

Nontransported Cases after Emergency Medical Service Callout in the Rural and Urban Areas of the Riyadh Region

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Abstract

Background: Callouts resulting in patient nontransportation can impact the overall quality of prehospital Emergency Medical Service (EMS), as resources in health care are finite. While some studies have investigated the causes of nontransportation, few have examined whether there are differences between urban and rural patients. Similarly, there has been limited research focused on rural EMS in locations such as the Middle East.

Objectives: This study investigated EMS cases that resulted in nontransportation in the urban and rural areas of the Riyadh region in the Kingdom of Saudi Arabia.

Methods: A cross-sectional study of 800 (400 rural and 400 urban) patient records was undertaken, using 12 months (January 1 to December 31, 2017) of data from the Saudi Red Crescent EMS. A random sampling method was used to select ambulance records from the 78 urban and rural EMS stations in the Riyadh region, with demographic data and reasons for patient nontransport analyzed comparatively.

Results: A total of 310 cases were nontransported (39%) (rural: 146; urban = 164). The highest rates of nontransportation cases were of medical and trauma callouts (44.6% and 39.6%, respectively), which was consistent in both areas. The most common reason for nontransportation in both urban and rural areas was refusal of treatment and transportation (66.5% and 59.9%, respectively). Further, 10 patients were treated on-scene and released by rural EMS, while no urban patients were treated and released. Overall, the case presentations of nontransported patients did not differ significantly between both areas, and it was found that gender, age, and geographic location were not predictors for nontransportation.

Conclusions: The high rate of nontransportation, particularly in medical and trauma callouts, indicates that a review of current EMS protocols may be required, along with consideration of relevant community education programs.

Keywords: Accident and emergency medicine, Emergency Medical Service, health services administration and management, nontransport, Saudi Red Crescent, urban–rural

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Submitted: 11-Aug-2020 **Revised:** 13-Nov-2020 **Accepted:** 22-Nov-2020 **Published:** 26-Dec-2020

Access this article online	
Quick Response Code:	Website: www.sjmms.net
	DOI: 10.4103/sjmms.sjmms_560_20

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How to cite this article: Alanazy AR, Wark S, Fraser J, Nagle A. Nontransported cases after emergency medical service callout in the rural and urban areas of the Riyadh Region. Saudi J Med Med Sci 2021;9:38-44.

INTRODUCTION

Prehospital Emergency Medical Services (EMS) play a vital role in the medical management of disasters, accidents and acute illness, providing rapid response to emergencies and transporting patients to the nearest suitable health-care facility.^[1-3] However, EMS does not transport all cases following an emergency call; the literature reports varying rates of nontransportation cases where the EMS was called but ultimately did not transport the patient.^[4,5]

Nontransportation sometimes results from a minor illness or injury that could have been treated safely at either a community medical practice or an outpatient clinic at a hospital.^[6] Such callouts for less severe cases can cause a cascade of issues for patients, EMS staff and the wider health systems, including increased response times and reduced access to emergency care for more urgent cases – which may result in mortality – and higher service running costs.^[6-8] In some cases, patient refusal of transportation may also result in a future deterioration of their condition, whereby they may have to re-contact the EMS.^[7,8] A systematic review noted nontransportation rates following callout for a fall ranging from 11% to 56%, with about half the nontransported cases having further unplanned health-care contact within 28 days of that initial nontransportation outcome.^[5]

The causes of nontransportation has been investigated in several studies across different countries,^[4,5,9-11] but few have examined whether there are differences in nontransportation rates between urban and rural patients. Similarly, little research has focused on rural EMS outside of the United States, Europe and Australia, with minimal focus on countries in Asia, Africa or the Middle-East.^[12] This lack of research on rural EMS delivery in such locations is an area of need, as the significant service delivery, cultural, geographic and economic differences mean that findings from research in Western countries cannot necessarily be generalized to these settings.

The current research was undertaken to gain a better understanding of EMS nontransportation cases in the urban and rural areas of the Kingdom of Saudi Arabia. Defining the clinical characteristics of EMS calls that do not result in transportation is a key component of planning that may assist in improving EMS services. Specifically, understanding the reasons for, and consequences of, nontransportation may assist decision-makers in Saudi Arabia to better allocate existing resources and also to develop targeted education programs to reduce unnecessary calls, if required. It is hypothesized that there will be a

significant difference in nontransportation cases due to the type of callout and location of injury, but not due to geographic location. This study is part of a larger project examining issues associated with EMS services in rural and urban locations within Saudi Arabia, with particular focus on the resourcing issues for rural areas.

