

# Aggressive behaviour in mentally altered patients in prehospital setting as a threat to emergency medical service personnel: potential predictors identification.

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## Abstract

**OBJECTIVES:** Patients are the most common source of violence against EMS personnel. This study aims at elucidating specific clinical features in patients with mental alteration and aggressive behaviour increasing risk of violence.

**MATERIAL AND METHODS:** This consecutive cross-sectional retrospective study analysed consecutive patients treated for prespecified list of primary diagnoses by one EMS provider in the Czech Republic between 1 January 2021 and 31 December 2023. The effect of individual features of medical history and present symptoms on the occurrence of violence, need for the Police assistance and use of restraints was evaluated, using linear regression model.

**RESULTS:** 410 patients were evaluated. Verbal and brachial violence was present in 21.5 and 12.9 %, respectively. Police assistance was needed in 48.3 %, restraints were used in 4.6 %. The most significant predictor for violence, need for Police or restraints was agitation (OR 7.02, CI 4.14 - 11.90; OR 2.60, CI 1.60 - 4.24, OR 11.02, CI 3.49 - 34.80 respectively). Other predictors of violence included history of acute psychotic attacks and psychotic disorders, or outpatient psychiatry care. Among other predictors for Police assistance was presence of delusions, paranoia and history of outpatient psychiatry care.

**CONCLUSION:** Prehospital care for patients with mental status alteration and aggressive behaviour is complex. Some clinical features seem to increase the risk of violence. Future research in the evaluation of agitated and violent patients is warranted to find strategies of risk mitigation for EMS personnel.

## INTRODUCTION

Emergency Medical Service (EMS) is an important part of health care and public safety system. It plays crucial role in providing prehospital emergency care to patients and accident victims and is an integral part of disaster response system (EuSEM 2024, Revue 2022, Aringhieri *et al.* 2017). In the Czech Republic, EMS is legally and practically organised within the framework of integrated rescue service system, alongside with Fire Department and Police Department (Czech Republic 2000). Being structured into 14 separate organisations in alignment with the country subdivision into 13 higher territorial administrative unit in the western part of the Czech Republic regions and the capital city of Prague, it responded to 801,852 of emergencies on average each year between 2007 and 2020, with an ever-increasing trend (Institute of Health Information and Statistics of the Czech Republic 2021). EMS responds to all kind of emergencies, among which psychiatric disorders are not the least frequent. There were 42,217 patients treated for psychiatric disorders in 2020 alone (Institute of Health Information and Statistics of the Czech Republic 2021).

There are many factors and situations, that pose a risk to physical safety of EMS personnel during execution of their duty of the pre-hospital care provision. EMS personnel have one of the highest rates of work-related injuries and even fatalities, well above the national averages or even above the rate of police officers or firefighters (Maguire *et al.* 2013, Maguire *et al.* 2018, Kearney *et al.* 2022). Alongside transport-related injuries, body motion related injuries and transmission of infectious disease, violence-related injuries represent the cause of considerable portion of all work-related injuries of EMS personnel (Maguire *et al.* 2013, Galazkowski *et al.* 2015, Yilmaz *et al.* 2016, Kearney *et al.* 2022).

Patients receiving the pre-hospital care are the most common source of violence against EMS personnel, with varying rates in different studies from 77 % (Maguire *et al.* 2017) to 90 % (Maguire *et al.* 2018a, Grange and Corbett 2002), 92 % (Bigham *et al.* 2014), or 77 to 95.3 % in review by Kearney *et al.* (2022). Gormley in her paper found, that the rate of both physical and verbal violence against EMS personnel was much higher from patients then from their family members or bystanders (43.4 % vs 5.8 % and 65.8 % vs 36.8 % respectively (Gormley *et al.* 2016).

Patient's agitation is among the most common causal conditions for violence against EMS workers, being triggered by various factors, such as shock-like response to unexpected illness or trauma, delayed response time and others (Knor *et al.* 2020). Another important and common cause of psychomotor agitation and aggressive behaviour is alteration of mental status. In a cross-sectional survey of violence against EMS staff of southeast Michigan counties, acute

mental health problems were apparent in the perpetrators of either verbal or brachial violence at the time of assaulting the EMS providers in 84.5 and 58.6 % respectively (Touriel *et al.* 2021). In another analysis, perceived psychiatric disorder was strongly predictive of violent episode during emergency response (Grange and Corbett 2002).

In more severe cases of agitation and aggressive behaviour, patient's condition may necessitate the assistance of the Police officers or even use of the mechanical and/or pharmacological restraints. Clinical practice varies among individual EMS systems concerning the use of restraints in agitated or aggressive patients (Nambiar *et al.* 2020), as no clear guidelines exist for their use, due to lack of data (McDowall *et al.* 2023).

Although several studies on pre-hospital management of agitated and aggressive patients with altered mental state provided some insights into this growing occupational hazard for EMS providers, paucity of data still exists regarding specific psychiatric diseases or symptoms associated with increased risk of verbal or brachial violence against EMS personnel. This study aims at elucidating specific clinical traits potentially increasing this risk.

