



An analysis of cost and time for non-emergency calls: A retrospective study on the Emergency Medical Services resources management

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ABSTRACT

Background: Non-transported calls refer to calls received by dispatchers, ambulances dispatched, and the patient not being transported to any health facility. There is a need to analyze and scrutinize the number of such calls and the monetary cost associated with them as it will help to build an effective system to prevent wastage of money and time.

Objective: The main objective of this study is to determine the cost and time lost due to the use of resources higher than required in non-emergency situations, and then a comparison is being made to determine the acceptable cost if the appropriate resources are used for such cases. Incidence of non-transported Emergency Medical Services (EMS) calls and the financial and time burdens in Jubail, classified non-urgent from 2017 to 2019, have wasted EMS resources. This information can be useful to improve EMS operations and allocate resources to control inappropriate usage.

Methodology: A retrospective cross-sectional study was conducted to assess non-emergency EMS calls in Jubail, Saudi Arabia. Study data were obtained from the Royal Commission Health Services Program- Jubail (RCHSP-J) key performance indicator (KPIs) system from 2017 to 2019. Descriptive statistical measures (sum, mean, and percentage), and comparison methods were obtained.

Results: The cost from 2017 to 2019 for the non-emergency calls by using the advanced life support ambulance (ALS) was 2,051,651 USD while the cost of emergency calls was 546,037 USD only. On the other hand, the time for the non-emergency calls was 6870 hours (78%) and the emergency calls were only 1769 hours (22%).

Conclusion: In systems with limited resources and poor regulation; the non-emergency calls having higher costs and time more than emergency calls from 2017 to 2019, might have caused a delay in providing care for the more serious cases. This involves a significant financial waste that could have been planned to make the system work more efficiently avoiding massive waste of resources.

Keywords: emergency medical services, non-emergency calls, waste management, cost, time

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<http://doi.org/10.5339/jemtac.2022.10>

Submitted: 28 March 2021

Accepted: 21 September 2021

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INTRODUCTION

The EMS is a vital part of the healthcare system because it is usually the primary purpose of contact for medical emergencies. The EMS in Saudi Arabia has seen a variety of positive changes over the past decade. Despite these positive changes, this EMS system in Saudi has long been facing several challenges, both structure and academic, together with the dearth of analysis, community involvement, the academic standing of practitioners, and therefore the inconsistencies of statistics concerning latent period and rate of transfer¹.

There is no written protocol throughout Saudi Arabia that permits dispatchers at the centers to refuse any request. Consequently, several resources can be wasted due to the laws and legislation that constitute emergency tasks and these cost the system significant sums. Incompatible use of ambulances could be a frequent phenomenon particularly in cases that are not emergency, and frequently it is applied in low-risk situations and unwilling to have paramedics ambulances such as unloading home, scheduled appointments, dialysis, transportation to and from facilities, and cases that may commute by personal automobiles, like superficial wounds, slight external bleeding, etc.

The lack of awareness of a non-minor proportion of the general population greatly affects the efficiency of the use of the ambulance, such as delayed response to critical calls such as MVC, cardiac arrest, heart attacks. Delayed treatments are associated with increased morbidity and mortality, which in turn reflect poor EMS performance. This is due to many factors, starting with lack of regulations, legislation, follow-up in optimal use, and lack of awareness, and in the end, these problems lead to increased waste of money and time in emergencies.

This research aims at investigating the quality of work to detect possible defects to help build highly efficient systems with limited resources, as in the case of third-world countries. Therefore, key performance indicators (KPI) from the Royal Commission Health Services Program- Jubail (RCHSP-J) to know the number of calls for each code and calculate their operational cost and the working hours for these calls were obtained. RCHSP-J plays the first line in response to prehospital emergencies in Jubail. According to the population census, Jubail Industrial City reached around 300,000 people in the population of 2019.

