The rate and predictors of violence against EMS personnel

Jani Paulin[1*] , Mari Lahti[1] , Heikki Riihimäki[2], Joonas Hänninen[3], Tero Vesanen[4], Mari Koivisto[4] and Laura-Maria Peltonen[4,5,6]

Abstract

Background Violence against Emergency Medical Services (EMS) personnel vary between studies. Current studies are mainly based on self-reporting, thus other designs are needed to provide more perspective. The purpose of this study was to explore the rate and predictors of violent behavior targeted at EMS personnel by exploring the Electronic patient care records (ePCR) documentation by EMS personnel.

Methods This was a retrospective cohort study of EMS patients in Finland. The data were collected from three regions between 1st June and 30th November 2018. Text mining and manual evaluation were used to identify and explore predictors of violence targeted at EMS personnel from the ePCR narratives. Multivariable logistic regressions were used to determine factors that were independently associated with violent behavior. The results are presented with odds ratios (ORs) with 95% confidence intervals (CIs).

Results The EMS personnel reported experiences of violence in a total of 297 identified missions (0.7%) of all EMS missions ($n = 40,263$). The violence was mostly verbal (62.3%) and the most common violence perpetrator was the patient (98.0%). The police were alarmed to many missions where violence was reported (40.7%). Sometimes violence occurred suddenly although the police were present. The multivariable logistic regression model indicates that violence occurred typically in urban areas (OR 1.699; 95% CI 1.283 to 2.248), at weekend nights (OR 1.357; 95% CI 1.043 to 1.765), by male (OR 1.501; 95% CI 1.160 to 1.942), and patients influenced by alcohol (OR 3.464; 95% CI 2.644 to 4.538). A NEWS2 score of 3 in any parameter (vs. score 0–4, OR 2.386; 95% CI: 1.788 to 3.185) and ALS unit type (vs. BLS, OR 1.373; 95% CI: 1.009 to 1.866) increased the likelihood as well.

Conclusions The documentation in ePCRs show low rates of violence targeted at EMS personnel. However, violence is a multidimensional phenomenon connected to unfamiliar patients, rushed situations, and an uncontrolled environment. This means that the EMS personnels' safety cannot be ensured in all situations. Therefore, a balance between safety margins and treating patients needs to be considered.

Keywords Prehospital emergency care, Emergency medical services, Violence, Violent behavior, Safety

*Correspondence:
Jani Paulin
jani.paulin@utu.fi
[1]Turku University of Applied Sciences and University of Turku, Turku, Finland
[2]The Wellbeing Services County of Southwest Finland, Turku University of Applied Sciences, Turku, Finland
[3]Southwest Finland Emergency Services, Turku, Finland
[4]University of Turku, Turku, Finland
[5]University of Eastern Finland, Kuopio, Finland
[6]Turku and Wellbeing Services County of Southwest Finland, Turku, Finland

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Background

Workplace violence against healthcare personnel is a globally recognized challenge [1, 2], which lacks optimal solutions [3]. Recent studies highlight that there is a need to develop strategies to protect professionals, along with targeted public policies to prevent workplace violence [4, 5]. In prehospital emergency care, the occurrence of violence against Emergency Medical Services (EMS) personnel varies between studies [6]. For example, in the USA over two-thirds of the personnel have experienced violence during the last year [7]. In Australia, the corresponding number was 75% [8], in Britain 27.6% [9], and in Sweden 64% [10]. A review reported that the career prevalence of experiences of violence can vary from 57 to 93% [6]. Workplace violence is a major burden on the health care sector and it leads to high costs. In 2016, treating and preventing worker injuries added an estimated $429 million in both direct and indirect costs to the US health systems [11].

The World Health Organisation (WHO) divides violence into physical and psychological violence [12], but in the context of prehospital emergency care, concept analyses and standardized definitions are still missing [6]. In this study, violence refers to physical, verbal, or sexual misbehavior against EMS personnel. Verbal abuse includes aggressive behavior and threats, for example. Property damages are not independently included, because these cases (for example kicking the ambulance) often include other violent behavior like physical or verbal aggression, and therefore presumably already included in the analyses [6].

