


Violence against emergency medical services personnel: A systematic review of the literature

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Background: Violence against emergency medical services (EMS) personnel is a growing concern. The aim of this systematic review is to synthesize the current literature on violence against EMS personnel.

Methods: We examined literature from 2000 to 2016. Eligibility criteria included English-language, peer-reviewed studies of EMS personnel that described violence or assaults. Sixteen searches identified 2655 studies; 25 studies from nine countries met the inclusion criteria.

Results: The evidence from this review demonstrates that violence is a common risk for EMS personnel. We identified three critical topic areas: changes in risk over time, economic impact of violence and, outcomes of risk-reduction interventions. There is a lack of peer reviewed research of interventions, with the result that current intervention programs have no reliable evidence base.

Conclusions: EMS leaders and personnel should work together with researchers to design, implement, evaluate and publish intervention studies designed to mitigate risks of violence to EMS personnel.

KEYWORDS

assault, EMS, fatality, paramedics, violence

1 | INTRODUCTION

Emergency medical services (EMS) personnel are a vital component of the health care, public health, public safety and disaster response systems.¹⁻⁴ In the United States alone, there are over 800 000 credentialed EMS personnel; approximately 21 000 EMS agencies respond to over 30 million calls for assistance each year.^{5,6}

A growing body of research shows that EMS personnel have a high level of occupational risks including a fatality rate comparable to police and firefighters and non-fatal injury rates similar to and above the rates for police and firefighters.⁷⁻¹⁴ There is also evidence that violence

against EMS personnel contributes to their occupational injury risks.¹⁵⁻¹⁸ The list of personal consequences associated with violent assaults includes physical injury, higher stress levels, loss of job satisfaction, anxiety, avoidance behavior, a negative impact on personal relationships and death.¹⁹

The aim of this systematic review is to synthesize the current literature on violence against EMS personnel. The goal for this review is to form a foundation for future intervention studies.

2 | METHODS

2.1 | Data sources and search strategy

This systematic review process followed the PRISMA-P checklist.²⁰ The principal investigator developed the strategy in May 2016 and two

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independent investigators conducted four separate search queries for the period January 2000 to May 2016, across these four databases: Medline, CINAHL, SCOPUS, and PubMed. The keywords used in the four search queries were (1) "Paramedic and assault"; (2) "Paramedic and violence"; (3) "Emergency medical services" AND "assault" AND "injuries"; and (4) "Emergency medical services" AND "occupational" AND "injuries." To confirm the strategy, an additional search was conducted on SCOPUS using the terms "emergency medical technician" and "assault OR violence" and "injury"; that search yielded no additional studies that met the inclusion criteria.

2.2 | Data selection

The selection criteria required articles have an abstract and full text available, be peer-reviewed and published in English. The selection process included reviewing the titles first and then reviewing abstracts and full texts as needed to confirm if inclusion criteria were met.

To find the most relevant citations the inclusion criteria were limited to research that focused primarily on risks of violence against EMS personnel including civilian and military ambulance officers, ambulance personnel, ambulance nurses, emergency medical technicians, paramedics, and mobile intensive care paramedics, who work on emergency medical service vehicles, including ground and air ambulances. Studies that focused primarily on other emergency service personnel such as police, firefighters not cross-trained in EMS, and air ambulance pilots were excluded.

The independent investigators submitted their lists of selected articles for discussion among the research team members. All the investigators agreed on the final selection of studies (there were no disagreements). The principal investigator managed and maintained the data throughout the review process.

2.3 | Data extraction

The principal investigator reviewed the literature and identified predominant topic areas that were modified and agreed upon with input from two other investigators. Two investigators then independently abstracted the information and findings related to the topic areas from each article using a data-abstraction tool. The tool was based on the Joanna Briggs Institute "Critical Appraisal Checklist for Descriptive/Case Series"²¹ and included clearly defined: inclusion criteria, study objective, population, study design, outcomes based on objective criteria, reliable outcome measurement, risk(s) of bias, and main finding(s) related to violence among EMS personnel. Any abstraction differences were resolved through consensus. The organization of the articles around topic areas was reviewed for face validity by three investigators. The table formats used in the paper were agreed upon by all the authors.

2.4 | Definitions

Because different countries have different employee categorizations, terms such as ambulance officers, ambulance personnel, ambulance

nurses, emergency medical technicians, paramedics, and mobile intensive care paramedics, will herein collectively be referred to as EMS personnel, unless the reference requires a specific title.

