which has a major impact in the community. It provides the continuous services related to medical and trauma emergencies. The service is rendered by the paramedics or emergency medical technicians (EMT) in purpose to provide out-of-hospital acute medical care or transport to the definitive care for patients with illnesses or injuries whereby the patient, or the medical practitioner, believes constitutes a medical emergency (Curka *et al.*, 1993). Before the EMS was introduced, the ambulance service provided mainly only transportation for the patient in acute emergency condition such as trauma and cardiac arrest**.** Over the time, the service had evolved from a simple system of ambulances providing only "scoop and run" to a system in which actual medical care is given on scene and during transport**.** In some developing countries however, the services still do not provide early treatment to the patients, but only the transport to the point of care, which usually the nearest hospital (Smith and Conn, 2009). Until now, the ambulance vehicle and their services are still evolving to meet the requirement largely due to the increasing skills of paramedics and other ambulance crew. Other factors contributing to the improvement include the needs to protect the ambulance crews from injury by ambulance crash as well as in catastrophic incidents such as disasters (Kuehl, 2002).

1.3 Ambulance performance measurements

Apparently, ambulance service providers and protocols vary between countries. Each country has its own approach on how to manage their ambulance services and who should be responsible to deliver such services (Rahman *et al.*, 2015). For example, some countries in Europe insist that the emergency medical services must be provided by physicians or specially trained nurses in advanced life support (ALS). Unlike North America, United Kingdom and Australia, those services are provided by paramedics and rarely by physician on site. Apart from government ambulance, local fire or police department also provide the services (Smith and Conn, 2009), (Perkins and Cooke, 2012), (Lord, 2003). Meanwhile in Asia, EMS systems are at different developmental phases and maturity. The more developed countries such as Singapore, Japan and Korea have more systematic and mature EMS systems as compared with less developed countries such as Thailand and Malaysia (Ong *et al.*, 2013), (Nielsen *et al.*, 2012), (Rahman *et al.*, 2015). Beyond all the differences, the type of EMS eventually will be determined by local jurisdictions and medical authorities, depending on the needs of the community and economic resources (VanRooyen *et al.*, 1999).

1.4 Quality performance

Due to its essential role for the public, it is undeniable that the ambulance services must be efficient and reliable so that the services provided are at their best in order to save people's lives in acute emergency setting. Increasing demand from the public for a better ambulance services system and an increase in the incidence of road traffic accidents become a catalyst for improvement of such services (VanRooyen *et al.*, 1999), (Hisamuddin *et al.*,

2007). Therefore, continuous measurement of ambulance quality performance is crucial and the need for key performance indicator (KPI) for ambulance services is beyond any doubt. According to MacFarlane and Benn (MacFarlane and Benn, 2003), ambulance services performance is basically evaluated based on ambulance response time and on-scene time. Indeed, many countries used these parameters to assess their ambulance services. As a result, many studies throughout the world have developed indicators based on these time intervals (Blackwell, 1993).

The importance of ambulance performance analysis is to identify areas of deficiencies so that the improvement can be made in the future (Al-Shaqsi, 2010). Apart from that, the need for quality performance measurements of ambulance services are also important to deliver information to aid government officials in establishing relevant policy and monitoring system quality and effectiveness. It is considered as a tool to evaluate the value of EMS to stakeholders and implies accountability and transparency of the system to the public and funders (Cote *et al.*, 2008). According to O'Leary (O'Leary, 1988), the performance evaluation of emergency medical services (EMS) is similar to mainstream medicine in being both a science and an art. Hence, it is essential for the emergency medical services agencies to have in-place quality control or quality improvement programs to monitor the system's performance and the effectiveness of services (El Sayed, 2011).