In a rare and recent study, it becomes clear that the excessive misuse of the emergency number suggests that there is a lack of awareness of the public and a careless attitude that can lead to death or a dangerous outcome of the emergency. Moreover, the inappropriate use of resources and non-emergency calls may result in denial to pay attention to real emergencies and economic losses as well². The problem lies in not allocating the right resources to several classes of ambulances according to different situations. This leads to inefficiency in the time response to emergencies. The current work is engaged in considering the effect of allocating a certain number of ambulances critical class calls and its effects on response time and cost reduction³.

On the other hand, the management of these sensitive systems must take into account their level of efficiency. It is important to determine the mechanism of use and consumption of resources, especially financial, to achieve a certain degree of agility. The system must be agile, but with a great degree of efficiency that allows it to function according to the actual needs of society. The arrival of the right ambulance team to the right patient at the right time is one of the most important factors by which we measure the efficiency of the system⁴.

MATERIALS AND METHODS

Study Design and Setting

A retrospective cross-sectional study was performed to evaluate cost and time for non-emergency calls in Jubail, Saudi Arabia. Study data were extracted from the Royal Commission Health Services Program- Jubail (RCHSP-J), EMS department's KPIs/dispatching system from 2017 to 2019. Also, the employee's hourly salaries and a list of operational costs were also obtained from the RCHSP-J business center. The operational cost list was for the ALS ambulance that has been used since 2017 for each call. In addition, the business center has estimated the price for BLS ambulances based on the use of less advanced equipment to compare the price difference. This will help to build a comparison in the operational cost of each call to plot the features of the difference in the operational cost in case a recommendation required a reduction in the resources used for a non-emergency call.

Data collection and procedures

Inclusion and exclusion criteria: All information in the KPIs system was reviewed. All data related to refusal to transfer from the patient or his guardian (CODE 8), cancellation before the team arrives at the

site modifying the desire to verify (CODE 10), or death on the scene (CODE o) classified as non-transported EMS calls. All data related to (CODE 5) were classified as non-emergency calls as the examination was performed and the patient was transferred to the facility. All data related to (CODE 4) are considered non-emergency and non-life-threatening in line with the foundations of modern medicine. Hence; data related to (CODE 5), (CODE 8), (CODE 10) were included, while (CODE o) calls were excluded from the analysis because they deal with death cases that are affected by many protocols and circumstances. Therefore, ethically, (CODE o) was not considered under the category of resource waste. Moreover, (CODE 4) was excluded from the Non-Emergency list because, according to the field assessment, the patient in a non-life-threatening situation in each case cannot be considered without transferring him/her for further investigations. Accordingly, those codes were excluded to assure more authenticity of data and ensure distance from simplifying cases that would tolerate more than one scenario. In addition, calls under code 5 with a distance of more than 50 km were excluded because, according to the RCHSP-J protocol, they are considered outside the borders of Jubail (long transportation).

To determine the marginal cost of running an ambulance, the cost data per (km) metric (< 50 km, 50 – 100 km, 100 – 300 km, and > 300 km) was used. Data with travel distances that were within 50 km or less were only included because it is considered within the correct metric distance according to the geography of the city of Jubail. The cost of a call in Saudi riyals of an hour or less was used to determine the average overall cost per code. Thereafter, the cost per month and year were averaged, and after that; all sums were converted into US dollars according to the exchange rate (1-dollar equals 3.75 Saudi riyals). The cost calculation was based on a team of two people (1 Paramedic and 1 EMT) per call and the one-hour operational cost for the advanced ambulance vehicle (ALS). For the (BLS) ambulance, the same distances were calculated, but the difference was in the operational cost. All These data are based on the division of the business administration center in the facility, which is concerned with issuing these numbers. A new code that includes all other codes except for (5, 8, 10, o, and 4) was created accordingly. Hence; any mention in this research of (other call) indicates responding to emergency calls.