The EMS personnel operate in an unpredictable and ever-changing environment with hectic and rushed situations [8]. The core is to treat critically ill or injured high-risk patients, but missions also include non-critical care and care for general acute patients [13]. Globally, the number of missions and overall pressure on EMS have increased and are explained by a centralization of health care facilities, limited access to primary health care, an aging population and a lack of social support [14].

The associations between a violent emergency call and violent behavior targeted at the EMS at the scene is unclear [6]. When presented with a mission, EMS personnel may not be informed of a risk of violent behavior at dispatch due to insufficient background information, which makes it difficult for the personnel to prepare for these situations appropriately [15]. While patients are the most common perpetrators of the violence, there is evidence that the patient's family members and friends, as well as bystanders may engage in violence [7, 16–18]. Violent behavior is more likely to occur in urban areas [7], and when attending drug or alcohol intoxicated patients. Additionally, an altered mental status such as diabetes, trauma, dementia and delirium also increase

the probability of violent behavior [6]. However, violence in prehospital emergency care is still fairly unexplored and violent encounters have been seen to be underreported [15, 19, 20].

Violence against EMS personnel lead to serious consequences. Approximately half of the experienced personnel have showed posttraumatic symptoms related to re-experiencing, avoidance and emotional numbing [21], also posttraumatic stress disorder (PTSD), depression and anxiety have been reported [22], as well as a decreased empathy towards patients [6]. Furthermore, violence at work tend to increase missed workdays for EMS personnel, which leads to economic consequences [23].

Finally, violence in prehospital emergency care needs greater consideration. Systems have been developed for the monitoring of violence, but these are not comprehensive enough to provide information of the risk of violence at dispatch. Prior research related to violent behavior targeted at EMS personnel is mainly descriptive and based on data collected with questionnaires or data self-reported methods. According to a recent review, more studies are needed with more rigorous study designs to deepen the understanding of this phenomenon [6] and develop means to systematically monitor the prevalence and quality of violent encounters at work. Prior analyses on data in electronic patient care records (ePCR) have shown a potential to provide valuable insights into understanding violence targeted at EMS personnel [24, 25]. This study aims to identify the nature, rate and predictors of violent behavior targeted at EMS personnel as displayed in the (ePCR) to expand knowledge for the development of robust systems to automatize the identification and risk assessment of violent missions in prehospital emergency care.

Methods

Design

This is a retrospective cohort study.

EMS in Finland

Prehospital emergency care is organized by the wellbeing services counties responsible for care provision based on the legislation in Finland. These counties arrange the EMS independently or in cooperation with fire services. The EMS may also be outsourced to a certain extent by the county to private operators: situation centres, EMS physicians and operative leaders must be public services. Nevertheless, EMS are required to be equal and accessible to all and these services must integrate firmly into in-hospital emergency and primary health care acute services.

The EMS system is four-tiered in Finland. The first level is a first response unit capable of basic first aid with

specific equipment, such as a defibrillator. The first level EMS operators are mainly authorities or volunteer organizations with main focus other than EMS, such as fire departments, sea rescue, border guard or police. The second level is a Basic Life Support (BLS) unit staffed with two basic level paramedics capable of basic life support and patient transportation. One of these basic level paramedics can be a firefighter with a Finnish degree in rescue services. The third level is an Advanced Life Support (ALS) unit staffed with at least one paramedic-nurse, although all transporting units are staffed with two paramedic-nurses or with a paramedic-nurse and a basic level paramedic. The fourth level is an EMS physician unit. This is commonly operated with a helicopter emergency medical services (HEMS) unit. The EMS physician unit also provides on-call consultation to other EMS units. The field Supervisor and Community Paramedic units staffed with paramedic-nurses may be utilized in local EMS systems based on service needs assessments.