## MATERIAL & METHODS

We performed a cross-sectional retrospective study of specific group of patients treated by one EMS provider organisation in the Czech Republic.

To each individual patient treated during the response to given emergency, EMS response team assigns primary diagnosis as per International Classification of Diseases by WHO. This diagnosis represents the presumed main cause of patient's current health problems, as determined by the responding EMS personnel based on all available clinical data. All consecutive patients treated by emergency response teams of EMS of Pilsen region during the period from 1<sup>st</sup> January 2021 to 31<sup>st</sup> December 2023, who had been assigned one of the preselected primary diagnoses, pertinent to altered mental state potentially linked with risk of violence were enrolled into the study. List of all considered diagnoses is shown in Table 1. No exclusion criteria were applied, only duplicate entries were excluded from further analyses.

The data were anonymously obtained from electronic patient medical records from the EMS of the Pilsen region database. Patient characteristics were described, including age, sex, consciousness level using Glasgow Coma Scale (GCS) (Teasdale and Jennett 1974, Teasdale *et al.* 1979) and severity of the emergency assessed using NACA score (Statistisches Bundesamt Wiesbaden 1968, Weiss, Bernoulli and Zollinger 2001). Each case was then evaluated in reference to medical and psychiatric history, current mental state symptoms and signs, need for the Police Officers assistance and need for mechanical or pharmaceutical restraints.

**Tab. 1.** List of primary diagnoses used for inclusion into the study

Primary diagnosis assigned to patient at given emergency incident (ICD10)		No (%)
F05.1	Delirium superimposed on dementia	1 (0.2)
F05.8	Other delirium	5 (1.2)
F05.9	Delirium, unspecified	9 (2.2)
F06.2	Organic psychotic disorder with delusions due to known physiological condition	36 (8.8)
F23.0	Acute polymorphic psychotic disorder without symptoms of schizophrenia	4 (1.0)
F23.1	Acute polymorphic psychotic disorder with symptoms of schizophrenia	3 (0.7)
F23.2	Acute schizophrenia-like psychotic disorder	16 (3.9)
F23.3	Other acute predominantly delusional psychotic disorders	50 (12.2)
F23.8	Other acute and transient psychotic disorders	62 (15.1)
F23.9	Acute and transient psychotic disorder, unspecified	32 (7.8)
F31.2	Bipolar affective disorder, current episode manic with psychotic symptoms	3 (0.7)
R41.0	Disorientation, unspecified	84 (20.5)
R44.0	Auditory hallucinations	12 (2.9)
R44.1	Visual hallucinations	10 (2.4)
R44.2	Other hallucinations	17 (4.1)
R44.3	Hallucinations, unspecified	49 (12.0)
R44.8	Other and unspecified symptoms and signs involving general sensations and perceptions	3 (0.7)
R45.0	Nervousness	1 (0.2)
R45.1	Restlessness and agitation	13 (3.2)

The effect of individual diagnoses from the psychiatric and medical history, as well as the effect of present symptoms and signs on the occurrence of violent behaviour, need for the assistance of Police officers and for the use of restraints during the emergency response was then evaluated, using linear regression model. Violent behaviour was analysed as overall violence (both verbal and brachial form), and as verbal and brachial aggression separately. Analysis was not performed for each gender separately. Sex, however, was included among the analysed parameters. All parameters of medical history and present symptoms and signs were recorded precisely and separately from electronic medical records. Similar diagnoses, as well as similar symptoms were then pooled together for the statistical analysis. Parameters with extremely low incidence would not render reliable results in used model and were therefore excluded from the analysis. Data were processed using MATLAB R2023b software (The MathWorks Inc.).

## RESULTS

During the period from 1<sup>st</sup> January 2021 to 31<sup>st</sup> December 2023, emergency response teams of EMS of Pilsen region responded to 410 emergencies with, in which treated patients were assigned one of the pre-selected primary diagnoses, pertinent to acute psychosis, delirium, delusions or hallucinations, disorientation or agitation, as shown in Table 1. The most

used primary diagnosis was “Disorientation, unspecified” (ICD10 code R41.0), other frequent diagnoses included various forms of acute psychotic disorder of unspecified hallucinations (ICD10 codes F06.2, F23.3, F23.8, F23.9 and R44.3).

216 patients (52.7 %) were men. Mean age was  $54.4 \pm 22.8$  years (mean  $\pm$  standard deviation) for the whole cohort, with men being slightly younger ( $49.5 \pm 22.1$  years) than women ( $59.9 \pm 22.3$  years). Patients' quantitative level of consciousness was evaluated as normal (GCS score of 15) by responding crew in 282 patients (68.8 %), slightly decreased (GCS score of 14) in 94 patients (22.9 %), GCS of 13 was recorded in 9 patients (2.2 %), lower GCS scores in 14 patients (4.3 %). Severity of the emergency was assessed in majority of cases as either mild to moderate (NACA score class II, 175 patients, 42.7 %) or moderate to severe, but without any threat to patient's vital signs (NACA score class III, 177 patients, 43.2 %). Only 18 patients (4.4 %) had their vital signs threatened and were assigned NACA score class IV or higher. Detailed patient characteristics is shown in Table 2.