Data analysis

Data were collected, summarized, and then analyzed using excel software. Data were extracted from four different electronic datasheets from the EMS system for 2017 – 2019, which were then merged into an excel software database for plot analysis and creation. Data for each year were summarized by months under each selected code and relevant descriptive statistical measures (sum, mean, and percentage) were obtained. The relevant plots were generated under each code based on the percentage and the number of calls for each month to look at the trend. The average total time for each code was also plotted per each year to compare among the codes including the category 'others.

RESULTS AND DISCUSSIONS

According to the salary charged by EMS department employees in one hour per shift, it was found that the ALS ambulance average cost for each call within the limits of Jubail is 308.5 USD, which covers the ambulance services 266.7 USD, one paramedic 21.8 USD per hour, and EMT 20 USD per hour. On the other hand, the BLS ambulance average cost for each call within the limits of Jubail is 201.9 USD, which covers the ambulance services 160 USD, paramedic 21.8 USD per hour, and EMT 20 USD per hour (Table 1).

Table 1 presents the costs and the time elapsed over the past three years according to codes 5, 8, and 10 compared with code (other). In 2017, the operating costs for ALS ambulance for codes 5, 8, and 10 were 870,740.4 USD for the full year compared to the code (other) was 86,401.8 USD. Whereas, an estimated calculation for the use of a BLS ambulance for the code (5, 8, and 10), the cost will be 569,

Table 1. Average EMS Call cost in USD within Jubail Industrial City, (duration = 1hr or less).

ALS cost (USD)		BLS cost (USD)	
1- paramedic	21.8	1- paramedic	21.8
1- EMT	20	1- EMT	20
ALS ambulance	266.7	BLS ambulance	160
Cost of the call	308.5	Cost of the call	201.9
For a minute	5.1	For a minute	3.36

732.5 USD, and this represents a reduction of operating expenses for non-emergency cases by 301,008.2 USD for one year. In 2018, the ALS operating costs for the code (5, 8, and 10) were 774,176.8 USD compared to the code (other) which was 167,584 USD. Whereas, if the BLS ambulance costs were used for the code (5, 8, and 10), the cost shall be 506,542.9 USD, and this will reduce the expenses by 267,633.8 USD.

In addition, in 2019, the ALS operating cost for the code (5, 8, and 10) was 406,733.3 USD and for the code (other) was 292,052 USD, while if BLS were used, the cost of the code (5, 8, and 10) shall be 266,128.5 USD, and this would have reduced expenses by 140,604.8 USD. Moreover, the data of the total time wasted for three years of code (5, 8, and 10) was 6870.46 hrs. While the operational cost was 2,051,651.2 USD for ALS ambulance only. On the other hand, the total actual time spent on 3-year of EMS work for code (other) which represents life/ limbs threatening situations was 1769.61 hrs. In addition, the cost was 546,037.8 USD for ALS.

Waste of resources can significantly affect health care delivery to patients and healthcare organizations. It was found that approximately 36% of patients did not require emergency medical services⁵. In our study in Jubail, it was found that code 5 which represents non-emergency calls such as regular appointments, discharges, patients on dialysis . . . etc.; makes up about 47% of the total calls only during 2018-2019. A study found that 16% of the ambulance requests were inappropriate. Every year in the UK, there are a huge number of calls to EMS that are not emergency calls, which leads directly to reduced ambulance response to emergencies and increasing the percentage of response time⁶.

Table 2. Wasted time and cost for code (5,8, and 10), and code (other). (CODE 5) classified as non-emergency calls, (CODE 8) refused to transfer from the patient or his guardian, (CODE 10) cancellation before the team reaches the site or adjusts the desire to check, CODE (other) includes responding to emergency calls.