The EMS in Finland is dispatched by the Emergency Response Center Agency, which operates the national emergency number 112. An EMS unit is dispatched according to the wellbeing services counties EMS guidelines with slight variance across the country. All EMS missions are classified into priority classes A-D: Class A being the most acute with an immediate response need, while the acuity class D mission requires EMS assessment within two hours. Related to EMS unit alarms, the police maintains a database of persons with previous violent behavior targeted at EMS personnel that may present a risk to the personnel in future EMS missions. This data is relayed automatically by the ERC to the EMS unit responding to a mission, if a risk person is identified during the emergency call, or if the mission address creates a hit in the automatic database search. However, this information is often irrelevant. For example, in the case of large apartment buildings, when exact risk-address information is missing, the entire building becomes a risk target.

Paramedic-nurses are the backbone of the Finnish EMS system. The education of a paramedic-nurse is a university-level bachelor's degree that provides a strong foundation for independent fieldwork in the EMS. The education covers patient assessment with a wide range of illnesses and trauma, advanced level life support (ALS), and patient stabilization. The students are also trained to provide self-care instructions and direct patients to other acute or non-acute health and social services if the conveyance is not necessary per the EMS assessment [26]. Mental health emergencies and illnesses and violent behavior prevention are also covered in the paramedic-nurses' curriculum.

Data

Data were collected between 1.6.2018–30.11.2018 from an area of three out of twenty-one wellbeing services counties in Finland (Fig. 1) covering both rural and urban settings. This data set covered about 8.8% of the Finnish population in 2018 with 482,805 inhabitants (26.1 people per square kilometer). The data set is based on EMS missions documented by EMS personnel and extracted from the three wellbeing services counties ePCR systems. The data is multimodal and consist of variables related to the EMS missions (e.g. different time variables, dispatch priority and code, address, conveyance or non-conveyance code), and the patient (vital signs, blood pressure, pulse, breathing rate etc.), but also narrative texts describing the case, the patient's status, previous diseases and medication, treatment, additional information, and the reasoning for the mission. Additionally, in one study area, there is a field with selectable structured information (yes or no) on whether the patient is violent, but only few have been filled. The data set al.so includes a specific description of an urban-rural classification, the International Classification of Primary Care (adjusted ICPC2 codes / main reason for care), the National Early Warning Score (NEWS2), which is a widely adopted simple scoring system for clinical deterioration detection, and measurements of alcohol usage [13].

Descriptive information of EMS missions

Detailed characteristics of the included EMS missions in the data set (n=40,263) (Fig. 1) have been reported previously [13]. Briefly described, a total of 64% of the missions occurred in urban areas. 72% of the missions were operated by ALS units and 28% by BLS units. A physician was on the scene in 0.7% of the missions and 29% of the missions were urgent using lights and sirens. The patients' median age was 71 (IQR 51–82) and 51.6% of them were female. The NEWS2-scores were low (median 1, IQR 0–2), and 10.0% of the patients were under the influence of alcohol. Most of the patients (71.7%) had only one mission during the study period, but some patients had several missions.

Text mining

In this study, an iterative process was used to identify from the data set all missions documented where violence was targeted at the EMS personnel. A set of keywords provided by domain experts based on clinical experience was used to screen through the data. The keywords were made into regular expression patterns, which would encompass all inflectional forms of the words, to identify and extract relevant mentions from the free-text fields.