Medical and psychiatric history was obtained from the EMS medical patient records. In 52 patients (12.7 %) medical history was not known or unavailable. 63 patients (15.4 %) had no previous ailments at the time of current emergency response. 41 patients had history of schizophrenia (10 %), 10 patients had known psychotic disorder (2.4 %), 20 patients suffered

**Tab. 2.** Patient Characteristics

Characteristic	No (%)	Value ( ± SD )
<b>Patients</b>		
Total	410 (100.0)	
Men	216 (52.7)	
Women	194 (47.3)	
<b>Age</b>		
Age min (all)		18
Age max (all)		99
Age average (all)		54.4 ± 22.8
Age min (men)		18
Age max (men)		99
Age average (men)		49.5 ± 22.1
Age min (women)		18
Age max (women)		94
Age average (women)		59.9 ± 22.3
<b>Initial GCS</b>		
unspecified	11 (2.7)	
15	282 (68.8)	
< 15	117 (28.5)	
14	94 (22.9)	
13	9 (2.2)	
12	5 (1.2)	
11	5 (1.2)	
10	3 (1.7)	
9	1 (0.2)	
<b>NACA (National Advisory Committee for Aeronautics) score</b>		
class I	40 (9.8)	
class II	175 (42.7)	
class III	177 (43.2)	
class IV	16 (3.9)	
class V	2 (0.5)	
mean		2.4 ± 0.7

from anxiety disorder, 45 from depression or bipolar disorder (4.9 and 11.0 % respectively). Alcohol or substance abuse was present in 39 patients (9.5 %). 122 patients were in outpatient care of a psychiatrist, while 18 had history of previous hospitalisation at psychiatry ward (29.8 and 4.4 % respectively).

102 patients (24.9 %) suffered from arterial hypertension, coronary artery disease and atrial fibrillation were present in 17 (4.1 %) and 15 (3.7 %) patients respectively. 43 patients had other cardiovascular condition (10.5 %). 45 patients had a history of diabetes mellitus (11.0 %), 19 patients (4.6 %) of thyroid disorder. Other medical conditions present included

**Tab. 3.** Psychiatric and medical history

Psychiatric and medical History	No (%)
not specified or unavailable	52 (12.7)
no serious ailments	63 (15.4)
schizophrenia	41 (10.0)
schizoid personality disorder	3 (0.7)
delusions	6 (1.5)
hallucinations	5 (1.2)
acute psychotic attacks	2 (0.5)
psychotic disorder	10 (2.4)
organic psychotic disorder	2 (0.5)
organic delusional disorder	5 (1.2)
anxiety disorder	20 (4.9)
depression / bipolar disorder	45 (11.0)
prior suicidal attempts or selfharm	3 (0.7)
prior alcohol or substance abuse	39 (9.5)
intellectual disability	4 (1.0)
dementia	8 (2.0)
speech impairment	2 (0.5)
history of psychiatry unit hospitalisation	18 (4.4)
in outpatient psychiatry care	122 (29.8)
history of epilepsy	28 (6.8)
extrapyramidal disorder	8 (2.0)
prior stroke	8 (2.0)
brain atrophy	1 (0.2)
other neurologic disorder	6 (1.5)
arterial hypertension	102 (24.9)
coronary artery disease	17 (4.1)
atrial fibrillation	15 (3.7)
other cardiovascular conditions	43 (10.5)
diabetes mellitus	45 (11.0)
thyroid disease	19 (4.6)
pulmonary disease	21 (5.1)
digestive disorder	23 (5.6)
chronic kidney disease	4 (1.0)
prior Covid infection	4 (1.0)

pulmonary or digestive diseases. From neurologic disorders, epilepsy was documented in 28 patients (6.8 %), incidence of others was low. Detailed history overview is shown in Table 3.

Among clinical symptoms and signs, present and recorded by medical response team during the emergency response, most common were delusions, hallucinations and disorientation, present in 168 patients (41.0 %), 130 patients (31.7 %) and 147 patients (35.9 %) respectively. Agitation was

present in 120 patients (29.3 %). Other symptoms included paranoia (63 patients, 15.4 %), anxiety or fear (36 patients, 8.8 %) or depression (38 patients, 9.3 %). 37 patients had suicidal thoughts or attempted self-harm (9.0 %), 19 patients (4.6 %) threatened to commit suicide. 88 patients were verbally aggressive (21.5 %), in 53 patients (12.9 %) given emergency escalated into brachial violence, which was directed at family members or bystanders in 47 emergencies (11.5 %) and at EMS personnel in 13 cases (3.2 %). Table 4 details present symptoms and signs.