	Time (H)		Cost (USD)			
	Code 5,8, and 10	Code (other)*	Code 5,8,10		Code (other)*	
			ALS	BLS	ALS	BLS
2017	3043.32	280.16	870,740.8	569,732.5	86,401.8	56,533.3
2018	2508.98	543.11	774,176.8	506,542.9	167,584	109,651.4
2019	1318.16	946.48	406,733.3	266,128.5	292,052	191,088.5
Total	6870.46	1769.61	2,051,651.2	1,342,404.2	546,037.8	357,273.6

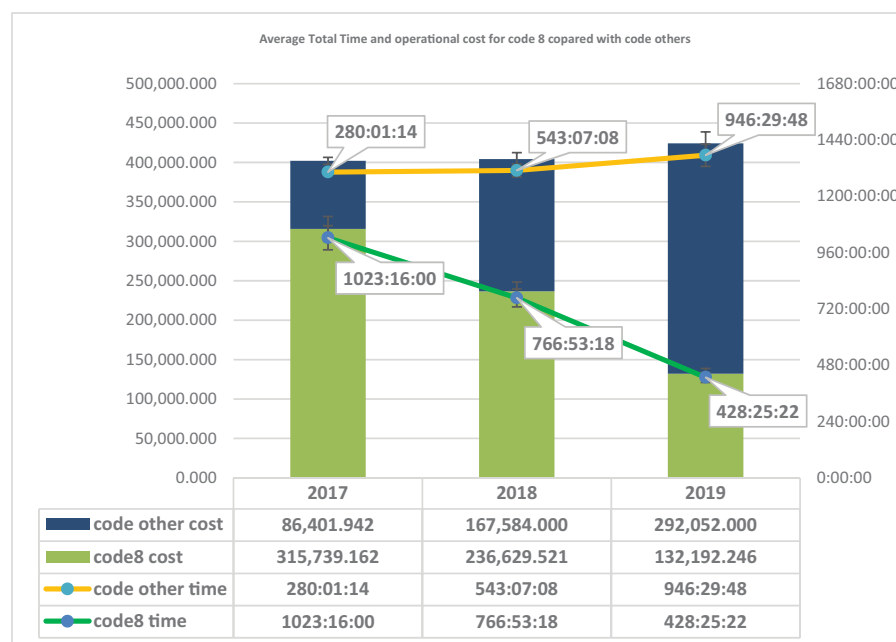


Figure 1. Average total time and operational cost for code 8 (refused to transfer from the patient or his guardian) compared with code other) emergency calls cost.

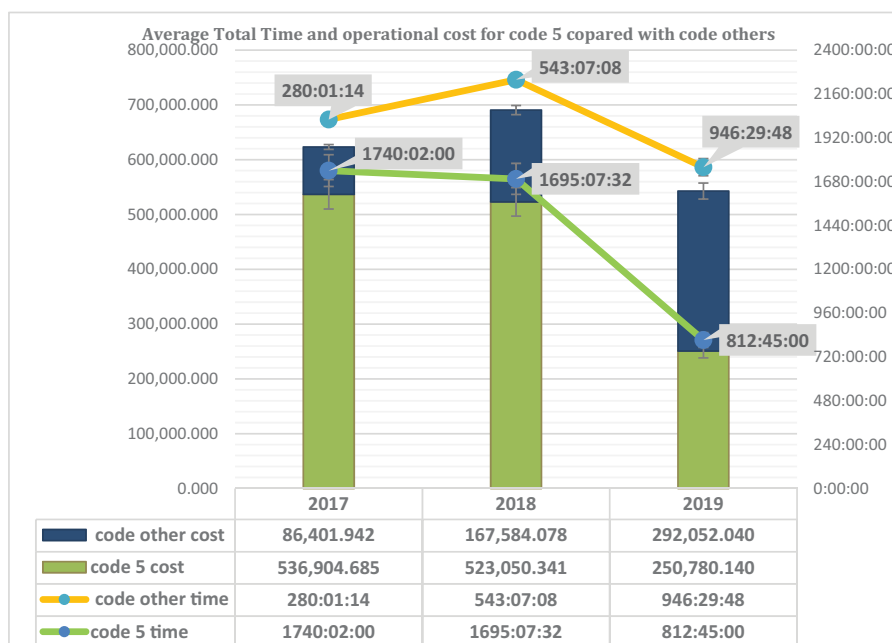


Figure 2. Average total time and operational cost for code 5 classified as (non-emergency calls) compared with code (other) emergency calls cost.