At first there was only one list of keywords related to violence, but it provided too many false positives, as it
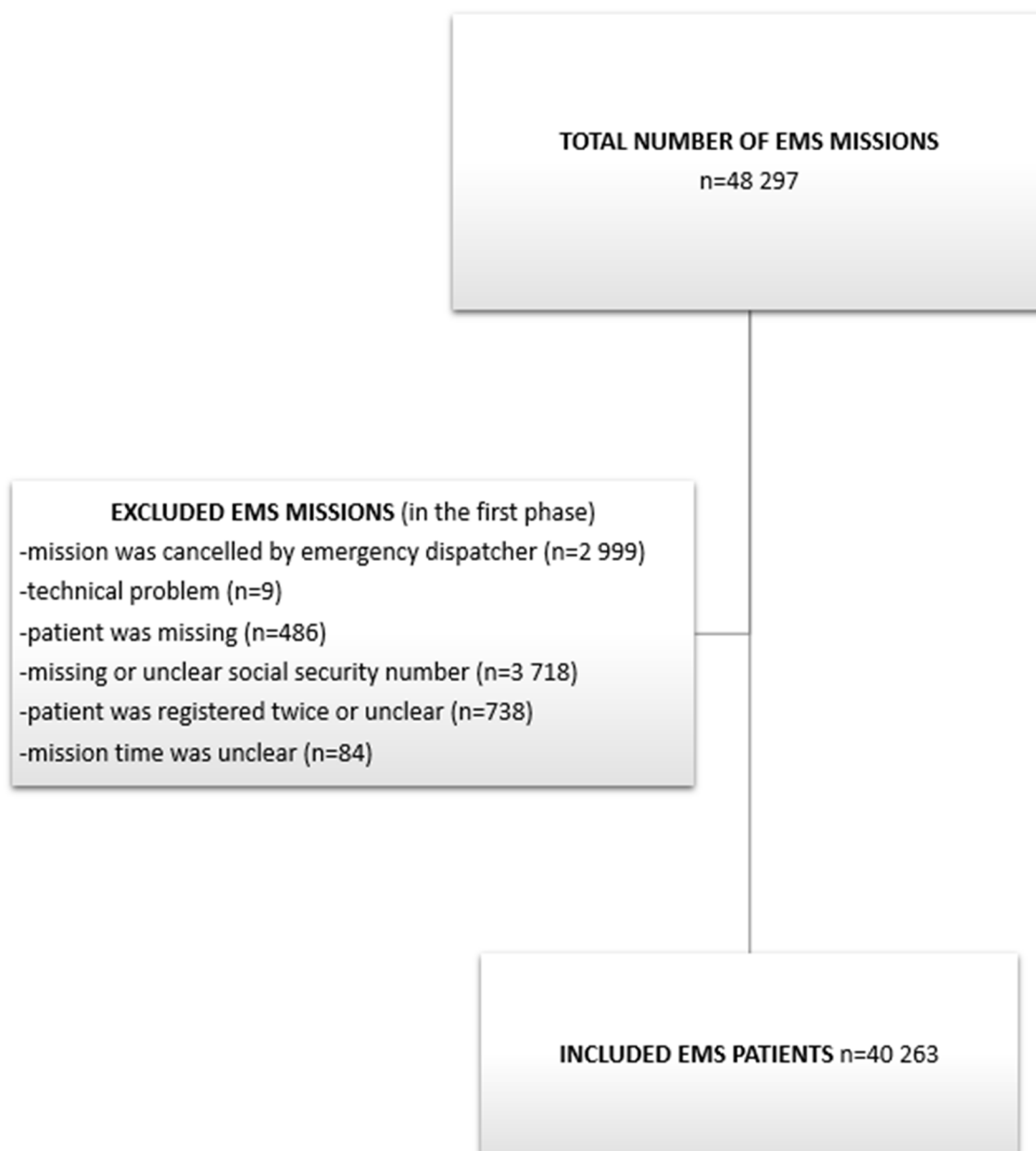
TOTAL NUMBER OF EMS MISSIONS
n=48 297

EXCLUDED EMS MISSIONS (in the first phase)
-mission was cancelled by emergency dispatcher (n=2 999)
-technical problem (n=9)
-patient was missing (n=486)
-missing or unclear social security number (n=3 718)
-patient was registered twice or unclear (n=738)
-mission time was unclear (n=84)

INCLUDED EMS PATIENTS n=40 263

Fig. 1 Flow chart

would find all mentions using the keywords, e.g. "…heart beating rapidly…" would be picked up. This original keyword list was then split into two, one screened the data with those keywords that functioned well while the other combined the keywords that picked up many false positives with the object of violence (EMS personnel) in the same sentence to reduce the number of false positives. The only manual exclusion used was for a structural field related to violence in the ePCR (Is the patient violent? Yes/No) where a negative answer would discard the entry.

The screening results included two lists:

A. Matches using the list with selected keywords (21 words, $n = 1245$, pos. 281).
B. Matches combining the object in the sentence using the keywords (66 words, $n = 89$, pos. 61).

As a result of the screening, list B had 16 positive findings that weren't in list A, resulting in a total of 297 identified positive cases of violence targeted at EMS personnel.