Majority of cases was managed by paramedic emergency response team only (390 patients, 95.1 %), collaboration of paramedic crew and crew including emergency physician happened in 20 cases (4.9 %). Assistance of Police officers was utilised in 198 patients (48.3 %). Condition of 19 patients (4.6 %) warranted use of some form of restraints, with mechanical and pharmacological restraints being used in 14 cases (3.4 %) and 10 cases (2.4 %) respectively. Among sedative drugs used were diazepam, midazolam, haloperidol and levopromazine, administered either intravenously or via intramuscular route.

Neither sex showed higher propensity for neither overall violence nor verbal aggression. Female sex seemed to be associated with lower risk of brachial violence, but without statistical significance (OR 0.53, CI 0.28 – 1.03,  $p = 0.062$ ). When individual diagnoses from history and current symptoms were analysed, history of either schizophrenia, schizoid personality disorder or hallucinations did not increase risk of any aggressive behaviour. History of acute psychotic attacks, psychotic disorder, organic psychotic disorder or organic delusional disorder did significantly increase the risk of verbal aggression (OR 3.35, CI 1.09 – 10.29,  $p < 0.05$ ), but not the risk of brachial violence (OR 0.31, CI 0.04 – 2.77,  $p = 0.297$ ) or overall violence (OR 0.57, CI 0.18 – 1.80,  $p = 0.340$ ). Depression or bipolar disorder was associated with lower risk of all violence (OR 0.33, CI 0.13 – 0.79,  $p < 0.05$ ), whereas no association was found for verbal or brachial violence separately ( $p = 0.262$  and  $0.383$  respectively). Patients known to be previously or currently in the outpatient psychiatry care had significantly higher risk of overall violence (OR 2.18, CI 1.06 – 4.47,  $p < 0.05$ ), with only modest increase of risk of verbal and brachial violence separately (OR 1.17 and 1.13 respectively,  $p = 0.702$  and  $0.804$  respectively). Previous hospitalisation at the psychiatry ward increased the risk of overall violence, without reaching statistical significance (OR 2.77, CI 0.86 – 8.95,  $p = 0.089$ ), but had no clear effect on the presence of neither of the individual forms of aggression.

Among medical conditions, history of arterial hypertension was associated with lower risk of overall violence (OR 0.44, CI 0.25 – 0.80,  $p < 0.05$ ), but not of verbal or brachial violence individually ( $p = 0.203$  and  $0.363$  respectively). Same was true for epilepsy (OR 0.33, CI 0.13 – 0.87,  $p < 0.05$  for all violence,  $p = 0.650$  for verbal

**Tab. 4.** Symptoms and signs present during emergency response

Acute symptoms and signs	No (%)
delusions	168 (41.0)
hallucinations	130 (31.7)
paranoia	63 (15.4)
anxiety or fear	36 (8.8)
depression	38 (9.3)
threats of suicide	19 (4.6)
suicidal thoughts or attempts	37 (9.0)
disorientation	147 (35.9)
agitation	120 (29.3)
verbal aggression	88 (21.5)
brachial violence	53 (12.9)
brachial aggression towards family/ bystanders	47 (11.5)
brachial aggression towards EMS personnel	13 (3.2)

**Tab. 5.** Patient management features during emergency response

Patient Emergency Management	No (%)
EMS crews involved (rendez-vous system)	
paramedic crew only	390 (95.1)
crew with physician and paramedic crew	20 (4.9)
Police Officer Assistance	198 (48.3)
Use of mechanical restrains and/or sedation	19 (4.6)
mechanical restraints	14 (3.4)
pharmacological sedation	10 (2.4)
diazepam 5 mg i.m.	1 (0.2)
midazolam 5 mg i.v. or i.m.	4 (1.0)
haloperidol 5 mg i.v.	5 (1.2)
levopromazine 25 mg i.m.	2 (0.5)

and  $p = 0.784$  for brachial violence separately). History of diabetes mellitus significantly increased the risk of verbal violence (OR 3.08, CI 1.45 – 6.54,  $p < 0.05$ ), but had no effect on brachial violence separately or on all violence ( $p = 0.436$  and  $0.724$  respectively).

From symptoms and signs expressed in the behaviour of patients during given emergency response, delusions, hallucinations or paranoia had no effect on the risk of violence of the patient in any form. Anxiety and fear were associated with significantly lower risk of verbal aggression (OR 0.20, CI 0.05 – 1.10,  $p < 0.05$ ) and overall violence (OR 0.26, CI 0.08 – 0.85,  $p < 0.05$ ), while the same trend was present for brachial violence, not reaching significance (OR 0.25, CI 0.05 – 1.16,  $p = 0.0764$ ). The strongest association with increased risk of violence was found for agitation, with significant increase in the risk of overall violence (OR 7.02, CI 4.14 – 11.90,  $p < 0.05$ ), verbal aggression (OR 6.44, CI 2.51

