

**FACTORS ASSOCIATED WITH DELAYED
AMBULANCE RESPONSE TIME IN HOSPITAL
UNIVERSITI SAINS MALAYSIA, KUBANG
KERIAN, KELANTAN**

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FAKTOR-FAKTOR YANG MENYEBABKAN KELEWATAN MASA TINDAK
BALAS AMBULANS DI HOSPITAL UNIVERSITI SAINS MALAYSIA, KUBANG
KERIAN, KELANTAN.

ABSTRAK

Masa tindak balas ambulans merupakan index petunjuk prestasi dalam perkhidmatan ambulans. Kajian ini bertujuan mengenalpasti faktor-faktor yang menyebabkan kelewatan masa tindak balas ambulans di Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan. Ini merupakan kajian keratan rentas yang dijalankan di Jabatan Kecemasan Hospital Universiti Sains Malaysia dan mengambil masa selama satu tahun bermula dari Januari 2016 sehingga Januari 2017. Kajian ini melibatkan 300 sampel dan sampel data ini diambil oleh ambulans paramedic dengan menggunakan borang ambulans iaitu 'Borang Sela Masa Tindak Balas Ambulans'. Borang ambulans yang tidak lengkap tidak diambilkira dalam kajian ini. Daripada 300 panggilan kecemasan ambulans, terdapat 254 kes (84.7%) yang respon lambat. Menurut kajian ini, masa tindak balas ambulans sekarang ialah 14 minit (IQR 5 minit). Antara faktor-faktor yang menyebabkan kelewatan masa tindak balas ambulans adalah jarak ke lokasi, jenis lokasi dan mekanisme ambulans. Keputusan analisis menunjukkan bahawa setiap peningkatan satu unit jarak, kebarangkalian ambulans respon lambat adalah 1.59 (95% CI, 1.37 hingga 1.85). Bagi jenis lokasi, kebarangkalian ambulans respon lambat di kawasan awam adalah 0.13 (95% CI, 0.04 hingga 0.45) berbanding dengan jalanraya. Manakala untuk mekanisme ambulans, kebarangkalian ambulans respon lambat dalam penggunaan lampu ambulans adalah 0.22 (95% CI, 0.01 hingga 0.69) berbanding dengan penggunaan siren ambulans. Keputusan analisis menunjukkan bahawa jarak ke lokasi, jenis lokasi dan ambulans mekanisme adalah faktor-faktor utama menyebabkan kelewatan masa tindak balas

ambulans. Penambahbaikan perlu dilakukan untuk meningkatkan mutu perkhidmatan ambulans.

DETERMINATION OF FACTORS ASSOCIATED WITH DELAYED
AMBULANCE RESPONSE TIME IN HOSPITAL UNIVERSITI SAINS MALAYSIA,
KUBANG KERIAN, KELANTAN

ABSTRACT

Ambulance response time is the key performance for ambulances services. The objective of this study is to determine the factors associated with delayed ambulance response time in Hospital Universiti Sains Malaysia. This was a cross sectional study conducted in Emergency Department Hospital Universiti Sains Malaysia between January 2016 to January 2017. A total of 300 samples had been collected by ambulance paramedic using validated ambulance form 'Borang Sela Masa Tindak Balas Ambulans'. All ambulance forms with missing data were excluded in this study. Of 300 cases of emergency ambulance call cases, there were 254 cases (84.7%) of delayed ambulance response time. Current ambulance response time is 14 minutes with interquartile range of 5 minutes. Factors which showed significant association delayed ambulance response time include distance, location type and ambulance mechanism. The odd of delayed ambulance response time by every increase in distance unit was 1.59 (95% CI, 1.37 to 1.85). For location type, the odd of delayed ambulance response time for public location as compared to road was 0.13 (95% CI, 0.04 to 0.45). For ambulance mechanism, the odd of delayed ambulance response time for beacon type as compared to siren type was 0.22 (95% CI, 0.01 to 0.69). Distance, location type and ambulance mechanism showed significant association with delayed ambulance response time. Further intervention should be derived to improve current ambulance response time.

