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Effects of the institutional structure and legislative framework on ambulance accidents in developing emergency medical services systems



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ABSTRACT

Objective: Turkey is a developing country undergoing a system change in the prehospital emergency medical services (EMS). The purpose of this study was to evaluate the effects of the institutional structure and legislative framework on the number of ambulance accidents in Turkey.

Methods: During the first phase of the study, ambulance accident data was requested and obtained from the Ministry of the Interior. Similarly, data on ambulance numbers were requested and obtained from the Ministry of Health through the Right to Information law. During the second phase of the study, a survey consisting of 112 EMS personnel viewpoints about the effects of the institutional structure and legislative framework on ambulance accidents was conducted using a structured questionnaire. A total of 209 EMS personnel completed the survey.

Results: The number of ambulance accidents increased by 42.5% over the last five years, whereas the area of coverage increased by 57.3% during the same period. The rate of EMS personnel experiencing ambulance accidents was 69.4%. When age, sex, and profession variables were considered, the varying profiles of the ambulance operators were found to have no significant effect on the number of ambulance accidents following the system change.

Conclusion: The rise in the number of ambulance accidents in Turkey was not significant when compared with the increase in the area of responsibility. The present system change was also found to have no effect on the number of accidents. On the other hand, problematic areas in the institutional structure and the legislative framework increased the risk of accidents.

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1. Introduction

Ambulance accidents are one of the most significant occupational health risks for emergency medical services (EMS) providers. These incidents may also prevent healthcare services from being delivered. Despite the literature covering studies related to ambulance accidents for years, they are being addressed as a new phenomenon in developing EMS systems. With the expanding coverage and increasing number of ambulances, ambulance

accidents have become more frequent and are discussed more seriously in these systems. Speeding and misinterpreting the right-of-way at intersections are two of the most common causes of ambulance accidents. However, the lack of established standards in the institutional (*organizational*) structure and the service delivery in developing systems can also be considered possible contributing factors for increasing ambulance accidents.

The beginning of the modern era of prehospital EMS in Turkey dates back to 1994, where the services were delivered in an organized fashion in three major cities. In the 2000s, this coverage significantly increased across the country with the number of ambulance stations reaching 600. By the end of 2013, there were 2072 ambulance stations in the country. The average daily response numbers rose to 5000 at the end of 2013 in contrast to numbers in

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the 900s during the early 2000s.^{1,2} The change during this period was not only observed in the numbers, but also in the overall emergency medical care system model. In the early 2000s, the ambulances were staffed by doctors, nurses, and dedicated ambulance drivers similar to that of the Franco-German model of emergency care. However, in recent years, paramedics and emergency medical technicians (EMTs) have been introduced into the system, which is based on the Anglo-American model.^{3,4} With this expansion in the service delivery, an increase in the number of ambulance accidents has become more visible and questionable by the public. Some suggest that this increase is a direct result of the increased number of young and inexperienced paramedics and EMTs driving ambulances, the majority of whom are females.⁵ While there is a need to investigate whether the increase in the number of ambulance accidents in Turkey in recent years is truly significant, the re-organization of the overall EMS system and the effects of problems related to the institutional structure and legislative framework also need to be discussed in greater detail.

The primary purpose of the present study is to evaluate the increase in the number of ambulance accidents in Turkey, where prehospital EMS has seen rapid growth in recent years while undergoing system change. The effect of parameters such as: (1) performance evaluations, (2) interfacility transfer organization procedures, and (3) the determination of roles and responsibilities on ambulance accidents are also investigated.

2. Material and methods

During the first phase of the study, data on ambulance accidents was requested from the Ministry of the Interior and the General Directorate of Security based on the Right to Information law. Similarly, data on the number of ambulances and services were obtained from the Ministry of Health. Data covering the five-year period between 2009 and 2013, when the most significant growth in ambulance services was observed nationwide, were used for the purposes of this study. During the second phase of the study, a survey consisting of 112 EMS personnel's viewpoints about the effects of the institutional structure and legislative framework on ambulance accidents was conducted using a structured questionnaire. The questionnaire included questions on demographics and professional background, personal experiences of ambulance accidents, opinions on causes of accidents, and prevention strategies. Close-ended questions were used for demographic properties, personal experiences, and opinions on ambulance accidents. However, the 5-point Likert scale was used for opinions regarding 'the cause of the accident' and recommendations for 'reducing the number of accidents in the survey.' The study population consisted of EMS personnel working in the City of Izmir. The reason for choosing this particular city was based on Izmir being one of first three cities where the organized EMS system was established in the country in the 1980s. The city has a fairly optimized service with one ambulance per 45,000 citizens. As of January 2014, 1142 EMS personnel were employed in the service.² The initial plan was to conduct the survey in a face-to-face fashion. However, the required

permission could not be obtained from the institution, and therefore was carried out via emails. The target population was invited to take part in the survey using email groups and social media platforms. Two hundred eighty three people agreed to participate in the survey and were sent the survey questions. Of those, 209 completed the survey via email. The data were analyzed using SPSS software (version 16). Frequency distribution and percentages were used to interpret the data, while the chi-square test was used for testing the differences between the variables. A *p*-value of less than 0.05 was considered significant in the study.

