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# TRAUMA PATIENTS IN THE PRACTICE OF MEDICAL RESCUE TEAMS IN POLAND

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## ABSTRACT

Quick and effective access to professional medical assistance in emergencies has become a key element of the modern healthcare system. Emergency medical services play a vital role in immediate response to medical emergencies, in particular traumatic injury. According to estimates, emergency medical services delivered to trauma patients account for 10-20% of all services provided by paramedic units in Poland. An analysis of paramedic services delivered to trauma patients will make a significant contribution to the effectiveness and optimization of emergency medical services.

**The aim** of this study was to analyze the emergency medical services delivered by paramedic units to trauma patients in the voivodeship of Warmia and Mazury over a period of three years. The study involved a retrospective analysis of statistical data for the above voivodeship. The patients were classified according to the 10$^{th}$ Revision of the International Classification of Diseases (ICD-10) [1]. Most trauma patients were assigned ICD-10 codes S (injury, poisoning, and certain other consequences of external causes) and T (injuries involving multiple body regions) categories.

**Results**: The diagnoses made by physicians, paramedics, and emergency nurses in patient care reports were the source of data for the retrospective analysis. A total of 400,251 cases ($n$= 400,251) were analyzed and 11,329 cases were selected ($n$=11,329), including 1130 patients ($n$=1130) who were assigned code S and 10,199 patients ($n$=10,199) who were assigned to code T. The examined database is administered by the Governor of the Voivodeship of Warmia and Mazury in Olsztyn [2]. The following types of information were analyzed: area of intervention, the patients' age and sex, type of medical emergency, location, date, and alcohol breath odor.

The collected data were analyzed to determine the presence of relationships between: a life-threatening medical emergency and the patient's age, a life-threatening medical emergency and the patient's sex, the patient's age and the diagnosis made by paramedics, alcohol breath odor and the patient's sex, and the patient's sex and the diagnosis made by paramedics.

**Conclusions:** The results of the study suggest that the risk of a life-threatening medical emergency is higher in younger patients and decreases gradually in older patients. The above risk is somewhat higher in men than in women. The percentage of patients assigned code S (injury, poisoning, and certain other consequences of external causes) increases with age. Alcohol breath odor is more frequently detected in patients residing in areas with a population above 10,000 than in patients residing in small towns and rural areas. The patient's sex is not significantly correlated with the type of medical emergency, and the prevalence of the diagnosed medical emergencies tends to be similar in both sexes.

**Keywords:** prehospital care, injury, alcohol, medical rescue, diagnosis

## INTRODUCTION

Traumatic injury is an emergency that requires immediate medical attention, but detailed information about emergency medical services delivered to trauma patients is not available in *Statistics Poland* databases. According to estimates, emergency medical services delivered to trauma patients account for 10-20% of all services provided by paramedic units in Poland [3,4,5]. The percentage of trauma patients in the total number of emergency medical services provided by paramedic units is determined by the size of the supported region, population density, road infrastructure (major transport routes and transport hubs), presence of large employers, and level of industrialization. The prevalence of traumatic injuries differs considerably across Polish regions. Trauma patients belong to different age groups, including youths (sports injuries), the working-age population (traffic accidents, workplace accidents, workplace hazards), as well as seniors (falls, transient loss of consciousness and the resulting physical injuries) [6,7,8].

The Polish emergency medical service system is similar to the Anglo-Saxon model. Emergency medical services in prehospital care are provided by two types of rapid response units: specialist units involving a physician and paramedics (at present, specialist teams usually consist of qualified paramedics and emergency nurses) and basic units involving only paramedics or emergency nurses [9,10].

According to the Act on the National Emergency Medical Services (NEMS), traumatic injury is defined as any type of bodily damage that is caused by external factors, poses an immediate threat to the patient's health, and can involve serious injuries to multiple organs and regions of the body [11].

Poland continues to expand its road network, but the quality of Polish roads still lags behind many Western European countries. Traffic accidents pose a significant threat to the citizens' health and life, and a total of 67,678 road accidents were reported in Poland between 2020 and 2022. In the analyzed period, 6632 people were killed and 77,621 were injured in road accidents. Despite the fact that traffic accidents continue to pose a serious challenge, the number of traffic-related deaths and injuries has been decreasing steadily in recent years [12].