CHAPTER 1

INTRODUCTION

1.1 Background

Ambulance service is one of the component of prehospital service. Time is crucial in handling medical emergencies such as cardiac arrest, airway obstruction, severe haemorrhage, severe chest or head injury¹. The effectiveness of ambulance service is characterised by the following two measures of performance: response time, service time². The shorter these time intervals the more effective is the system². Ambulance response time is defined as the period between emergency call received and ambulance arrival at scene³. Current recommendation of ambulance response time in response to medical emergencies is within 8 minutes for at least 90% ambulance calls. This response time guideline was based on an article published in 1979 that evaluated patient outcome after out of hospital nontraumatic cardiac arrest⁴. The investigators reported that survival decreased significantly if emergency response was not initiated within 8 minutes⁴. A study regarding ambulance response time in Kelantan was conducted in 2004 by Shaharudin et al⁵ and concluded that ambulance response time in EDHUSM Kelantan is 15 minutes, which was much slower than international standard time.

1.2 Literature review

A study by Lam et al⁶ on factor affecting ambulance response time of trauma incidents in Singapore was published in May 2015. This was a retrospective study based on two years of trauma data (1 January 2011 till 31 December 2012) obtained from the national EMS operations centre of Singapore. Among the factors, traffic, weather and place of incident were found to be significant in affecting ambulance response time.

- Heavy traffic has the largest odd ratio of 12.98 (95% CI: 10.66-15.79)
- Heavy rain weather 1.58 (95% CI :1.26-1.97)
- Place of incident 1.32 (95% CI: 1.2-1.45)

In 2001, Altintas et al⁷ on Ambulance time of Ankara Emergency Aid and Rescue Services Ambulance system stated that factors causing delayed ambulance time are:

- The person (patient, citizen, policemen, physician etc) who decides whether the situation is an emergency or not.
- Unwillingness to make decision which will lead to ambulance, physician, hospital personnel or police involvement due to various reasons.
- Not knowing relevant telephone number
- Ambulance diversion

Breen, Woods, Bury et al¹ on national census of ambulance response time to emergency calls in Ireland identified the factors that influenced response time performance include :

- Geographical distribution of ambulance stations

- Availability of crewed vehicles to respond
- Distance and travelling conditions
- Use of emergency ambulances for routine patient transfer.

Campbell et al⁸ on Ambulance arrival to patient contact: hidden component of prehospital response time interval stated that the potential barrier that affect ambulance response time are:

- Patient extrication
- Police securing site
- Physical barriers (doors, stairs, elevator)
- Bystander interference
- Bad weather condition

1.3 Problem Statement

Ambulance response time is the measurement of ambulance performances. Short ambulance response time can improve patient survival outcome. Delayed in ambulance response time result in delay medical treatment which can worsen patient condition, as shown in Valenzuela et al⁹ and trauma patient Feero et al¹⁰. Average ambulance response time in emergency department Hospital Universiti Sains Malaysia was 15 minutes⁵. Only 40% of total ambulance call in Emergency Department Hospital Universiti Sains Malaysia responded within 8 minutes. This is far from international standard of criteria of 8 minutes or less in at least 90% of ambulance calls.

1.4 Research Question

1. What are the factors that contribute to delayed ambulance response time.

2. What is the current ambulance response time?

1.5 Objectives

1.5.1 General Objective

- To determine factors that contribute to delayed ambulance response time.

