

Comparing EMS interventions involving persons after alcohol intake before and during the COVID-19 pandemic

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Abstract

Background. The COVID-19 pandemic has caused profound changes in the functioning of emergency medical services (EMS). This research was conducted to find out how the pandemic impacted EMS interventions involving patients after alcohol intake.

Material and methods. This study covered EMS interventions that were reported from March 14, 2019, to March 13, 2021, in the eastern part of the Mazovia Province (Poland) and involved patients under the influence of alcohol. The research methodology combined descriptive statistics, Welch's t-test, and the chi-square test.

Results. The proportion of EMS interventions involving individuals after alcohol intake decreased during the COVID-19 pandemic ($p < 0.0001$; 8.3% vs. 6.1%) compared to the pre-pandemic period. During the COVID-19 pandemic period, a medical emergency was diagnosed less frequently ($p < 0.0001$; 43.3% vs. 76.3%). EMS interventions involving individuals following alcohol consumption were more frequently associated with a concomitant condition ($p = 0.0032$; 29.0% vs. 25.5%) and elevated body temperature ($p = 0.0028$; 1.6% vs. 0.8%). During the pandemic, patients involving alcohol intake more frequently exhibited aggressive behaviors compared the pre-pandemic period ($p = 0.0054$; 3.2% vs. 2.0%).

Conclusions. Although the number of EMS interventions involving individuals after alcohol intake decreased during the COVID-19 pandemic, such interventions may still require considerable EMS resources.

Keywords: ethanol, emergency medical services, pandemic, COVID-19, alcohol

Introduction

Alcohol is produced through the fermentation of sugars by yeasts. Alcoholic fermentation in grains and fruits is a natural process, suggesting that alcohol in various forms may have been consumed, both intentionally and unintentionally, by early humans. However, the earliest reliable evidence of alcohol beverage production dates back to around 8000 BC [1]. Over the centuries, alcohol consumption has become deeply integrated into human civilization.

Although alcohol consumption is often associated with maintaining and strengthening social relationships, excessive alcohol use can lead to serious psychosocial, physiological, and social consequences, including family problems, issues at work, financial problems, and unemployment [2-4]. Alcohol is a psychoactive and toxic substance with dependence-producing properties [4,5]. Despite all these negative effects, alcohol remains the most widely

consumed psychoactive substance; its use is widely socially accepted, and social norms encourage activities associated with its consumption [4].

According to data from the World Health Organization (WHO), more than 60% of the world's adult population (aged 15 and older) consumes alcohol [4]. Alcohol consumption, even in small amounts, is an important risk factor for many health problems; however, most alcohol-related harm stems from occasional heavy drinking or chronic, long-term consumption of large amounts of alcohol [4]. The WHO also estimates that in 2019, 7% of the world's adult population (9.3% of men, 4.8% of women) had an alcohol use disorder, while 3.7% met the criteria for alcohol dependence (4.9% of men, 2.5% of women). Worldwide, 4.7% of all deaths in 2019 were attributable to alcohol consumption and were related mainly to noncommunicable diseases, injuries, and mental disorders. Consequently, alcohol consumption plays a causal role in more than 200 health conditions, including infectious diseases, cancers, mental and behavioral disorders, neurological disorders, cardiovascular diseases, gastrointestinal conditions, and injuries [4]. However, the consequences of alcohol intake on health depend on individual consumer susceptibility, on the drinking patterns, and the level of consumption.

Thus, alcohol consumption has a significant impact on the health of the global population and constitutes a major public health concern worldwide. Both occasional and chronic alcohol consumption creates a significant burden on healthcare systems, including emergency medical services (EMS), which frequently respond to individuals who are under the influence of alcohol or experience its direct or indirect health effects [6-8]. Pre-hospital diagnostics and providing care following alcohol consumption pose a significant challenge for EMS personnel. In the Polish healthcare system, patient assessment by EMS teams for alcohol consumption is based solely on medical history and physical examination, as EMS teams are not equipped to perform blood alcohol tests in the field, and there are no protocols in place to determine the intoxication level. Individuals who have consumed alcohol may exhibit behaviors and symptoms that may make it even more difficult for EMS personnel to make an accurate clinical assessment and informed treatment decisions [9]. They may also behave aggressively or violently to the point that they pose a threat to the health and safety of ambulance personnel [10]. The number of EMS call-outs related to mental health problems and alcohol abuse has continuously increased over the past years [11].

The emergence of the COVID-19 pandemic, as declared by the WHO in March 2020, has brought unprecedented changes to everyday life, both in social and organizational terms. The sanitary restrictions, lockdowns, closures of dining establishments, and social distancing measures that were implemented also affected alcohol consumption patterns [12,13]. In

addition to its impact on daily life, the pandemic has also significantly altered the functioning of healthcare systems, including that of EMS. EMS teams tasked with providing medical assistance to individuals facing acute threats to health and life were also involved in emergencies resulting from the pandemic [14], including interventions involving individuals following alcohol consumption. At the same time, individuals who consumed alcohol may have been particularly affected by pandemic-related changes in everyday life, which may have contributed to changes in patterns of EMS utilization [15-17].

Aim of the work

This study was designed to examine differences in the characteristics and frequency of EMS interventions involving patients after alcohol intake between the pre-COVID-19 pandemic period and the pandemic period.

Material and methods

The study was conducted in the eastern part of the Mazovia Province (Poland). The area covered by the analysis spans 7,350 km² with a population of approximately 530,000 as of the end of 2024 (51% women, 49% men) [18].

This was a retrospective study that examined EMS interventions during the period from March 14, 2019, to March 13, 2021. This period was divided into the pre-pandemic period (March 14, 2019 – March 13, 2020) and the COVID-19 pandemic period (March 14, 2020 – March 13, 2021). This classification is based on the fact that the first confirmed case of COVID-19 in Poland was reported in March 2020, while the state of epidemic threat and the first nationwide lockdown were officially declared on March 14, 2020 [19].

This study used data provided by Independent Public Health Care Center RM-MEDITRANS Emergency Station and Sanitary Transport in Siedlce (Poland) and were sourced from the Command Support System for the State EMS, which is an electronic registry of EMS interventions in Poland. The identification of EMS interventions for inclusion in the analysis was based exclusively on ICD-10 diagnoses indicating that the patient was under the influence of alcohol. In the pre-hospital setting, such a diagnosis is based solely on the patient's medical history and physical examination. Out of all 77,579 EMS interventions that were reported during the analyzed period and in the analyzed area, 5,642 (7.3%) involved patients under the influence of alcohol, based on the International Classification of Diseases, ver. 10 (ICD-10).

The categorization used did not distinguish between cases where alcohol consumption was the sole cause of the EMS call-out or whether the primary cause was an injury or illness, with alcohol consumption as an additional component of the intervention. The analyses covered the following ICD-10 diagnoses: *F10-Mental and behavioral disorders due to use of alcohol* (including codes *F10.0-F10.9*), *T51-Toxic effect of alcohol* (including codes *T51.0-T51.0*, *T51.8* and *T51.9*), *X45-Accidental poisoning by and exposure to alcohol*, *X65-Intentional self-poisoning by and exposure to alcohol*, *Y15-Poisoning by and exposure to alcohol, undetermined intent*, *Y90-Evidence of alcohol involvement determined by blood alcohol level* (including codes *Y90.0-Y90.9*), *Y91-Evidence of alcohol involvement determined by level of intoxication* (including codes *Y91.0-Y91.3* and *Y91.9*), and *Z72.1-Alcohol use*.