2.5 | Risk of bias and study quality

To assess risk of bias in each paper the investigators initially considered using STROBE,²² the Agency for Healthcare Research and Quality (AHRQ) guidelines, and the Cochrane Collaboration's tool for assessing risk of bias.²³ However, as the selected studies were reviewed, it was determined that there were no intervention studies, therefore, obviating the use of tools that were largely focused on evaluating intervention studies. It was then decided to keep all 25 studies and to describe a general risk of bias in each study based upon both the AHRQ guidelines in "Assessing Risk of Bias and Confounding in Observational Studies of Interventions or Exposures: Further Development of the RTI Item Bank"²⁴ and the criteria described in the Quality Assessment Tool for Quantitative Studies developed by the Effective Public Health Practice Project.²⁵

2.6 | Ethical approval

Since this is a review of the literature with no human subjects, IRB/Ethics approval was not required or sought.

3 | RESULTS

The 16 searches yielded 2655 results. After eliminating 2542 articles based on title and 88 duplicates, 25 studies were critically appraised by two investigators and found to be appropriate for the review. Figure 1 illustrates the progression of the search strategy.

The 25 studies were published in 18 separate journals. None of the studies described an intervention. Table 1 illustrates a summary of the studies by citation, objective, population, study design, risk of bias, and main findings related to violence.

Table 2 illustrates that data regarding assaults were collected either at the agency level or in national databases or through self-reported data that were captured in surveys. Eleven studies used existing databases; six used national databases while five studies used agency-level databases. Fourteen studies used surveys of EMS personnel. One study used an agency database, as well as interviews and a focus group.

Twenty-three of the studies reported the type of violence and six reported information on perpetrators. The studies used three types of output data: total cases per year, cases per 10 000 employees per year, and percentage (eg, percentage of total cases, respondents or calls). Table 2 illustrates reports of violence against EMS personnel by country, input data type, type of violence, perpetrator and output data type, arranged by output data type, for the years 2000-2016.

3.1 | Risks of bias within the studies

Overall the surveys suffered from small sample size and poor or no time restrictions for recall of events. The surveys had generally low

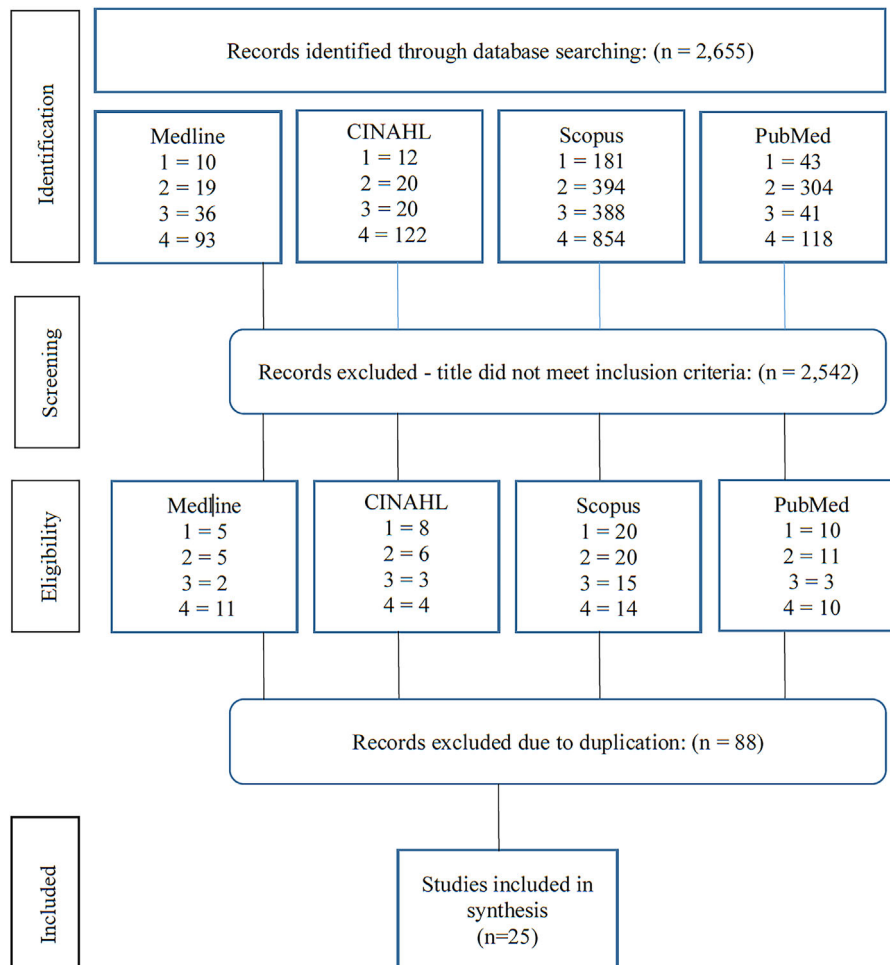


FIGURE 1 Stages of systematic review of studies investigating violence against emergency medical service personnel

response rates. Of the ten surveys that noted response rates, three surveys had response rates under 30%, two had response rates of 34% and 41% and two had rates of 59% and 60%; three reported response rates over 80%.