Ambulance service in Malaysia has different perspective. According to Sethi et al, (Sethi *et al.*, 2002), government ambulance services in Malaysia is predominantly hospital-based facility. Civil defense and private sector ambulances have their own facilities. Some urban area such as Kuala Lumpur has many ambulance providers from governments and private

sectors. However, fire and police department do not contribute to pre-hospital EMS (Hisamuddin *et al.*, 2007). Similar to some other countries, ambulance quality performance measurements in Malaysia also rely on ambulance response time. The effectiveness of response time depends on three components, which are emergency call processing time, crew mobilization time, and travel time to the scene. In fact, recent policy on ambulance performance published by Ministry of Health (MOH) stated that ambulance will be assessed on their response time. 15 to 30 minutes within 5 km radius is the time frame targeted by the ministry from the time of receiving a call to the time ambulance reaches the victims in acute emergency cases (Malaysia, 2012). Figure 1, extracted from Emergency Medical Services Council Hong Kong, summarizes the major steps and their respective performance measures in providing EMS or Emergency Ambulance Services (EAS) in general (Liu *et al.*, 1996).

Apart from time intervals, there are no other standardized indicators to measure the quality of ambulance service in Malaysia. Patient's satisfaction, protocol compliance and patient's outcome are some of the recommended measurements that should make into consideration in assessing the quality of ambulance services (Al-Shaqsi, 2010).