This data was then analyzed manually by one researcher (HR) who extracted the following information related to the identified cases: (1) Was the case related to violence against EMS personnel? (2) Was the violence physical,

verbal, or sexual? (3) Was the violence perpetrator the patient, family member, or a bystander? (4) Where did the violence occur? (5) Were the police at the scene? (6) Was the violence directed to other parties? Whether the case was unclear, it was discussed in the research group. Also, if essential information was missing, the case was left unclear and excluded from the analyses.

Data analysis

Categorical variables are presented with frequencies and percentages, and continuous variables with medians and IQRs (interquartile range). The age groups were defined according to the Finnish national classification provided by Statistics Finland. Univariate associations between violence cases and study variables were studied using logistic regression analysis. The multiple logistic regression analysis included statistically significant variables (based on univariate analysis), which were clinically relevant according to the literature (urban – rural classification, EMS arrival time, gender, and usage of alcohol).

Table 1 Characteristics of EMS missions related to violent behavior (n=297)

	Missing	n	%
Mission priority			
A		17	5.7
B		70	23.6
C		95	32.0
D		115	38.7
EMS units			
ALS		247	83.2
BLS		49	16.5
Community Paramedic		1	0.3
Field Supervisor		0	0.0
Weekday			
Monday		33	11.1
Tuesday		41	13.8
Wednesday		38	12.8
Thursday		41	13.8
Friday		48	16.2
Saturday		65	21.9
Sunday		31	10.4
EMS arrival time			
08:00–20.00		182	61.3
20:00–08:00		115	38.7
Urban–rural classification	35		
Urban area		196	74.8
Rural area		66	25.2
Distance to nearest health care facility	35		
<5 km		71	27.1
5–20 km		112	42.8
21–40 km		48	18.3
>40 km		31	11.8
Median distance 7 km, IQR 5–25			
Mission duration: median 72 min., IQR 53–104			

The results are presented with odds ratios (OR) together with 95% confidence intervals (CIs) and p-values, where p-values<0.05 are considered significant. Statistical analyses were done with SAS for Windows version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

Overall, a total of 48 297 missions were identified: the highest priority A was recorded for 4 615 missions, immediate priority B in 10 941 missions, priority C in 18 054 missions, and the lowest priority D in 14 560 missions. A total of 8034 missions were excluded due to e.g., a mission cancellation by the dispatcher, or a missing or an erroneous social security number. Of all analyzed EMS missions (n=40,263) (Fig. 1), the keyword-based text mining approach identified a total of 1,334 missions (two searches: n=89 and n=1245), but the manual evaluation showed that the EMS personnel was faced by violence only in 297 of these missions (22.2%), which equals to 0.7% of all EMS missions. Of these missions related to violence, 29.3% were urgent using lights and sirens, 74.8% occurred in urban areas, 83.2% were performed by ALS units, and one of three (35.9%) ended with a non-conveyance decision, in which 12.9% of the patients were handed over to the police (Table 1).

The violence was mostly verbal (n=185, 62.3%), but also physical violence (n=72, 24.2%), and a combination of both (n=39, 13.1%) was documented. In one mission, sexual, physical, and verbal violence were reported to occur together (0.3%). The patient was the most common violence perpetrator (n=291, 98.0%), but also family members (n=3, 1.0%), and bystanders (n=3, 1.0%), behaved violently. The violence occurred most often at home or at another's residence (n=103, 34.7%), in the ambulance (n=46, 15.5%), at a health care facility (n=59, 19.9%), and in public places (n=51, 17.2%). EMS personnel also documented that violence occurred in jail (n=7, 2.4%) and sometimes in several places during one mission (n=14, 4.7%) (e.g. in the ambulance and the health care facility). The location for where the violence occurred was unclear in seventeen cases (5.7%). Overall, in the reported 121 missions (40.7%) where violent behavior was targeted at the EMS personnel, the police were in attendance in the mission (EMS personnel called the police after the violence occurred or vice versa or the EMS personnel and the police were present when the violence occurred). In addition to the violence targeted at the EMS personnel in these missions, also the police (n=27, 9.1%), the nurses (n=26, 8.8%), both police and nurses (n=5, 1.7%), and relatives (n=4, 1.3%) faced violence during the missions.