3.2 | Synthesis of findings

The 25 studies originating from nine different countries indicate the global reach of violence against EMS personnel. Eleven studies were from the United States, four from Australia, two each from Sweden, Canada, and Spain, and one each from Poland, Iran, India, and Turkey.

Four studies specifically described EMS personnel's occupational fatalities related to violence. There were ten homicides in 6 years documented in Maguire's 2002 national study³⁹ while Maguire's 2005 study found that there were zero occupational fatalities reported among 409 EMS personnel during one 5-year study period.⁷ In 2013, Maguire and Smith found that five EMS occupational fatalities in the United States were secondary to assaults during a 5-year period.⁸ A 2014 report described eight occupational fatalities among Australian EMS personnel and found that none were secondary to violence.⁴⁰

In the United States, national data indicated an EMS personnel occupational assault rate of 5.2 cases per 10 000 workers per year,⁸ while the only research using agency-level data indicated a rate of 60 cases per 10 000 workers per year.⁷ In Australia, national data document 10 assault injuries among EMS personnel per year,⁴⁰ while one Australian State reported 102 assault cases against EMS personnel in 1 year.¹⁷ The data from these two countries indicate a potentially 10-fold difference in findings between national and local sources.

Six of the studies included some reference to perpetrators, with the patient identified as the most likely perpetrator. However, about 6% of the cases of violence against EMS personnel were perpetrated by friends or family members of the patient.³⁶ In other studies, about 4% of physical assaults were perpetrated by a "colleague"²⁷ and bystanders were perpetrators for some cases.⁴⁷

The studies documented the high risk of exposure to violence. Boyle and Brough found high rates of verbal abuse, while Deniz, Furin and Suserud documented that about 80% of personnel had been subjected to some form of violence.^{28,29,31,33,45} Petzäll found that about two-thirds of EMS personnel experienced threats or violence⁴² while Rahmani found that it was 75% of respondents that had experienced workplace violence.⁴³ Gómez-Gutiérrez found that over a

TABLE 1 Summary of the 25 selected articles

Citation	Objective	Population	Study design	Risk of bias	Main finding(s) related to violence
Bernaldo-De-Quirós et al. ²⁶	To evaluate the psychological consequences of exposure to workplace violence.	A randomized sample of 441 health care workers (135 physicians, 127 nurses and 179 emergency care assistants).	Retrospective cross-sectional study, utilizing a survey of 70 pre-hospital emergency care services located in Madrid region.	Minimal. Used validated tools including the General Health Questionnaire (GHQ-28) and the Maslach Burnout Inventory (MBI).	Personnel exposed to physical and verbal violence presented with a significantly higher risks of anxiety, emotional exhaustion, depersonalization and burnout syndrome.
Bigham et al. ²⁷	To describe and explore violence experienced by EMS personnel.	A convenience sample of rural, suburban, and urban-based ground ambulance EMS personnel in two Canadian provinces. 1,676 responses (89% response rate).	A cross-sectional study utilizing a mixed-methods paper survey in two Canadian provinces.	Survey requested description of events up to 12 months so there is some potential recall bias.	The majority (75%) of Canadian EMS personnel who responded experienced violence in the workplace.
Boyle et al. ²⁸	To identify the percentage of EMS personnel who had experienced six different forms of workplace violence.	Of the approximately 270 participants (28% response rate), 75% were male with a median of 14.3 years of experience. Participants were from one state in Australia.	A survey based study of Australian EMS personnel explored experience of workplace violence using six forms of violence: verbal abuse, property damage or theft, intimidation, physical abuse, sexual harassment, and sexual assault.	Survey requested description of events up to 12 months ago so there is some potential recall bias.	Verbal abuse was the most prevalent form of workplace violence (82%), followed by intimidation (55%), physical abuse (38%), sexual harassment (17%) and sexual assault (4%).
Brough ²⁹	To investigate the types of violent incidents experienced by EMS personnel during their operational duties.	Out of a population of 500 EMS personnel, 119 (24%) responded.	A survey-based study to investigate the types of violent incidents experienced by EMS personnel in one Australian state.	Potential risk of recall bias. Low response rate indicates that results should be interpreted with caution.	Verbal violence was frequently encountered; physical violence experienced occasionally. Workplace violence had adversely predicted levels of job satisfaction but not psychological strain. Supervisor support moderated psychological strain.
Cheney et al. ³⁰	To determine whether assaults on EMS personnel by patients requiring restraints is correlated with demographic information, patient condition, and other scene information such as presence the of law enforcement.	271 restrained patients over a 12-month period.	A one-year prospective cross-sectional study of EMS personnel restraint use and assault on EMS personnel in an urban area of the US A data collection form was completed by EMS personnel for each patient placed in restraints.	The study has little likelihood of selection bias. However, there is a risk of possible bias related to incomplete documentation, or bias in preferential reporting.	77 (28%) cases were positive for assaults on EMS personnel.
Deniz et al. ³¹	To determine the condition of EMS personnel who have been exposed to any kind of violence and to predict risk of development of burnout syndrome.	120 EMS personnel completed the survey.	A questionnaire distributed to members of an ambulance agency in one area of Turkey.	There was no indication of the total number of personnel in the agency nor of any method used to select subjects so results should be interpreted with caution.	81 (67.5%) participants had been subjected to at least one type of violence (verbal or physical); 62% were exposed to verbal abuse and 55.8% to verbal threats.