**Tab. 6.** Association of individual clinical features with violent behaviour

	All forms of violence				Verbal aggression only				Brachial violence only			
	OR	95% CI LL	UL	p-Value	OR	95% CI LL	UL	p-Value	OR	95% CI LL	UL	p-Value
<b>Patient's history</b>												
sex	0.70	0.45	1.09	0.116	0.91	0.54	1.54	0.718	0.53	0.28	1.03	0.062
schizophrenia, schizoid personality disorder, hallucinations	0.51	0.22	1.17	0.113	1.60	0.67	3.82	0.291	0.99	0.33	2.93	0.981
acute psychotic attacks, psychotic disorder, organic psychotic disorder, organic delusional disorder	0.57	0.18	1.80	0.340	3.35	1.09	10.29	<0.05	0.31	0.04	2.77	0.297
anxiety disorder	0.63	0.21	1.87	0.410	0.43	0.10	1.74	0.234	0.44	0.05	3.61	0.441
depression / bipolar disorder	0.33	0.13	0.79	<0.05	1.71	0.67	4.36	0.262	1.64	0.54	4.95	0.383
prior alcohol or substance abuse	1.69	0.76	3.78	0.198	1.46	0.64	3.33	0.373	1.28	0.47	3.51	0.629
intellectual disability, dementia, speech impairment	1.38	0.42	4.54	0.600	2.16	0.64	7.24	0.213	2.30	0.62	8.55	0.215
history of psychiatry unit hospitalisation	2.77	0.86	8.95	0.089	1.09	0.32	3.67	0.887	0.33	0.04	2.76	0.305
in outpatient psychiatry care	2.18	1.06	4.47	<0.05	1.17	0.52	2.63	0.702	1.13	0.43	2.99	0.804
epilepsy	0.33	0.13	0.87	<0.05	0.79	0.28	2.21	0.650	1.17	0.39	3.50	0.784
all other neurologic disorders	0.62	0.21	1.76	0.366	0.92	0.30	2.81	0.879	1.17	0.30	4.51	0.825
arterial hypertension	0.44	0.25	0.80	<0.05	0.63	0.31	1.28	0.203	0.67	0.29	1.58	0.363
other cardiovasc. conditions (incl. CAD and AFib)	0.77	0.39	1.52	0.458	1.15	0.53	2.50	0.728	0.93	0.35	2.46	0.877
diabetes mellitus	0.88	0.43	1.80	0.724	3.08	1.45	6.54	<0.05	1.47	0.56	3.89	0.436
thyroid disease	0.66	0.21	2.10	0.485	1.09	0.31	3.88	0.889	1.03	0.21	5.15	0.967
pulmonary disease	0.52	0.19	1.42	0.205	0.47	0.12	1.86	0.283	0.36	0.04	2.86	0.332
digestive disorder	1.08	0.43	2.72	0.876	0.74	0.23	2.37	0.613	0.23	0.03	1.84	0.168
<b>Symptoms and signs present</b>												
delusions	1.13	0.62	2.08	0.683	1.22	0.38	1.66	0.527	0.76	0.37	1.60	0.475
hallucinations	0.66	0.36	1.22	0.184	0.71	0.23	1.06	0.278	0.48	0.22	1.05	0.065
paranoia	0.80	0.36	1.82	0.602	0.71	0.34	2.44	0.418	1.02	0.38	2.73	0.974
anxiety or fear	0.26	0.08	0.85	<0.05	0.20	0.05	1.10	<0.05	0.25	0.05	1.16	0.076
depression	1.64	0.58	4.66	0.354	1.69	0.17	2.72	0.320	0.69	0.17	2.88	0.613
threats of suicide, suicidal thoughts or attempts	0.50	0.19	1.35	0.173	0.51	0.14	1.59	0.175	0.51	0.15	1.74	0.282
disorientation	0.64	0.34	1.21	0.170	0.57	0.17	0.80	0.087	0.39	0.18	0.84	<0.05
agitation	7.02	4.14	11.90	<0.05	6.44	2.51	8.92	<0.05	4.72	2.49	8.95	<0.05

\*OR: Odds ratio, CI: confidence interval, LL: lower limit, UL: upper limit, CAD: coronary artery disease, Afib: atrial fibrillation