1.5.2 Specific Objective

To determine factors that contribute to delayed ambulance response time:

- Geographical
- Temporal
- Mechanical

1.6 Methodology

1.6.1 Method

This was a cross sectional study conducted in Emergency Department Hospital Universiti Sains Malaysia between January 2016 to January 2017. All ambulance calls data were collected using ambulance form 'Borang Sela Masa Tindak Balas Ambulans' which was validated by expert reviewers. All study subjects (ambulance paramedic) were briefed regarding the purpose of the study with 'Borang Maklumat Kajian' and a written consent form were obtained from them. Once consented, ambulance form was given to them and they were required to complete and submit the form after responding to each emergency ambulance calls. These ambulance forms were divided into 4 categories: call receiver data and biography of ambulance despatcher, ambulance call time (call received time, time activation time, ambulance despatch time and time arrive at scene) patient's data(triaged zone) and studied factor (mechanical , geographical, temporal factor). Sample size calculation were done using power and sample size calculation version 3.0.10. In

order to determine sample size for this study, data on three factor that were found to be significant in affecting ambulance response time based on previous study⁶ were used in calculation. Alpha level of 0.05 and statistical power of 0.8 were used. For this study, the highest sample size, 1356 were not chosen due to its large sample size. The average ambulance call in HUSM was 60 call per month and it is not affordable to be carried out. Therefore, the sample size for this study was 300 with 20% drop off rate.

1.6.1 Ethical Consideration

This study had obtained ethical approval from The Human Research Ethics Committee of USM [USM/JEPeM/15110497].

1.6.2 Inclusion Criteria

- All emergency ambulance calls within study period of Jan 2016 to Jan 2017 were included in the study.
- All paramedics who worked in emergency department HUSM within the study period and consented to participate in this study will be included.

1.6.3 Exclusion Criteria

- All 'Borang Sela Masa Tindak Balas Ambulan' with missing data will be excluded from the study.
- Paramedics who refused or not consented to participate in this study.
- Paramedics who did not work in emergency department HUSM within the study period.
- Paramedics who withdraw themselves throughout the study period.

1.6.5 References

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CHAPTER 2

MANUSCRIPT

2.1 TITLE PAGE

Factors Associated With Delayed Ambulance Response Time in Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan.

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2.2 ABSTRACT

Ambulance response time is one of the key performance of ambulances services. The objective of this study is to determine the factors associated with delayed ambulance response time in Hospital Universiti Sains Malaysia. This was a cross sectional study conducted in Emergency Department Hospital Universiti Sains Malaysia (EDHUSM) between January 2016 to January 2017. A total of 300 ambulance calls were included in our analysis. Data were collected by ambulance paramedic using validated ambulance form. All ambulance forms with missing data were excluded from this study. Of the 300 ambulance calls within the study periods, 254 cases (84.7%) were determined to have delayed ambulance response time. Current ambulance response time is 14 minutes with interquartile range of 5 minutes. Factors which showed significant association delayed ambulance response time include distance from hospital, location type of emergency and ambulance mechanism. The odd of delayed ambulance response time by every increase in distance unit was 1.59 (95% CI, 1.37 to 1.85). For location type, the odd of delayed ambulance response time for public location as compared to road was 0.13 (95% CI, 0.04 to 0.45). For ambulance mechanism, the odd of delayed ambulance response time for beacon type as compared to siren type was 0.22 (95% CI, 0.01 to 0.69). Further intervention should be initiated based on our findings to improve current ambulance response time.

Keywords : delayed ambulance response time, associated factors, emergency medical service.