(Continues)

TABLE 1 (Continued)

Citation	Objective	Population	Study design	Risk of bias	Main finding(s) related to violence
Dhar et al. ³²	To identify the problems faced by ambulance drivers working in a conflict zone.	Of the 58 EMS personnel, 35 (60%) were randomly selected and interviewed.	Interview based study consisting of 30 work-related questions asked of EMS personnel working for the four major hospitals within the conflict zone in Kashmir, India.	Although 60% of the population participated, the small sample size means the results should be interpreted with caution.	29 (83%) of the personnel experienced more than one threat of physical harm; 18 (54%) experienced physical assaults; and 31 (89%) reported evidence of psychological morbidity associated with their jobs.
Furin et al. ³³	To describe self-reported abuse and perceptions of safety to determine any differences between gender, shift, and years of experience.	Of the approximately 221 EMS provider respondents 89% (196) completed the survey.	A secondary analysis of an anonymous, cross-sectional work safety survey of EMS providers in one US urban agency. The survey included demographics, years of experience, history of verbal and physical assault, safety behavior following an assault and perceptions of safety.	No indication of time frame so high risk of recall bias.	80% of respondents reported physical assaults; 40% sought medical care and 49% reported the assaults to the police. There were no differences in rate of assault by gender.
Gałązkowski et al. ³⁴	To describe the type, incidence and consequences of occupational accidents among EMS personnel.	All personnel of the National Emergency Medical Services in Poland. 72 incidents involving 153 EMS workers who reported 128 injuries.	Cross sectional retrospective study reviewed all occupational accidents among the EMS personnel reported to the National Labour Inspectorate in Poland 2008–2012.	Little risk of bias because 100% of cases were included for review. However, small sample size means results should be interpreted with caution.	Six percent of all EMS occupational injuries were caused by assault.
Gómez-Gutiérrez et al. ³⁵	To assess the presence of posttraumatic symptoms and posttraumatic stress disorder (PTSD) and to identify compliance diagnoses for PTSD.	Out of a population of 1,310 emergency medical service personnel, 441 workers (34%) completed the questionnaire and 358 met the inclusion criteria.	Cross sectional, retrospective study using a questionnaire distributed to pre-hospital emergency care workers assaulted by patients/relatives in Madrid.	Small since their response rate was 89.5%.	Over one third of participants had been assaulted. The experience of aggression with fear, helplessness, or horror is associated with the presence of posttraumatic symptoms.
Gormley et al. ³⁶	To describe the prevalence of violence directed at EMS personnel by type and source, and to identify characteristics associated with experiencing violence.	Out of a population of 4,238, 2,515 (59.3%) responses were received and 1,789 met inclusion criteria.	A review of the US-based 2013 Longitudinal EMT Attributes and Demographics Study which contained 14 items assessing violence experienced in the past 12 months.	Survey requested description of events up to 12 months ago so there is some potential recall bias.	Over two-thirds (69.0%) of the study population experienced at least one form of violence in the past 12 months. Paramedics had nearly triple the odds of experiencing violence as EMTs.
Grange and Corbett ³⁷	To determine the factors and prevalence of violence against EMS providers in the prehospital setting and to determine factors associated with such violence.	There were 4,102 cases available for analysis.	A prospective study of consecutive medical calls for EMS agencies in a southern California metropolitan area were prospectively analyzed for one month.	Used 100% of records for the time frame studied; little likelihood of bias.	Some sort of violence occurred in 8.5% (349/4,102) of patient encounters. Of this reported violence, 52.7% was directed against EMS personnel, while 47.3% was directed against others; patients accounted for 90% of this violent behavior.