METHODS

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE checklist), the standard reporting checklist endorsed by the EQUATOR network, was used when writing this manuscript.^[13]

Setting

This study was based in the Riyadh region in the Kingdom of Saudi Arabia. Riyadh is one of the 13 administrative regions in the Kingdom and is geographically located in the center. The project had originally planned to examine data from the Makkah administrative region, as it has both the largest population and highest EMS transportation rates. However, activities associated with pilgrimage in Makkah results in a huge temporary population influx, which is not experienced by the other regions, and thus EMS data from Makkah is unlikely to be representative of other areas.^[14] The Riyadh region has the second largest population with an estimated population of 8 million people, and includes the capital city of Saudi Arabia, also called Riyadh. Therefore, this region was evaluated as being a more representative source of data for Saudi Arabia.

Participants, patients, and public involvement

This retrospective cross-sectional study analyzed a randomly drawn sample of de-identified Emergency Patients Records (EPRs) from the Saudi Red Crescent Authority EMS during the period January 1 to December 31, 2017. Across Saudi Arabia, the Red Crescent Authority is the primary provider of EMS for the general community; there are specialist EMS for military and some industrial locations.^[2,3,15] Data were sourced from the Saudi Red Crescent central office in Riyadh city, and it included data from all 78 EMS stations (30 rural/48 urban sites) in the region. In accordance with the geographic classification provided by the Saudi Red Crescent and used on EPR forms, Riyadh city was considered as “urban,” while all other areas of Riyadh region were “rural.”

Procedures

A sample size calculation was conducted to ensure a suitable dataset, and this was determined to be 392 EPRs. Prior to the study commencement, it was agreed that 400 patient records each would be selected from urban and rural areas

($n = 800$). The archived EPR files were selected based on a computer-generated random number list.

Data were extracted from the hard-copy paper records, as electronic versions of EPRs were not available. An independent supervisor from the Saudi Red Crescent de-identified the records and provided the lead author with copies of the original after confirming the EPR was complete (i.e., no missing data). These de-identified EPRs were then scanned, and key data were transcribed into SPSS Statistics for Windows version 25 (IBM Corp., Armonk, NY, USA). Cross-checking of data transcription and entry was undertaken by the second author to minimize the potential for data errors. Translation was not required, as the EPR includes both English and Arabic text headings for each category. The decision to start with a random sample of all 800 cases and then identify the nontransportation outcomes, rather than initially selecting only nontransportation cases from the Red Crescent records, was deliberate to examine whether there were any discernable patterns within the overall data that may provide insights into the reasons for nontransportation.

Statistical analysis

Demographic data and the EMS staff's nominated reason for nontransportation were collected from the EPR. Reasons for nontransportation were reported directly from the categories on the Saudi Red Crescent EPR as follows:

- Treated and released at scene
- Refused treatment and transportation
- Treated and refused transportation
- Attended ambulance station in person and treated on-site without transportation
- No injury
- Call canceled on route
- Transported by third party
- Death on site.

Data were compared between the urban and rural groups using the chi-square test. Continuous data were presented in mean and standard deviation. Categorical data were presented as frequency and percentage. Logistic regression models were used to identify the significant predictors of nontransportation. $P < 0.05$ was considered statistically significant.

Ethical approval

Prior to commencement, ethical and project approval was granted by the University of New England's Human Research Ethics Committee, the Saudi Arabia Ministry of Health Ethics Committee, the King Abdulaziz Medical Cities Ethical Committee, and the Saudi Red Crescent Authority.

RESULTS

Demographic data

Of the 800 EPRs analyzed, 310 callouts (39%) did not result in transportation (urban: $n = 164$; rural: $n = 146$). All further analysis included the data of only the nontransported patients. The mean age of the urban and rural groups was 41.9 and 43.5 years, respectively, which represented a nonsignificant difference ($P = 0.391$). The urban group was composed of 103 (62.8%) males and 61 (37.2%) females, while the rural group included 101 (69.2%) males and 45 (30.8%) females. These data are approximately representative of the 800 records screened, where 66% of urban participants and 73.8% of rural participants were male, respectively. Overall, there was no significant difference in the number of nontransportation cases between the urban and rural areas ($P = 2.80$).