2.3 INTRODUCTION

Background

Ambulance service is one of the components of prehospital service. Response time is crucial in managing medical and trauma emergencies such as cardiac arrest, airway obstruction, severe hemorrhage, severe chest or head injury¹. This was proven particularly for out-of-hospital-cardiac arrest² and trauma victims in urban settings³. The effectiveness of ambulance service is characterised by the following two measures of performance: response time and service time⁴. The shorter the time intervals, the more effective the system⁴. Ambulance response time (ART) is defined as the period between emergency call received and ambulance arrival at scene⁵. Current recommendation of ambulance response time in response to medical emergencies is within 8 minutes for at least 90% ambulance calls. This response time had evolved into a guideline that had been incorporated into operating agreements for many emergency medical service providers⁶. At present, ambulance services in Malaysia are provided countrywide by governmental and non-government bodies⁷. Government provisions is under control of Ministry of Health (MOH), Ministry of Education (MOE) and Civil Defense (CD) whereas nongovernmental bodies are private sectors such as St John's Ambulance, Red Crescent and some at private hospitals⁷. Most government ambulances are based in hospital facilities⁸. In EDHUSM, ambulance services are run under hospital based system whereby all ambulances are located in hospital compound (near Emergency Department)⁹. Ambulances will be despatched to scene site as soon as possible once emergency calls were received. Since January 2005 an Emergency Medical Dispatcher (EMD) squad was launched in EDHUSM⁹. This is a dedicated unit which consist of ambulance crews who were trained under EMD course that was modified from Emergency Medical Services Authority of California to become EMD to manage all ambulance calls in EDHUSM⁹. In addition to this EMD team, a team called Rescue 991 under Jabatan Pertahanan Awam Malaysia (JPAM) (specialised government body established to assist disaster and emergency event) were located in EDHUSM since 2000. Their main purpose was to extend social work services to public including ambulance services¹⁰. This is a unique team which only exists in EDHUSM. A study regarding ART in Kelantan was conducted in 2004 by Shaharudin et al¹⁰ concluded that ART in EDHUSM Kelantan was 15 minutes. Only 40% of the total ambulance call in EDHUSM responded within 8 minutes. This is far from international standard of criteria of 8 minutes or less in at least 90% of ambulance calls. The objective of this study was to determine factors that contribute to delayed ambulance response time.

2.4 METHODOLOGY

Setting, study design, sample size determination

This was a cross sectional study conducted in HUSM between January 2016 to January 2017. In order to determine the sample size for this study, data on three factors that were determined to be significant in affecting ambulance response time based on previous study¹¹ were used in calculation. Alpha level of 0.05 and statistical power of 0.8 were used. A sample size of 300 including 30% drop-out rate was determined.

Data collection and processing

All data were collected by ambulance paramedics of Hospital Universiti Sains Malaysia using a standardized form 'Borang Sela Masa Tindak Balas Ambulans'. Ambulance form with missing data were excluded in the study. All ambulance forms were completed by paramedics after attending each ambulance calls during the study periods. The ambulance forms consists of 6 sections: (1) Call receiver and biography of ambulance team (2) Call time (3) Patients information (4) Route to location (5) Ambulance specification (6) Geographical factor. Call receiver were hospital attendant, Emergency Medical Despatcher (EMD), medical assistant or staff nurse, doctors and others. Biography data of ambulance team consist of their working experiences, highest academic achievement, age and gender. Call time were recorded as international time and include call receiving time, team activation time, ambulance despatch time and scene arrival time. Ambulance response time was measured as the time between scene arrival time and call received time. Patients information encompasses zone that they were triaged to upon arrival to hospital (critical-red, semi critical-yellow and noncritical-green) and the location of incident (roadside, housing area, public area, working place and others). Route to location include congested or smooth-noncongested route and these

parameters were determined subjectively by ambulance drivers. Ambulance specification were ambulance brands (Toyota, Mercedes, Aveco, Ford), ambulance type (A,B,C) and ambulance warning system (siren, beacon, public announcement system). Geographical factors consist of precision location, distance from hospital to location and other factors such as flood, landslide, heavy rain). Precised location was defined as the ambulance arrived at the correct location with the address that were given by the caller.

Statistical Analysis

Statistical analysis was performed using IBM SPSS version 22. P value < 0.05 was considered statistically significant. Categorical variables were summarised using percentages and compared using Chi-square test. Mean values of numerical variables between two groups were compared by student t test. Logistic regression was used to identify factors associated with delayed ambulance response time and to estimate odd ratio(ORs) and 95% confidence interval (CI) for the association between variables. Variables with p values <0.25 were introduced in multivariate logistic regression model. A manual backward stepwise approach was used to remove non significant variables; only variables with p<0.05 were retained in the final model.

Ethical Issues

Only the consented ambulance paramedics were involved in this study. This study had obtained ethical approval from The Human Research Ethics Committee of USM [USM/JEPeM/15110497].