(Continues)

TABLE 1 (Continued)

Citation	Objective	Population	Study design	Risk of bias	Main finding(s) related to violence
Koritsas et al. ³⁸	To determine predictors of violence for EMS personnel.	The surveys were distributed randomly to 430 metropolitan EMS personnel in South Australia and 500 rural EMS personnel in Victoria; 260 (28%) surveys were returned.	A questionnaire based retrospective study-focused on the experiences of EMS personnel with six forms of violence: verbal abuse, property damage/theft, intimidation, physical abuse, sexual harassment, and sexual assault.	Survey requested description of events up to 12 months ago so there is some potential recall bias.	Female EMS personnel were at higher risk of intimidation, sexual harassment, and sexual assault.
Maguire et al. ³⁹	To describe occupational fatalities among EMS personnel in the US.	Approximately one million EMS personnel in the United States.	A retrospective analysis of three independent fatality databases: the Census of Fatal Occupational Injuries (1992 to 1997), the National EMS Memorial Service (1992 to 1997), and the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (1994 to 1997).	Analyzed 100% of available data; data specifically included injuries and assaults so there is little chance of bias.	Ten fatal assaults of EMS personnel (1.6/year).
Maguire et al. ⁷	To describe the epidemiology of occupational injuries among EMS personnel in two urban agencies in the US.	A total of 409 EMS personnel worked an estimated 2,829,906 hours during the study periods.	A retrospective review of injury records kept by two urban EMS agencies. The agencies submitted all 617 case reports for three periods between January 1, 1998, and July 15, 2002.	Analyzed 100% of available data; data specifically included injuries and assaults so there is little chance of bias.	Approximately 3% of total injures were secondary to assault.
Maguire and Smith ⁸	To determine injury and fatality rates among EMS personnel in the US.	21,749 reported cases that resulted in lost work days among EMS personnel.	A retrospective review of data collected by the US. Department of Labor (DOL) Bureau of Labor Statistics were reviewed to identify injuries and fatalities among EMTs and paramedics from 2003 through 2007.	Analyzed 100% of available data; data specifically included injuries and assaults so there is little chance of bias.	17% of injuries resulted in ≥ 31 days of lost work time; 530 assaults were reported during the study period (>100 /year). 8% of fatalities were homicides.
Maguire et al. ⁴⁰	To identify the occupational risks for Australian EMS personnel.	The 6,728 cases were Australian EMS personnel who had been injured in the course of their duties and for whom a claim had been made for workers compensation payments.	A retrospective descriptive study using data provided by Safe Work Australia for the period 2000–2010.	Analyzed 100% of available data; data specifically included injuries and assaults so there is little chance of bias.	The risk of serious injury among Australian EMS personnel was found to be more than seven times higher than the Australian national average for all workers. Ten Australian EMS personnel were seriously injured each year as a result of an assault.
Mechem et al. ⁴¹	To determine the nature and frequency of injuries resulting from assaults on EMS personnel and non-crosstrained firefighters in one US city.	There were 1,100 injury reports submitted during the study period, of which 44 (4.0%) were secondary to an assault.	A retrospective analysis of an occupational injury database. All injury reports involving assaults from 1996 to 1998.	Analysed 100% of available data; data specifically included injuries and assaults so there is little chance of bias.	41 assaults (93.2%) occurred during patient care activities. Medical attention was sought in 36 (81.8%) cases, and in 14 (31.8%) the employee lost time from work; 26 assaults (59.1%) were classified as intentional and 17 (38.6%) as unintentional.

(Continues)

TABLE 1 (Continued)