The data used in the study included patients' age and sex, the site of EMS intervention, the diagnosis, the intervention outcome, key symptoms, vital signs, and the medical procedures performed. The analyses covered only pre-hospital emergency care. The analyzed dataset was characterized by a moderate proportion of missing data. Missing data concerned patients' age, presenting symptoms, vital signs, and pharmacological treatment administered. In cases of missing data, analyses were conducted based on the available information, with records containing missing values excluded from the analyses. A comparison was also performed between the analyzed periods with respect to the occurrence of medical emergencies. The presence or absence of a medical emergency was documented by EMS personnel during each intervention based on the patient's medical history and physical examination. According to the Polish legislation governing the EMS system, a medical emergency may be defined as a sudden or anticipated, within a short period of time, onset of symptoms indicating deterioration in health, which may directly result in serious impairment of bodily functions, bodily injury, or loss of life [20].

The data were compiled in Microsoft Excel (MS Office 2021) for Windows 11. R version 4.4.0 [21], and the tidyverse package suite version 2.0.0 [22] was used for statistical analyses and data visualization.

Associations between qualitative variables was examined using the chi-square test of independence (χ^2). For contingency tables with small, expected cell frequencies, the chi-square test with Yates' continuity correction was applied. The results are presented as sample size (n) and percentage (%). The Kolmogorov-Smirnov test was used, followed by the Welch's t-test and descriptive statistics: mean (M), median (Me), standard deviation (SD), and interquartile range (IQR), to analyze the normal distribution of quantitative variables. The level of statistical significance was set to $p < 0.05$.

Results

There were 77,579 EMS interventions recorded in the analyzed area between March 14, 2019, and March 13, 2021. Of these, 5,642 interventions (7.3%) involved patients after alcohol intake. A significant difference was observed (Table 1) between the pre-pandemic period (March 14, 2019, to March 13, 2020) and the COVID-19 pandemic period (March 14, 2020, to March 13, 2021) in the proportion of EMS interventions involving individuals following alcohol consumption ($p < 0.0001$; $n = 3370$, 8.3% vs. $n = 2272$, 6.1%).

Table 1. EMS interventions before and during the pandemic for sober patients and individuals after alcohol intake

EMS intervention: patient	N (%)	Prior to the pandemic	During the pandemic	Test	
		n (%)	n (%)	χ^2 (df)	p-value
Consumed alcohol	5642 (7.3)	3370 (8.3)	2272 (6.1)	135.8 (1)	<0.0001
Sober	71937 (92.7)	37179 (91.7)	34758 (93.9)		
Total	77579 (100.0)	40549 (52.3)	37030 (47.7)	-	-

The patients' age was found to be significantly different ($p = 0.0166$) (Table 2, Figure 1). The mean age of patients after alcohol intake provided with emergency medical care was slightly higher before the COVID-19 pandemic ($M = 45.8$ vs. $M = 44.9$ years). No significant differences were observed among the analyzed age groups (decades); patients after alcohol consumption were most often those aged 30-69 during both periods (Table 3, Figure 2). No cases of patients after alcohol intake under the age of 10 were reported.

Table 2. Age of patients after alcohol intake before and during the pandemic

Age (years)	Parameters	Prior to the pandemic	During the pandemic	Test	
				t-Welch (df)	p-value
	n (%)	3321 (59.4)	2272 (40.6)	2.4 (4814.7)	0.0166
	Mean (SD)	45.8 (14.4)	44.9 (14.7)		
	Median (IQR)	45 (22)	44 (22.2)		
	Range	10-94	10-93		

