AMBULANCE RESPONSE TIME TO EMERGENCY DEPARTMENTS

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ABSTRACT

The study was conducted to ascertain the time it takes an ambulance team to reach a patient and transport the patient to an emergency department after a 995 call.

One hundred and sixty-two cases brought to two emergency departments (Singapore General Hospital and Tan Tock Seng Hospital) between 11 March 1992 and 16 March 1992 were studied. The information was obtained from ambulance officers of the Singapore Civil Defence Force.

It took an average of 11.40±4.88 minutes for an ambulance team to reach a patient and 30.50±10.62 minutes for the patient to reach an emergency department after a 995 call. With the present level of staff in Singapore, basic life support care starts 11.40 minutes and advanced life support care 30.50 minutes after a 995 call. These times are unacceptable if it involves a cardiac arrest or a trauma patient.

Factors which cause these long time intervals include traffic congestion, inadequate public education, location of patient (whether on ground level or highrise) and distance from the emergency departments.

Keywords: cardiopulmonary resuscitation, highrise, response time, basic life support, advanced life support.

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INTRODUCTION

It has always been assumed that as Singapore is an urban area with a comprehensive road network, travelling time would be short.

The study evaluated the time taken for patients to reach an emergency department after a 995 call had been made.

The statistics were taken from cases brought to the two largest emergency departments in Singapore. the Singapore General Hospital (SGH) and Tan Tock Seng Hospital (TTSH), by the Singapore Civil Defence ambulances from 11 March 1992 to 16 March 1992.

METHODOLOGY

A questionnaire was completed by the ambulance offer (a staff nurse) whenever a patient was brought to the emergency department of the Singapore General Hospital (SGH) or Tan Tock Seng Hospital (TTSH) during the study period. One hundred and sixty-two cases were studied.

The following information was obtained:

1) Time when the 995 call was received;
2) Time the ambulance team left the ambulance centre;
3) Time the ambulance reached the location;
4) Time the ambulance team reached the patient;
5) Location where the patient was found (whether it was ground level or highrise);
6) Time the ambulance left the location with the patient;
7) Time the ambulance reached the emergency department.

These times were compiled through the despatch logs, run reports or from the ambulance team when it was not available from the former two. Times on the run reports were recorded by the ambulance team.

A second part of the study consisted of interviews with ambulance officers.

STATISTICAL ANALYSIS

The following time intervals were calculated for each run:

(a) Time of 995 call to the time an ambulance team reached the patient which was assumed to be the time interval before basic life support (BLS) care was started;
(b) Time of 995 call to the time the patient reached an emergency department which was assumed to be the time interval before advanced life support (ALS) care was started;
(c) Time the ambulance reached the location to the time ambulance team reached patient ('search time');
(d) Time the ambulance team reached the patient to the time the ambulance team left location with the patient ('on-scene time');
(e) Time the ambulance left the ambulance centre to the time the ambulance reached the location ('travel time to the location');
(f) Time the ambulance left the location with the patient to the time the ambulance reached the emergency department ('travel time to emergency department').

The mean and 2SD were calculated for the above. The 162 cases were then sorted out to separate SGH cases (sample size 85) and TTSH cases (sample size 77). Using Statgraphics, the student t-test for unpaired samples was then applied to test if the differences between the SGH and TTSH cases were significant.

The study sample was sorted into 2 groups; those found on ground level and those located above ground level ('high rise').

The mean and two standard deviations for the search and on-scene times were calculated for these two groups. The t-test for unpaired samples was also applied to test for statistical significance, if any, between the groups.

In Tables I, II, III and IV, S represents 'significant' which indicates that the null hypothesis (H_o) is rejected.

In Tables I, II, II and IV, NS represents 'not significant' which indicates that the null hypothesis (H_o) is not rejected.

RESULTS

During the study period 11 March 1992 to 16 March 1992, a total of 162 questionnaires were completed. Of these, two were incomplete and this was taken into account in the analysis of the data.

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Table I – Mean time differences (in mins) by hospital

	Time Interval Mean+2SD SGH	Mean+2SD TTSH	t-test (p = 0.05 H_o: Diff = 0)	Total
Time of 995 call to time ambulance reached patient (BLS)	10.70±3.75	12.03±5.82	NS t = -1.9575	11.40±4.88
Time of 995 call to time patient reached an A&E dept (ALS)	28.25±9.52	32.98±11.26	S t = -2.8876	30.50±10.62

SD : standard deviation
NS : not significant
S : significant

Table II – Search time (in mins) and on-scene time (in mins) by level of location

Level of Location	Ground Level (n = 91)	Highrise (n = 71)	t - test (p = 0.05 H_o: Diff = 0)
Search time	1.12±3.11	2.72±1.71	S t = 3.8835
On-scene time	5.68±3.77	8.16±3.58	S t = 4.2398

S : significant

Table III – Travel time (in mins) to location by hospital

	SGH (n = 85)	TTSH (n = 77)	t - test (p = 0.05 H_o: Diff = 0)
Travel time (Mean+2SD)	6.93±2.67	9.08±5.32	S t = – 3.2967

S : significant

Table IV – Travel time (in mins) to the emergency department by hospital

	SGH (n = 85)	TTSH (n = 77)	t - test (p = 0.05 H_o: Diff = 0)
Travel time (Mean+2SD)	11.5±6.37	13.77±7.95	S t = – 2.3190

Key: S : significant

DISCUSSION

Basic life support care starts when the ambulance team finds the patient. In very few cases is bystander cardiopulmonary resuscitation instituted.