A total of 2790 road accidents were reported in the voivodeship of Warmia and Mazury in the analyzed period. These accidents were responsible for 295 fatal injuries and 3188 non-fatal injuries [12]. In the studied region, the number of traffic-related fatalities and injuries has been also declining steadily in recent years. Poland has sixteen voivodeship, and Warmia and Mazury ranks 9$^{th}$ or 10$^{th}$ in terms of road traffic safety [12].

The number of road accidents and fatal and non-fatal injuries in Warmia and Mazury between 2020 and 2022 is presented in Table 1.

*Table 1. Number of road accidents and fatal and non-fatal injuries in the voivodeship of Warmia and Mazury between 2020 and 2022.*

| Year | Accidents | Fatal injuries | Non-fatal injuries |
|---|---|---|---|
| 2020 | 1040 | 115 | 1186 |
| 2021 | 920 | 96 | 1074 |
| 2022 | 830 | 84 | 928 |

*Source: National Police Headquarters.*

It should be noted that the above data point to a positive tendency, namely a decrease in the number of traffic accidents, and reduced severity of the related injuries.

## MATERIALS AND METHODS

The study was conducted in the voivodeship of Warmia and Mazury which spans an area of 24,173 $km^2$ and is the fourth largest Polish voivodeship (out of 16 voivodeships) [13]. Warmia and Mazury has a population of 1,374,700, including 671,500 men and 703,200 women. Urban dwellers account for 59.2% and rural residents account for 40.8% of the voivodeship's population. The local population can be divided into the following age categories: children and adolescents – 18.5%, working-age population – 59.6%, and elderly persons – 21.9% [14].

A wide range of statistical methods were used in the analysis of empirical data. A frequency analysis with cross tabulation was performed to determine data distribution and the relationships between the variables. The presence of statistically significant relationships between nominal variables or between a nominal (dependent) variable and an ordinal (independent) variable was investigated with the use of the chi-squared test of independence ($\chi^2$). The test results were presented in tables, where N represents the size of the sample, and percentage values are divided into three categories: in rows (%), in columns (%), and in total (%). To facilitate data interpretation, the results were also presented in figures as percentage values. Mean values in two associated groups were compared by Student's t-test for dependent samples, and the results were used to assess changes within groups under different conditions or over time. All analyses were conducted at a significance level of $p < 0.05$, which implies that the observed differences or relationships were regarded as significant if the probability that the results were found by chance alone was less than 5%. Statistical analyses were conducted using advanced computational tools such as IBM SPSS Statistics, Jamovi, Jasp, and MS Excel. The data were analyzed with the use of various statistical tools to ensure the reliability and accuracy of the results.

The study was approved by the Research Ethics Committee of the University of Warmia and Mazury in Olsztyn (decision No. 11/2023).

# RESULTS

## CHARACTERISTICS OF THE STUDIED POPULATION

*Table 2. Patient's age*

| | S | T |
|---|---|---|
| Mean | 52.17 | 44.50 |
| Standard deviation | 23.87 | 22.02 |

*Source: Authors' own study.*

*Table 3. Frequency of emergency medical services delivered to male and female patients*

| Code | Sex | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Female | 287 | 25.40 | 38.22 | 38.22 |
| | Male | 464 | 41.06 | 61.78 | 100.00 |
| | Data not available | 379 | 33.54 | | |
| | Total | 1130 | 100.00 | | |
| T | Female | 2465 | 24.17 | 36.24 | 36.24 |
| | Male | 4337 | 42.52 | 63.76 | 100.00 |
| | Data not available | 3397 | 33.31 | | |
| | Total | 10199 | 100.00 | | |

*Source: Authors' own study.*

*Table 4. Area of intervention*

| Code | Area of intervention | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Population up to 10,000 | 535 | 47.35 | 47.35 | 47.35 |
| | Population above 10,000 | 595 | 52.65 | 52.65 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 1130 | 100.00 | | |
| T | Population up to 10,000 | 4448 | 43.61 | 43.61 | 43.61 |
| | Population above 10,000 | 5751 | 56.39 | 56.39 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 10199 | 100.00 | | |

