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Differences between EMS Stations in Riyadh, KSA Regarding Reasons, Response Time and in-Field Time of Non-transported Emergency Medical Services (EMS) Calls

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Abstract
The primary objective of this study is to evaluate reasons, response and in-field time differences of Non-transported EMS calls in EMS stations in Riyadh, KSA. **Design:** Retrospective, descriptive analytical study to scrutinize data in patient care reports (PCR) of non-transported emergency calls documented by responding SRCA Emergency Medical Technicians obtained from 10 EMS stations (distributed in East, West, South, North and Center of Riyadh) in Riyadh, Saudi Arabia for 3 consecutive months. The PCRs obtained of the months of March, April and May 2014. The analysis and data manipulation chosen for the data set was cross-tabulation, mean and standard deviation. **Results:** Overall 7178 emergency calls were made to 10 different SRCA EMS centers in Riyadh during 03 months period from March to May 2014. All these emergency calls were responded by respective emergency centers in their location. 1791 emergency calls were reported as non-transported in patient care reports which accounts for 24.95% of the overall calls. From these non-transported calls, 401 (22.38%) calls were found be cancelled by dispatch before the arrival at scene. In addition, 91 (5.08%) calls of that amount, patients were found dead on arrival at the scene. As SRCA is not allowed to transport dead patients, so the ambulances came back to their respective base stations without transporting the patient. Therefore, cancelled and dead calls were excluded from our analysis because these PCR were found majorly incomplete. In addition, due to Stations' number was not specified in 171 calls (8.8%), these statistics were excludes to end up with 1219 (68%) calls satisfy the inclusion criteria of this study. **Conclusion:** The larger volume of calls' responses of EMS stations, the larger volume of non-transported calls . This study found that the busiest EMS stations scores high in not transporting patients. The study found also that the shorter response time doesn't affect the decision of the transportation. A managerial and quality assurance review of the outcomes of non-transported calls is required, especially for patients with certain medical conditions. This study delineates the need for electronic reporting system.

Introduction

A large Portion of Emergency Medical Services (EMS) calls received and dispatched by the Saudi Arabian EMS system - Saudi Red Crescent Authority (SRCA)-, ended up with not transporting patients, more specifically in the EMS provided in the city of Riyadh, Saudi Arabia.

Riyadh, the capital city of Saudi Arabia. Its population is above 5 million of population with a density of 4400/square kilometers[1]. The city of Riyadh is in continuous development and growth since last few decades that attract world population to come and work, which resulted in mixed population between citizens and expatriates. At present 65% of Riyadh population is constituted by citizens and 35% of population is composed of expatriates from different parts of the world[2]. The increasing growth and development resulted in increased demands for system of EMS.

SRCA is the only agency to provide EMS in Saudi Arabia. From its establishment, SRCA is trying to combat with increasing demands of EMS by providing efficient services to the population. Providing emergency medical care to the ill and injured patients is the primary responsibility of any EMS system. SRCA response to EMS with well-equipped fleet of ground as well as air ambulances with trained Paramedics ranging from EMT-B, paramedics to Emergency specialists. SRCA's EMS teams face various challenges that affect the decision of transporting the patients to the health facilities. In general the non-transported calls might ultimately affects the quality of the EMS services in general and how efficiently the EMS could have been provided to other urgently needed patients.

Not transporting patients who sought for help involves to a great extent the quality of the EMS provided, the effectiveness of the EMS system operations and the cost-effectiveness of the system expenditure on its operations[11]. The non-transported EMS calls carry higher risk of increasing the rate of morbidity and consequently litigation and legal action[3,4,5]. In many of these non-transported calls, patients might have refused transport or denied transport by EMS staff.

Objectives

Primary objective of this study is to evaluate reasons, response and in-field time differences of Non-transported EMS calls in EMS stations in Riyadh, KSA.

Literature Review

Non-transported EMS calls are the calls, where patient have made a distress call to emergency services provider (997), emergency service vehicle dispatched to the scene, but the patients were not transported to medical facility. The research has been published about the non-transported calls of EMS in this regard in Saudi Arabia is not evident. Only a disseminated information was obtained conference presentation by D alrazeeni 2015[19]. He raised an idea about the non-transportation issue in EMS which might raise a concern for both ground and air ambulance. The presentation reveals that overall Saudi Arabia, the total EMS calls received in 2014 were 363736 calls. The transported calls was 252137 (69.3%) and non-transported was 111599 (30.68%). For the air ambulance the total trips by the SRCA Helicopters was 1192, transported 1506 patients while 243 (19.6%) were not-transported.

