

Adequacy of placement of EMS units in Central Poland based on an analysis of interventions in road accidents.



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ABSTRACT

INTRODUCTION: Road accidents lead to injuries which are one of the most common causes of hospitalisation in trauma centres. Proper placement and number of EMS units determine quick arrival in the scene of accident and need for transport to the adequate healthcare entity.

MATERIAL AND METHODS: An analysis was carried out of the profile of the patient, the distance to the scene of accident as well as the allocation of accident casualties to healthcare entities. A statistical analysis was conducted by means of the Chi-Square Test of Independence and the Kruskal–Wallis test by ranks.

RESULTS: Distances between the scenes of accidents and places where EMS units were stationed was from 0.5 to 37 kilometres (mean: 9.8 km). 170 patients participated in the accidents. Most frequently, these were males at the age from 21 to 40 (mean: 35.77 ± 15.45). The most common diagnoses according to ICD-10 were injuries to the head (42.7%) and injuries of lower limbs (12%). In most cases, the accident casualties were transported to the Emergency Department in Łuków. 21 patients in total were placed in hospital facilities outside the catchment area. The Polish Medical Air Rescue transported the 10 patients in the most severe condition.

CONCLUSIONS: Road accidents are most frequently experienced by middle-aged men. Injuries to the head and of lower limbs are the most common injuries. The placement of EMS units in the area under analysis is optimal, but the mean distance covered by the ambulance to reach to scene of accident is nearly 10 kilometres. Despite the presence of the Emergency Department in Łuków, one in ten injured patient warrants transport outside the catchment area and almost 6% of patients qualify for transport by air.

KEY WORDS: Road accidents, emergency medical service, EMS, injuries, organization of rescue.

INTRODUCTION

There are a lot of factors leading to road events with casualties [1, 2]. The safety of traffic participants can also be threatened by the behaviours of pedestrians themselves, who also cause many accidents. According to the data of the General Police Headquarters, there were 30,288 accidents on Polish public roads in 2019. This figure shows a downward trend compared to the previous years: 31,674 (-4.4%) accidents were reported in 2018 and 32,760 (-7.5%) accidents were reported in 2017. Despite the decreasing number of road accidents, they result in more deaths: there were 2,909 deaths in 2019, which is more by 47 compared to 2018 and by 78 compared to 2017.

The determination of priorities regarding the placement of emergency medical service (EMS) units for medical interventions is a significant point of operation systematisation. Receipt of reports, analysis and determination of priorities or allocation of the proper EMS unit to the scene of accident, are the main tasks the responsibility for which rests with emergency medical dispatchers. The time required to arrive at the scene of accidents in life-threatening situations is a key element of pre-hospital care. To that end, the placement of emergency medical teams warrants optimisation [3].

The study aimed to analyse EMS interventions for casualties of road events in the area of central and eastern Poland in 2019. The authors attempted to evaluate the profile of the patient, the distance covered by ambulances to arrive at scenes of road accidents and the allocation of accident casualties to healthcare entities.

MATERIAL AND METHODS

The data were obtained from the medical records of the Emergency Medical Services in Łuków. The analysis covered interventions from seven months in 2019 (from January to July). The catchment area covered the powiat of Łuków, with the total area of 1394 km², the population of 107,896 and the population density of 76.6 person/km². Two specialised emergency medical service (SEMS) and two basic emergency medical service (BEMS) are stationed in the area. Their location is indicated in Figure 1. There is one hospital in Łuków.

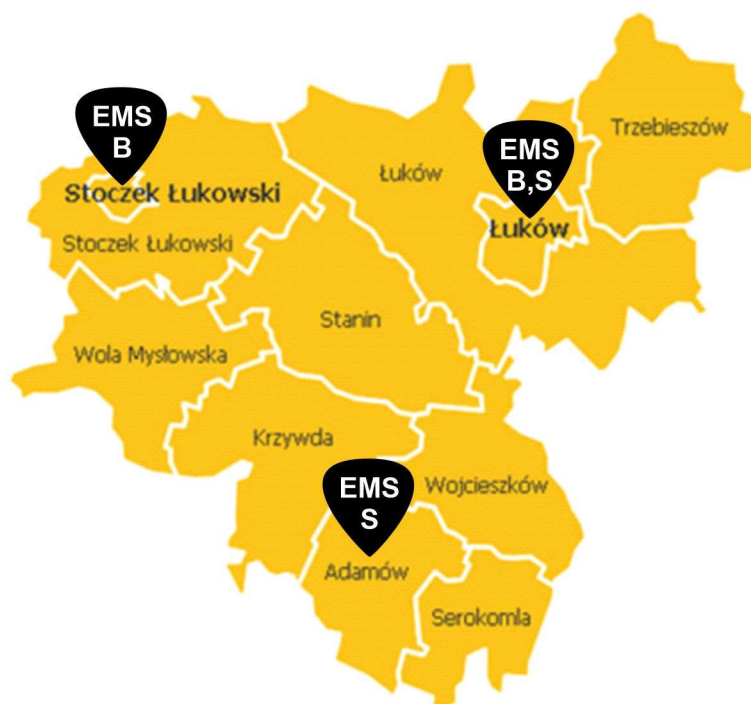


Figure 1. The deployment of EMS in the operational area.