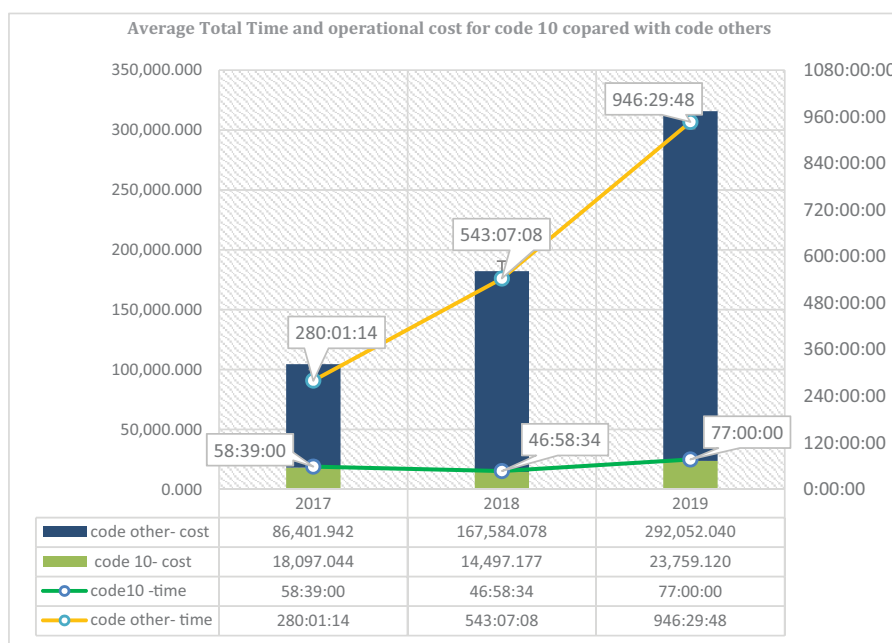


Figure 3. Average total time and operational cost for code 10 classified as (cancellation before the team reaches the site or adjusts the desire to check) compared with code (other) emergency calls cost.

In other studies, it was found that the percentages vary in the non-emergency use of ambulances from 16 to 54%, and the same context in America, they found that 30% of patients refuse transportation for other reasons⁷⁻¹¹. In our study, the refusal rate of transportation to a health facility reached 26% between 2017 and 2019. The percentage of non-emergency cases requiring an ambulance reached 60%. Comparatively, in Dallas and Texas, it has reached 70% of the 1.5 million calls to the ambulance¹². In the same context in our study, code 5, which represents non-emergency cases, reached 49% of all calls between 2017 and 2019. In another study, it was found that 38% of the reports were not emergency, did not call an ambulance for emergency transport, and did not require any emergency

intervention. In addition, 3.7% does not require transportation, mainly to any health facility¹³. Moreover, in Snox, 40% of the calls do not require a transfer to any health facility for emergency intervention¹⁴.

On the other hand, the UNSW results in 2012 show that 11–52% of calls to 999 were unnecessary and 6-9% of emergency calls needed secondary triage. In addition, they developed a study on emergency calls data to refer the calls for secondary triage, they discovered that between 32–83% of the calls are non-emergency¹⁵. Another study in London showed that they receive 50,000 calls a year, of which 15.7% is considered inappropriate. In this way, we deduce the huge amount of resources loss. Gardner et al., have recently tended to question unnecessary use of ambulances in the UK. They clarify that between 38.0% and 51.7% of emergency calls are not medically justified¹⁶.