In Taiwan 32% of emergency calls ended in patients not being transported to the facility as reported by Chen al el[6]. In United States Hipskind et al[7], reported that 30% emergency ambulances run as no transport runs resulting because of patients refusals.

Significant number of non-transported patients may result in unwanted outcomes of these patients in addition to extra burden over resources. An evidence reported in North America by Deborah Shaw et al[8], reveals that, of those who were not transported either due to patient's refusal or by EMS paramedics, almost half of them required further attention within a week, a significant minority required hospital admission and many agreed to be admitted following telephone advice from medical personnel.

Recent study from UK Dale J et al[9] showed that, prior assessment of the call by paramedics to identify the non-urgent calls are helpful to find out the patients who are less likely to need emergency care. For those patients who refused to be transported, alternative methods like community services, alternative transport and specific interventions such as community falls programs has been suggested by Snooks HA et al[10].

Non-transport run by ambulance leads to wastage of resources, which can be prevented by identification of non-emergency call to EMS provider. Study by Fischer AJ et al[11] have stated that demands for Pre-hospital emergency care by EMS is on the rise and increased at the rate of almost 4% each year throughout the last decade in the UK, which in turn increase the cost of ambulance run. In UK only circumstances where patient can be left at the scene officially is the refusal by the patient to be transported to the hospital which account for 30%. Almost similar rates of non-transportation of patients are reported in USA which is between 23% to 33%. At present in the US only few emergency services providers (17%) have written protocols to refuse patients transport to the hospital and even fewer (10%) emergency service providers have the alternative means of transportation like Taxi or Minivan H A Snooks et al[10].

Study by G J Gardner et al[13], done to find out social and practical points to look if they are able to find the group of patients who use the emergency ambulance service without medical need. It reveals that 36% of cases were not in need of emergency assistance by EMS. In UK, F F Palazzo et al[14], mentioned that all were agreed that approximately 16% emergency calls made were inappropriate. Study suggests that even in cases where transportation was refused by paramedic, there is evidence that most of these clients did not require immediate or urgent medical care J. Khal'e et al[15].

In Barbados, cancelled calls were in the highest proportion on non-transported calls and these cancelled calls were directly related to the response time, which shows longer the caller had to wait, more likely they were to cancel the call Sherwin E et al[16]. This is further confirmed by O. Braun et al[17], who found that proportion of non-transported calls arise from long waiting time experienced by the callers. He recommended that other contributory factors, other than availability of ambulance unit/population should be sought out to decrease the response time. He suggests improvements in the amount and quality of equipment and human resources, improved access to training may provide for better practice methodologies, and good ambulance maintenance plan.

A major goal in the EMS should be to minimize the ambulance response time as mentioned by H. Snooks et al[18], which in turn depends on the efficient and targeted use of limited resources. In many countries, efficiency of EMS has been marred by the fact that needs for significant number of callers can better be met by the way other than by the dispatch of an emergency ambulance.

Research Methodology

Design

Retrospective, descriptive analytical study to scrutinize data in patient care reports (PCR) of non-transported emergency calls documented by responding SRCA Emergency Medical Technicians obtained from 10 EMS stations (distributed in East, West, South, North and Center of Riyadh) in Riyadh, Saudi Arabia for 3 consecutive

months. The PCRs obtained of the months of March, April and May 2014.

The data related to the details of the ambulance runs and patients characteristics served by each EMS unit in the 10 EMS station selected is the main focus. Variables related to the calls are reason for non-transportation, response time, time spent in scene, are cross-tabulated with EMS EMS stations. All data related to (not found) or (dead patient) calls were removed. In addition any unavailable information were excluded as well.

The rational for choosing PCR documents' review is to be able to examine unstated, implied and concealed meanings embedded within the documents, in which they might refer to certain underlying factors associated with various patterns or values.