Citation	Objective	Population	Study design	Risk of bias	Main finding(s) related to violence
Petzäll et al. ⁴²	To investigate the incidents of threats and violence within the Swedish ambulance service.	134 registered nurses and paramedics from 11 ambulance stations located in four counties.	Data were collected using questionnaires.	Survey requested description of events up to 12 months ago so there is some potential recall bias. Small sample size means results should be interpreted with caution.	66% of the ambulance personnel experienced threats and/or violence during their work while 26% experienced threats and 16% faced physical violence during the last year; 27% of the respondents experiencing threats involving weapons.
Rahmani et al. ⁴³	To describe the exposure of Iranian EMS personnel to workplace violence.	Out of a population of 160 EMS personnel, 138 (86%) returned questionnaires.	A survey-based study that collected data regarding the exposure to the following forms of workplace violence: verbal abuse, physical assault, cultural harassment, sexual harassment and sexual assault.	Survey requested description of events up to 12 months ago so there is some potential recall bias. Because of the small sample size the results should be interpreted with caution.	103 (75%) respondents experienced at least one form of workplace violence; 30% considered workplace violence as common in their job.
Reichard and Jackson ¹⁰	To characterize injuries among EMS personnel, firefighters, and police in the US. by using national data.	All EMS workers in the US. (Also included firefighters and police).	This retrospective analyses used data from the National Electronic Injury Surveillance System-Occupational Supplement (NEISS-Work) for injuries treated in US. hospital emergency departments in 2000-2001.	Analyzed 100% of available data; data specifically included injuries and assaults so there is little chance of bias.	Of 21,900 injuries to EMS personnel, 1,100 (5%) were assaults.
Sibley et al. ⁴⁴	To characterize the epidemiology of occupational injuries experienced by Canadian rotor-wing health care providers.	Out of a population of 166, 67 (40.6%) of all eligible crew members) completed the survey.	A survey of crews of four rotor wing programs in Canada.	The small sample size and low response rate means the results should be interpreted with caution.	330 acute injuries were reported. 5% of respondents reported that exposure to violence on the scene was somewhat to very frequent.
Suserud et al. ⁴⁵	To describe how EMS personnel perceive, how they are subjected to, and are influenced by, threats and violence in their day-to-day work.	66 EMS personnel.	A questionnaire comprising a total of 13 questions.	No indication of time frame so there is a high risk of recall bias; the small sample size means results should be interpreted with caution.	53 (80.3%) EMS personnel were subjected to threats and/or violence.
Taylor et al. ⁴⁶	To investigate the workplace hazards and safety concerns of EMS personnel in the US.	Found 769 'non-fire emergency event' reports from the NFFNMRS using a mixed methods approach; identified 185 emergency medical calls.	A retrospective analysis of near-miss and injury events reported to the National Fire Fighter Near-Miss Reporting System (NFFNMRS).	Two possible sources of bias are the use of a database not specifically meant for this type of information and the possibility of missing some relevant cases.	The most commonly identified Mechanisms of Near-Miss/Injury to EMS personnel was assaults.

(Continues)

TABLE 1 (Continued)

Citation	Objective	Population	Study design	Risk of bias	Main finding(s) related to violence
Taylor et al. ⁴⁷	To describe EMS personnel's experiences from patient-initiated violence.	No description of sample size.	A convergent parallel mixed methods design was employed. Using a linked injury dataset, patient-initiated violence estimates were calculated comparing genders. Semistructured interviews and a focus group were conducted with injured EMS personnel in the US.	Using 100% of available injury data to identify cases resulting from violence and then conducting interviews and focus groups with injured EMS workers is an ideal approach with minimal risk of bias.	Female EMS personnel reported a six times higher odds of patient-initiated violence injuries compared to males.

EMS, Emergency Medical Services; EMT, Emergency Medical Technician; US, United States.

third of personnel had been assaulted.³⁵ Grange showed that violence occurred on 8.5% of patient encounters³⁷ while Sibley found that 5% of EMS respondents described violence on the scene as somewhat to very frequent.⁴⁴ Reichard and Galazkowski found that 5% to 6% of all EMS occupational injuries were secondary to assault.^{10,34} Taylor found that assaults were the most common near-miss events for EMS personnel.⁴⁶ Bernaldo-De-Quirós and Dhar described the psychological impact of violence among EMS personnel.^{26,32}

This review demonstrated that there is a paucity of published data on critical questions such as how risks of violence for EMS personnel may vary based upon demographic factors. Three studies published between 2006 and 2016 found that female EMS personnel had higher risks of violence than males.^{30,38,47} Maguire found that female EMS personnel have a higher overall rate of injuries than male EMS personnel⁷ and that female EMS personnel might have a higher risk of homicide than males.³⁹ There were also differences in risks of violence based on job title. Paramedics had nearly triple the risk of assault compared to EMTs.³⁶ Mechem found that there were 35 assaults among the 193 EMS personnel in the department compared to nine assaults among the 1973 firefighters in the same department (the risks of assaults for EMS personnel were about 40 times higher than the risks for fire personnel in the same department).⁴¹

4 | DISCUSSION

This review found that researchers in nine countries had investigated some aspect of violence against EMS personnel. The overall findings of this review indicates that violence against EMS personnel is a problem for many EMS agencies worldwide. The literature is limited to preliminary examinations of the problem with few rigorous studies and none investigating interventions. The limited data on the magnitude of the problem, discussed in the Synthesis of Findings section above, indicate a 10-fold difference in risk estimates between local and national data sets. The inconsistencies in, or absence of,

specific definitions of violence is an example of the challenges associated with EMS violence related research.