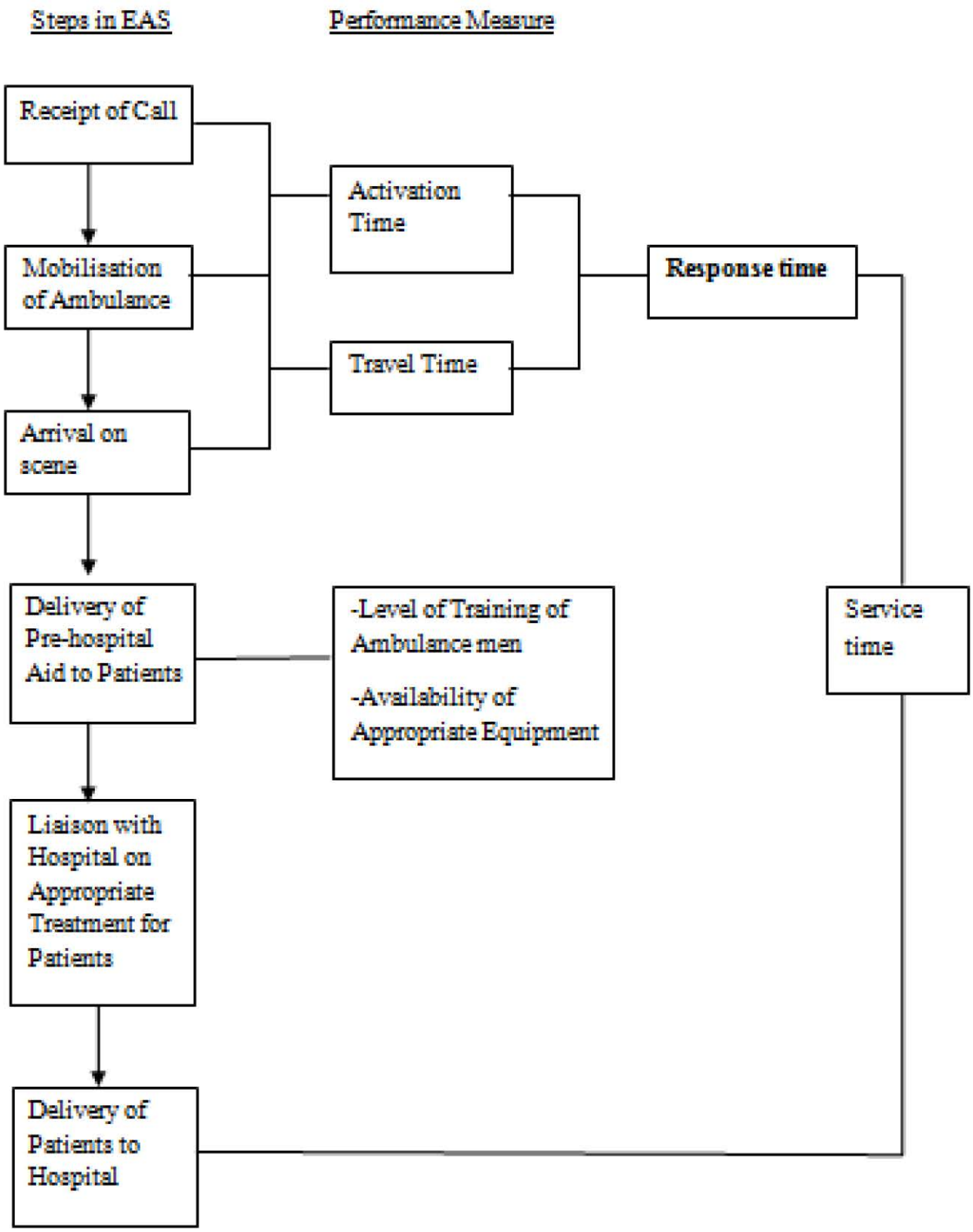

Figure 1: Major steps and Performance Measures of EAS

The purpose of this study is to evaluate the level of quality performance of ambulance services in Malaysia, not only based on ambulance response time but also from other perspectives, such as number of ambulance crash incidents and patients' complaints. As this country is rapidly progressing on its economic status and population, it is hoped that the outcome of this study will trigger the policymaker to identify better quality performance indicators for ambulance services and eventually leads to a good quality control in order to deliver the best quality of care to the public. It is hoped that this study will be the initial step to understand the quality of EMS in East Coast Malaysia.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

The emergency medical service (EMS) is a unique system whereby it provides various services depending on the calls such as providing an emergency medical technician, a paramedic, or transportation in pre-hospital setting ranging from urban to the rural area (Chanta, 2011). The first EMS system was started in United States of America (USA) in 1966 in the Department of Transportation through the Highway Safety Act. According to National Academy of Sciences, prior to that particular year, ambulance transport programs develop without standard operating protocols or direction (Gibson, 1973). Subsequently, various pilot studies had been conducted at the local level then followed by the federal legislation until the modern EMS systems had been established in 1973 known as EMS Act (Moore, 1999). According to the Act, 15 standard component were identified and continued to serve as the basis of EMS in USA which include: 1) adequate manpower and personnel with appropiate experience and training, 2) properly equipped transportations with adequate number of ground, 3) air and water vehicles based on the needs, 4) systematic and organised link communications, 5) provide adequate training of personnel with continuous education programs, 6) adequate number of easily accessible EMS facilities, 7) transfer of patients, and 8) disaster linkage (Physicians, 1988),(Carli and Barrier, 1992), (Moore, 2002). Although from time to time, the demand for EMS quality is high, it will not be achieved if the government leaders failed to effectively evaluate the system, determining the needs and enhance budget for pre hospital care providers to develop better quality control (Moore, 2002).

2.2 Quality of care

The quality of care is indeed difficult to measure and challenging (Harrawood and Easton, 2000). According to Institute of Medicine (IOM), quality in healthcare is defined as "the degree to which health services for individuals and populations increase the likelihood of desired health outcome and are consistent with current professional knowledge" and described six dimensions of quality care: a care that is safe, effective, patient-centered, timely, efficient, and equitable (Berger, 2006). Some of the literature suggested that quality of healthcare should include appropriate delivery of healthcare without compromising its cost-effectiveness (America, 2001). Quality indicators (QI) are qualitative and quantitative measures used to determine the quality of health. Although there had been multiple approaches to develop QI, to date, there is no standard consensus on the best methodological approach noted (Kotter *et al.*, 2012). In order to create good QI to identify the magnitude and nature of the problem so that improvement and corrective actions can be made, information and systematic data collections are essential (Moore, 1999), (Bloom, 2002),(Stelfox and Straus, 2013).