Data analysis

A descriptive analysis of data carried out by using the Statistical Package for Social Science (SPSS) version 21. The analysis and data manipulation chosen for the data set was cross-tabulation, (mean and standard deviation). This tool is thought to serve the purpose of finding acceptable answer for research objectives. After collecting the PCRs we looked carefully at the various types of information, and then selected several variables for coding. Constructive data that included are reason of non-transportation, trip and timing information, in-field length of stay.

Ethical Consideration

The collected PCRs are official documents and are property of Riyadh SRCA's EMS. These PCRs contain confidential information about the patients and providers and the system. Therefore, sincere measures applied to maintain the confidentiality and the protection of information entrusted and ensure there no any misuse or wrongful disclose of them. The PCRs were kept with primary researcher all time. PCR for each month were marked and kept with each other. Ten envelopes were received. Data entry took place in a meeting room and not to be taken anywhere else.

Strength and Limitations

This study is the first that evaluates Saudi EMS system in regard with the non-transported emergency calls. Furthermore, the study uses a research design that is suitable and feasible to achieve the study purpose and to accomplish the study objectives. Moreover, this sampling design will help in generalization of the study results in similar cities in Saudi Arabia, but not the rural areas.

The limitation of this study is expected incompleteness of large number of the collected PCRs resulting in large proportion of missing data. Another challenge comes in the lack of ability to read some of individual hand writing of those reports.

Results

Overall 7178 emergency calls were made to 10 different SRCA EMS centers in Riyadh during 03 months period from March to May 2014. All these emergency calls were responded by respective emergency centers in their location. 1791 emergency calls were reported as non-transported in patient care reports which accounts for 24.95% of the overall calls. From these non-transported calls, 401 (22.38%) calls were found be cancelled by dispatch before the arrival at scene. In addition, 91 (5.08%) calls of that amount, patients were found dead on arrival at the scene. As SRCA is not allowed to transport dead patients, so the ambulances came back to their respective base stations without transporting the patient. Therefore, cancelled and dead calls were excluded from our analysis because these PCR were found majorly incomplete. In addition, due to Stations' number was not specified in 171 calls (8.8%), these statistics were excludes to end up with 1219 (68%) calls satisfy the inclusion criteria of this study.

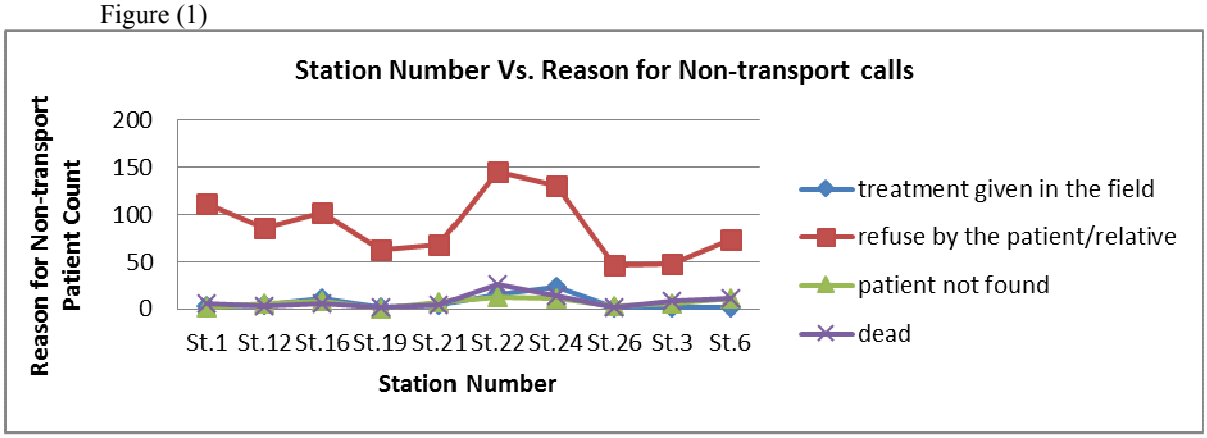
Reasons for non-transport

Table (1) surmises the reasons for non-transported emergency calls in 5 categories. It shows that Station 22 and 24 was reported to be the highest in not transporting calls of 232 and 189 calls representing (19% and 15%), while station 26 was reported to be the lowest of 47 calls. The rest of stations varies from 63 to 119 calls Table (1). The category of refused by patient / relatives represent 876 (71.86%) of all non-transported calls. These two stations also scored the highest of 146 (15%) and 131(13.5%). The central tendency of this category of all stations was (X = 87.6), while the average deviation from the mean was 34.06, indicating a high scoring of the two stations from the rest.