*Source: own study.*

*Table 5. Frequency of life-threatening emergencies*

| Code | Life-threatening emergency | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Yes | 416 | 36.81 | 36.81 | 36.81 |
| | No | 714 | 63.19 | 63.19 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 1130 | 100.00 | | |
| T | Yes | 4396 | 43.10 | 43.12 | 43.12 |
| | No | 5798 | 56.85 | 56.88 | 100.00 |
| | Data not available | 5 | 0.05 | | |
| | Total | 10199 | 100.00 | | |

*Source: Authors' own study.*

*Table 6. Frequency of emergency medical services delivered in various locations*

| Code | Site | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Home | 619 | 54.78 | 57.58 | 57.58 |

| | | | | | |
|---|---|---|---|---|---|
| | Public site | 328 | 29.03 | 30.51 | 88.09 |
| | Road traffic | 128 | 11.33 | 11.91 | 100.00 |
| | Data not available | 55 | 4.87 | | |
| | Total | 1130 | 100.00 | | |
| T | Home | 5888 | 57.73 | 59.99 | 59.99 |
| | Public site | 3278 | 32.14 | 33.40 | 93.39 |
| | Road traffic | 649 | 6.36 | 6.61 | 100.00 |
| | Data not available | 384 | 3.77 | | |
| | Total | 10199 | 100.00 | | |

*Source: Authors' own study.*

*Table 7. Frequency of emergency medical services delivered in various periods*

| Code | Period | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | 1 Jan. 2020-30 June 2020 | 193 | 17.08 | 17.08 | 17.08 |
| | 1 July 2020-31 Dec. 2020 | 181 | 16.02 | 16.02 | 33.10 |
| | 1 Jan. 2021-30 June 2021 | 196 | 17.35 | 17.35 | 50.44 |
| | 1 July 2021-31 Dec. 2021 | 164 | 14.51 | 14.51 | 64.96 |
| | 1 Jan. 2022-30 June 2022 | 186 | 16.46 | 16.46 | 81.42 |
| | 1 July 2022-31 Dec. 2022 | 210 | 18.58 | 18.58 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 1130 | 100.00 | | |
| T | 1 Jan. 2020-30 June 2020 | 1799 | 17.64 | 17.64 | 17.64 |
| | 1 July 2020-31 Dec. 2020 | 1605 | 15.74 | 15.74 | 33.38 |
| | 1 Jan. 2021-30 June 2021 | 1761 | 17.27 | 17.27 | 50.64 |
| | 1 July 2021-31 Dec. 2021 | 1502 | 14.73 | 14.73 | 65.37 |
| | 1 Jan. 2022-30 June 2022 | 1703 | 16.70 | 16.70 | 82.07 |

| | | | | | |
|---|---|---|---|---|---|
| | 1 July 2022-31 Dec. 2022 | 1829 | 17.93 | 17.93 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 10199 | 100.00 | | |

*Source: Authors' own study.*

*Table 8. Frequency of trauma patients with alcohol breath odor*

| Code | Alcohol breath odor | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Yes | 249 | 22.04 | 22.04 | 22.04 |
| | No | 881 | 77.96 | 77.96 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 1130 | 100.00 | | |
| T | Yes | 3026 | 29.67 | 29.67 | 29.67 |
| | No | 7173 | 70.33 | 70.33 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 10199 | 100.00 | | |

*Source: Authors' own study.*

*Table 9. Type of emergency medical services delivered at the site of accident*

| Code | Type of EMS | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Patient received medical assistance and was transported to a hospital | 887 | 78.50 | 78.50 | 78.50 |
| | Patient was transported by air medical services | 3 | 0.27 | 0.27 | 78.76 |
| | Patient was left at the site of accident | 231 | 20.44 | 20.44 | 99.20 |
| | Patient refused to accept medical assistance | 9 | 0.80 | 0.80 | 100.00 |
| | Data not available | 0 | 0.00 | | |
| | Total | 1130 | 100.00 | | |
| T | Patient received medical assistance and was transported | 6314 | 61.91 | 61.93 | 61.93 |

| | | | | | |
|---|---|---|---|---|---|
| | to a hospital | | | | |
| | Patient was transported by air medical services | 84 | 0.82 | 0.82 | 62.75 |