2.3 Performance measurement

Performance measurement has a broad context. Generally, it refers to the process of quantifying actions, in which measurement is defined as a process of quantification (Neely *et al.*, 2005). Throughout the world, there had been many attempts to develop the key performance indicators in their respective countries to monitor their emergency medical systems agencies (Moore, 1999), (VanRooyen *et al.*, 1999), (Sørup *et al.*, 2013). According to the study done by Sørup *et al* to evaluate on recommended performance and quality-in-care measures, in the identified performance measures, review articles from USA, United Kingdom (UK), Sweden and Canada revealed that time intervals and patient related measures

were dominant. Length of stay, time between patient arrivals to admission, time between patient arrival to initial clinical assessment, patients left without being seen, unplanned re-attendance within a maximum 72 hours, patient's mortality, morbidity and number of unintended incidents are the highlighted performance measures in Emergency Department (Sørup *et al.*, 2013).

Emergency Medical System Performance Measurement (EMSPM) is important to continously maintain the standard quality of care to the public. The aim of EMSPM is to apply experience, data and knowledge to assess and improve its delivery, clinical care as well as personnel performance (Rahman *et al.*, 2015).

A report entitled "Emergency Medical Services at the crossroads" published by IOM in 2006 suggested the development of evidence-based performance indicators which can be nationally standardized so that statewide and national comparisons can be made. The development and implementation of these indicators are believed would increase the accountability and provide EMS agencies with data to measure their system's overall performance as much as developing strategic quality improvement planning (Berger, 2006).

In December 2009, National Health Traffic and Safety Administration (NHTSA) has published the recommended attributes and indicators for system and service performance for EMS. This document is the outcome of EMS Performance Measures Project started in 2002 and end in 2007. It contains 18 questions areas and 35 indicators or attributes that are recommended for performance measurements for EMS systems. The objective of this

recommended attributes is to facilitate other EMS system in other countries to develop and measure their own EMS services (Administration, 2009).

According to Moore (Moore, 2002), the importance of performance measurement instruments for prehospital EMS are:

1. To allow the policymaker to evaluate the performance and establish a baseline performance level based on the indicators
2. To establish goals based on current performance
3. Identify the gap between the desired goals and current performance level
4. To track the progress in order to achieve goals
5. To set a benchmark and comparing the performance with other organizations (i.e private sector)
6. To monitor performance for quality control
7. To identify problems and causes
8. To plan for the future.

Despite various significant works of evaluating the quality performance of EMS services generally and ambulance services specifically, a paper published by Emergency Medical Journal in 2003 stated that the true efficacy and value of the system is difficult to determine (MacFarlane and Benn, 2003). This is due to the multitude of variations and combinations of involved factors present. The paper also suggested that in making predictions regarding effectiveness, factors such as patient survival, morbidity and subsequent hospital discharge must be part of the assessment. Resources, education, planning, control, geography, population density, distances, and cultural diversity all need to be taken into consideration when planning, assessing and monitoring the EMS services (MacFarlane and Benn, 2003).

2.4 Ambulance Response Time

Each second is crucial when dealing with acute medical emergencies such as airway obstruction, cardiac arrest, severe hemorrhage, severe head injury or severe chest injury. It accounts for many hospital deaths or morbidity if not responded and treated early (Scallan *et al.*, 2001). Many published literature focused on the ambulance response times associated with the survival of cardiac arrest and trauma patients. This is because the EMS systems are primarily designed to rapidly deliver advance medical care to critical patients in such condition (Bandara, 2012). A study done by Department of Medical Cardiology, University of Glasgow in June 2001 regarding the effect of reducing ambulance response times on deaths from out of hospital cardiac arrest had suggested that by reducing ambulance response times to 5 minutes could almost double the survival rate for cardiac arrests not witnessed by ambulance crews. The study showed that from 13 822 arrests not witnessed by ambulance crews but attended by them within 15 minutes, 653 (6%) survived to hospital discharge. After other significant covariates were adjusted for, shorter response time was significantly associated with increased probability of receiving defibrillation and survival to discharge among those being defibrillated. Reducing the 90th centile for response time to 8 minutes increased the predicted survival to 8%, and reducing it to 5 minutes increased survival to 10-11% (Pell *et al.*, 2001)

Another study done by O'Keeffe et al from University of Sheffield, United Kingdom regarding role of ambulance response times in the survival of patients with out-of-hospital cardiac arrest concluded that the early arrival of paramedics to the scene increases the chance

of patients' survival to sevenfold (O'Keeffe *et al.*, 2010). The study revealed that of the 1161 patients with cardiac arrest, 30 (2.6%) survived to hospital discharge. If the paramedics were on scene while patient arrested, survival to hospital discharge was increased to 14%. Authors also stated that the most important predictive factors for survival were response time, initial presenting heart rhythm in ventricular fibrillation and whether the arrest was witnessed. The estimated effect of a 1 minute reduction in response time improved the odds of survival by 24%.