Table (1): Station Number Vs. No. of calls in of Reason for Non-transport Patient

Station No.	Reason for Non transport Patient						Total
	treatment given in the field V1	Refused by the patient/ relative V2	Patient not found V3	Dead V4	Other (police, etc)	Na	
1	3	111	2	6	3	4	129
12	4	86	5	3	8	15	121
16	11	102	9	6	2	5	135
19	1	63	0	1	2	2	69
21	4	68	7	4	2	6	91
22	15	146	13	26	1	31	232
24	23	131	11	14	7	3	189
26	1	47	3	1	0	5	57
3	2	48	6	8	2	2	68
6	2	74	11	11	7	23	128
Total	66	876	67	80	34	96	1219
Mean	6.6	87.6	6.7	8			
Std. Deviation	7.38	34.06	4.296	7.57			

Figure (1)



Response time:

Response time -which refers to the time was taken for the EMS units to reach the scene- was analyzed and found to include four categories; (1-10),(11-20),(21-30) and (na=not available) Table (2). The EMS units reach the patients in less than 10 minutes in 601 (49.3%) calls, in time between 11-20 minutes there was 351 (28.79%) and in a response time of 21-30 minutes there was 131 (10.74%) non-transported calls.

In the category (1-10), Station 22 was reported to be the highest in not transporting calls of 126 (20.96%) calls, while station 26 was reported to be the lowest of 13 calls. The central tendency of this category of all stations was (X = 59.9), while the average deviation from the mean was 30.435, indicating a high scoring of station 22 from the rest, while station 26 also scores high in term of a very low non-transported call volume in this response time category.

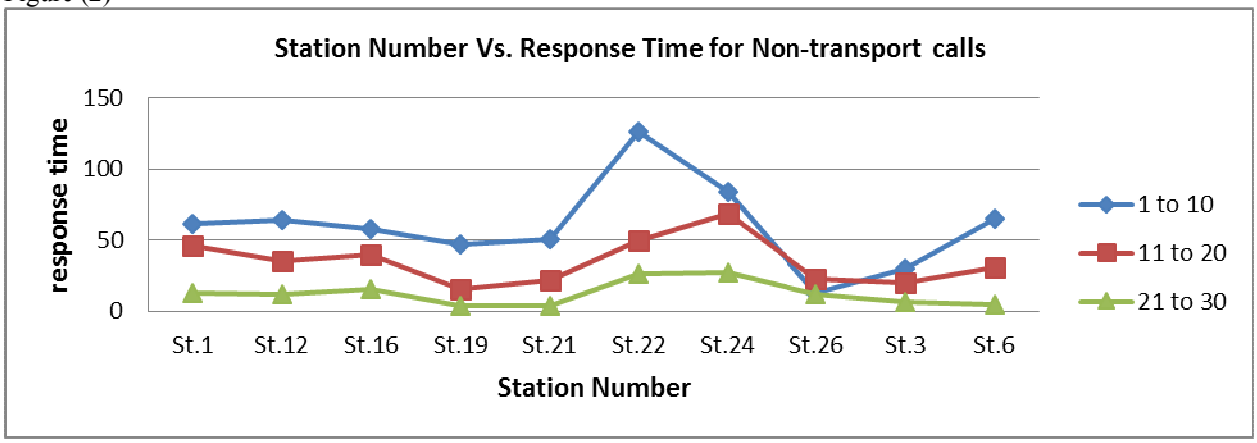
In the category (11-20) Station 24 was reported to be the highest in not transporting calls of 69 (19.6%) calls, while station 19 was reported to be the lowest of 15 (4.27%) calls. The central tendency of this category of all stations was (X = 35.1) while the average deviation from the mean was 16.6, indicating less scattered scoring in this response time category.

In the category (21-30), station 24 and 22 were reported to be the highest in not transporting calls of 27 and 26 (20.6% and 19.8%, respectively) calls, while station 19 and 21 were reported to be the lowest of 4 (3.05%) calls. The central tendency of this category of all stations was (X = 12.4) while the average deviation from the mean was 8.44, indicating lesser scattered scoring in this response time category.