3. Findings

Based on the data obtained from the General Directorate of Security, 1886 ambulance accidents occurred, and resulted in 1857 injuries and 55 fatalities between 2009 and 2013. Interestingly, the frequency of ambulance accidents increased by 42.5% during that same five-year period. The most significant increases were observed in 2011 and 2013, with a rises of 23.2% and 21.2%, respectively. It is worth noting that the General Directorate of Security does not track incidents that only involve property damage (Table 1).⁶

The total number of Ministry of Health ambulance crews employed across Turkey was 1317 in 2009, which increased to 2072 by 2013 (a 57.3% increase). The most significant increase in the number of annual ambulance responses were seen in 2011 by 24.3%, in 2012 by 8.9%, and in 2013 by 11.2%. The overall number of annual ambulance responses was 1,869,277 in 2009, while there were 3,980,464 responses in 2013 (a 112.9% increase) (Table 2).²

The average age of the participants who completed the questionnaire survey was 28.18 (s.d. = 7.748, range 19–54). Of those, 47.4% (n = 99) were female and 52.6% (n = 110) were male. When work locations were considered, 56.5% (n = 118) of the participants were working in an urban environment, whereas the 43.5% (n = 91) were employed at rural stations. The professions of the survey participants were as follows: 41.1% (n = 86) EMTs, 40.7% (n = 85) paramedics, 10.5% (n = 22) ambulance drivers, 5.7% (n = 12) doctors, and 1.9% (n = 4) nurses. The average experience of the participants was 6.63 years (range 1–26), while 48.3% stated their experience was less than three years.

More than half of the participants (57.4%, n = 120) stated that they had operated ambulance vehicles during their professional work. This figure indicates not only those whose primary responsibility was driving ambulances (n = 22), but also those driving ambulances along with their primary responsibility as medical providers [EMTs (n = 50) and paramedics (n = 48)]. Of those who drove ambulances, 54.2% (n = 65) stated that they have attended "Ambulance Driving Skills Training," and 28.3% stated that they knew the legal responsibilities and rights with regards to ambulance drivers. More than two-thirds (69.4%, n = 145) of the study participants stated that they were involved in an ambulance accident at least once during their professional life. Of those accidents, 82.1% (n = 119) were classified as property damage, whereas 17.9% (n = 26) were classified as injuries. None of the participants were

Table 1
Ambulance accidents in Turkey between 2009 and 2013.⁴

	Fatal accidents	Number of fatalities	Injury accidents	Number of injured	Annual total
2009	3	3	265	595	268
2010	6	9	304	698	310
2011	5	10	377	846	382
2012	7	17	456	1.222	463
2013	8	16	455	1.128	463
Total	29	55	1857	4.489	1886

Table 2
Growth data on prehospital emergency medical services in Turkey between 2009 and 2013.²

	# of ambulance crews	# of ambulance responses
2009	1317	1,869,277
2010	1375	2,248,423
2011	1710	2,955,064
2012	1863	3,510,536
2013	2072	3,980,464
5-year growth	57.3%	112.9%

involved in a fatal accident. Based on the General Directorate of Security data, the only fatal ambulance accident occurring during the studied period was in the city of Izmir in 2009. The driver of that incident, who survived with injuries, was invited to take part in the study but declined the invitation.

No significant relationship was found between drivers who were involved in accidents ($n = 88$) and the variables of sex, age, experience, and professional title ($p > 0.05$). Similarly, no significant relationship was found between those involved in accidents and working in rural or urban stations ($p > 0.05$). However, the likelihood of being involved in accidents resulting in injury in the rural environment was found to be significantly higher than in the urban environment ($p < 0.05$).

The study participants' perception of the problematic areas in the system is given in Table 3.

Participant evaluation of conditions that would reduce the risk of ambulance accidents are summarized in Table 4.