2.5 RESULTS

A total of 300 cases of emergency ambulance call cases were included for analysis in this study. Out of these cases, 254 (84.7%) ambulance calls had delayed ambulance response time. Four cases were excluded due to missing data. 271 cases (90.3%) of all emergency ambulance call were received by EMD, followed by others (JPAM) 14 cases (4.7%), medical attendant 8 cases (2.7%), medical assistant or Staff nurses 3 cases (1%). The median time for call processing, time to prepare ambulance team and time to arrive at scene was 2 minutes with interquartile range(IQR) of 2 minutes, 3 minutes (IQR 2 minutes) and 8 minutes (IQR 5 minutes) respectively. The median ambulance response time was 14 minutes (IQR 5 minutes). 155 (51.7%) cases of emergency ambulance call were subsequently triaged to yellow zone, 100 (33.3%) cases to red zone and 41 (13.7%) cases to green zone once arrived at the ED.

The median distance travelled by ambulances in this study was 7.80 km with IQR of 6.00km. Traffic was smooth for 186 cases (62%) and congested for 101 cases (33.7%).

The most common location that the emergency ambulance call responded was housing area with 128 (42.7%) cases, followed by roadside 111 (37%), others places 39 (13%), public places 13 (4.3%) and working places 5 (1.7%). Most of the given location was precise with a prevalence of 263 cases (87.7%).

Siren with beacon was the most frequent ambulance warning system being used with 187 cases (62.3%), followed by siren 71 cases (23.7%), beacon 22 cases (7.3%), and simultaneous usage of siren, beacon and public announcement system 7 cases (2.3%).

Descriptive analysis of the factors associated with delayed ART were presented in Table 1.

Table 1: Descriptive analysis for factor associated with delayed ART (N=254)

	n(%)	Median (IQR)
Call Receiver		
Attendant	8 (2.7)	
EMD	271 (90.3)	
MA/SN	3 (1)	
Others	14 (4.7)	
Ambulance Response time (minutes)		
Call processing time		
Time to prepare team		2.00 (2.00)

<i>Time to arrive at scene</i>		3.00 (2.00)
		8.00 (5.00)
Response time (minutes)		14.00 (5.00)
Distance (km)		7.80(6.00)
Hospital Triage		
<i>Red</i>	100 (33.3)	
<i>Yellow</i>	155 (51.7)	
<i>Green</i>	41 (13.7)	
Route		
<i>Smooth</i>	186 (62)	
<i>Congested</i>	101 (33.7)	
Location		
<i>Road</i>	111 (37)	
<i>Housing area</i>	128 (42.7)	
<i>Public</i>	13 (4.3)	
<i>Working place</i>	5 (1.7)	
<i>Others</i>	39 (13)	
Ambulance Warning System		
<i>Siren</i>	71 (23.7)	
<i>Beacon</i>	22 (7.3)	
<i>Siren & beacon</i>	187(62.3)	
<i>Siren & beacon & PA</i>	7 (2.3)	
Location Precision		
<i>Yes</i>	263 (87.7)	
<i>No</i>	23 (7.7)	

EMD= Emergency Medical Despatch, MA= Medical Assistant, SN= Staff nurse
PA = Public announcement system, IQR = interquartile range

Simple Logistic Regression on Factors Associated With Delayed Ambulance Response Time

The factors which showed significant association with delayed ambulance response time include distance ($p=0.00$), location type ($p=0.00$) and ambulance mechanism ($p=0.01$). The odd of delayed ambulance response time by every increase in distance unit was 1.59 (95% CI, 1.37 to 1.85). For location type, the odd of delayed ambulance response time for public location as compared to that of road was 0.13 (95% CI, 0.04 to 0.45). For ambulance mechanism, the odd of delayed ambulance response time for beacon type as compared to that of the siren type was 0.22 (95% CI, 0.01 to 0.69).

Analyses of the associated factors for delayed ambulance response time by simple logistic regression is summarized in *Table 2*.