*Source: Authors' own study.*

*Table 9. Patients transported to medical emergency facilities*

| Code | Medical facility | Frequency | Percent | Valid percent | Cumulative percent |
|---|---|---|---|---|---|
| S | Hospital emergency department | 664 | 58.76 | 74.86 | 74.86 |
| | A&E unit | 211 | 18.67 | 23.79 | 98.65 |
| | Specialized hospital department | 3 | 0.27 | 0.34 | 98.99 |
| | Trauma center | 2 | 0.18 | 0.23 | 99.21 |
| | Other | 7 | 0.62 | 0.79 | 100.00 |
| | Data not available | 243 | 21.50 | | |
| | Total | 1130 | 100.00 | | |
| T | Hospital emergency department | 4671 | 45.80 | 74.11 | 74.11 |
| | A&E unit | 1480 | 14.51 | 23.48 | 97.59 |
| | Specialized hospital department | 20 | 0.20 | 0.32 | 97.91 |
| | Trauma center | 3 | 0.03 | 0.05 | 97.95 |
| | Other | 129 | 1.26 | 2.05 | 100.00 |
| | Data not available | 3896 | 38.20 | | |
| | Total | 10199 | 100.00 | | |

*Source: Authors' own study.*

**Table 10. Relationship between a life-threatening emergency and the patient's age**

An analysis of the relationship between a life-threatening emergency and the patient's age revealed significant differences across age groups. In patients younger than 18, life-threatening emergencies accounted for 623 out of 1073 cases in age group (58.06%). In the 18-40 age group, life-threatening emergencies were diagnosed in 1282 out of 2079 cases (61.66%). In the 41-60 age group, life-threatening emergencies accounted for 1140 out of 1886 cases (60.45%). In patients aged 61-75, life-threatening emergencies were diagnosed in 621 out of 1112 cases (55.85%). In the 76+ age group, life-threatening emergencies accounted for 356 out of 712 cases (50%). Overall, life-threatening emergencies accounted for 4022 out of 6862 cases in all age groups. The chi-squared test revealed a statistically significant relationship between a life-threatening emergency and the patient's age (Chi2 (df=4) = 36.01; $p<0.001$). These results suggest that the risk of a life-threatening emergency is higher in younger patients and decreases gradually with age, excluding the oldest population where this risk approximates 50%.

**Cross tabulation analysis**

| Age in years | | Life-threatening emergency | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| 0-17 | Number of cases | 450.00 | 623.00 | 1073.00 |
| | % in row | 41.94% | 58.06% | 100.00% |
| | % in column | 15.85% | 15.49% | 15.64% |
| | % in total | 6.56% | 9.08% | 15.64% |
| 18-40 | Number of cases | 797.00 | 1282.00 | 2079.00 |
| | % in row | 38.34% | 61.66% | 100.00% |
| | % in column | 28.06% | 31.87% | 30.30% |
| | % in total | 11.61% | 18.68% | 30.30% |
| 41-60 | Number of cases | 746.00 | 1140.00 | 1886.00 |
| | % in row | 39.55% | 60.45% | 100.00% |
| | % in column | 26.27% | 28.34% | 27.48% |
| | % in total | 10.87% | 16.61% | 27.48% |
| 61-75 | Number of cases | 491.00 | 621.00 | 1112.00 |
| | % in row | 44.15% | 55.85% | 100.00% |
| | % in column | 17.29% | 15.44% | 16.21% |
| | % in total | 7.16% | 9.05% | 16.21% |
| 76+ | Number of cases | 356.00 | 356.00 | 712.00 |
| | % in row | 50.00% | 50.00% | 100.00% |
| | % in column | 12.54% | 8.85% | 10.38% |
| | % in total | 5.19% | 5.19% | 10.38% |
| Total | Number of cases | 2840.00 | 4022.00 | 6862.00 |
| | % in row | 41.39% | 58.61% | 100.00% |
| | % in column | 100.00% | 100.00% | 100.00% |
| | % in total | 41.39% | 58.61% | 100.00% |