The significance of rapid ambulance response to emergency medical scenario has been well-documented. In fact, American Heart Association (AHA) 2010 reported that early access to advanced care is a crucial link in the Cardiac Chain of Survival (Lloyd-Jones *et al.*, 2010). A study in North America showed that the delay of starting the cardiopulmonary resuscitation (CPR) in cardiac arrest could increase the morbidity and mortality up to 7-10% (Brown, 1999). Similarly, a study done in 2002 to evaluate the differences in proportion of bystander CPR, response time interval and type and tier of EMS on out of hospital cardiac arrest survival concluded that the survival rate for patients who discharged from the hospital could be associated with reducing response time interval (Cone, 2002).

A study in Southwestern metropolitan county regarding myocardial infarction survival rate was found that a response time under 5 minutes would have a beneficial impact on survival as compared to response time exceeding 5 minutes (Blackwell and Kaufman, 2002). A study in Ontario, Canada concluded that ambulance response time must be reduced and frequency of bystander-initiated cardiopulmonary resuscitation (CPR) have to increase in order to improve survival rates after cardiac arrest in pre-hospital setting (Brison *et al.*, 1992)

Shorter ambulance response time also correlate significantly with improving survival in trauma patients. One study was done by Fiedler MD *et al.* found that survival rates increased with shorter response time and also transport time in abdominal gunshot wounds patients (Fiedler *et al.*, 1986). A study done retrospectively in Emergency Department in St.Peter's Hospital in USA concluded that a short overall out-of-hospital time interval may positively affect patient survival in selected urban major trauma patients (Feero *et al.*, 1995). On the other hand, a paper published in 2009 revealed that rapid transport from injury site to the nearest hospital in trauma patients (scoop and run) are better than attempting major intervention at the scene (stay and play) in the urban setting (Smith and Conn, 2009).

However, despite the significant shorter response time with increasing survival in trauma cases, in a study by Pons and Markovchick in 2002 revealed that there was no significant difference in trauma survival when the ambulance response time exceeded 8 minutes (Pons and Markovchick, 2002).

In Malaysia, the acceptable range for ambulance response time is between 15 to 30 minutes within 5 km radius (Malaysia, 2012). However, a press statement made by Malaysia Health Ministry's Director in 2006 stated that any response time that was longer that 15 minutes is unacceptable (Zaharudin, 2011).

2.5 Factors associated with ambulance respons time

A national census of ambulance response time to emergency calls in Ireland published in 2000 had identified the factors that influence the response time performance include geographical distribution of ambulance stations, availability of the crewed vehicle to respond, distance and travelling conditions and use of the emergency ambulance for patient transfer (Breen *et al.*, 2000). This study also suggested that ambulance despatch priority to the life-threatening emergencies rather than non-urgent cases should be implemented. A study was done in Singapore by Earnest et.al (Earnest *et al.*, 2012) also revealed that better traffic conditions, distance from the closest fire station and good accessibility to transport areas were determinants of a better response time. Similarly, a recent study done in the same country revealed that heavy traffic condition, weather such as heavy rain and the place of incident including home and commercial place significantly affect the ambulance response time in trauma incidents (Lam *et al.*, 2015).

In Malaysia, several factors had been identified to influenced longer ambulance response time such as incomplete information from the caller, unavailability of ambulance when needed, poor choice of route taken to the emergency location and distance of ambulance station to emergency location (Zaharudin, 2011).