**Tab. 7.** Association of individual clinical features with the need for Police assistance and use of restraints

	Assistance of Police officers				Mechanical or pharmacological restraints			
	OR	95 % CI		p-Value	OR	95 % CI		p-Value
		LL	UL			LL	UL	
<b>Patient's history</b>								
sex	0.70	0.45	1.09	0.116	0.59	1.67	0.21	0.316
schizophrenia AND schizoid personality disorder AND hallucinations	0.51	0.22	1.17	0.113	1.08	6.70	0.17	0.937
acute psychotic attacks AND psychotic disorder AND organic psychotic disorder AND organic delusional disorder	0.57	0.18	1.80	0.340	0.65	7.06	0.06	0.721
anxiety disorder	0.63	0.21	1.87	0.410	1.40	13.61	0.14	0.772
depression / bipolar disorder	0.33	0.13	0.79	< 0.05	1.97	12.13	0.32	0.463
prior alcohol or substance abuse	1.69	0.76	3.78	0.198	2.64	11.88	0.59	0.207
intellectual disability AND dementia AND speech impairment	1.38	0.42	4.54	0.600	NA due to low numbers			
history of psychiatry unit hospitalisation	2.77	0.86	8.95	0.089	NA due to low numbers			
in outpatient psychiatry care	2.18	1.06	4.47	< 0.05	1.09	5.60	0.21	0.918
epilepsy	0.33	0.13	0.87	< 0.05	1.64	8.54	0.32	0.555
all other neurologic disorders	0.62	0.21	1.76	0.366	NA due to low numbers			
arterial hypertension	0.44	0.25	0.80	< 0.05	0.80	3.31	0.20	0.762
other cardiovasc. conditions (incl. CAD and atrial fibrillation)	0.77	0.39	1.52	0.458	1.44	6.59	0.31	0.642
diabetes mellitus	0.88	0.43	1.80	0.724	1.08	5.87	0.20	0.926
thyroid disease	0.66	0.21	2.10	0.485	NA due to low numbers			
pulmonary disease	0.52	0.19	1.42	0.205	NA due to low numbers			
digestive disorder	1.08	0.43	2.72	0.876	0.79	7.27	0.09	0.836
<b>Symptoms and signs present</b>								
delusions	2.09	1.28	3.42	< 0.05	1.68	0.57	4.89	0.344
hallucinations	1.07	0.66	1.75	0.782	0.51	0.13	2.00	0.335
paranoia	2.28	1.15	4.49	< 0.05	0.86	0.16	4.61	0.860
anxiety or fear	0.30	0.13	0.68	< 0.05	0.60	0.07	5.24	0.6405
depression	1.72	0.75	3.93	0.200	NA due to low numbers			
threats of suicide, suicidal thoughts or attempts	1.88	0.91	3.88	0.088	NA due to low numbers			
disorientation	0.51	0.31	0.86	< 0.05	2.11	0.74	6.01	< 0.05
agitation	2.60	1.60	4.24	< 0.05	11.02	3.49	34.80	< 0.05

"OR: Odds ratio, CI: confidence interval, LL: lower limit, UL: upper limit, CAD: coronary artery disease, Afib: atrial fibrillation

– 8.92,  $p < 0.05$ ), and brachial violence as well (OR 4.72, CI 2.49 – 8.95,  $p < 0.05$ ). Disorientation significantly decreased the risk of brachial violence (OR 0.39, CI 0.18 – 0.84,  $p < 0.05$ ), while showing trend toward decreasing the risk of verbal violence (OR 0.57, CI 0.17 – 0.80,  $p = 0.087$ ), and no effect on the risk of overall violence (OR 0.64, CI 0.34 – 1.21,  $p = 0.170$ ).

Patient's sex had no effect on the need for the assistance of Police officers or use of restraints. Presence

of depression or bipolar disorder, epilepsy and arterial hypertension in the medical history all significantly decreased the risk of need for the Police assistance (OR 0.33, CI 0.13 – 0.79, OR 0.33, CI 0.13 – 0.87, and OR 0.44, CI 0.25 – 0.80 respectively,  $p < 0.05$  for all). Being in the outpatient psychiatry care significantly increased the risk of need for the Police assistance during the emergency response (OR 2.18, CI 1.06 – 4.47,  $p < 0.05$ ), while previous psychiatry unit hospitalisation

increased this risk as well, but without reaching significance (OR 2.77, CI 0.86 – 8.95,  $p = 0.089$ ). No clear effect on the risk of restraint use was seen for any specific item of psychiatric or medical history.

While anxiety or fear, as well as disorientation significantly decreased the risk of need for Police assistance (OR 0.30, CI 0.13 – 0.68, and OR 0.51, CI 0.31 – 0.86 respectively,  $p < 0.05$  for both), delusions, paranoia and agitation had significant opposite effect (OR 2.09, CI 1.28 – 3.42, OR 2.28, CI 1.15 – 4.49, and OR 2.60, CI 1.60 – 4.24 respectively,  $p < 0.05$  for all). Threats of suicide, suicidal thoughts or attempts together increased the need for Police assistance, although the increase was not significant (OR 1.88, CI 0.91 – 3.88,  $p = 0.088$ ). The risk of need for restraint use, either mechanical or pharmacological was significantly increased in case of disorientation and agitation (OR 2.11, CI 0.74 – 6.01, and OR 11.02, CI 3.49 – 34.80 respectively,  $p < 0.05$  for both). There was no association found for other symptoms or signs.

## DISCUSSION

This study described various clinical features of patients with altered mental status in prehospital setting, with special focus on association of these features with risk of violence against EMS workers during the emergency response.

We analysed electronic medical records of Emergency Medical Service of the Pilsen region of two consecutive years. 410 emergency responses were identified with one of prespecified primary diagnoses indicating altered mental status of the treated patient.