Types of calls that resulted in nontransportation

The data for all cases were initially stratified by the type of call, location of the injury on the body and setting location (e.g., home, street, etc.), then with respect to the transportation outcome, and then again by rural versus urban location [Table 1]. As overall numbers are low, which may make some statistical comparisons less reliable, the data were evaluated for any possible trends. Nearly half (44.6%) of medical callouts did not result in transportation, while approximately 40% of trauma cases were also not transported. No obvious trends were evident within the injury location data, although extremities reported the highest nontransportation rate at 34.7%. Data for the setting location was similar, with the home (42.3%) being slightly higher in nontransportation outcomes than either a street or other public setting (such as shopping centers). An area in which there was a possible difference was the greater number of callouts for motor vehicle accident in rural areas (18.5%) that resulted in nontransportation when compared to urban areas (5.4%).

Reasons for nontransportation: Urban versus rural

The EPR form does not record patient-nominated reasons for refusal of treatment or transportation. Of the original sample of 800 EMS users, the number of patients who were noted on the EPR as refusing treatment and transport or who were treated and then refused transport was higher in the urban areas. Callouts in the urban areas resulted in 147 patients (36.8%) refusing transport compared to 114 patients (28.5%) in the rural areas. The proportion of male patients refusing transportation (64.4%) was higher than females (35.6%) across both areas. It is worth noting that there were no cases noted on the EPRs for either rural or urban areas in which the on-scene EMS staff made the

Table 1: Type of call, injury location, scene location and transportation outcome

Variable	All callouts (n=800)	Nontransported cases (n=310), n (%)	Nontransported cases in urban (n=164), n (%)	Nontransported case in rural (n=146), n (%)
Type of call				
Motor vehicle collisions	158	36 (22.8)	9 (5.4)	27 (18.5)
Industrial	13	2 (15.4)	1 (0.6)	1 (0.6)
Medical	460	205 (44.6)	116 (70.7)	89 (61)
Trauma	169	67 (39.6)	38 (23.2)	29 (19.9)
Location of injury (when recorded)				
Head	110	27 (24.5)	13 (7.9)	14 (9.6)
Face	32	7 (21.9)	5 (3)	2 (1.4)
Chest	38	9 (23.7)	5 (3)	4 (2.7)
Abdomen	36	10 (27.8)	5 (3)	5 (3.4)
Back	75	11 (14.7)	7 (4.3)	4 (2.7)
Extremity	170	59 (34.7)	25 (15.2)	34 (23.3)
Scene location				
Street or highway	284	94 (33.1)	47 (28.7)	47 (32.2)
Home	383	162 (42.3)	85 (51.8)	77 (52.7)
Hospital	11	11 (100)	8 (4.9)	3 (2.1)
Public setting	122	43 (35.2)	24 (14.6)	19 (13)

decision to refuse to transport a patient, but it is not clear from the EPR form if the EMS staff could make this decision independently.

In rural areas, either the patient or a relative refused both the treatment and transport in 86 cases (58.9%) once the EMS arrived on the scene. Another 28 rural patients (19.2%) refused transportation after being treated on-scene. The urban areas reported a similar trend, with 109 (66.5%) patients refusing both treatment and transportation, and 38 patients (23.2%) refusing transportation after treatment [Table 2]. There were slightly more deaths on-scene reported for rural areas, but total deaths were low across both rural and urban sites. While a small number of rural patients (10) were treated and released at the scene by the EMS, no urban patients were treated and released. Again, the overall numbers are small, so caution is advised in assigning significance to this finding, but it should be a subject of future consideration.

Predictors of nontransportation

A regression analysis of the 310 nontransported cases examined several variables, including age, gender, location and the type of injury and illness, to determine outcome predictors. This analysis showed that fracture–laceration injury, head-neck injury, chest injury and motor vehicle collision were the significant predictors for transportation. However, age, response time, location and sex were all not significant predictors of nontransportation of EMS cases [Table 3].

DISCUSSION

EMS plays a vital role in the management and transfer of injured individuals during health emergencies; an efficient

Table 2: Reasons for nontransportation of emergency medical service cases in rural and urban areas

Reason for nontransport	Frequency (%)	
	Rural areas	Urban areas
Treated and released at scene	10 (6.8)	0 (0)
Refuse treatment and transport	86 (58.9)	109 (66.5)
Treated and refuse transport	28 (19.2)	38 (23.2)
Attended ambulance station	3 (2.1)	7 (4.3)
No injury	1 (0.7)	0 (0)
Call canceled on route	1 (0.7)	0 (0)
Transported by third party	4 (2.7)	2 (1.2)
Death on site	13 (8.9)	8 (4.9)
Total	146 (100)	164 (100)