Furthermore, violence against EMS personnel may be greater than reported because a large proportion of incidents of violence against EMS personnel may be unreported.⁴⁸ Underreporting may occur because EMS personnel consider events insignificant, they view violent encounters as part of the job, or they are afraid to report them out of concern that they will be seen as not being able to handle the situation.³⁷ This underreporting is an issue with other health care professionals, as 65% of assaulted emergency department staff did not report the incident⁴⁹ and 43% of health care workers⁵⁰ did not report physically violent incidents.

The findings indicate that homicides are relatively rare but not insignificant. There is, on average, 1.0-1.6 homicides a year among EMS personnel in the United States alone.^{8,39}

Different case descriptions between the studies available further challenges understanding the scope of the problem. For example, when examining national data, a 2013 US study used data from the US Department of Labor (DOL) that reported cases missing even a single day of scheduled work⁸ while a 2014 Australian study used data from Safe Work Australia that reported only "serious cases" that involved missing a week or more of scheduled work.⁴⁰ Differences such as these preclude exact comparisons of injury rates.

A comparison of the risks for EMS personnel to other occupations, however, has helped to put the severity of the problem in perspective. A study in Australia found that 87.5% of surveyed EMS personnel reported being exposed to workplace violence²⁸ in comparison to 68% of nurses in Australia.⁵¹ The rate of assault cases resulting in lost work days for EMS personnel in the United States is 56.5 per 10 000 full time workers per year, a rate about 23 times higher than the national average of 2.6 for all occupations⁵² and about seven times higher than the rate of 9.1 for health care providers.⁵³

In addition, six of the papers reviewed found that the patient was the most common perpetrator. In comparison, the World Health Organization (WHO) found that coworkers are the perpetrators in 45-72% of assaults against healthcare workers.⁵⁴

TABLE 2 Reports of assault cases against EMS personnel in Australia, Canada, India, Iran, Poland, Spain, Sweden, Turkey, and the United States; arranged by output data type and chronological order (2000–2016)

Study	Input data type				Output data type				
	Country	Agency level data	National data	Survey	Type of violence	Perpetrator	Rate—cases/10 000 year	Rate—cases/year	Percent
Maguire ⁴⁰	Australia		X		Physical		10		
Maguire ⁸	US		X		Physical		5.2		
Maguire ⁷	US	X			Physical		60		
Maguire ³⁹	US		X		Physical		1.6		Among 114 fatal occupational injuries, 10 were homicides.
							Percent		
Deniz ³¹	Turkey			X	Physical and verbal				Among 120 respondents, 67.5% had been subjected to at least one type of violence.
Gómez-Gutiérrez ³⁵	Spain			X					Among 358 respondents, 34.5% had been physically assaulted.
Gormley ³⁶	US			X	Physical or verbal	Patient (43.4%), patient's family member or bystander (5.8%)			Among 1789 respondents, 69% experienced at least one form of violence. Verbal violence was more prevalent than physical (67.0% vs 43.6%).
Taylor ⁴⁷	US		X	*	Physical	Found that EMS personnel were threatened or assaulted by patients as well as family members and bystanders.			Increased odds of patient-initiated violence injuries for women compared to males.
Taylor ⁴⁶	US		X		Physical				Assaults most common injury incident.
Galazkowski ³⁴	Poland		X		Physical				Among 128 reported injuries, 6% were secondary to assault.
Furin ³³	US			X	Physical and verbal				Among 196 respondents, 80% reported physical assaults.
Bernaldo-De-Quirós ²⁶	Spain			X	Physical and verbal				Among 179 respondents, 65 reported that they were victims of verbal and physical violence.
Bigham ²⁷	Canada			X	Verbal (67%), intimidation (41%), physical (26%), sexual harassment (14%), and sexual assault (3%)	Patients were identified as the most common			Among 1676 respondents, 75% reported experiencing violence in past 12 months.
Rahmani ⁴³	Iran			X	Physical				Among 138 respondents, 75% experienced at least one form of workplace violence.
Dhar ³²	India			X	Threat of physical harm and physical assaults				Among the 35 respondents, 83% experienced more than one threat of physical harm.
Petzäll ⁴²	Sweden			X	Threats and physical violence	In most cases, patients			Among 134 respondents, 66% experienced threats

(Continues)

TABLE 2 (Continued)