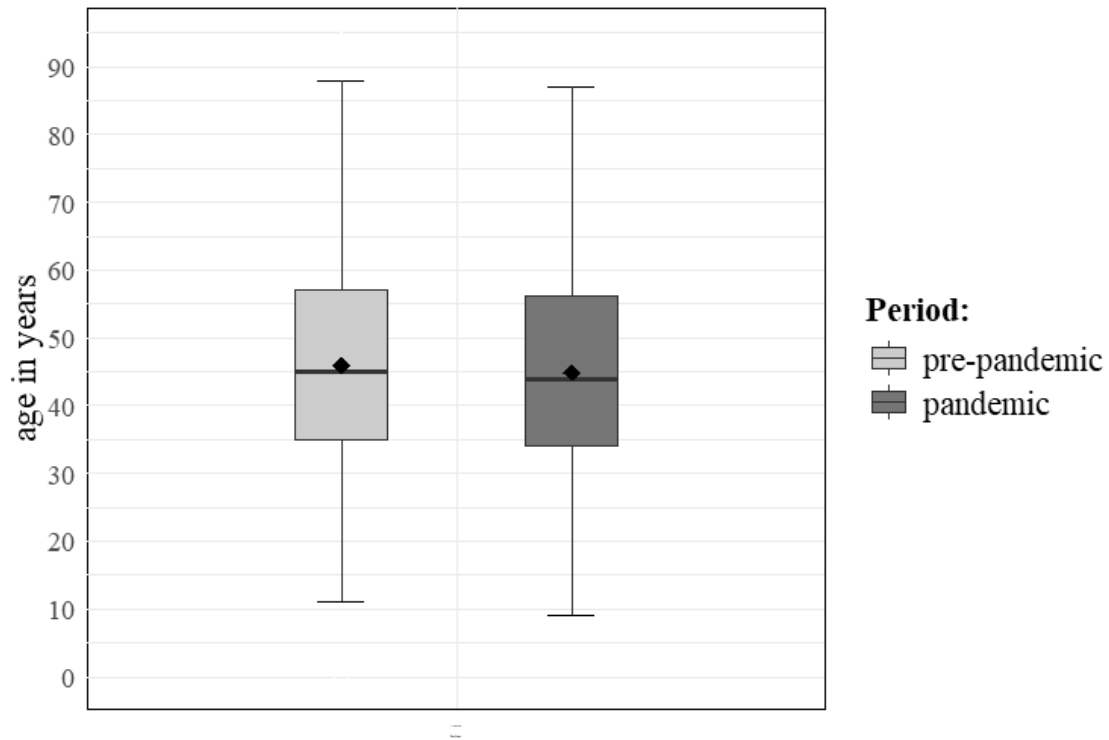


Figure 1. Age of patients after alcohol intake before and during the pandemic

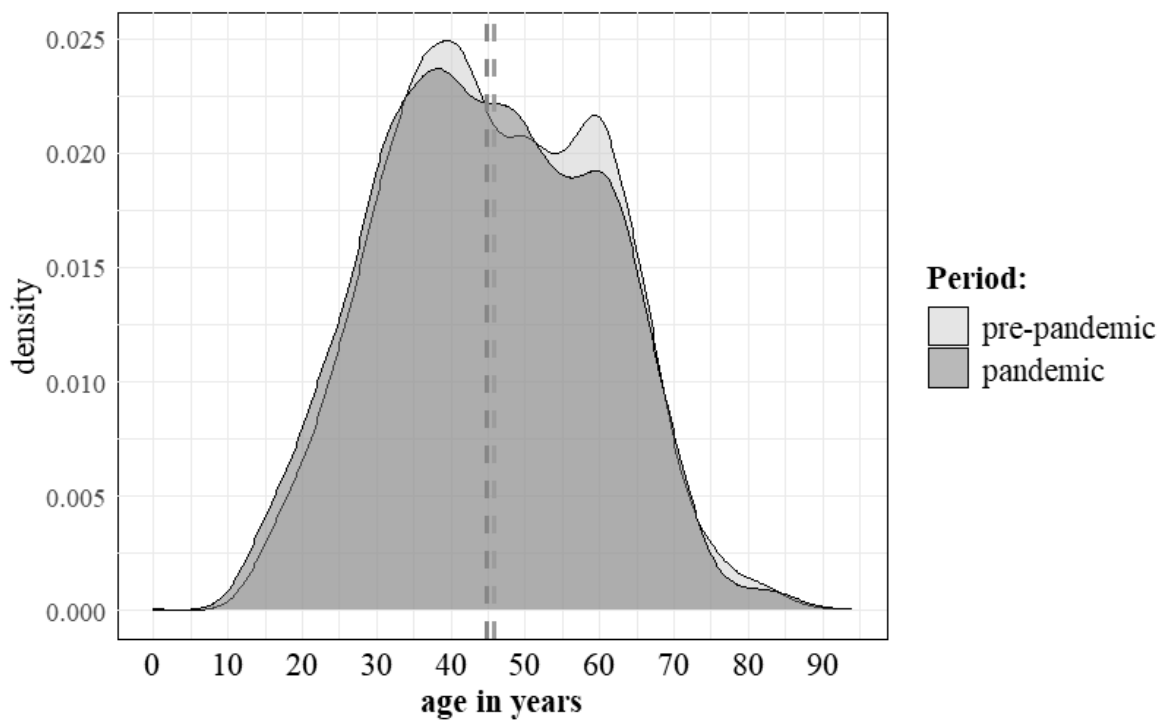


Figure 2. Age of patients after alcohol intake before and during the pandemic – a density plot

In both periods, mental disorders, injuries, being found lying down, and feeling unwell were the most common reasons for EMS call-outs for patients under the influence of alcohol.

Significant differences were identified between the pre-pandemic and pandemic period in the proportion of EMS call-outs related to mental disorders ($p<0.0001$; $n=576$, 17.1% vs. $n=503$, 22.1%) and feeling unwell ($p=0.0334$; $n=361$, 10.7% vs. $n=204$, 9.0%) (Table 3). No significant differences were observed in EMS interventions involving patients after alcohol intake between the two periods or with respect to the patient's sex, the intervention area (rural, urban), or the intervention location (home, public place) (Table 3). EMS team interventions engaging police responders in cases involving patients after alcohol intake were more common during the pandemic ($p<0.0001$, $n=729$, 32.1% vs. $n=854$, 25.3%); however, such patients were significantly less likely to be classified as facing a medical emergency ($p<0.0001$, $n=983$, 43.3% vs. $n=2570$, 76.3%), and fewer of them were transported to medical facilities ($p<0.0001$, $n=1311$, 57.7% vs. $n=2163$, 64.2%) (Table 3).

Table 3. Profile of EMS interventions involving patients after alcohol intake before and during the pandemic

Patient after alcohol intake	N (%)	Prior to the pandemic	During the pandemic	Test	
		n (%) 3370 (59.7)	n (%) 2272 (40.3)	χ^2 (df)	p-value
Reason for/category of EMS call-outs					
Mental disorders	1079 (19.1)	576 (17.1)	503 (22.1)	22.4 (1)	<0.0001
Injury/trauma	1062 (18.8)	659 (19.6)	403 (17.7)	2.9 (1)	0.0898
Lying down	997 (17.7)	608 (18.0)	389 (17.1)	0.8 (1)	0.3742
Feeling unwell	565 (10.0)	361 (10.7)	204 (9.0)	4.5 (1)	0.0334
Fainting	338 (6.0)	204 (6.1)	134 (5.9)	0.1 (1)	0.8092
Unconscious	328 (5.8)	195 (5.8)	133 (5.9)	0.0 (1)	0.9153
Seizures	247 (4.4)	139 (4.1)	108 (4.8)	1.3 (1)	0.2575
Chest pain	184 (3.3)	115 (3.4)	69 (3.0)	0.6 (1)	0.4361
Hemorrhage, bleeding	143 (2.5)	89 (2.6)	54 (2.4)	0.4 (1)	0.5358
Shortness of breath	137 (2.4)	78 (2.3)	59 (2.6)	0.5 (1)	0.4993
Other	562 (10.0)	346 (10.3)	216 (9.5)	0.9 (1)	0.3498
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Patient sex					
Female	793 (14.1)	463 (13.7)	330 (14.5)	0.6 (1)	0.4273
Male	4849 (85.9)	2907 (86.3)	1942 (85.5)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Age group					
10-19	175 (3.1)	93 (2.8)	82 (3.6)	2.8 (1)	0.0915
20-29	616 (11.0)	350 (10.5)	266 (11.7)	1.9 (1)	0.1697
30-39	1254 (22.4)	733 (22.1)	521 (22.9)	0.6 (1)	0.4473

40-49	1274 (22.8)	758 (22.8)	516 (22.7)	0.0 (1)	0.9232
50-59	1102 (19.7)	674 (20.3)	428 (18.8)	1.8 (1)	0.1906
60-69	949 (17.0)	577 (17.4)	372 (16.4)	0.9 (1)	0.3467
70-79	180 (3.2)	109 (3.3)	71 (3.1)	0.1 (1)	0.7443
80+	43 (0.8)	27 (0.8)	16 (0.7)	0.2 (1)	0.6477
Total	5593 (100.0)	3321 (59.4)	2272 (40.6)	-	-
Intervention area					
Rural area	3152 (55.9)	1856 (55.1)	1296 (57.0)	2.1 (1)	0.1519
Urban area	2490 (44.1)	1514 (44.9)	976 (43.0)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Intervention site					
Home	3109 (55.1)	1838 (54.5)	1271 (55.9)	1.1 (1)	0.2991
Public space	2533 (44.9)	1532 (45.5)	1001 (44.1)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Police call-out					
Yes	1583 (28.1)	854 (25.3)	729 (32.1)	30.6 (1)	<0.0001
No	4059 (71.9)	2516 (74.7)	1543 (67.9)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Medical emergency					
Yes	3553 (63.0)	2570 (76.3)	983 (43.23)	633.6 (1)	<0.0001
No	2089 (37.0)	800 (23.7)	1289 (56.7)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Intervention outcome					
Discharged on-scene	2168 (38.4)	1207 (35.8)	961 (42.3)	23.8 (1)	<0.0001
Transported to the hospital	3474 (61.6)	2163 (64.2)	1311 (57.7)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-

A comparison between the pre-pandemic and pandemic period shows no significant differences in the number of patients under the influence of alcohol who were provided with emergency medical care for alcohol intake without trauma or alcohol consumption complicated by a concomitant injury (Table 4). However, such differences were observed for interventions involving alcohol consumption combined with a co-morbidity ($p=0.0032$; $n=858$, 25.5% vs. 659, 29.0%). The most common injuries among patients under the influence of alcohol in both periods were head injuries (approximately 70%); no significant differences were observed in terms of injury types (Table 4). Significant differences in the incidence of health conditions associated with alcohol consumption (Table 4) were observed for cardiovascular diseases (I00-I99), which were significantly more common during the pandemic among individuals after alcohol intake ($p=0.0088$; $n=86$, 13.1% vs. $n=76$, 8.9%). Among individuals in whom alcohol

consumption was accompanied by mental and behavioral disorders, significant differences were identified between the pre-pandemic and pandemic period (Table 4) in terms of disorders related to the use of psychoactive substances (codes F11-F19) ($p=0.0127$; $n=4$, 4.0% vs. $n=12$, 16.2%).