Of the violently behaving patients, 3.4% were <15 years of age, 62.0% were aged between 15 and 64, 24.9% were between 65 and 84, and 9.8% were over the age of 85. The

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median age was 53 (IQR 31–71) and the patients were mostly men (62.6%). The NEWS2 scores were low (score 0–4: $n=200$, 71.2%), but one out of five patients ($n=61$, 21.7%) had a score of three for any parameter. Around 7.1% ($n=20$) of the patients had an aggregate score of 5–6 or 7 or more. The median NEWS2 score was one point (IQR 0–3, missing 16). The most common ICPC2 codes, which indicates the patient's work diagnosis chosen by the EMS personnel, were psychological symptom/complaint other ($n=66$, 24.4%), acute alcohol abuse ($n=49$, 18.1%), weakness/tiredness, general ($n=24$, 8.9%), head trauma ($n=13$, 4.8%), psychosis ($n=13$, 4.8%), and no disease ($n=13$, 4.8%). The patient's main problem was related to an assault or a harmful event in four cases (1.5%). Overall, 30.3% of the patients were under the influence of alcohol.

The multivariable logistic regression model showed that an urban area (OR 1.699; 95% CI 1.283 to 2.248), an EMS night-time arrival between Friday and Saturday (OR 1.357; 95% CI 1.043 to 1.765), male gender (OR 1.501; 95% CI 1.160 to 1.942), and whether the patient had used alcohol (OR 3.464; 95% CI 2.644 to 4.538), were associated with violence against EMS personnel (Table 2). Also, the univariate analyses indicated that the ALS unit type (ALS vs. BLS, OR 1.373; 95% CI: 1.009 to 1.866) and patients age between 15 and 64 (15–64 vs. 65–84, OR 2.75; 95% CI: 2.10 to 3.60 and 15–64 vs.>85 (OR 3.32; 95% CI: 2.24 to 4.91) increased the likelihood of violent behavior. Also, a patient's NEWS2 score of three for any parameter (vs. score 0–4, OR 2.386; 95% CI: 1.788 to 3.185) increased the probability of violence. However, the mission priority (p-value=≥0.929), and an increase in the patient's NEWS2 score by one point (p-value=≥0.734), were not related to violence.

Discussion

The main findings of this study were as follows. Firstly, missions where EMS personnel had documented experienced violence were only found in 0.7% of all missions in the data set. Secondly, documentation of experienced violence was found even when the police were present on the mission. Thirdly, violent behavior typically occurred in an urban area at weekend nights by male perpetrators who were under the influence of alcohol. Respectively, mental health problems seemed to be common, but also high NEWS2 scores and clinical deterioration were related to the documented violent behavior.

Our study demonstrated that violence was reported in less than 1% of EMS missions. The number seems smaller when compared to other studies, but notably, a lack of more diverse study designs have been recognized as most studies in the area are based on self-reported data collected with questionnaires on experienced violence, which makes a more in depth comparison challenging [6]. However, our results are similar to a recent study done in Sweden [27] and an older one exploring ambulance records [28] as well as a meta-analysis from the emergency department setting [29], but our prevalence is smaller when compared to a registry study from the USA [30] with a much smaller sample size. An Australian study, which was based on ambulance data, found that if the mission was related to substance use, the prevalence of violence was 5.76% [25]. It is noteworthy, as mentioned before, that violent behavior is not necessarily always reported or documented [15, 19, 20]. Thus, there is a possibility that the real prevalence is higher than reported.