Table 2: Associated factors of delayed ambulance response time by Simple Logistic Regression model

Variables	Regression coefficient (b)	Crude Odd Ratio (95% CI)	Wald statistic	p-value
Geographical				
Distance	0.46	1.59 (1.37,1.85)	0.00	0.000

Location type				
<i>Road</i>	-	-	-	-
<i>Housing Area</i>	0.51	1.66 (0.73,3.79)	1.46	0.227
<i>Public</i>	-2.01	0.13 (0.04,0.45)	10.46	0.001
<i>Working place</i>	-0.47	0.63 (0.07, 5.98)	0.17	0.683
<i>Others</i>	-0.50	0.61 (0.23,1.56)	1.07	0.300
Precision of location				
<i>No</i>	19.51	2.98x10 ⁸ (0.00, -)	0.00	0.998
<i>Yes</i>	-	-	-	-
Mechanical				
Ambulance Brand				
<i>Toyota</i>	-	-	-	-
<i>Mercedes</i>	0.418	1.52 (0.19, 12.32)	0.153	0.695
Ambulance Category				
<i>A</i>	-23.03	0.00 (0.00, -)	0.00	0.999
<i>B</i>	0.02	1.023 (0.47, 2.22)	0.00	0.953
<i>C</i>	-	-	-	-
Ambulance Warning System				
<i>Siren</i>	-	-	-	-
<i>Beacon</i>	-1.50	0.22 (0.01, 0.69)	6.71	0.010
<i>Siren, beacon</i>	-0.20	0.82 (0.35, 1.92)	0.20	0.652
<i>Siren, beacon, PA</i>	19.14	2.05x10 ⁸ (0.00, -)	0.00	0.999
Temporal				
Route				
<i>Smooth</i>	-	-	-	-
<i>Congested</i>	1.30	3.67 (1.49, 9.06)	7.96	0.005

Multiple Logistic Regression on Factor Associated With Delayed Ambulance Response Time
Analyses of the significant associated factors for delayed ambulance response time by multiple logistic regressions was shown in *Table 3*.

Table 3: Associated factors of delayed ambulance response time by Multiple Logistic Regressions model

Variables	Regression coefficient (b)	Adjusted Odd Ratio (95% CI)	Wald statistic	p-value
Geographical				

Distance	0.417	1.52 (1.30, 1.77)	27.73	0.000
Location type				
<i>Road</i>	-	-	-	-
<i>Housing Area</i>	0.81	2.25 (0.85, 5.93)	2.67	0.102
<i>Public</i>	-0.99	0.37 (0.08, 1.84)	1.47	0.225
<i>Working place</i>	0.86	2.37 (0.11, 53.06)	0.29	0.588
<i>Others</i>	0.36	1.43 (0.43, 4.82)	0.33	0.567
Mechanical				
Ambulance Warning System				
<i>Siren</i>	-	-	-	-
<i>Beacon</i>	-1.08	0.34 (0.08, 1.53)	1.98	0.159
<i>Siren, beacon</i>	0.03	1.03 (0.37, 2.88)	0.03	0.954
<i>Siren, beacon, PA</i>	18.56	1.15x10 ⁸ (0.00, -)	0.00	0.999
Temporal				
Route				
<i>Smooth</i>	-	-	-	-
<i>Congested</i>	0.791	2.21 (0.76, 6.37)	2.136	0.144

Multiple Logistic Regression ($p < 0.05$ was significant); The goodness of fit of the model was checked using Hosmer-Lemeshow test. The result gives no evidence of lack of fit of the model. According to the analysis, there was only the increment of distance showed significant association with the delayed ambulance response. Hence, the three associated factors for delayed ambulance delayed likely to be independent associated than group factor.

2.6 DISCUSSIONS

2.6.1 Key factors affecting ambulance response time

ART is the measurement of ambulance performances. It consists of call processing time, time to prepare response team and time taken to travel to scene¹². These time intervals had shown improvement compared to previous study¹⁰. Based on the current study, the mean ambulance response time in HUSM was 14.1 minutes and 14.3% of ambulance calls respond within 8 minutes. This result shows that there was 7.2% improvement of mean ambulance response time from 15.2 minutes¹⁰ to 14.1 minutes. However, current ambulance response time is still far from international standard criteria which is 8 minutes or less in at least 90% of ambulance calls.