Statistical analysis

The obtained data were presented in figures and arithmetic means taking into consideration the standard deviation. The statistical analysis was conducted by means of the Chi-Square Test of Independence and the Kruskal–Wallis test by ranks, performed in the PAST 3.20 software. All results were regarded as statistically significant at $p < 0.05$.

RESULTS

116 road accidents were recorded in the period under analysis, where EMS intervened 137 times in total, which is because of accidents with a higher number of casualties. The SEMS stationed in Łuków had the highest number of interventions ($n=52$) and the BEMS in Stoczek Łukowski – the lowest number ($n=21$).

Profile of the patient

170 patients were provided care during 137 EMS interventions concerning road events in the catchment area. These were most often men (58.2%), who were 35.77 years old on average ($SD \pm 15.45$).

The highest percentage of accident casualties provided with medical service were patients at the age from 21 to 30 – 25.9%. Patients in extreme age groups – children under the age of 10 and people at the age of 81 and more – accounted for a small percentage: 3.5% and 1.8%, respectively. Diagnoses based on the ICD-10 international classification most frequently regarded bodily injuries, but there were also other diseases, which is illustrated in Table 1.

Table 1. List of ICD-10 diagnoses of road accident victims

ICD-10	Number of diagnoses [n]
F - mental and behavioral disorders (F10.2; F43-F43.9; F48)	6
I - cardiovascular disease (I15; I15.9; I46.1)	4
J - respiratory system diseases (J42)	1
R - symptoms (R10.0 - R55)	4
S - injuries, poisoning and other specific effects of external factors (S00-S89.9)	150
T - poisoning and other specific effects of external factors (T00-T79.9)	39
V, W, Y - external causes of behavior and death (V03-V99; W50; Y85.0;Y91)	82
Z - factors influencing health condition (Z02-Z53)	19
Totally:	305

The most common injuries were injuries to the head (42.7%) and injuries of lower limbs (12%). A detailed specification can be found in Figure 2.