Table 3: Regression analysis for nontransportation

Variable	Beta (regression coefficient)	P
Age	0.005	0.109
Response time	-0.010	0.163
Location	0.010	0.950
Sex	-0.198	0.275
Motor vehicle collision	-1.135	0.000*
Industrial accident	-1.492	0.070
Medical incident	-0.330	0.253
Fracture-laceration injury	-1.222	0.000*
Head-neck injury	-1.290	0.000*
Chest injury	-1.087	0.045*
Dizziness	0.145	0.563
Wound burn	-0.219	0.567
Cardiac illness	-0.406	0.352
Gastrointestinal illness	0.228	0.525
Neurological illness	-0.058	0.895
Respiratory illness	-0.040	0.907

*Indicates statistically significant difference

EMS will decrease the mortality and morbidities resulting from emergency injuries or illness.^[16] However, cases that result in the nontransportation of patients can impair the overall performance of the EMS.^[17] Published data from worldwide studies report substantial nontransportation rates, which constitute impediments to the capacity of EMS response in emergency conditions.^[18,19] The present study

examined a sample of nontransportation cases following EMS calls in both urban and rural areas of Riyadh in the Kingdom of Saudi Arabia to expand the existing knowledge base regarding this issue.

The results showed that approximately two-fifths (39%) of the callouts did not result in transportation. This finding falls within the very wide range of 3.7% to 93.7% noted by Ebben *et al.*^[20] and was very similar to that reported by Pekanoja *et al.* in Finland.^[21] However, it is far higher than that reported in some countries, such as in Canada, where Goldstein *et al.*^[22] noted that just 12.3% of the cases resulted in nontransportation, although the focus of that study was an older population. The Red Crescent EMS is naturally subject to resource limitations, and this high rate of nontransportation indicates that current resources may be being diverted from other areas. The data indicated that medical and trauma callouts in particular had very high rates of nontransportation in both rural and urban areas. The reasons for this are not possible to determine in a cross-sectional analysis, but studies in Saudi Arabia report a lack of general awareness among the public regarding the role of EMS,^[2,3] and specifically in relation to dealing with routine versus emergency health situations. This confusion may underpin the large numbers of callouts for potentially a relatively minor health concern.

The most common reason for nontransportation in the study population was the patient refusing both treatment and transport, which accounted for 66.5% and 58.9% of the nontransportation cases in urban and rural areas, respectively. It is not clear from this data why there is such a high proportion of patients refusing treatment and transportation, particularly when alternatives, such as patients being treated and released on-scene, was very low. It is suggested that specific consideration of why emergency callouts result in patients refusing treatment and transportation be a focus of future research in Saudi Arabia.

Regression analysis on the nontransported cases revealed that predictors for transportation included fracture-laceration, head–neck injury and chest injury. It is believed likely that this is simply a reflection of the severity of the injuries arising from trauma, but again that cannot be determined from the EPR data. It is worth noting that other factors such as geographic location, sex and age did not predict nontransportation.

A 2016 study by Alrazeeni *et al.* in Saudi Arabia indicated approximately 70% of nontransported cases were caused by refusal of the patients or their relatives,^[19] which is similar to the findings of the current research where patient

or relative refusal accounted for 66.5% and 58.9% of the nontransportation cases in the urban and rural areas, respectively. Phillips *et al.*^[23] studied the reasons for the nontransport of potential emergency cases in Barbados emergency ambulance service and found that 19% of these were because of cancellations related to the response time or using another alternative transport system, which differs from the current study's findings. In the current cross-sectional analysis, the exact reasons on how patients reached their decision cannot be established. However, it is possible that some of the issues again stem from the lack of understanding among the general public regarding the role of EMS in Saudi Arabia.^[2,3] Education programs regarding the type of emergencies to call an EMS may assist in reducing the number of callouts that result in nontransportation. This is particularly relevant for the high rates of nontransportation for medical and trauma callouts.

The current study showed that no decisions of nontransportation were made by the on-scene response team, while just 10 rural and no urban cases were recorded where a patient was treated and released on-scene. It is acknowledged that the provision of EMS in Saudi Arabia is structurally quite different to that of Europe or the USA, with a higher proportion of the workforce being Emergency Medicine Technicians than paramedics.^[2,3] It is not clear from the EPRs whether on-scene staff have the autonomy to make nontransportation decisions, or whether the varying training and knowledge of potential responders, exemplified by the ETMs versus paramedics distinction, may be a factor. The low rates of “treatment and release” in the current study, and particularly in urban areas, indicate that Saudi Arabian EMS staff, in general, may err on the side of caution in their decision making. Literature from other countries indicates that EMS nontransported cases were often due to on-scene decision and evaluation of the EMS team. Beerman *et al.*^[24] conducted a prospective observational study in the Netherlands to evaluate whether nontransporting decisions taken by EMS staff were correct. They found that of 1095 nontransported cases, 24% required secondary medical consultation within 7 days for the same condition. A systematic literature review by Fraess-Phillips investigated whether nontransporting decisions were in line with that of emergency medicine staff.^[25] Their results showed that there was an overall poor agreement between decisions of on-scene EMS staff and emergency medical-care providers. Therefore, the conservative decision making of the Saudi EMS may well be very appropriate to avoid the problems identified by Beerman *et al.* and Fraess-Phillips.^[24,25] However, it may also result in more patients being transported to hospital than necessary, and this issue requires additional research