This study shows that the violence against EMS personnel was mostly verbal (62.3%), or physical (24.2%), or both (13.1%). These numbers are roughly similar when compared to previous studies [6, 7, 16, 18]. Previous studies showed that violence cases are not necessarily reported, because violence is thought to be "a part of the job" and reporting processes may be perceived as burdensome [6, 20]. Our study indicates a possibility of underreporting, as one case identified was related to sexual violence, which is less than typically reported in health care in general [1]. One explanation may be, a change in culture and that sexual violence nowadays receives more attention across settings, although a Canadian study highlighted a much higher prevalence of sexual violence in prehospital

Table 2 Multivariable logistic regression model of violence predictors ($n=297$)

	Missing	Univariate			Multivariate		
		OR	95% CI	p	OR	95% CI	p
Rural	35	1.000					
Urban	35	1.660	1.255–2.197	<0.001	1.699	1.283–2.248	0.002
EMS arrival time							
Sunday 05.00–Friday 18.00		1.000					
Friday 18.00–Sunday 05.00		1.659	1.299–2.120	<0.001	1.357	1.043–1.765	<0.023
Gender female		1.000					
male		1.794	1.417–2.271	<0.001	1.501	1.160–1.942	<0.002
No alcohol		1.000					
Alcohol		3.973	3.095-5.100	<0.001	3.464	2.644–4.538	<0.001

Likelihood ratio: Chi-Square 120.9, p-value<0.0001

emergency care when compared to our study already ten years ago [16]. Thus, more studies are needed to explore the forms of violence and interventions on how to prevent them.

Our data revealed that a patient is the most common perpetrator of violent behavior targeted at the EMS personnel (98.0%), which is more than other studies have reported, where non-patients were highlighted as a more common perpetrator [7, 10, 16, 17]. The location where the violence occurred was mostly at the patient's home, or another apartment, but one out of five cases occurred in health care facilities. Clearly, the nature of reported violence differs between situations involving illicit drug users, which pose significant risks to EMS personnel, and those involving elderly patients in residential care homes, who are often in more stable conditions. In some cases, hazard flags indicating previous violent behavior are known to the EMS personnel in advance [20], but the evidence of the violent behavior and the history of the violence is not always clear [6]. The police were involved in over 40% of the missions where violence occurred, but in some cases sudden violence still occurred although the police were present on the mission. Clearly, violence in any form is not acceptable, but it seems that even the police cannot ensure 100% safety of the EMS personnel [6]. Moreover, the violence was targeted at the EMS personnel, but also towards police, nurses, and relatives during the missions. In some cases, the violence was also repeated many times, and in different settings during the care pathway like at home and in an ambulance in the same mission.

Our multivariable logistic regression model (Table 2) and previous studies [7, 25] indicate that violent behavior was more likely to occur in urban areas instead rural, at Friday or Saturday nights, and when the patient was male and had used alcohol. Our results also indicate that approximately half of the work diagnoses chosen by the EMS personnel (adjusted ICPC2) were related to mental health problems, which partly explain these findings. Surprisingly, drug abuse was not among the most common codes, as has been in previously reported studies related to violence [17]. However, an altered mental status was commonly recognized as a violence predictor [10, 16]. On the other hand, our study demonstrates, based on univariate analyses, that abnormal vital signs (a NEWS2 score of three in any parameter vs. score 0–4) increased the likelihood of violent behavior. This finding is consistent with a review, which reported that a patient's medical status (for example trauma) was associated with violence [6].

This study shows that the personnel in ALS-units faced more likely violence compared to the personnel BLS in units. Other studies have reported that paramedics had higher odds than firefighters of experiencing violence

[6, 15]. This increased risk has been simply explained, for example, that paramedics spend more time providing patient care. On the other hand, ALS units face more high acute patients like head trauma and patients with significantly altered level of consciousness, for instance, which can increase the risk of violence. However, this fact may also be explained by better documentation, maybe higher education and better competence improves the quality of documentation. On the other hand, rescue services are very physical and maybe the firefighters' experience of threat may differ from that of paramedic-nurses. Hence, further studies are needed to explore the perceptions of violence experienced by personnel with different backgrounds.