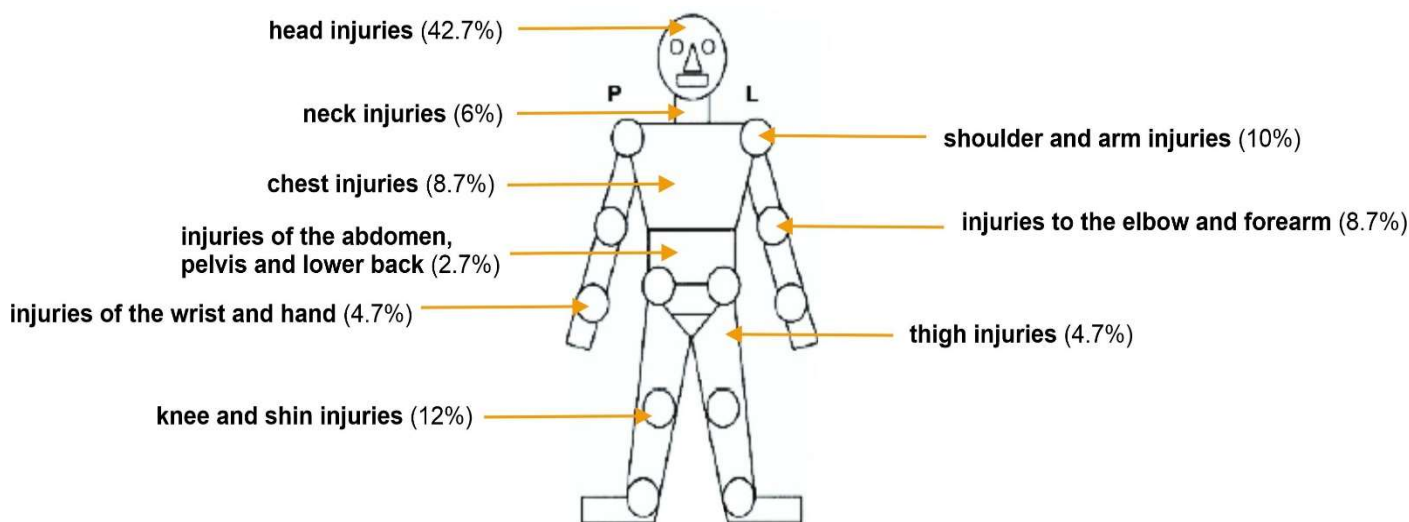


Figure 1. Patients' injuries in road accidents

Evaluation of EMS unit placement

The vast majority of accidents occurred outside the city or town where emergency medical services were stationed (n=102). The distance covered by EMS ranged from 0.5 to 37 kilometres. The mean distance covered by individual teams ranged from 8.4 to 10.8 kilometres. The distance covered on average by all emergency medical teams in the given catchment area from the placement site to the scene of accident was 9.8 kilometres. The BEMS from Stoczek Łukowski covered the longest distance in the catchment area, namely 37 kilometres. The teams from Łuków and the SEMS from Adamów intervened in the closest distance from the place where they were stationed. Detailed data can be found in Table 2.

Table 2. Distances traveled by EMS for road accidents

Place of stationing EMS	The distance of departures	Average distance	Standard deviation
BEMS Łuków	0.5 km – 32.0 km	10.8 km	9.6 km
BEMS Stoczek Łukowski	1.2 km – 37.0 km	9.7 km	9.7 km
SEMS Łuków	0.5 km – 26.2 km	8.4 km	7.0 km
SEMS Adamów	0.5 km – 29.8 km	10.6 km	7.5 km

The statistical analysis did not indicate any significant correlation in the distances covered from the place where emergency medical teams were stationed (Kruskal–Wallis test=2; $p=0.485$).

Transport of patients

The ED in Łuków was the facility to which casualties of road accidents were transported most frequently ($n=110$). The Psychiatric Admission Room took one patient due to a stress reaction induced by the accident. 21 patients in total were placed in hospital facilities outside the catchment area (Siedlce, Garwolin, Radzyń Podlaski). The Polish Medical Air Rescue (PMAR) transported the 10 patients who were in the most severe condition or who required transport at longer distances. Out of all patients who were provided with care by emergency medical teams, 40 were not transported to hospital facilities (no indications or no consent of the patient).

DISCUSSION

Road accidents, leading to danger in traffic, are most frequently caused by failure to respect the right of way and speed too high for the weather conditions or the road infrastructure. They are also more and more often caused by inadequate behaviour towards pedestrians [4]. Interestingly enough, drivers with more driving experience cause accidents more often than beginner drivers [5]. The study demonstrated that the mechanism of accident and the speed of the vehicle result in injuries to the head and to the limbs in most cases. Injuries in road accidents are ones of the most common causes of hospitalisation in trauma centres [6]. Apart from the injuries visible to the naked eye, the internal organs and the mental state of the casualties suffer as well.

Quick provision of care by EMS in the scene of accident is key here. The catchment area in Łuków includes a poviast hospital, where the most ($n=110$) casualties of accidents were transported out of all places of hospitalisation. The study results indicate a markedly higher number of departures of specialised emergency medical teams to accidents compared to the basic emergency medical teams (SEMS=78 vs. BEMS=59). Contrary to appearances, it turns out that most minor road accidents happened on rural roads ($n=107$) compared to urban roads ($n=30$), where the street density and traffic intensity is higher.

170 patients were included in the study – the mean age of the casualties was 35.77 (SD ± 15.45), they were most frequently men at the age of 21-30 and 31-40. A vast majority of patients were transported to the local Emergency Department (ED). The distances covered by EMS oscillated between 0.5 and 37 kilometres (mean: 9.8 km). No statistically significant correlation was found in the distance of the EMS unit from the scene of accident, which seems to confirm that the units are placed in the powiat of Łuków adequately. In addition, the interventions of the Polish Medical Air Rescue are worth the attention, which supported the ground units in 5.88% of cases, thus confirming the need for rescue missions to be carried out by PMAR [7]. Furthermore, the authors point to a considerable number of casualties (12.35%) whose condition warranted transport outside the catchment area as the hospital in Łuków did not allow their target treatment. The results seem to suggest that the issue requires analysis in order to ensure treatment to trauma patients.

CONCLUSIONS

Road events are most frequently experienced by middle-aged men. Injuries to the head and of lower limbs are the most common injuries. The placement of EMS units in the area under analysis is optimal, but the mean distance covered by the ambulance to reach to scene of accident is nearly 10 kilometres. Despite the presence of the Emergency Department in Łuków, one in ten injured patient warrants transport outside the catchment area and almost 6% of patients qualify for transport by air. The option of increasing the number of EMS units in the catchment area should be taken into consideration.

Disclosure statement

The authors did not report any potential conflict of interest.

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