to better understand factors affecting the on-scene decision making of EMS staff.

Research from the UK showed that ambulance calls that did not result in transportation tended to be for elderly people (aged >70 years) who had fallen over or with a less urgent condition.^[10] The current study did not replicate these findings, with age not being a predictor of nontransportation; the reasons for this are not clear and may benefit from additional exploration in subsequent research. While road accident trauma is generally recognized as a significant health concern in Saudi Arabia,^[14] the data trend were for a greater rate of nontransportation following road accident trauma in the rural areas. This was opposite to what was expected, as rural areas have a greater likelihood of high speed accidents and subsequent trauma, and further investigation are required to understand whether this was simply an anomalous finding or if there are underlying reasons that may explain it. As a cross-sectional study, there was no opportunity to determine the longer-term consequences of nontransportation in the current research, and data matching to longer term health outcomes were not possible.

Medical and trauma cases overall had high rates of nontransportation. Chronic health problems including cardiac, respiratory, gastrointestinal and neurological issues, could not significantly predict nontransportation of EMS cases, but cases with acute injuries, such as fracture-laceration injury, head-neck injury and chest injury, were more likely to be transported. These findings are similar to that of Tiedmann *et al.*, who found cases that resulted in nontransportation had a high prevalence of chronic medical conditions, functional limitations and past falls.^[26] In the Canadian study of older people,^[22] female gender and longer on-scene duration were common in the nontransported group. However, in our study, neither gender nor the response times was significant predictors of nontransportation. Gerlacher *et al.*^[27] compared the characteristics of a pediatric population who were not transported versus those who were transported by the EMS. Their results showed that the most common conditions among nontransported population were injuries (27.7%) followed by motor vehicle accidents (20.4%) and then choking (10.2%). Although our sample was not solely pediatric, motor vehicle collisions and injuries were also found to be predictors of transportation.

Limitations

This study was derived from a random sample of 800 EMS callouts in the Riyadh region of the Kingdom of Saudi Arabia. While the sample size was sufficient with

respect to the power calculation, it is acknowledged that it would have been desirable to have a larger dataset, as the statistical soundness of results increases with the number of observations. However, as there were no electronic records with this information readily available, hand-written hard copy files had to be initially de-identified by a Red Crescent supervisor, and then individually transcribed by the lead author. As a consequence of the time-intensive nature of this process, developing a bigger dataset was beyond the scope of this project.

As noted earlier, the deliberate choice of the Riyadh region was to increase the potential relevance of results for other areas of Saudi Arabia. However, caution is still recommended when considering these findings even within the Kingdom, and readers will need to consider any relevant social, geographic and political factors in their specific location. Similarly, it is again acknowledged that the retrospective nature of the study limits the ability to accurately interpret all the results, with some important variables not being available because of how the data were recorded.

CONCLUSIONS & RECOMMENDATIONS

The current study found no evidence of significant geographic disadvantage resulting in nontransportation, with no major differences being detected between urban and rural areas. It is not clear why Saudi Arabia has such a high level of nontransportation, and additional research is recommended to better understand the factors that may be underpinning this outcome. It is suggested that in-depth qualitative interview with EMS staff in particular may be advantageous to tease out the issues identified through the EPR data that lead to nontransportation outcomes. Similarly, it is suggested that education programs that better guide the public on when to call the EMS may assist to reduce the overall number of nontransportation cases. This, in turn, will potentially free up resources to be utilized in other areas requiring attention.

Ethical considerations

Ethical and project approval for this study was prospectively granted by the University of New England's Human Research Ethics Committee (HE-18-246), the Saudi Arabia Ministry of Health Ethics Committee (16/08/2017/AD), the King Abdulaziz Medical Cities Ethical Committee (RC17/243/R), and the Saudi Red Crescent Authority (15757-9/11/18). The study used de-identified files, and thus the need for consent was waived.

Peer review

This article was peer-reviewed by four independent and anonymous reviewers.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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