Table (2): Station Number Vs. No. of calls in Response of Time categories (Cross-tabulation)

Station No.	Response Time				Total
	1-10 V1	11-20 V2	21-30 V3	Na	
1	61	46	13	9	129
12	64	35	12	10	121
16	58	40	15	22	135
19	47	15	4	3	69
21	51	22	4	14	91
22	126	50	26	30	232
24	84	69	27	9	189
26	13	23	12	9	57
3	30	20	6	12	68
6	65	31	5	27	128
Total	601	351	131	145	1219
Mean	59.9	35.1	12.4		
Std. Deviation	30.435	16.60	8.448		

Figure (2)



Time in the Field

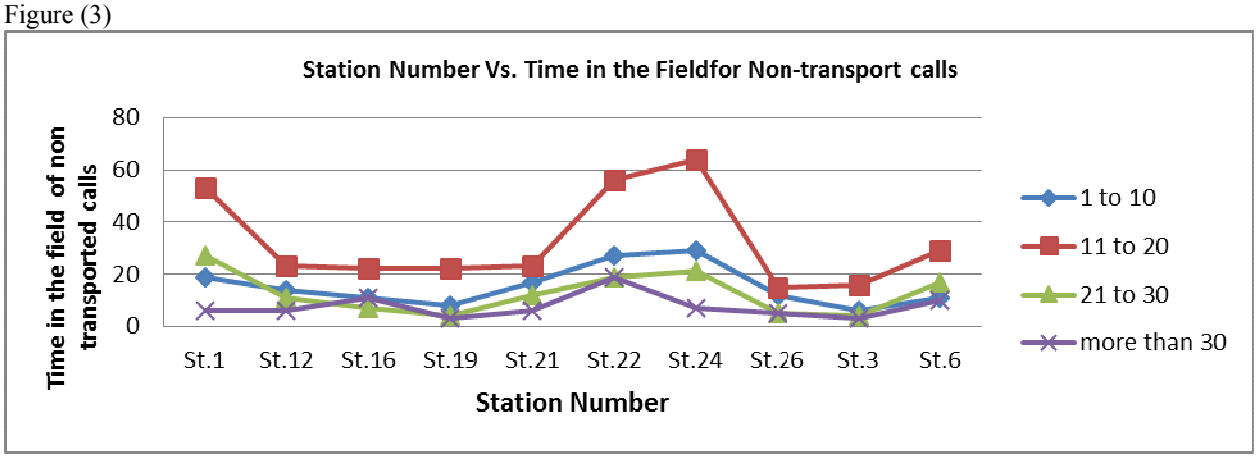
Time in the field analyzed and divided in five categories (1-10),(11-20),(21-30),(>30) and (Na=not available) Table and figure (3). The (Na) category was excluded from the analysis. Stations' units staying time in the field vary.

In the category (1-10) Station 24 was reported to be the highest in not transporting calls of 29(20%) calls, while station 3 was reported to be the lowest of 6 (4%) calls. The central tendency of this category of all stations was (X = 15.4%) while the average deviation from the mean was 7.677, indicating relatively narrow scattered scoring in time in-field category. In the category of 11-20 minutes, all stations shared the highest scores of 323 (26.4%) calls. In the category (11-20) Station 24 was reported to be the highest in not transporting calls of 64 (19.8%) calls, while station 26 was reported to be the lowest of 15 (4.6%) calls. The central tendency of this category of all stations was (X = 32.3) while the average deviation from the mean was 18.12, indicating relatively wider scattered scoring in time in-field category. In the category (21-30) Station 1 was reported to be the highest in not transporting calls of 27 (21.2%) calls, while stations 19 and 3 were reported to be the lowest of 4 (3.14%)calls. The central tendency of this category of all stations was (X = 12.7%) while the average deviation from the mean was 8.01, indicating relatively narrow scattered scoring in time in-field category. In the category (>30), Station 22 was reported to be the highest in not transporting calls of 19 (25%) calls, while station 19 and 3 was reported to be the lowest of 3 (3.9%) calls. The central tendency of this category of all stations was as low as (X = 7.6%) while the average deviation from the mean was 4.76, indicating the narrowest scattered scoring in the time in-field category.