Unfortunately, at the moment only 2 of the 15 ambulances in Singapore carry a defibrillator although there are plans to so equip all ambulances. None of the ambulance officers are trained in advanced life support (ALS). So for all intents and purposes in Singapore, advanced life support which encompasses intubation, intravenous drugs administration and defibrillation begins at the emergency department.

In the study, a patient received basic life support (BLS) care at 11.40±4.88 minutes (6.52 to 16.28) and advanced life support (ALS) care 30.5±10.62 minutes (19.88 to 41.12) after a 995 call (Table I).

The time of the incident to the time the 995 call was received ('reaction time') plays a significant role in the final outcome of the patient but it is a difficult factor to quantify. The study did not measure the reaction time.

Were these time intervals acceptable? How did we fare in comparison to other cities?

Several researchers found the combination of BLS care starting more than 4 minutes and ALS care more than 12 minutes after collapse particularly lethal[1-3]. Some have called these dimensions the resuscitation 'failure zone'[4]. Eisenberg et al[2] in 1979 concluded that in order to maximise reduction in mortality, cardiac arrest patients must have cardiopulmonary resuscitation (ie BLS) initiated within 4 minutes and definitive care (ie ALS) provided within 10 minutes.

Eisenberg et al[5] in 1990 reviewed published studies conducted from 1967 to 1988 on 39 emergency medical services programs from 29 different locations. We compared the time we took to provide BLS and ALS care with the cities that provided a double-response system in the form of emergency medical technician/paramedic personnel. Emergency medical technicians (EMTs) are trained to provide BLS care. Paramedics are trained to provide ALS care.

Table V – Comparison of response times (in mins) of six cities

Cities	Mean EMT response time (BLS care)	Mean Paramedic response time (ALS care)
Columbus	3	5
Durham	6.5	8.7
King County	4.4	9.1
Milwaukee	2	5
Seattle	3	6.5
Singapore	11.4	30.5

Singapore's BLS response time of 11.40 minutes is the slowest and is almost double that of Durham (6.5 minutes). Singapore's ALS response time of 30.5 minutes is also the slowest and more than triple that of King County (9.1 minutes). The figures show that when ALS care has started in the other 5 cities, BLS care would not even have commenced in Singapore.

For the major trauma victim, his golden hour starts from the onset of injury. There is then a race against time to reach an appropriate operating theatre (Level I) within 60 minutes. If it takes the ambulance team 41.12 minutes (30.50+10.62) to transport the trauma victim to the emergency department, there is very little time left of the golden hour to assess, resuscitate and stabilise the victim as well as carry out the essential investigations and assemble the necessary team before arriving at the operating theatre. In fact, for some victims there may only be 18.88 minutes or less left if reaction time was included.

What are the factors causing this delay?

One of the factors we studied was the level at which the patient was found. We postulated that one would need more time to reach a patient (search time) in a highrise location than on ground level. The on-scene time would also be longer if a patient was found in a highrise location than ground level.

The results in Table II supported this hypothesis. Searching for a patient in a highrise location takes a longer time as the ambulance team will need to climb stairs or use lifts. It is also more difficult to move a patient from a highrise location to the ambulance. On-scene time in a highrise location may also take longer when equipment need to be obtained from the ambulance.

Another factor studied was the distribution of catchment areas for ambulance centres and the two hospitals. These were inferred from travel times from ambulance centre to location and from location to the two emergency departments. The results (Tables III and IV) show that the catchment areas for ambulance centres and the receiving hospitals are not equitably distributed. This could be due to the location of the ambulance centres and hospitals in relation to the population they serve or it may be due to the design and layout of existing road infrastructure. It would be interesting to find out whether the discrepancies between travel time to location and travel time to the emergency departments exist for other hospitals.

We asked some ambulance officers for probable causes of this delay. Wrong addresses and unclear directions were cited. There were few good Samaritans who would point the team to where the patient was. Traffic congestion and drivers who do not instinctively give way to ambulances also prolong the response time. Ambulance drivers although allowed to go through red lights seldom have the opportunity. Ambulances have also been known to break down on the way to an emergency department. In most cases, inadequate information on the condition of the victim meant prolonged on-scene time as needed equipment would be left in the ambulance.

We would like to suggest the following as solutions to the problem of delay in response time.

There is a need to solve the traffic problem faced by ambulance teams. This can be multi-pronged: through public education of Singapore drivers, with the help of police escorts and possible mandatory fine for obstruction.

The situation would be greatly improved if callers give accurate information of patient location so that the ambulance teams could be directed to where patient was and if the way to the patient could be kept clear eg holding lifts for them. This may be achieved through public education.

Is it possible to upgrade the skills of our ambulance team?

At the moment, none of the ambulance officers are trained in ALS care. If it is not possible to shorten the time interval from a 995 call to the patient reaching an emergency department, then perhaps personnel with ALS skills should be sent to the patient.

Is there a possible role for a double-response system in Singapore?

This could be achieved with an ambulance team capable of BLS care reaching the patient first and then calling for a second team capable of ALS care, if necessary. This would be more cost effective than insisting that all ambulance teams have ALS capabilities.

CONCLUSION

The time taken for ambulances to reach patients and to transfer them to an emergency department is surprisingly long: 11.4 minutes to reach the patient and 30.5 minutes to reach an emergency department. These times are unacceptable if the case is a cardiac arrest patient and dangerous if it is a major trauma victim. The response times reflect badly on our pre-hospital emergency care system especially when these times are compared to those in the cities listed in Table V. There is an urgent need for improvement.

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