As mentioned above, violence has serious consequences to professionals and the health system. Thus, solutions are still needed to reduce the incidence of workplace violence. Taylor et al. (2016) argued that there is a lack of knowledge and skills on how to prevent violence in prehospital emergency care, although mitigation strategies have been developed [4, 15]. Grossman et al. (2019) suggests that new regulations and guidelines are needed to create occupational safety standards for workplaces, as current voluntary guidelines lead to inconsistent implementation of preventive measures [11]. Notably, ePCRs are not primarily designed for scientific research, but this study indicates that the EMS personnels' documentation can be a rich source of information for exploring the experiences of violence targeted at EMS personnel through routinely collected data. Furthermore, as there currently is a lack of ICPC2 codes specifically describing a patient's violent behavior towards EMS personnel, it is necessary to develop such codes that may be used for the systematic evaluation of its occurrence. In the present system only one adjusted ICPC2 code is related to an assault or a harmful event as a patient's main problem, but this does not specify a patient's violent behavior. However, the ePCRs, documentation guidelines and the quality of documentation require attention to ensure reliable results. But still, the information is based on the EMS personnel willingness to document with high quality.

This study shows that violence against EMS personnel is rare, but not random and must be addressed by the EMS organizations. In Finland, stab/bulletproof vests are worn by EMS personnel in high-risk missions and a radio distress call button provides a way to alert the police in case of sudden violence. Pepper spray or defensive combat sport training is occasionally suggested, but many fear that physical response may lead to a vicious circle of increasing violence against the EMS. Therefore, preventive training, such as those improving readiness to observe behavioral violence warning signs, is increasing. Gormley et al. (2016) highlighted that unmarried EMS

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personnel experienced more of each type of violence when compared to married personnel [7]. Correspondingly, according to Gillespie et al. (2010) married personnel are maybe more used to working with others to obtain a mutual understanding of an issue [31]. If there is a lack of knowledge and skills, it may be possible that the EMS personnels' inappropriate behavior provokes violent behavior, while on the other hand competent professionals may be able to prevent situations from escalating. However, real-time observation with body-worn cameras, for example, would enable a more reliable research setup to explore what predicts these cases [4]. Therefore, more studies are needed on means to understand how these situations develop and how they may be prevented.

Limitations

This study has limitations, in which excluded patients, NEWS2 points, and adjusted ICPC2 codes were described in previous study [13]. The overall data set was big, but a few years old. Despite several test searches and the carefully made word lists, it may still be that some information was missed. Moreover, the data set consisted of information documented by EMS personnel, but as mentioned before, not all violence is documented and reported forward by the personnel, so cases may have been missed due to the research design, and hence future research should explore the occurrence with other approaches.

The narrative texts of ePCRs are difficult to analyze computationally due to the Finnish language expressions (many inflections), shortness of texts (typically only few sentences in different sections like case info, status, patient medication and history, and treatment) and number of abbreviations [32]. Future work could assess the possibilities of more advanced methods, such as Large Language Models for better identification. This would however require the model to be available for use in a safe computing environment, where patient data may safely be handled [33]. However, we manually analyzed 1000 missions that were screened by our text mining approach and could not find any new cases that would have been missed by our search, which increases the reliability of our results to provide a comprehensive description of the missions.

A further perspective to acknowledge is that EMS personnel's education and practices in prehospital emergency care vary between countries and we did not compare different areas in this study, where, understandably, patients and treatment practices differ as well. Thus, generalization of the results may be limited.

Conclusions

In this study, the violence against EMS personnel was rarely documented in the ePCR. This raises the question, is it rare, or is it just underreported. However, this study showed that violence, in the context of prehospital emergency care, is a multifaceted phenomenon, of which type, location, participants, and predictors vary. This combined with unknown patients, rushed situations, and uncontrolled environments indicates that ensuring the EMS personnel's safety in all situations is not possible. Thus, the balance between safety margins and treating the patient needs to be considered. More studies are needed especially to explore how to monitor, evaluate and support safe work environments to understand the reasons of violence against EMS personnel, and to develop new safety regulations and guidelines for occupational safety standards for workplaces.

Abbreviations
EMS   Emergency medical services
ALS   Advanced Life Support
BLS   Basic Life Support
NEWS2   National Early Warning Score

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12873-024-01116-5.

Supplementary Material 1

Data availability
Due to patients' privacy, the data are not publicly available.

Declarations

Ethics approval and consent to participate
The Ethics Committee of the Hospital District of Southwest Finland (Approval no: DNRO: 70 /1802/2018) provided ethical approval. The use of patient identifiable data was obtained from the Finnish Institute for Health and Welfare, and Finnish Social and Health Data Permit Authority.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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