Table (3): Station Number Vs. No. of calls in Time in Field categories (Cross-tabulation)

Station No.	Time in the Field					Total
	1-10 V1	11-20 V2	21-30 V3	>30 V3	Na	
1	19	53	27	6	24	129
12	14	23	11	6	67	121
16	11	22	7	11	84	135
19	8	22	4	3	32	69
21	17	23	12	6	33	91
22	27	56	19	19	111	232
24	29	64	21	7	68	189
26	12	15	5	5	20	57
3	6	16	4	3	39	68
6	11	29	17	10	61	128
Total	145	323	127	76	539	1219
Mean	15.4	32.3	12.7	7.6		
Std. Deviation	7.677	18.12	8.01	4.765		

Figure (3)



Discussion

This is the first study of its kind to delineate that the percentage of non-transported calls received by the dispatch of 24.95% of all received EMS distressed calls. No previous studies can be compared with this outcome in setting of the study. This percentage, however, is lower than what has been reported by Chen al el[6] in Taiwan of 32%, Hipskind et al[7] of 30% and the report by Fischer AJ et al[11] in UK of 30%.

We found that non-transported calls due to call cancellation by dispatch before the arrival at scene were 401 (22.38%) calls, for reasons not mentioned in the patient care reports. This corresponds with the study in Barbados by Sherwin E et al[16], where cancelled calls were in the highest proportion on non-transported calls. However, this study revealed that the EMS units reach the patients in less than 10 minutes in 601 (49.3%) calls, which represent the highest category of response time. As this outcome suggests the response time is less likely to be affecting the non-transportation. This contradict with Sherwin E et al[16] and O. Braun et al[17] studies and implying that the waiting time might not be the direct cause of non-transporting the patient.

Due to the lack of sufficient information in the examined PCR and un-following up with non-transported patients, this study cannot confirm the outcomes reported by G J Gardner et al[13] and F F Palazzo et al[14] to determine the extent of the real medical need of those patients nor the appropriateness of these calls. In fact, another study emphasizes on following up with patients or relatives to explore whether these non-transported patients require immediate or urgent medical care or not. Also more emphasis needs to paid toward whether these patients and/or relatives made the decision of not to transport or EMS personnel. Also, the social and traditional values and believes and their effect on refusals need investigation.

Upon the analysis of PSR there was no evidence that patient's non-transport protocols which might corresponds with the American study reported by H A Snooks et al[10] that few emergency services providers (17%) have written protocols to refuse patients transport to the hospital. Moreover, SRCA EMS do not seem to illustrate any utilization of any supplemental forms of refusal forms approved by the system to protect the patient right and protect the EMS providers from any legal action. It is apparent from the analyzed PCRs that the EMS

providers have major deficiency in applying thorough assessment for the non-transported cases. This concern will be analyzed in another separated paper.

This study delineates that non-transportation decision by patient /relatives represent 876 (71.86%) of all non-transported calls. In fact all the 10 stations share this high figure in this category. It is apparent that stations 22 and 24 are more likely to respond more to the calls and scores high in not transporting the patients. These two stations seems to be more busy stations, however more managerial and quality assurance investigation needs to be in place.

This study attains positive impression about the response time to reach the scene of the patient. In the majority of calls 601 (49.3%) the patients were reached in response time of 10 minutes and below. In addition the time in field were looked at in association with stations and found that the time of 10-20 minutes was consumed in the scene in 323 (26.4%) of the non-transported calls. This indicates this period of time is sufficient to obtain and document comprehensive patients' assessment.

What seems to be a common negative character in all reviewed PCRs of all 10 stations were Incomplete documentation with poor hand writing by EMS providers. This delineates the system need to establish an electronic reporting system to allow technology to solve very basic operational problems.

Strength and Limitations

This study is the first that evaluates Saudi EMS system in regard with the non-transported emergency calls dispatched by EMS stations.

The limitation of this study is large amount of incompleteness of large number of the included PCRs resulting in large proportion of missing data. Another challenge comes in the lack of ability to read some of individual hand writing of those reports.

Conclusion

The larger volume of calls' responses of EMS stations, the larger volume of non-transported calls . This study found that the busiest EMS stations scores high in not transporting patients. The study found also that the shorter response time doesn't affect the decision of the transportation. A managerial and quality assurance review of the outcomes of non-transported calls is required, especially for patients with certain medical conditions. This study delineates the need for electronic reporting system.

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Conflicts of interest

The authors declare that they have no conflicting interests with respect to this project.

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