*Chi2 (N=6862, df=4) = 36.01; p<0.001*
*Source: Authors' own study.*

**Table 11. Relationship between a life-threatening emergency and the patient's sex**

An analysis of the relationship between a life-threatening emergency and the patient's sex revealed significant differences between the sexes. Life-threatening emergencies were diagnosed in 1228 out of 2752 female patients (44.62%) and in 1928 out of 4798 male patients (40.18%). Non-life-threatening emergencies were diagnosed in a total of 4394 cases, including 1524 (55.38%) women and 2870 (59.82%) men. Life-threatening emergencies accounted for 3156 (41.80%) out of the total number of 7550 analyzed cases.

The chi-squared test revealed a statistically significant relationship between a life-threatening emergency and the patient's sex (Chi2 (df=1) = 14.16; p<0.001). These results indicate that the risk of a life-threatening emergency is somewhat higher in men than in women.

| Life-threatening emergency | | Sex | | Total |
|---|---|---|---|---|
| | | Women | Men | |
| No | Number of cases | 1524.00 | 2870.00 | 4394.00 |
| | % in row | 34.68% | 65.32% | 100.00% |
| | % in column | 55.38% | 59.82% | 58.20% |
| | % total | 20.19% | 38.01% | 58.20% |
| Yes | Number of cases | 1228.00 | 1928.00 | 3156.00 |
| | % in row | 38.91% | 61.09% | 100.00% |
| | % in column | 44.62% | 40.18% | 41.80% |
| | % total | 16.26% | 25.54% | 41.80% |
| Total | Number of cases | 2752.00 | 4798.00 | 7550.00 |
| | % in row | 36.45% | 63.55% | 100.00% |
| | % in column | 100.00% | 100.00% | 100.00% |
| | % total | 36.45% | 63.55% | 100.00% |

*Chi2(N=7550; df=1) = 14.16; p< 0.001*
*Source: Authors' own study.*

**Table 12.Relationship between the patient's age and diagnosis**

An analysis of the relationship between the patient's age and the diagnosis revealed significant differences across age groups. In the total number of 1451 cases in the 0-17 age group, 101 patients (6.96%) were assigned the ICD-10 diagnostic code S and 1350 patients (93.04%) were assigned code T. In the total number of 3397 cases in the 18-40 age group, 273 patients (8.04%) were assigned code S and 3124 patients (91.96%) were assigned code T. In the total number of 3284 cases in the 41-60 age group, 289 patients (8.80%) were assigned code S and 2995 patients (91.20%) were assigned code T. In the total number of 1838 cases in the 61-75 age group, 231 patients (12.57%) were assigned code S and 1607 patients (87.43%) were assigned code T. In the total number of 1051 cases in the 76+ age group, 211 (20.08%) patients were assigned code S, and 840 patients (79.92%) were assigned code T. In the overall number of 11,021 analyzed cases, code S was assigned in 1105 cases (10.03%) and code T was assigned in 9916 cases (89.97%). The chi-squared test revealed a statistically significant relationship between a patient's age and the diagnosis (Chi2 (df=4) = 166.33; p<0.001). These results suggest that the prevalence of patients assigned code S tends to increase with age. The percentage of cases assigned code S was lowest in the youngest group and highest in the oldest group of patients.