Table 4. Profile of patients after alcohol intake, before and during the pandemic

Patient after alcohol intake	N (%)	Prior to the pandemic	During the pandemic	Test	
		n (%)	n (%)	χ^2 (df)	p-value
Patients after alcohol intake – profile					
Only alcohol intake	2510 (44.5)	1523 (45.2)	987 (43.4)	1.7 (1)	0.1943
Alcohol intake and co-morbidity	1517 (26.9)	858 (25.5)	659 (29.0)	8.7 (1)	0.0032
Alcohol intake and trauma	1615 (28.6)	989 (29.3)	626 (27.6)	2.1 (1)	0.1436
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Trauma					
Head (S00-S09)	1139 (70.5)	709 (71.7)	430 (68.7)	1.6 (1)	0.1978
Other	476 (29.5)	280 (28.3)	196 (31.3)		
Total	1615 (100)	989 (61.2)	626 (38.8)	-	-
Co-morbidity					
F00-F99	171 (11.3)	99 (11.5)	72 (10.9)	0.1 (1)	0.7083
G00-G99	97 (6.4)	59 (6.9)	38 (5.8)	0.8 (1)	0.3810
I00-I99	162 (10.7)	76 (8.9)	86 (13.1)	6.9 (1)	0.0088
R00-R99	751 (49.5)	433 (50.5)	318 (48.3)	0.7 (1)	0.3932
Z00-Z99	162 (10.7)	85 (9.9)	77 (11.7)	1.2 (1)	0.2665
Other	174 (11.4)	106 (12.3)	68 (10.2)	1.5 (1)	0.2175
Total	1517 (100.0)	858 (56.6)	659 (43.4)	-	-
Mental disorders					
F11-F19	16 (9.2)	4 (4.0)	12 (16.2)	6.2 (1)	0.0127*
F20-F29	19 (10.9)	11 (11.0)	8 (10.8)	0.0 (1)	0.9684
F30-F39	21 (12.1)	11 (11.0)	10 (13.5)	0.3 (1)	0.6148
F40-F48	27 (15.5)	16 (16.0)	11 (14.9)	0.0 (1)	0.8380
F90-F98	16 (9.2)	8 (8.0)	8 (10.8)	0.4 (1)	0.5258
F99	60 (34.5)	39 (39.0)	21 (28.4)	2.1 (1)	0.1450
Other	15 (8.6)	11 (11.0)	4 (5.4)	1.7 (1)	0.1936*
Total	174 (100.0)	100 (57.5)	74 (42.5)	-	

Notes: * – Yates' continuity correction; S00-S09 – Injuries to the head; F00-F99 – Mental and behavioral disorders (excluding code F10); G00-G99 – Diseases of the nervous system; I00-I99 – Diseases of the circulatory system; R00-R99 – Symptoms, signs and abnormal clinical and laboratory findings; Z00-Z99 – Factors influencing health status and contact with health services; F11-F19 – Mental and behavioral disorders due to psychoactive substance use; F20-F29 – Schizophrenia, schizotypal and

delusional disorders; F30-F39 – Mood [affective] disorders; F40-F48 – Neurotic, stress-related and somatoform disorders; F90-F98 – Behavioral and emotional disorders with onset usually occurring in childhood and adolescence; F99 – Unspecified mental disorder.

The incidence of elevated body temperature ($p=0.0028$) and psychomotor performance scores (decreased $p=0.0072$ and aggressive $p=0.0054$) were found to be significantly different among patients after alcohol intake before and during the pandemic (Table 5). Normal, lowered, and elevated body temperature was reported in 95.7% ($n=2999$), 3.5% ($n=109$), and 0.8% ($n=24$) of such patients in the pre-pandemic period, and 95.3% ($n=1191$), 3.1% ($n=65$), and 1.6% ($n=35$) of interventions during the pandemic, respectively. The share of aggressive patients was higher during the pandemic ($n=66$, 3.2% vs. $n=62$, 2.0%), and those with impaired motor function – before the pandemic ($n=921$, 29.2% vs. $n=535$, 25.8%), based on the assessment of psychomotor performance.

Table 5. Key symptoms in patients after alcohol intake, before and during the pandemic

Symptom	N (%)	Prior to the pandemic	During the pandemic	Test	
		n (%)	n (%)	χ^2 (df)	p-value
Shortness of breath					
Yes	56 (1.0)	35 (1.1)	21 (1.0)	0.1 (1)	0.8059
No	5310 (99.0)	3185 (98.9)	2125 (99.0)		
Total	5366 (100.0)	3220 (60.0)	2146 (40.0)	-	-
Vomiting					
Yes	318 (5.9)	180 (5.6)	138 (6.4)	1.7 (1)	0.1986
No	5081 (94.1)	3061 (94.4)	2020 (93.6)		
Total	5399 (100.0)	3241 (60.0)	2158 (40.0)	-	-
Fainting					
Yes	494 (9.2)	309 (9.6)	185 (8.6)	1.4 (1)	0.276
No	4888 (90.8)	2924 (90.4)	1964 (91.4)		
Total	5382 (100.0)	3233 (60.1)	2149(39.9)	-	-
Body temperature					
Normal	5017 (95.6)	2999 (95.7)	2018 (95.3)	0.7 (1)	0.4123
Lowered	174 (3.3)	109 (3.5)	65 (3.1)	0.7 (1)	0.4141
Elevated	59 (1.1)	24 (0.8)	35 (1.6)	8.9 (1)	0.0028
Total	5250 (100.0)	3132 (59.7)	2118 (40.3)	-	-
Psychomotor performance					
Normal	2965 (56.8)	1774 (56.3)	1191 (57.5)	0.7 (1)	0.3993
Decreased	1456 (27.9)	921 (29.2)	535 (25.8)	7.2 (1)	0.0072
Agitated	674 (12.9)	394 (12.5)	280 (13.5)	1.1 (1)	0.2870

Aggressive	128 (2.4)	62 (2.0)	66 (3.2)	7.7 (1)	0.0054
Total	5223 (100.0)	3151 (60.3)	2072 (39.7)	-	-

Significant differences were also observed between the pre-pandemic and pandemic period in two vital signs measured in patients under the influence of alcohol (Table 6). These differences concerned the pre-pandemic and pandemic mean systolic blood pressure ($p=0.0038$) ($M=136.5$ vs. $M=138.2$) and blood glucose levels ($p=0.0099$, 120.7 mg% vs. 125.0 mg%), respectively.