4. Discussion

The number of ambulance accidents has increased in Turkey over the years. However, this increase may not be meaningful on its own. Especially, when the rate of growth in ambulance services as well as the increase in the number of ambulance stations are considered. It is particularly interesting that the number of ambulance responses more than doubled during the five-year period of 2009 to 2013.⁶ The effects of changes in the system were all found to have no significant effect on the increased number of ambulance accidents, including the switch: (1) from employing ambulance drivers whose only role and responsibility was to drive ambulances; to employing paramedics and EMTs; (3) the increased number of female drivers; and (4) the decreased level of overall driving experience of the newly appointed paramedic/EMT drivers.

The prehospital EMS have seen greater growth in the rural areas of Turkey recently.⁷ In separate studies, Ray and Kupas (2007) and Weiss et al. (2001) have shown that the frequency of ambulance accidents are significantly higher in urban environments, whereas the severity of accidents and the number of those resulting in injuries are greater in rural environments.^{7,8} While significant differences in the number of accidents based on the service area were not found in the present study, a higher incidence of injury accidents in the rural areas was found and supports the evidence in the literature.

Table 3
Evaluation of conditions that might cause time pressure.

	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	n	%	n	%	n	%	n	%	n	%
Performance evaluations based on response times put time pressure on ambulance drivers resulting in speeding.	127	60.8	57	27.3	10	4.8	13	6.2	2	1
Problems related to interfacility transfers put time pressure on ambulance drivers resulting in speeding.	91	43.5	62	29.7	28	13.4	25	12	3	1.4

In their study, Karcioğlu and Yıldıırım (2006) stated that the likelihood of ambulance personnel being involved in an ambulance accident during the first 10 years of service was approximately 50.0%. In the present study, the average professional years of experience was 6.63 and the likelihood was 70.0%. This higher rate makes ambulance accidents one of the factors negatively effecting the success of prehospital EMS in Turkey.⁹ Between 2002 and 2013, 135 prehospital care providers lost their lives in ambulance accidents in Turkey, putting the average annual death rate above 6.¹ The likelihood of prehospital care providers in Turkey being killed in an ambulance accident was 21.4/100,000. This figure is significantly higher than that reported in the United States (US) (9.6/100,000).^{10,11} Furthermore, traffic accidents in general constitute a greater problem in Turkey compared to the developed nations. The likelihood of a citizen being killed in an accident is about 4.84/100,000 in Turkey, which is more than double the US data of 2/100,000.¹² Because of these facts, it is hard to evaluate the ambulance accidents in Turkey separately from traffic problems in general.

Time and speed pressures increase stress levels in ambulance drivers, which in turn increase both the likelihood of accidents and the severity of injury.¹³ In their study, Clark et al. (2009) enrolled ambulance drivers and found that the primary reasons for ambulance accidents were excessive speed and time pressure.¹⁴ The data from the General Directorate of Security in Turkey outlines excessive speed as the primary cause of ambulance accidents in nearly one-third of the accidents resulting in injury or death.⁶ Excessive speed increases the stress levels of the drivers, and negatively effects the performance of particularly inexperienced drivers.^{15,16} Several problematic areas exist in the institutional structure and legislative regulations, which create time pressures and the need to speed in Turkey. A common misconception persists among ambulance drivers and the general public that suggests ambulances can exceed speed limits, even though no such regulation exists.¹⁷

Two of the organizational performance indicators in Turkish EMS systems are crew reaction time (time between alert for call and beginning of ambulance journey) and response time (time until arriving the incident location). Both of these are considered very important by the regulators and, in turn, put significant pressure on the ambulance drivers. During the re-organization of the existing model, a manual consisting 112 EMS quality standards was published in 2009. Response time was included as a performance indicator in that particular manual, irrespective of road and traffic conditions, climatic conditions, and distance of the patient's location.¹⁸ Nearly 90.0% of the study participants stated that the response time indicator caused drivers to exceed speed limits. Another condition putting time pressure on drivers is the inefficiency of the interfacility transfer planning. Coordination between the EMS and hospital-based emergency department services is not as efficient as expected.¹⁷ Almost 75.0% of the study participants reported that the lack of proper planning in interfacility transport caused time pressures and excessive speeds.

Ambulance accidents occurring in intersections are among the most common. This finding is supported in a study by Ray and

Table 4
Evaluation of conditions that would reduce the number of accidents.