| Age | | Diagnosis | | Total |
|---|---|---|---|---|
| | | Code S | Code T | |
| 0-17 | Number of cases | 101.00 | 1350.00 | 1451.00 |
| | % in row | 6.96% | 93.04% | 100.00% |
| | % in column | 9.14% | 13.61% | 13.17% |
| | % total | 0.92% | 12.25% | 13.17% |

| | | | | |
|---|---|---|---|---|
| 18-40 | Number of cases | 273.00 | 3124.00 | 3397.00 |
| | % in row | 8.04% | 91.96% | 100.00% |
| | % in column | 24.71% | 31.50% | 30.82% |
| | % total | 2.48% | 28.35% | 30.82% |
| 41-60 | Number of cases | 289.00 | 2995.00 | 3284.00 |
| | % in row | 8.80% | 91.20% | 100.00% |
| | % in column | 26.15% | 30.20% | 29.80% |
| | % total | 2.62% | 27.18% | 29.80% |
| 61-75 | Number of cases | 231.00 | 1607.00 | 1838.00 |
| | % in row | 12.57% | 87.43% | 100.00% |
| | % in column | 20.90% | 16.21% | 16.68% |
| | % total | 2.10% | 14.58% | 16.68% |
| 76+ | Number of cases | 211.00 | 840.00 | 1051.00 |
| | % in row | 20.08% | 79.92% | 100.00% |
| | % in column | 19.10% | 8.47% | 9.54% |
| | % total | 1.91% | 7.62% | 9.54% |
| Total | Number of cases | 1105.00 | 9916.00 | 11021.00 |
| | % in row | 10.03% | 89.97% | 100.00% |
| | % in column | 100.00% | 100.00% | 100.00% |
| | % total | 10.03% | 89.97% | 100.00% |

*Chi2(N=11021; df=4) = 166.33; p<0.001*
*Source: Authors' own study.*

**Table 13. Relationship between alcohol breath odor and the area of intervention**

An analysis of the relationship between alcohol breath odor and the area of intervention revealed significant differences between the examined areas. In the total number of 4983 emergency interventions in areas with a population of up to 10,000, alcohol breath odor was reported in 1223 (24.54%) cases and was not reported in 3760 (75.46%) cases. In the total number of 6346 interventions in areas with a population above 10,000, alcohol breath odor was determined in 2052 (32.34%) cases and was not determined in 4294 (67.66%) cases. In the overall number of 11,329 interventions, alcohol breath odor was detected in 3275 (28.91%) cases and was not detected in 8054 (71.09%) cases.

The chi-squared test revealed a statistically significant relationship between the area of intervention and alcohol breath odor (Chi2 (df=1) = 82.46; p<0.001). These results suggest that alcohol breath odor is more frequently reported in trauma patients who reside in areas with a population above 10,000 than in patients who reside in small towns and villages.

| **Area of intervention** | | **Alcohol breath odor** | | **Total** |
|---|---|---|---|---|
| | | **No** | **Yes** | |
| Population up to 10,000 | Number of cases | 3760.00 | 1223.00 | 4983.00 |
| | % in row | 75.46% | 24.54% | 100.00% |

| | | | | |
|---|---|---|---|---|
| | % in column | 46.68% | 37.34% | 43.98% |
| | % Total | 33.19% | 10.80% | 43.98% |
| Population above 10,000 | Number of cases | 4294.00 | 2052.00 | 6346.00 |
| | % in row | 67.66% | 32.34% | 100.00% |
| | % in column | 53.32% | 62.66% | 56.02% |
| | % Total | 37.90% | 18.11% | 56.02% |
| Total | Number of cases | 8054.00 | 3275.00 | 11329.00 |
| | % in row | 71.09% | 28.91% | 100.00% |
| | % in column | 100.00% | 100.00% | 100.00% |
| | % Total | 71.09% | 28.91% | 100.00% |

*Chi2 (N=11329; df=1) = 82.46; p<0.001*
*Source: Authors' own study.*

**Table14. Relationship between alcohol breath odor and the patient's sex**

An analysis of the relationship between alcohol breath odor and the patient's sex revealed significant differences between the sexes. In the total number of 2752 interventions involving female trauma patients, alcohol breath odor was determined in 442 (16.06%) cases and was not determined in 2310 (83.94%) cases. In the total number of 4801 interventions involving male trauma patients, alcohol breath odor was identified in 1886 (39.28%) cases and was not identified in 2915 (60.72%) cases. In the overall number of 7553 interventions, alcohol breath odor was reported in 2328 cases (30.82%) and was not reported in 5225 (69.18%) cases.