EMS of the Pilsen region is the sole provider of prehospital emergency care in the Pilsen region, one of fourteen higher territorial administrative units within the Czech Republic, that covers an area of 7,649 km<sup>2</sup>, has 613,374 permanent residents, with population density of 80.2 inhabitants/km<sup>2</sup>. The EMS of Pilsen region is based in the city of Pilsen, administrative centre of the region, which has 194,280 inhabitants. In accordance with the legal requirements and standard of practice within the Czech Republic, EMS of Pilsen region operates in the rendez-vous mode, with two types of response teams, a paramedic-based team comprised of a driver and a paramedic, and physician-based team consisting of a paramedic and a physician. Paramedic crew is dispatched to predominant majority of all emergencies, while physician crew collaborates only in the emergencies with higher degrees of severity, i.e. when patient's vital functions are imminently threatened or already failing. Minority of cases are dealt with by physician crews only.

In our study, the percentage of physician crew involvement in the management of psychotic patients was 4.9 %, which was well correlated with the severity of patients' condition. That was measured by the NACA

score, an eight-level scale to assess severity of patient's status in the prehospital emergency care, defined by the most serious clinical state experienced at any given time during the emergency response. The NACA score is commonly used throughout the Europe in pre-hospital emergency medicine and is significantly correlated with survival (Sefrin and Sellner 1993, Bonatti *et al.* 1995). In our study, NACA score of class IV and higher, indicating direct threat to patient's vital functions and thus warranting presence of physician was recorded in 18 cases (4.4 %).

Among the 410 analysed patients, 88 (21.5 %) were verbally aggressive during the emergency response. In 53 cases (12.9 %), patient's altered mental status resulted in some form of brachial violence against either family member or EMS crew member. The ratio between verbal and physical violence was similar to that observed in previous studies (Gormley *et al.* 2016, Touriel *et al.* 2021).

In the Czech Republic, legitimate provision of the health care is only possible with patient's consent. Exceptions to this general rule are listed in the Health Services Act (Czech Republic 2011a). Situations of patient exerting signs of mental disorder, which could lead to serious health impairment if left untreated, or patient suffering from psychiatric disorder imminently endangering his own life or health of that of those around him, rank among such exceptions. According to the Emergency Medical Service Act, EMS crews are entitled to temporarily withhold the provision of prehospital health care and wait in safety for the arrival of the Police officers, if their safety cannot be assured, particularly in case of patient being disoriented and aggressive. Similar precautions are valid in the Emergency Department (Czech Republic 2011b).

Police officers assisted at the scene or during the transport to the hospital in 198 cases (48.3 %). This fact was probably one of the key factors, that kept the rate of physical violence low. Similar conclusion was arrived at in a mixed-methods study focused on preventing the violence against EMS personnel, based on the experience of EMS workers who had been the assaulted by treated patient (Maguire *et al.* 2018).

The use of restraints was low in our study. Altogether 19 patients were restrained (4.6 %), 14 patients (3.4 %) by means of mechanical restraints, 10 patients (2.4 %) by pharmacological sedation. Mechanical restraints were applied by Police officers in all cases. The only form of restraining the patient used by EMS personnel alone was pharmacological sedation. This finding is in line with results of the review of agitated patient management by Australian and New Zealand EMS providers (Nambiar *et al.* 2020). Same authors listed droperidol, midazolam and ketamine as the most frequently used sedative agents. In our study midazolam and haloperidol were the mostly used agents, while ketamine was not used. Haloperidol and droperidol belong to the same class of neuroleptic drugs, the observed difference



in their use is due to regional availability. Ketamine is not approved for sedation in agitated patients in Czech Republic (State Institute for Drug Control 2021).

No specific psychiatric diagnose was found to be predominant in our cohort. 10 % of patients were schizophrenic, 11 % suffered from depression of bipolar disorder, 9.5 % had history of alcohol or substance abuse. 29.8 % of patients were in the outpatient psychiatric care.

We tried to identify specific diagnoses or symptoms, that would predict aggressive behaviour. While presence of schizophrenia, schizoid personality disorder or hallucinations in patient's history did not increase risk of any violent behaviour, previous acute psychotic attacks or various forms of psychotic disorder did significantly increase the risk of verbal aggression, but not the risk of brachial violence. To the contrary, depression or bipolar disorder was associated with lower risk of all violence, however this effect was not preserved when verbal or brachial violence was considered separately. This finding could be explained by the clinical features of depression, among which the violence against other people is not common.

Previous or current outpatient psychiatric care significantly increased risk of overall violence, while increase of risk of verbal and brachial violence separately was only modest and not significant. Previous hospitalisation at the psychiatry ward tended to increase the risk of overall violence but without statistical significance. Of note, there were no data available on previous aggressive behaviour of patients in our cohort.

Among medical conditions, history of arterial hypertension was associated with significantly lower risk of overall violence, with the same trend for verbal or brachial violence individually. This finding is supported by a study of medical conditions in restrained delirant and aggressive patients, in which the presence of hypertension was observed in small minority of cases (Strote et al. 2014). Among other medical conditions, epilepsy was also significantly associated with decreased risk for overall violence, with similar trend for both verbal and brachial violence individually. History of diabetes mellitus significantly increased the risk of verbal violence, but had no effect on brachial violence separately or on all violence.