Table 6. Vital signs in patients after alcohol intake, before and during the pandemic

Vital signs	Parameters	Prior to the pandemic	During the pandemic	Test	
				t-Welch (df)	p-value
Glasgow Coma Scale (GCS)	n (%)	3305 (59.8)	2219 (40.2)	0.5 (4790.6)	0.6502
	Mean (SD)	14.2 (1.9)	14.1 (1.9)		
	Median (IQR)	15 (1)	15 (1)		
Respiratory rate (breaths per minute)	n (%)	3232 (60.1)	2142 (39.9)	0.4 (5101.5)	0.7176
	Mean (SD)	16 (5)	15.9 (4.1)		
	Median (IQR)	16 (4)	16 (4)		
SpO2 (%)	n (%)	3113 (59.9)	2086 (40.1)	-1.6 (4263.5)	0.1158
	Mean (SD)	96 (5.9)	96.3 (6.3)		
	Median (IQR)	97 (2)	97 (2)		
Systolic blood pressure (mmHg)	n (%)	3071 (59.9)	2055 (40.1)	-2.9 (3977.1)	0.0038
	Mean (SD)	136.5 (18.8)	138.2 (21.7)		
	Median (IQR)	140 (15)	140 (20)		
Diastolic blood pressure (mmHg)	n (%)	3065 (59.9)	2050 (40.1)	-1.8 (4166.1)	0.0798
	Mean (SD)	83.5 (12.3)	84.2 (13.3)		
	Median (IQR)	80 (10)	80 (10)		
Heart rate (beats per minute)	n (%)	3170 (59.9)	2118 (40.1)	-0.3 (4586.4)	0.7404
	Mean (SD)	95.3 (18.6)	95.5 (18.3)		
	Median (IQR)	90 (25)	92 (24)		
Blood glucose level (mg%)	n (%)	2119 (61.2)	1346 (38.8)	-2.6 (2924.1)	0.0099
	Mean (SD)	120.7 (48.5)	125.0 (47.1)		
	Median (IQR)	111 (35)	115 (37)		

The study found considerable differences between the two periods with regard to two of the five medical procedures performed in patients after alcohol intake (Table 7). Intravenous access ($p=0.0303$) was obtained in 19.9% ($n=671$) and 17.6% ($n=400$), while blood glucose ($p=0.0065$) was measured in 62.9% ($n=2119$) and 59.2% ($n=1346$) of patients under the influence of alcohol during EMS interventions, before and during the pandemic, respectively.

Table 7. Selected medical procedures performed in patients after alcohol intake, before and during the pandemic

Medical procedures	N (%)	Prior to the pandemic	During the pandemic	Test	
		n (%)	n (%)	χ^2 (df)	p-value
Oxygen therapy					
Yes	61 (1.1)	42 (1.2)	19 (0.8)	2.1 (1)	0.1441
No	5581 (98.9)	3328 (98.8)	2253 (99.2)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
ECG					
Yes	827 (14.7)	488 (14.5)	339 (14.9)	0.2 (1)	0.6467
No	4815 (85.3)	2882 (85.5)	1933 (85.1)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Intravenous access					
Yes	1071 (19.0)	671 (19.9)	400 (17.6)	4.7 (1)	0.0303
No	4571 (81.0)	2699 (80.1)	1872 (82.4)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Blood glucose test					
Yes	3465 (61.4)	2119 (62.9)	1346 (59.2)	7.4 (1)	0.0065
No	2177 (38.6)	1251 (37.1)	926 (40.8)		
Total	5642 (100.0)	3370 (59.7)	2272 (40.3)	-	-
Administration of medications					
Yes	181 (3.8)	98 (3.4)	83 (4.4)	3.1 (1)	0.0806
No	4614 (96.2)	2797 (96.6)	1817 (95.6)		
Total	4795 (100.0)	2895 (60.4)	1900 (39.6)	-	-

Discussion

The COVID-19 pandemic represented one of the most significant public health challenges in recent history. It affected various aspects of social and economic life and altered healthcare systems, including EMS [23]. Among other aspects, the pandemic affected the provision of EMS to specific groups of patients, namely those after alcohol intake. This study was designed to examine differences in the characteristics and frequency of EMS interventions involving patients after alcohol intake between the pre-COVID-19 pandemic period and the pandemic period. This study may help address existing knowledge gaps regarding EMS interventions involving patients after alcohol intake, particularly within the Polish EMS system.

Throughout the study period, EMS call-outs involving patients after alcohol intake accounted for as much as 7.3% of all interventions (Table 1). In the subsequent years, the proportion of EMS call-outs involving individuals under the influence of alcohol was 6.4%

between March 14, 2021, and March 13, 2022, 6.8% between March 14, 2022, and March 13, 2023, 7.5% between March 14, 2023, and March 13, 2024, 6.7% between March 14, 2024, and March 13, 2025, and 6.9% between March 14, 2025, and March 13, 2026. Thus, interventions involving this type of patient may place an additional demand on EMS teams and could potentially affect the availability of EMS resources. For comparison, a disproportionately high proportion of alcohol-related EMS call-outs (16.2%) was reported between 2016 and 2019 in the Scottish Ambulance Service [7]. In contrast, 10.0% of EMS call-outs were related to alcohol in Finland [24].

Based on the analyzed data, the proportion of EMS call-outs involving patients after alcohol intake decreased from 8.3% to 6.1% during the pandemic compared with the period before the outbreak (Table 1). This may have been related to measures introduced to limit virus transmission, such as restrictions on social contacts, stay-at-home orders, the transition to remote work and education, and the closure of establishments serving alcohol. A similar two-year study (2021-2022) covering data from the northern part of the Lublin region (Poland) revealed that during the pandemic, 5.92% of all EMS interventions involved patients who had consumed alcohol [25]. A Finnish study found a decrease in the number of interventions involving patients after alcohol intake, from 16.2% to 15.0% [26]. Data from the Israeli EMS system reveal that alcohol-related overdose cases showed marked short-term fluctuations across distinct pandemic phases [27]. The WHO also reports that the COVID-19 pandemic has had a visible impact on global alcohol consumption and estimates that per-adult consumption dropped by as much as 10.1%, from 5.5 liters in 2019 to 4.9 liters of alcohol in 2020 [4]. Sohi et al. demonstrated that alcohol consumption and drinking patterns may have decreased in some regions, increased in others, and stayed stable elsewhere [13]. Acuff et al. suggested that the main cause of increased alcohol consumption in some countries during the pandemic was the uncertainty and stress caused by the pandemic [12].