2.6 Ambulance Crash

Another indicator proposed by NHTSA (Administration, 2009) is number of ambulance crash. This indicator reflects the quality of ambulance services as well as giving a significant risk to ambulance care providers and the patients they are carrying. According to Sanddal et al

(Sanddal *et al.*, 2010), vehicle performance standards, improper maintenance, variable operator training, and improper safety restraint use have been recognized as contributing factors. Apart from that, the paper also stated that inadequate screening of vehicle operators, inadequate driver training, fatigue and distraction, poor knowledge of driving laws, poor vehicle design and inadequate policies and procedures are associated with increased crash rates. Another issue that had been highlighted in this paper is regarding the use of lights and sirens. This paper revealed that the use of lights or lights and sirens often places the responding ambulance and the civilian population at risk. This is due to assumptions made by pre hospital personnel that the uses of these warnings give them license to disregard certain rules of the road such as stop signs and traffic signals and direction of travel such as move against traffic. Thus, it is recommended that all jurisdictions should adopt and enforce policies regarding the use of lights and sirens.

There are many published papers evaluated that the risk of ambulance crash are highly predictable, which include high speed driving, intersection crashes, risky driving practice and lights and sirens use, suboptimal vehicle design and unsecured equipment (Becker *et al.*, 2003), (Maguire *et al.*, 2002),(Kahn *et al.*, 2001). A recent journal published by NHTSA entitled '*A National Perspective on Ambulance Crashes and Safety*' reported that improper safety restrained on ambulance healthcare personnel as well as patients inside the ambulance had contributed to a significant caused of fatality in ambulance crashes (Smith, 2015). Apart from that, driver fatigue, equipment defects such as suspension and braking system and ineffective driver training also play important factors in contributing the crash.

2.7 Patients' satisfaction

According to World Quality Movement, providing the service that the customer need and satisfied with is the best course of action for organisations (Stewart, 2002). Emergency pre-hospital care always dealing with patients as well as their relatives and considered the first contact of emergency treatment in healthcare system (Esmaeili Vardanjani SA, 2011). A study conducted by Anisah et al (Anisah *et al.*, 2008) with regards to patients' perception of ambulance services at Hospital Universiti Sains Malaysia, Kelantan reveals that the patients generally satisfied with the service provided. However, the author concluded that patient's perceptions can be very misleading, subjective and may be culturally influenced. This study also did not reflect the overall patients' perception in Malaysia regarding ambulance services. Therefore, patient's satisfaction and number of patient's complaint regarding ambulance services also recommended to evaluate the overall service performance.

Similarly, a study done in Shahrekord, Iran in 2012 regarding patients perception and satisfaction of the ambulance service revealed that patients' satisfaction with pre-hospital emergency service was good and achieved satisfaction level, with higher score among male patients, married people, low education level, those with the record of using emergency services and also those with emergency problems (Sharifi *et al.*, 2012).

Thus, it is no doubt that the efficiency of ambulance service plays a major role to serve its purpose to the public. This study is meant to assess the quality performance of the service in terms of ambulance responds time, ambulance crash incidents, and number of patient

complaint in East Coast Malaysia. It is hoped that by conducting this study, we will have a better idea on quality performance of ambulance services in Malaysia so that we will recognize the loopholes of such services in order to improve it in the future. It is hoped that the outcome from this study can be utilised in setting a new guideline or indicator for continuous assessment of the services in order to keep it to the standard performance.

CHAPTER 3

OBJECTIVES

3.1 GENERAL OBJECTIVE

1. To evaluate the quality performance of ambulance services in goverment hospitals in East Coast Malaysia.

3.2 SPECIFIC OBJECTIVES

1. To evaluate the quality performance of ambulance services in government hospital in East Coast Malaysia based on ambulance response time, number of ambulance crash and number of patients' complaint.

2. To determine the factors affecting quality perfomance of ambulance services in East Coast Malaysia based on ambulance response time and ambulance crash incident.

3. To compare the quality of ambulance services between hospital with emergency physician and hospital without emergency physician.

3.3 HYPOTHESES

1. There will be different level of quality performance of ambulance services in each government hospital in East Coast Malaysia based on ambulance response time and ambulance crash.