During the emergency response patients were recorded to exhibit various symptoms, the most common being delusions (41 %), disorientation (35.9 %), hallucinations (31.7 %) and agitation (29.3 %). While the presence of delusions was found to be a risk factor for violent behavior in patients with schizophrenia in study of Soyka and Morhart-Klute (2002), in our study occurrence of delusions was not associated with violence, despite being quite common. The incidence of hallucinations was rather high in our study, especially when compared with that of most likely causal diagnoses. Given the observational design

of our study, it can be assumed that not all potential underlying psychiatric pathologies were recorded. One of potential explanations might be presence of some other disorder, such as borderline personality disorder, for which speaks also the number of reported threatened suicides (Kantor et al. 2022). Hallucinations however did not increase the risk for violence. Disorientation was associated with risk reduction of both verbal and brachial violence, with the association being significant for the latter. Anxiety and fear significantly reduced the risk of overall and verbal violence, with trend for reduction of brachial violence. Agitation was the only symptom, that significantly increased the risk of violence, consistently for overall violence and for both forms individually. Similar results were observed by Weiss et al. in whose study agitation was among the most significant predictors for pharmacological restraint use due to aggressivity and violence (Weiss et al. 2012).

Assistance of Police officers plays an important role in ensuring the safety of EMS workers while responding to aggressive or violent patients (Furin et al. 2015, Maguire et al. 2017, Maguire et al. 2018b, Nambiar et al. 2020). In our study, Police officers assisted the EMS response in slightly less than half of all emergency responses. Only minority of cases led to use of mechanical or pharmacological restraints. Being in outpatient psychiatric care was significantly associated with increased risk of need for Police assistance, which is in concurrence with the fact, that it significantly increased the risk of overall violence. Other factors significantly increasing the need for Police assistance included presence of delusions, paranoia and agitation. Disorientation and anxiety and fear were associated with decreased need for the assistance of Police officers, again in accordance with their association with decreased violence risk. Only agitation and disorientation increased the risk of restraint use, however these findings must be evaluated with caution due to small number of cases.

Despite copious research on violence against EMS workers, identifying patients as the most frequent perpetrators of such violence, dearth of data exists related to patients with agitated and aggressive behaviour due to mental disorders as cause for such violence. Even less is known about individual clinical predictors of violence in such patients. This study brings first insights into this relevant topic, identifying some of clinical features that may lead to patient's violence and could therefore be used as warning red-flags for EMS workers.

There are various limitations of this study, that may affect its results and conclusions. This study was retrospective in nature. Data were obtained from one EMS provider in the Czech Republic. It represents the real-world practice, but the sample size is limited. Prespecified list of relevant primary diagnoses reflecting the focus on patients with acute psychotic

condition was used, which helped to create more homogenous group of patients, but it defined the sample size and could lead to selection bias. Further studies based on unselected patient pool could help to further validate and support our findings. Another limitation arises from the data collection method. Our data were collected from electronic medical records and as such are dependent on the subjective patient evaluation by responding crew. Full access to complete patient medical history was not available in all patients, which was duly reported. Our analyses are based on the available data.

This study illustrates the complexity of prehospital care for patients with alteration of mental status and aggressive behaviour. Some clinical features present in the patient during the emergency response seem to indicate increased risk of violence. There is a need for the development of strategies mitigating ensuing risks to EMS personnel. Of note, patient's violent behaviour might have serious consequences not only for EMS workers, but also for the patient himself or for the persons the patient is accompanied by. Violent episodes can further promote patient's stigma and self-stigma accompanying mental disorders, especially schizophrenia and psychotic disorders. These can worsen the course of disease and limit success of the treatment (Ociskova *et al.* 2023).

Therefore, in concurrence with Nambiar *et al.* (2022), McDowall *et al.* (2023) and other authors, we believe that future research in the assessment and evaluation of agitated and violent patients in prehospital setting is warranted, in order to optimise the management strategies and mitigate risks for the EMS workers.

## STATISTICS

MATLAB R2024b (Statistics and Machine learning toolbox) was used for statistical analysis of the results (The MathWorks Inc. 2023). To maintain statistical stability and reliability of the analysis results, categories with frequencies less than or equal to 5 were merged or excluded from the analysis. The effect of independent variables (diagnosis or symptoms) on dependent variables (e.g., brachial aggression) was analysed using generalized linear models (GLM) modified for the binomial data. The odds ratio (OR) and statistical significance ( $p$ -value) of the effect of independent variables were calculated from the coefficient estimates ( $\hat{\beta}$ ) of GLM using the Wald test. The 95% confidence intervals (CI) for the OR were calculated using the coefficient estimates and their standard errors (SE). Specifically, the confidence intervals (CI) for the logit coefficients were computed as  $CI = \hat{\beta} \pm 1,96 \times SE(\hat{\beta})$ , and these intervals were exponentiated to obtain the OR confidence intervals. This approach accounts for the uncertainty in the estimated OR derived from the GLM. All then  $p$ -values were double-tailed and the significance level was 0,05.

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