In our study, we investigated both geographical and mechanical factors that contributed to the delayed ART. Among the geographical factors, distance and location were associated with delayed ambulance response time. The percentage of ambulance to respond within 8 minutes were higher, which was 7% if distances were within 8km, in comparison to those that responded beyond the 8km radius (0.7%). This is in agreement with *Breen et al (2000)* who reported that ambulance calls responding to emergencies more than five miles away from nearest ambulance station had less than 5% likelihood of ability to respond within 8 minutes¹. The median distance HUSM's ambulances responded was 7.8 km. This had exceeded the requirement range which is within 6km radius from Hospital Universiti Sains Malaysia. The reason for this is due to lack of manned vehicles from nearby ambulance base station, which is also one of the identified factor that influenced response time performance in *Breen et al*¹. Paramedic who were involved in

ambulance calls from these ambulance base station were actually those who involve in other daily work in their hospitals. Therefore, EMD program should be implemented in order to create a dedicated emergency ambulance team to manage ambulance calls.

From this study, 65.4% of ambulance calls cases that responded were non-life threatening. Prioritised dispatching (give priority to those cases needing urgent paramedic care or urgent transport to hospital) has been shown to be an effective strategy for use in ambulance service¹³. Ambulance responses in less than or equal to 8 minutes were higher and the odds of dying was 1.4% less by using priority dispatch system for ambulance deployment¹⁴.

Another geographical factor that contributed to delayed ambulance response time was the type of location. Among the studied locations, ambulance response time to public places (schools, market, commercial places) were longer compared to other locations. This might be due to bystander interference and physical barriers (stairs, elevators) causing difficult accessibility to the scene site. These two factors were among the factors that affect the interval between ambulance arrival at scene and ambulance personnel arrival to patient¹⁵. Incident that occur at high rise building also contribute to delay response time. This is due to the vertical response time (the need to climb stairs and or board elevators) needed for paramedic team to reach the patient's side¹⁶.

Lateef et al (2000) reported that the problems encountered in high rise building were multiple stops of the elevator for use by the public, preset elevator stops, all elevators being in use, lack of directions, and inadequate space in the stairwell or the elevator prohibiting use of a stretcher¹⁷. Therefore, building structures which take into consideration of emergency access should be enforceable in all high rise buildings. Not only the ambulance respond time can be improved, the safety of paramedics and patients also can be ensured.

In this study, we observed that usage of only beacon light was associated with delayed ambulance response time. The chance of delayed ambulance response time when using beacon light was 22%. This contradicts with Brown et al (2000) who reported lights and siren (L&S) reduce ambulance response time by 1 minutes 46 seconds, a statistically significant time saving. However this time saving is only clinically relevant in very few cases and it requires a larger multi-center L&S trial to address this issue¹⁸. A study conducted by *Brien et al (1998)* also showed that L&S shortens transport time but the time saved was not associated with immediately apparent clinical significance. In addition to this, L&S was reported as direct cause of emergency vehicles crashes²⁰, hence the time saving with L&S should be balanced against the risk associated with its usage.

2.6.2 Limitation

Samples data were completed by ambulance paramedics who responded to ambulance calls, therefore bias and poor documentation were unavoidable.

2.7 CONCLUSIONS

Current ambulance response time in Hospital Universiti Sains Malaysia was 14.1 minutes. This showed that we still have not reach the international standard for ambulance response time. Distance, location type and ambulance mechanism showed significant association with delayed ambulance response time. Among these factors, distance was found to have the largest effect.

2.8 ACKNOWLEDGEMENT

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CHAPTER 3

STUDY PROTOCOL

3.1 Study Protocol For Ethical Approval

UNIVERSITI SAINS MALAYSIA KUBANG KERIAN

Dissertation Proposal

Determination Of Factors Associated With Delayed Ambulance Response Time in Hospital Universiti Sains Malaysia, Kubang kerian, Kelantan.

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