This analysis revealed that most patients under the influence of alcohol who received EMS care before and during the COVID-19 pandemic were aged 30-69 (Table 3, Figure 2). Overall, patients after alcohol intake who received pre-hospital care during the pandemic were slightly younger (Table 2, Figure 1) compared with this group of patients before the pandemic (45 vs. 46 years). In contrast, the number of EMS interventions involving individuals after alcohol intake, broken down with respect to sex, area of intervention (urban, rural), and location of the intervention (home, public place), did not differ significantly before and during the pandemic (Table 3). In both periods, as many as 85.9% of patients under the influence of alcohol were men (Table 3). In an Israeli study covering the pre-pandemic and pandemic period, men

accounted for the largest proportion of alcohol-related EMS interventions, and individuals aged 21-65 consistently represented the largest proportion of such cases [27]. This study also indicates that adolescents and young adults (ages 11-21) showed the most notable fluctuations between the analyzed periods in terms of alcohol-related EMS interventions. Similarly, a study covering data from north-eastern Poland found that the number of alcohol-related medical interventions during the COVID-19 pandemic increased only among adolescents (ages 12-18) (2.5% vs. 1.6%) [14]. These findings indicate differences in alcohol-related EMS interventions among younger individuals between the analyzed periods. However, the extent to which pandemic-related measures, such as lockdowns and school closures, may have contributed to these differences remains unclear.

In Italy, Giustino et al. [16] observed a nearly 30% reduction in emergency calls for alcohol-related issues during the pandemic compared to the period preceding it. In this study, the most common reasons for EMS call-outs involving patients after alcohol intake (Table 3) were mental health disorders (19.1%), injuries (18.8%), being found lying down (17.7%), and feeling unwell (10.0%), both before and during the pandemic, with significant differences identified between the pre-pandemic and pandemic period for mental health disorders (17.1% vs. 22.1%) and feeling unwell (10.7% vs. 9.0%). These reasons for EMS interventions may be only indirectly related to alcohol consumption. For anyone calling an ambulance, especially in a public place and if a stranger is involved, it can be difficult to determine the actual reason for the intervention. However, such key details about the condition of the affected individual reported to a medical dispatcher may suggest that the EMS intervention could be alcohol-related. Bearing in mind that alcohol affects the central nervous system and, when consumed in moderation, causes relaxation, suppresses inhibitions, and induces emotional arousal, whilst higher doses lead to depression, aggression, mood swings, sadness, and anger, medical dispatchers may classify a significant proportion of such EMS call-outs as related to mental health disorders. It is important, nevertheless, to point out that the COVID-19 pandemic did not significantly affect the number of EMS responses related to mental health disorders, even though the percentage of emergency calls regarding mental health rose slightly during the initial phase of the pandemic [26,28].

We found that emergency medical responders classified a lower proportion of EMS interventions involving individuals following alcohol consumption as medical emergencies during the pandemic (43.3% vs. 76.3%). This finding coincided with a lower proportion of patients transported to medical facilities (57.7% vs. 64.2%) (Table 3). This difference in the incidence of medical emergencies is unclear. However, the lower number of hospital transfers

may have been related to either the patients' overall health condition or the fear of being exposed to COVID-19 at a healthcare facility. Paulin et al. demonstrated that alcohol consumption is strongly associated with an increased likelihood of a patient being conveyed to a healthcare facility by the EMS team [24]. Lane et al. also revealed a general drop in overall EMS call-out volumes and an increase in non-transport rates during the COVID-19 pandemic, specifically for patients in good health [29]. A Polish study also found that there was an increase in the percentage of patients left on-scene after EMS assessment, both for medical emergencies and injuries, during the COVID-19 pandemic [23].

Based on our findings, EMS interventions for individuals after alcohol intake can be categorized into three groups: interventions solely related to alcohol consumption (44.5%), interventions for patients after alcohol intake with a coexisting medical condition (26.9%), or interventions for patients after alcohol intake and who had sustained an injury (28.6%) (Table 4). Although the overall number of patients encountered by EMS following alcohol consumption fell during the pandemic, the proportion of patients for whom the cause of EMS intervention was alcohol consumption alone, or alcohol consumption combined with a concomitant injury, remained at a similar level before and during the pandemic. In both analyzed periods, approximately 70% of individuals following alcohol consumption who had a concomitant injury also sustained a head injury (Table 4). The share of EMS interventions caused solely by alcohol, as well as those involving concurrent injury, remained stable during the pandemic. Regardless, these findings align with evidence that alcohol consumption increases the risk of sustaining injuries [4]. In contrast, Azbel et al. reported that, during the pandemic, the number of calls involving injured individuals following alcohol consumption decreased by 41.8%, while their proportion among all trauma-related calls decreased by 24.2% [30].

However, our analysis revealed an increase in the percentage of EMS interventions for patients who had consumed alcohol and presented with a coexisting medical condition (29.0% vs. 25.5%) during the pandemic (Table 4). This increase is consistent with the overall pattern of EMS responses during the pandemic. This trend – an increase in the proportion of EMS interventions for patients with medical conditions – was reported by Mitura et al. [23]. In one notable study, 0.4% of COVID-19-positive patients attended to by EMS were under the influence of alcohol during the pandemic [31]. Furthermore, alcohol consumption increases the risk of developing a number of infectious diseases, including COVID-19 [4]. Wei et al. [32] found that alcohol consumption was associated with greater COVID-19 severity and that alcohol abuse was associated with an increased risk of being hospitalized due to COVID-19.

During the pandemic, there was an increase in EMS interventions involving co-occurring alcohol consumption and cardiovascular diseases (13.1% vs. 8.9%) (Table 4). Both chronic and occasional alcohol consumption can adversely affect multiple body systems and are associated with a range of cardiovascular diseases [5]. The increase in the proportion of EMS interventions involving patients with co-occurring alcohol consumption and cardiovascular diseases may have been associated with changes in healthcare-seeking behavior during the pandemic.

In cases where alcohol consumption was accompanied by mental and behavioral disorders, a marked increase was observed during the pandemic in the proportion of patients who consumed alcohol and were also diagnosed with mental and behavioral disorders caused by the use of psychoactive substances (excluding those induced by alcohol) (16.2% vs. 4.0%) (Table 4). An increase in the prevalence of symptoms associated with poor mental health and mental disorders during the COVID-19 pandemic was also reported in several studies conducted in different countries [28,33,34]. Similar to alcohol consumption, the use of psychoactive substances represents a major public health burden that worsened during the COVID-19 pandemic [17,27].

This study revealed no differences in EMS interventions before and during the pandemic with regard to patients who had consumed alcohol and presented with symptoms such as shortness of breath, vomiting, or fainting (Table 5). This may be attributed to the fact that alcohol consumption causes a range of symptoms, including behavioral disturbances of varying severity, anxiety, profuse sweating, tremors, headache, visual disturbances, altered perception, palpitations, tachycardia, arrhythmia, nausea and vomiting, elevated temperature, and, in extreme cases, heart failure and respiratory arrest [5,8]. As a result, the alcohol-related symptoms may be further aggravated by the underlying comorbidities or injuries. Conversely, alcohol consumption may mask or affect the signs and symptoms of medical conditions and injuries that a patient presents with. During the pandemic, elevated body temperature (1.6% vs. 0.8%) and disorders associated with aggressive behavior (3.2% vs. 2.0%) were more frequently observed among patients who had consumed alcohol (Table 4, Table 5). Therefore, it is unsurprising that during the pandemic, police involvement in EMS operations concerning patients under the influence of alcohol was significantly more frequent (32.1% vs. 25.3%) (Table 3). This finding may have been related to concerns regarding the safety of EMS personnel arising from patients' behavior.