Currently, the percentage of written protocols that pass the paramedic the right to refuse to transport a patient does not surpass 17% of all protocols in the United States of America¹³. On the other hand, in the Kingdom of Saudi Arabia, especially in Jubail RCHSP-J, the EMS does not have the right to refuse to transport a patient even after the initial assessment has been made and the case that was found does not require any emergency transport. In the UK, the percentage of patients who are not transferred after the ambulance arrived is 30%¹⁷.

In the United States of America, the percentage ranges from 23% to 33% of calls with the patient are not transmitted to any health facility⁷. In Jubail, in 2018 the number of patients who were not transported to any medical facility was 19%. According to the statistics in Barbados, the canceled calls reach 7.5%, while 3.4% of calls refused to be transferred by the patient¹³. In addition, in Jubail, the canceled calls and the patients were not found to represent 2% of total calls in 2017, 2018, and 2019. While in 2018 and 2019 the percentage of patients who refused to transfer was 22.4%. In recent surveys conducted in Riyadh, Saudi Arabia, which lasted for three months and included 10 ambulance stations from March to May 2014 the results showed that the total calls were 7178 of which 1,791 were not transported. This number represents 24.95% of all claims. According to the studies, 22.2% of non-transported calls were trauma cases and 55.7% medical, while the rest were not subject to a specific classification¹⁸. According to the “London assembly” health committee, the questionnaire proved that young Londoners would use the ambulance because they had a GP (GD) appointment earlier. 50% aged 18-24 years would call ambulance services if something happened to them and they did not know what to do. Four out of ten people believe that if they ask for an ambulance, they would seek medical care faster. Three out of ten believe that if they call EMS, an ambulance shall be sent anyway¹⁰. After reviewing the statistics in this work, and after comparing between codes (5, 8, and10) and code (other), it was found that codes (5, 8, and10) had 78% of working hours and the code (other) 22% only.

This analytical study is one of the first studies that dealt with the issue of unintended waste of resources (cost and time) in the emergency medical services sector over a relatively long period. In addition, detailed information was provided on the number and type of cases according to each code. Precise operational costs were also calculated monthly and annually in hours and minutes so that the image becomes clear to decision-makers when updating or developing the emergency medical services system in the Kingdom. The limits encountered in this work were expected, namely the failure to register and clarification as to why the patient was not transferred, except in (Code o).

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, it was found that non-emergency calls have a higher percentage than other codes. This leads to many issues, the most important of which is the delay for the patient who is in critical condition due to calling the ambulance for a non-emergency call at the same time due to limited resources and their incorrect use. The results support our theory that the use of higher resources for simple cases is too expensive, and this causes an imbalance in the better allocation of resources. Many lines intersect to solve this dilemma, but the most important of them remains the continuous detection of defects in the management of emergency medical care systems to discover the defect and then work to fix it. Hence; this work strongly recommends supporting the creation of new policies to separate emergency and non-emergency cases that do not require advanced ambulances with expensive resources and equipment and allocate emergency teams to handle critical cases only without the simple ones so as not to drain their energy and wasting time and money. Ambulance teams with simple equipment are allocated to transport patients to appointments or return home or assistance in transportation, especially since in our region there is a great waste of the efforts of ambulance teams in cases that have nothing to do with emergencies, as shown in the results. Community education has a big role in this issue. The community should be educated about emergency medical services, when to call them and

when they should not. It is also recommended to update the EMS protocol to give the emergency provider to refuse patient transfusion after the initial assessment if the case is not critical at all.

ACKNOWLEDGMENTS

We cannot express our thanks and appreciations enough to Aledhaim, Ali PA-S1, NRP, MS, DrPH, Department of Health Sciences-Towson University for the support and constant review throughout all parts of the research. His comments had a great impact on the success of this work.

Disclaimer

No other relationships/conditions/circumstances present a potential conflict of interest.

Source(s) of support/funding

Non

Disclosure of relationships and activities

Authors declare that they have no competing interests.

Ethical issues

The Research Ethics Review Board of the Royal Commission for Jubail - Health Services Program Reference No. (IRB-RCH-).

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