The chi-squared test revealed a statistically significant relationship between alcohol breath odor and the patient's sex (Chi2 (df=1) = 442.43; p<0.001). These results indicate that alcohol breath odor is significantly more prevalent in male than female trauma patients receiving emergency medical care.

| **Sex** | | **Alcohol breath odor** | | **Total** |
|---|---|---|---|---|
| | | **No** | **Yes** | |
| Women | Number of cases | 2310.00 | 442.00 | 2752.00 |
| | % in row | 83.94% | 16.06% | 100.00% |
| | % in column | 44.21% | 18.99% | 36.44% |
| | % total | 30.58% | 5.85% | 36.44% |
| Men | Number of cases | 2915.00 | 1886.00 | 4801.00 |
| | % in row | 60.72% | 39.28% | 100.00% |
| | % in column | 55.79% | 81.01% | 63.56% |
| | % total | 38.59% | 24.97% | 63.56% |
| Total | Number of cases | 5225.00 | 2328.00 | 7553.00 |
| | % in row | 69.18% | 30.82% | 100.00% |
| | % in column | 100.00% | 100.00% | 100.00% |
| | % total | 69.18% | 30.82% | 100.00% |

*Chi2 (N=7553; df=1) = 442.43; p<0.001*
*Source: Authors' own study.*

**Table 15. Relationship between the patient's sex and diagnosis**

An analysis of the relationship between the patient's sex and the type of diagnosis made by paramedics revealed that in the total number of 2752 cases involving women, 287 patients (10.43%) were assigned code S and 2465 patients (89.57%) were assigned code T. In the total number of 4801 cases involving men, 464 patients (9.66%) were assigned code S and 4337 patients (90.34%) were assigned code T. In the overall number of 7553 cases, 751 patients (9.94%) were assigned code S and 6802 patients (90.06%) were assigned code T.

The chi-squared test did not reveal a statistically significant relationship between the patient's sex and the type of diagnosis made by paramedics. The chi-squared (df=1) statistic reached 1.14 with a p-value of 0.29. These results imply that the type of diagnosis made by paramedics is not significantly differentiated by sex because similar proportions of male and female patients were assigned ICD-10 codes S and T.

| Sex | | Diagnosis | | Total |
|---|---|---|---|---|
| | | Code S | Code T | |
| Women | Number of cases | 287.00 | 2465.00 | 2752.00 |
| | % in row | 10.43% | 89.57% | 100.00% |
| | % in column | 38.22% | 36.24% | 36.44% |
| | % total | 3.80% | 32.64% | 36.44% |
| Men | Number of cases | 464.00 | 4337.00 | 4801.00 |
| | % in row | 9.66% | 90.34% | 100.00% |
| | % in column | 61.78% | 63.76% | 63.56% |
| | % total | 6.14% | 57.42% | 63.56% |
| Total | Number of cases | 751.00 | 6802.00 | 7553.00 |
| | % in row | 9.94% | 90.06% | 100.00% |
| | % in column | 100.00% | 100.00% | 100.00% |
| | % total | 9.94% | 90.06% | 100.00% |

*Chi2 (N=7553; df=1) = 1.14; p<0.29*
*Source: Authors' own study.*

## DISCUSSION

The study demonstrated that the number of emergency medical services delivered to trauma patients assigned ICD-10 codes S and T was fairly similar in each year of the analyzed period. The number of emergency medical services for trauma patients reached 130,575 in 2020, 131,399 in 2022, and it was highest at 138,254 in 2021, which could be associated with the peak of the COVID-19 pandemic.