	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	n	%	n	%	n	%	n	%	n	%
Developing lights & siren protocols for ambulance drivers would reduce the risk of accidents.	59	28.3	99	47.4	32	15.3	16	7.7	3	1.4
Better organizing interfacility transfers would reduce the risk of accidents.	61	29.2	100	47.8	38	18.2	10	4.8	0	0
Clearly defining the roles and responsibilities of ambulance drivers in legislation would reduce the risk of accidents.	68	32.5	93	44.5	34	16.3	11	5.3	3	1.4

Kupas (2005) who found that intersection accidents are the most common in urban environments.¹⁹ Furthermore, the rate of intersection accidents was reported as 46.0% in the Schmitter's study (2007) and as 43.0% in the Ballam's study (2011).^{20,21} According to the General Directorate of Security statistics, this rate is about 30.0% in Turkey, and intersection accidents are seen as easily preventable accidents.⁹ To achieve this, regulations clearly defining the 'right of way' should be prepared. This concept of 'right of way' for emergency vehicles is vaguely defined in the Turkish Traffic Code. Apart from this, no other regulation related to the 'right of way' for emergency vehicles is in place.²²

Another concept that needs to be addressed as part of intersection accidents is the use of lights and sirens. Merlin et al. (2012) found that the use of lights and sirens reduces ambulance travel times only by a few minutes. The additional risks taken in order to save these few minutes of response time is the subject of great debate.²³ No regulation or protocol exist for the use of lights and sirens in Turkey. This leaves the initiative for using lights and sirens to the driver, who tends to regularly use those warning tools on every ambulance call.²⁴ In their study, Sandal et al. (2010) reported an increased risk of accidents with the routine use of lights and sirens.²⁵ Another concern regarding the routine use of lights and sirens is the desensitization of other drivers against emergency vehicles. This condition reduces the effectiveness of lights and sirens at intersections and increases accident risks.²⁶ The participants in the present study stated that developing a new lights and sirens protocol would help to reduce ambulance accidents.

Driver-specific factors in ambulance accidents should be evaluated, including excessive speed and misconduct at intersections.²⁷ In a study by Ray and Kupas (2005), they found that driver factors were the primary cause of accidents in 93.0% of the accidents occurring in urban environments and 75.0% in rural environments.¹⁹ Similarly, Kahn et al. (2001) found that the ambulance driver did not obey the traffic rules in 16.0% of the fatal accidents.²⁰ The risk of ambulance accidents increases as a result of insufficient policies and regulations on prehospital EMS systems and the ambulance drivers' lack of a specific set of knowledge and skills about the ambulance operations.²²

A legislative framework defining the roles and responsibilities of ambulance drivers does not exist in Turkey. The "Provincial Ambulance Service Operating Directive," which was published in 2005 specified the roles and responsibilities of every single actor in the EMS system with the exclusion of ambulance drivers.²⁸ Only about one-quarter of the participants in the present study stated that they were aware of the legal roles and responsibilities of ambulance driving. On the other hand, 80.0% of the participants stated that clearly defining the roles and responsibilities of ambulance drivers would help to reduce ambulance accidents.

Another important factor in reducing the number of accidents is to train ambulance drivers. The Ministry of Health has been providing "Ambulance Driving Techniques Training" for its employees since 2006. By the end of 2013, 3558 EMS providers had received training in this course. This data represents nearly half of the employees who are responsible for ambulance driving in

Turkey.² In the present study, nearly half of the participants were found to attend this training. We put forth the notion that the inability to provide this training to every driver poses a major problem. Currently, the training is only provided to the drivers after they have been hired. This constitutes a serious problem for those who begin working as ambulance drivers without specific training and who lack experience.¹⁷ Initial and ongoing training of ambulance drivers is an important factor to reduce the number of ambulance accidents.²⁹

5. Study limitations

A 'face-to-face' interview methodology was initially planned. However, the researchers could not obtain the necessary permissions from the City of Izmir EMS Management and thus, chose to conduct an Internet survey. The prehospital EMS has seen enormous developments in recent years in Turkey. Most of the employees in the system are typically young with limited work experience. Therefore, it may not be feasible to generalize the results of the study without considering the age and experience variables. Similarly, the risk of encountering ambulance accidents based on professional titles (such as EMTs, paramedics, and ambulance drivers) was not evaluated in this study. Therefore, the results should not be generalized for prehospital care occupations.

6. Conclusion

The increase observed in the number of ambulance accidents in recent years in Turkey is not significant when compared to the increase in the rate of growth in ambulance services and the increase in the number of ambulance stations. The system change in prehospital EMS observed in Turkey in recent years does not seem to affect ambulance accidents. Instead, the problematic areas that increased the risk of ambulance accidents seem to be associated with the institutional structure and the legislative framework. Problematic areas in the institutional structure and the legislative framework should be addressed in a timely fashion with the growth in the services. This would help to avoid ambulance accidents, which negatively affect the services provided in the developing systems. Collectively, these data suggest that finding solutions to problems that pose time pressures on drivers may help reduce the number of ambulance accidents.

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