The key vital signs assessed in patients after alcohol intake were generally similar between the two periods (Table 6). Systolic blood pressure and blood glucose levels were the

only parameters that differed significantly. In both analyzed periods, patients under the influence of alcohol presented with a similar level of consciousness as assessed using the GCS score. At the same time, it should be noted that alcohol consumption alone may interfere with the assessment of neurological status, while the final GCS score may be further influenced by coexisting medical conditions or injuries [35,36].

Lane et al. [29] demonstrated that ambulance staff spent significantly more time at the scene with patients during the COVID-19 pandemic than before the pandemic. However, our analysis showed that during the pandemic, EMS teams were less likely to establish intravenous access (17.6% vs. 19.9%) and measure blood glucose levels (59.2% vs. 62.9%) in patients under the influence of alcohol (Table 7). The lower proportion of blood glucose measurements performed during the pandemic warrants consideration. Blood glucose assessment in patients under the influence of alcohol is an important component of routine clinical evaluation, as alcohol can depress the central nervous system and produce signs and symptoms that overlap with those of other medical conditions, including hypoglycemia and hyperglycemia.

The key strength of this study is that the study data were sourced from the nationwide, integrated Command Support System of the State Medical Emergency Service. However, several limitations should be acknowledged. First, the study was retrospective and regional in scope. Another limitation is the performance of multiple statistical comparisons without adjustment for multiple testing. Consequently, findings with marginal statistical significance should be interpreted with appropriate caution. Furthermore, the analysis was based exclusively on data collected in the pre-hospital setting, where, due to the specific nature of EMS, blood alcohol concentrations are not routinely measured, and no subsequent patient data are available to verify the accuracy of the diagnoses and medical procedures documented by EMS teams. It cannot be excluded that, in some cases, particularly when alcohol consumption was not the sole reason for the intervention, an alcohol-related diagnosis may not have been documented by the EMS team. The analyzed records also contained some missing data, particularly regarding symptoms and vital signs. In addition, repeated EMS interventions involving the same patients following alcohol consumption cannot be excluded. Finally, changes in EMS practices during the COVID-19 pandemic may have influenced the collected data and should therefore be considered when interpreting the findings.

Conclusions

From a public health perspective, this study provides useful insights that may contribute to the evaluation and potential improvement of alcohol control policies aimed at reducing the adverse effects of alcohol consumption on individuals, society, and public health. Analyzing EMS interventions involving individuals who had consumed alcohol, particularly in the context of the COVID-19 pandemic, may also provide valuable insights into how rapid and substantial changes in social and healthcare conditions can affect patterns of alcohol consumption, alcohol-related behaviors, associated health consequences, and the utilization of EMS resources.

This study may also contribute to improving the delivery of pre-hospital emergency care by enhancing EMS preparedness to provide appropriate medical assistance to patients after alcohol intake. Although the number of EMS interventions involving individuals under the influence of alcohol decreased during the COVID-19 pandemic, such interventions may still require considerable EMS resources. Patients attended by EMS following alcohol consumption shared several common characteristics before and during the pandemic. However, during the pandemic, patients under the influence of alcohol were more likely to exhibit aggressive behavior, and EMS interventions involving these patients were more frequently supported by police presence. During the pandemic, patients after alcohol intake were also more likely to be left at-scene after medical assessment and were less likely to be considered a medical emergency.

However, further research is needed to more closely examine the health status of specific patient groups, including individuals who require medical assistance while under the influence of alcohol.

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As this study did not involve human participants and because of the study design and the type of data analyzed, no approval from the Research Ethics Committee or informed consent to participate in the study were requested. No access was provided to any information that could identify individual study participants. This study analyzed historical anonymized administrative

and clinical data; it did not involve any direct monitoring of or interactions with patients; it complied with the provider's terms and conditions regarding data access, use, and dissemination and was conducted in accordance with the relevant guidelines and provisions of the Declaration of Helsinki.

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References:

1. Khaderi SA. Introduction: alcohol and alcoholism. *Clinics in Liver Disease*. 2019; 23(1): 1-10. <https://doi.org/10.1016/j.cld.2018.09.009>
2. Campbell DD, Green M, Davies NM, Harrison S, Demou E, Howe LD, et al. Effects of alcohol consumption on employment and social outcomes: a Mendelian randomisation study. *Alcohol Alcohol*. 2025; 60(5): agaf038. <https://doi.org/10.1093/alcac/agaf038>
3. Acuff SF, Padovano HT, Carpenter RW, Emery NN, Miranda R, Jr. Effects of social drinking context on subjective effects, affect, and next-day appraisals in the natural environment. *Alcohol Clin Exp Res*. 2024; 48: 755-765. <https://doi.org/10.1111/acer.15286>
4. WHO. Global status report on alcohol and health and treatment of substance use disorders [Internet]. Geneva: WHO; 2024 Jun 25 [access 2026 Jun 1]. Available from: <https://www.who.int/publications/i/item/9789240096745>
5. Varghese J, Dakhode S. Effects of alcohol consumption on various systems of the human body: a systematic review. *Cureus*. 2022; 14(10): e30057. <https://doi.org/10.7759/cureus.30057>
6. Marshall B, McGlynn E, King A. Sobering centers, emergency medical services, and emergency departments: a review of the literature. *Am J Emerg Med*. 2021; 40: 37-40. <https://doi.org/10.1016/j.ajem.2020.11.031>
7. Manca F, Lewsey J, Waterson R, Kernaghan SM, Fitzpatrick D, Mackay D, et al. Estimating the burden of alcohol on ambulance callouts through development and validation of an algorithm using electronic patient records. *Int J Environ Res Public Health*. 2021; 18(12): 6363. <https://doi.org/10.3390/ijerph18126363>
8. Cholerzyńska H, Zasada W, Kłosiewicz T, Konieczka P, Mazur M. The burden of alcohol-related emergency department visits in a hospital of a large European city. *Healthcare*. 2023; 11(6): 786. <https://doi.org/10.3390/healthcare11060786>