The retrospective data analysis revealed that the risk of traumatic injury was significantly correlated with the patient's age. The prevalence of trauma was higher in younger patients, decreased gradually with age, but increased again in the oldest population. Similar observations were made by Lilley et al. who found that the risk of prehospital death was higher in trauma patients aged 24-54 [15]. Interestingly, the cited study revealed that the burden of prehospital fatal injury was highest among young men. Similarly to the present study, Witkowski reported a higher risk of traumatic injury in the oldest population [16]. In the cited study, the mean age at which seniors become susceptible to injury was determined at 75 years. Isolated injuries were reported in more than 85% of seniors, and multiple injuries were noted in nearly 15% of seniors. The majority of seniors who sustained traumatic injuries were women (68%). According to Michael et al., the demand for ambulance services in trauma cases is highest among persons aged 85 and older, which corroborates previous findings and the results of the present study [17]. Alexandrescu et al. reviewed the

literature on the epidemiology of injuries and found that both fatal and non-fatal injury rates were highest among young men [18]. A staggering 23% of young male trauma patients are killed or permanently disabled. The cited authors also noted that high injury rates in the working-age population have adverse economic consequences. Similar observations were made in the current study. However, researchers focusing solely on traumatic brain injury arrived at different conclusions. In the work of Munivenkatappa et al., the prevalence of both mild and severe brain injury was highest in female patients, and the greatest differences were observed between pediatric patients and older seniors [19]. Gioffre-Florio et al. analyzed the prevalence of trauma in geriatric patients and found that injury rates were higher among women [20]. Timler et al. investigated the frequency of emergency medical services delivered to Polish patients older than 65, but they did not note significant differences between genders [21]. Gianakos et al. analyzed the prevalence of orthopedic injuries in male and female patients and found that gender-specific injury patterns were rarely evaluated in the literature [22]. Gender was included as a variable in more than 30% of the reviewed articles, and these studies revealed differences in the outcomes of male and female orthopedic trauma patients. Polish and foreign researchers clearly differ in opinion, which is why further research on gender- and age-specific injury patterns is warranted.

The Polish National Institute of Public Health published a report on the prevalence of fatal injuries in different age groups [23]. According to the report, the age of 40 years is a cut-off point after which the prevalence of fatal injuries increases significantly. Many researchers found that the risk of death following traumatic injury increases at an annual rate of 6.5% past the age of 65 years and can be as high as 10% in persons older than 80. Similar results were obtained by Clare et al. who observed that the prevalence of trauma in geriatric patients older than 65 will continue to increase as the population ages [24]. The number of geriatric trauma patients increases steadily, and this problem has attracted the interest of researchers and medical professionals around the world. These observations were corroborated by Gioffre-Florio et al. who found that head and limb injuries were the most prevalent types of trauma, in particular in persons older than 80 [20]. These results are consistent with other authors' findings. Elderly persons with multiple comorbidities constitute a large group of trauma patients who require a specialist approach and multidisciplinary knowledge.

The present study also demonstrated that alcohol abuse is a serious social problem. A retrospective data analysis revealed that the percentage of patients who sustained traumatic injury under the influence of alcohol was lower in small towns and villages than in areas with a population higher than 10,000. Similar results were reported by Aftyka who analyzed urban and rural areas without a population criterion [25]. In the cited study, urban dwellers also constituted the majority of patients who were injured under the influence of alcohol. However, the analysis conducted by Aftyka relied on 2012 data. According to 2020 data, alcohol consumption is not influenced by location [26]. No significant differences were found between any of the studied groups. These findings suggest that alcohol consumption patterns in Poland have changed in the last decade. The alcohol abuse statistics presented in the report differ from research results. Therefore, further research is needed to elucidate these discrepancies.

## CONCLUSIONS

The results of the study suggest that the risk of a life-threatening medical emergency is higher in younger patients and decreases gradually in older patients. The above risk is somewhat higher in men than in women. The percentage of patients assigned to code S (injury, poisoning, and certain other consequences of external causes) increases with age. Alcohol breath odor is more frequently detected in patients residing in areas with a population above 10,000 than in patients residing in small towns and rural areas. The patient's sex is not significantly correlated with the type of medical emergency, and the prevalence of the diagnosed medical emergencies tends to be similar in both sexes.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

## DECLARATIONS

**Ethical Approval**: The study was approved by the Research Ethics Committee of the University of Warmia and Mazury in Olsztyn (decision No. 11/2023). The study did not receive external funding.

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**Availability of data and materials:** The analysis relied on a database administered by the Governor of the Voivodeship of Warmia and Mazury in Olsztyn.

**Competing interests:** The authors declare that they have no competing interests"

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