2. Factors such as heavy traffic, distance of ambulance station to emergency location, inadequate staff to respond, unable to identify location, poor road condition and lack of number of ambulance available and will affect the ambulance response time among goverment hospitals in East Coast Malaysia.

3. Human factors such as ambulance drivers training, traffic summons among ambulance drivers and age of the drivers as well as ambulance safety features such as using seatbelts, airbag and speed limit will affect the ambulance crash among government hospitals in East Coast Malaysia.

4. There will be difference in ambulance quality performance between hospitals with emergency physician and hospitals without emergency physician based of ambulance response time and ambulance crash incident.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 RESEARCH QUESTIONS

4.1.1 What are the level of ambulance service quality among goverment hospitals in East Coast, Malaysia?

4.1.2 What are the factors affecting the quality of ambulance services in government hospitals in East Coast, Malaysia?

4.1.3 Is the quality of ambulance service in hospital with emergency physician better than hospitals without emergency physician?

4.2 STUDY DESIGN

This was a cross-sectional study. Data were collected based on questionnaires which were distributed to each Emergency Department in government hospitals in East Coast, Malaysia within 12 months period from January 2014 to December 2014.

The questionnaire content had been validated by four emergency physicians from Ministry of Health, Malaysia Only simple validation including content and face validation was done prior to data collection.

4.3 STUDY PERIOD AND LOCATION

Data collection was started from January 2015 until April 2015 after ethical clearance were obtained from Hospital Universiti Sains Malaysia (HUSM) and Ministry of Health (MOH) Malaysia. The timeline for the data was in January 2014 until December 2014. It was carried out in each government hospitals of Ministry of Health in East Coast, Malaysia which consist of Kelantan, Terengganu and Pahang. Hence, Hospital University Sains Malaysia will not be included because this study only focused on hospitals under Ministry of Health Malaysia.

4.4 POPULATION AND SAMPLE

4.4.1 Reference population:

All emergency medical services in government hospitals in Kelantan, Terengganu and Pahang, Malaysia.

4.4.2 Source population:

The main persons who in-charged of ambulance services in government hospitals in Kelantan, Terengganu and Pahang,Malaysia such as Assistant Medical Officers (AMO).

4.4.3 Inclusion criteria/Exclusion criteria

Inclusion criteria was all EMS agencies/hospital that agree to take part in the study whereas exclusion criteria were those who refused to take part in the study, incomplete data and unreturned questonnaires. The person who eligible to answer the questionnaires will be AMO level U32 and above or Emergency Physicians in the hospitals which were included in the study.

4.5 SAMPLING METHOD AND SAMPLE SIZE

No sampling method was used as all hospitals in East Coast, Malaysia were included in the study. A list of all government hospitals in Kelantan, Terengganu and Pahang, Malaysia had been obtained from Ministry Of Health Malaysia website. All the hospitals were selected in this study.

4.6 DATA COLLECTION

A one-time interview was conducted based on the questionnaire to the assistant medical officer level U32 and above who were in-charged of ambulance services in each hospital in Kelantan and Terengganu whereas in Pahang, an assistant medical officer U41 in Hospital Tengku Ampuan Afzan, Kuantan was appointed to be in-charged of data collection for all hospitals in that particular state. He had been briefed on how to conduct the data collection and in case of any doubt he called the investigator personally. This was to avoid any misleading questions and missing data. The investigator then contacted Medical

Emergency Coordination Centre (MECC) of each state to collect any missing data particularly pertaining to ambulance response time. Data which were obtained from MECC were more accurate because there were computerized system to measure the ambulance response time from the time the operators or call receivers finished receiving information from the callers to the time ambulances arrived at the site. The MECC operators will then keep track on the particular ambulance through either GPS system or Government integrated Radio Network (GIRN) system.

Data regarding factors associated with delayed ambulance response time and ambulance crash were only obtained from personal experience of person in-charged of ambulance services and therefore it were not measured accurately.

Data regarding ambulance service complaints made by public or patients from January 2014 to December 2014 was obtained from the person in-charged of ambulance services. The person in-charged looked into their department's complaint record to clarify regarding the total numbers of complaints.