9. Kauppila T, Virta J, Lindgren L, Virkkunen I, Kämäräinen A. Alcohol use in the prehospital setting: a diagnostic challenge in patients treated by a physician staffed mobile intensive care unit. *SpringerPlus*. 2016; 5: 1247. <https://doi.org/10.1186/s40064-016-2921-y>
10. Coomber K, Curtis A, Vandenberg B, Miller PG, Heilbronn C, Matthews S, et al. Aggression and violence at ambulance attendances where alcohol, illicit and/or pharmaceutical drugs were recorded: a 5-year study of ambulance records in Victoria, Australia. *Drug Alcohol Depend*. 2019; 205: 107685. <https://doi.org/10.1016/j.drugalcdep.2019.107685>
11. Andrew E, Nehme Z, Cameron P, Smith K. Drivers of increasing emergency ambulance demand. *Prehosp Emerg Care*. 2020; 24(3): 385-393. <https://doi.org/10.1080/10903127.2019.1635670>
12. Acuff SF, Strickland JC, Tucker JA, Murphy JG. Changes in alcohol use during COVID-19 and associations with contextual and individual difference variables: a systematic review and meta-analysis. *Psychol Addict Behav*. 2022; 36(1): 1-19. <https://doi.org/10.1037/adb0000796>
13. Sohi I, Chrystoja BR, Rehm J, Wells S, Monteiro M, Ali S, et al. Changes in alcohol use during the COVID-19 pandemic and previous pandemics: a systematic review. *Alcohol Clin Exp Res*. 2022; 46(4): 498-513. <https://doi.org/10.1111/acer.14792>
14. Mitura KM, Celinski D, Snarska J, Szajda SD. Effect of the COVID-19 pandemic on potential health emergencies in paediatric patients: a retrospective cohort study. *Front Public Health*. 2024; 12: 1402525. <https://doi.org/10.3389/fpubh.2024.1402525>
15. Ogeil RP, Scott D, Faulkner A, Wilson J, Beard N, Smith K, et al. Changes in alcohol intoxication-related ambulance attendances during COVID-19: How have government announcements and policies affected ambulance call outs?. *Lancet Reg Health West Pac*. 2021; 14: 100222. <https://doi.org/10.1016/j.lanwpc.2021.100222>
16. Giustino A, Natola A, Savoia G, De Salvia MA, Finelli C. Reduced pharmacological intervention of prehospital services for acute alcohol intoxication during the COVID-19 pandemic in a large district of southern Italy. *J Clin Med*. 2024; 13(11): 3057. <https://doi.org/10.3390/jcm13113057>
17. Kabadayi Sahin E, Usul E. Prehospital emergency service use for substance-related issues before and during COVID-19. *Emerg Med Int*. 2023; 8886832. <https://doi.org/10.1155/2023/8886832>

18. Statistics Poland. [Demographic Yearbook of Poland] [Internet]. Warsaw: Statistics Poland; 2025 Nov 24 [access 2026 Jun 10]. Available from: <https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-demograficzny-2025,3,19.html> (in Polish).
19. [Regulation of the Minister of Health of March 13, 2020, on declaring a state of epidemic threat in the territory of the Republic of Poland (Journal of Laws 2020, Item 433)] (in Polish).
20. [Act of 8th September 2006 on state emergency medical services (Journal of Laws 2006, Item 1410)] (in Polish).
21. Core Team R. A language and environment for statistical computing: r foundation for statistical computing [Internet]. Vienna: Core Team R; 2020 [access 2026 May 27]. Available from: <https://www.R-project.org>
22. Wickham H, Averick M, Bryan J, Chang W, D'Agostino McGowan L, François R, et al. Welcome to the Tidyverse. *Journal of Open Source Software*. 2019; 4(43): 1686. <https://doi.org/10.21105/joss.01686>
23. Mitura KM, Celiński D, Snarska J, Szajda SD. Impact of COVID-19 pandemic on health and life emergencies resulting from illness cases and injuries – a preliminary study. *J Clin Med*. 2024; 13(12): 3552. <https://doi.org/10.3390/jcm13123552>
24. Paulin J, Kurola J, Salanterä S, Moen H, Guragain N, Koivisto M, et al. Changing role of EMS-analyses of non-conveyed and conveyed patients in Finland. *Scand J Trauma Resusc Emerg Med*. 2020; 28: 45. <https://doi.org/10.1186/s13049-020-00741-w>
25. Dudziński Ł, Czyżewski Ł, Oczkoś K. Interventions of Emergency Medical Teams for health threats caused by ethyl alcohol intoxication in 2021-2022. *Emerg Med Serv*. 2024; 11(1): 21-27. <https://doi.org/10.36740/EmeMS202401103>
26. Laukkanen L, Lahtinen S, Liisanantti J, Kaakinen T, Ehrola A, Raatiniemi L. Early impact of the COVID-19 pandemic and social restrictions on ambulance missions. *Eur J Public Health*. 2021; 31(5): 1090-1095. <https://doi.org/10.1093/eurpub/ckab065>
27. Khalemsky A, Abramowitz MZ, Sonkin R, Knobler HY, Jaffe E. Temporal patterns of alcohol- and drug-related overdoses during the COVID-19 pandemic: a national EMS-based study by age and gender in Israel. *Int. J. Environ. Res. Public Health*. 2026; 23(5): 619. <https://doi.org/10.3390/ijerph23050619>
28. Dudziński Ł, Glinka M, Panczyk M. Psychiatric conditions in the practice of National Emergency Medical Services teams in eastern Poland during the SARS-CoV2 pandemic. *Psychiatr Pol*. 2023; 57(3): 621-635. <https://doi.org/10.12740/PP/150330>

29. Lane DJ, Blanchard IE, Buick JE, Shaw M, McRae AD. Changes in presentation, presenting severity and disposition among patients accessing emergency services during the first months of the COVID-19 pandemic in Calgary, Alberta: a descriptive study. *CMAJ Open*. 2021; 9(2): E592-E601. <https://doi.org/10.9778/cmajo.20200313>
30. Azbel M, Heinänen M, Lääperi M, Kuisma M. Effects of the COVID-19 pandemic on trauma-related emergency medical service calls: a retrospective cohort study. *BMC Emerg Med*. 2021; 21: 102. <https://doi.org/10.1186/s12873-021-00495-3>
31. Mitura KM, Celiński D, Bielan O, Snarska J, Szajda SD. Sex differences in response to COVID-19 infection: a retrospective study based on emergency medical team interventions. *Front Public Health*. 2026; 14: 1747666. <https://doi.org/10.3389/fpubh.2026.1747666>
32. Wei B, Liu Y, Li H, Peng Y, Luo Z. Impact of alcohol consumption on coronavirus disease 2019 severity: a systematic review and meta-analysis. *J Med Virol*. 2023; 95(2): e28547. <https://doi.org/10.1002/jmv.28547>
33. Cummings JR, Zhang X, Gandré C, Morsella A, Shields-Zeeman L, Winkelmann J, et al. Challenges facing mental health systems arising from the COVID-19 pandemic: Evidence from 14 European and North American countries. *Health Policy*. 2023; 136: 104878. <https://doi.org/10.1016/j.healthpol.2023.104878>
34. Hegenberg K, Althammer A, Gehring C, Prueckner S, Trentzsch H. Pre-hospital Emergency Medical Services utilization amid COVID-19 in 2020: descriptive study based on routinely collected dispatch data in Bavaria, Germany. *Healthcare*. 2023; 11(14): 1983. <https://doi.org/10.3390/healthcare11141983>
35. Kelly CA, Upex A, Bateman DN. Comparison of consciousness level assessment in the poisoned patient using the alert/verbal/painful/unresponsive scale and the Glasgow Coma Scale. *Ann Emerg Med*. 2004; 44(2): 108-113. <https://doi.org/10.1016/j.annemergmed.2004.03.028>
36. Pina C, Marco CA. Intoxication and Glasgow coma scale scores in patients with head trauma. *Am J Emerg Med*. 2024; 80: 8-10. <https://doi.org/10.1016/j.ajem.2024.02.039>