Study	Input data type			Survey	Type of violence	Perpetrator	Output data type	
	Country	Agency level data	National data				Rate—cases/10 000	Rate—cases/year
Reichard ¹⁰	US		X		Physical			and/or violence; 26% experienced threats and 16% faced physical violence during the last year. Among 21 900 injuries to EMS personnel, 1100 (5%) were assaults.
Koritsas ³⁸	Australia			X	Violence: verbal abuse, property damage/theft, intimidation, physical abuse, sexual harassment, and sexual assault.			Female EMS personnel were at higher risk of intimidation, sexual harassment, and sexual assault.
Boyle ²⁸	Australia			X	Verbal abuse (82%), intimidation (55%), physical abuse (38%), sexual harassment (17%), and sexual assault (4%)			Among the 270 participants, 87% were exposed to violence; 38% were victims of physical abuse.
Cheney ³⁰	US	X			Physical	All were restrained patients		Among 271 restrained patients, 28% of restrained patients were positive for assaults on EMS personnel.
Sibley ⁴⁴	Canada			X				Among 67 respondents, 5% reported that exposure to violence on the scene was somewhat to very frequent.
Mechem ⁴¹	US	X			Physical			Among 1100 injuries, 44 (4%) were assaults.
Grange ³⁷	US	X			Verbal 21%, physical 49%, and both verbal and physical attacks 30%	Patients (90%)		Of 4102 patient encounters, 8.5% resulted in violence.
Suserud ⁴⁵	Sweden			X	Threats and/or violence			Among 66 respondents, 80% were subjected to threats and/or violence.
Brough ²⁹	Australia			X	Verbal and physical		Other	Verbal violence encountered frequently, physically violent incidents were encountered occasionally.

Natl, National; yr, year; EMS, Emergency Medical Services; US, United States.

The reviewed studies also found that female EMS workers have a higher risk of violence than male EMS personnel. In the general US population of all occupations, males have a rate of occupational violence that is about 50% higher than females⁵⁵ and Gerberich found that male nurses had a higher rate of assault than female nurses.⁵⁶ The differences in risk by gender is an important issue and a potentially alarming concern as the percentage of female EMS personnel increases. In the United States, the percent of female EMS personnel grew from 29 in 2005⁵⁷ to 33 in 2010⁶ while in Australia the percent of female EMS personnel grew from 26 in 2006 to 32 in 2011.⁵⁸

In this review, risks were also found to vary by job title. A crude estimated rate based on Mechem's data⁴¹ shows a rate of six cases per 100 EMS personnel per year compared to 0.15 cases per 100 firefighters per year; therefore, the relative risk is about 40 times higher for EMS personnel.

The finding that risks vary by demographic factors implies that incidents are not random. Thus, they may be predictable and demographic-specific mitigation strategies may be necessary.

Finally, this review identified three topics that are central to the issue and critical to the development of intervention studies but are absent from the literature. These topics include studies documenting changes in risk over time, the economic impact of violence against EMS personnel, and outcomes of risk-reduction interventions. The World Health Organization (WHO) noted that there has been a "dramatic worldwide increase in the incidence of intentional injuries"⁵⁹; any possible influence of those changes on EMS risks should be considered before appropriate and effective interventions can be developed. Economic impact is an important consideration because the cost to American businesses from workplace violence may be \$120 billion a year with an average jury award of \$3.1 million per person per incident when the employer failed to take proactive, preventive measures.⁶⁰

Intervention analyses and reports are critical if others are to benefit from the EMS agencies' experiences. Such analyses are also important to the agency to ensure that, for example, the intervention did not result in an increase in assault cases or have other unintended consequences. Interventions have been shown to work in other populations. The US Centers for Disease Control and Prevention (CDC) recommends a specific step-by-step public health approach to violence prevention. The approach includes defining the problem, identifying risk factors, developing and testing prevention strategies and then assuring widespread adoption of the intervention.⁶¹

4.1 | Risk of bias

The risk of bias in the selected studies was expected to be low since all were describing cases of violence in a defined population. However, the findings from studies that were based on self-reports need to be viewed with caution. Recall bias is possible when respondents are asked to recall events that occurred up to 12 months prior.⁶² Furthermore, studies based on surveys can suffer from interpretation bias because, as we have noted above, the definition of violence may not always be clear or the definition may have varied between respondents. Sample bias seems likely as EMS personnel who were

assaulted would be expected to have a higher rate of response than those who had not been assaulted. The generally low survey response rates might have introduced a self-selection bias in to the studies. Any study that did not use a pre-validated survey tool may suffer from survey bias. Despite these limitations the authors decided to include all studies that met the inclusion criteria and describe any risk of bias.

4.2 | Limitations of the review

In some countries EMS personnel may include physicians or nurses, or may be referred to by names other than the ones used here and so it is therefore possible that studies using those terms might not have been found during the searches. The exclusion of non-English language papers may have reduced the number of papers and the generalizability of the findings.

There are differences in EMS workforce and system design between countries. For example, national data from Australia and the United States illustrate the differences in the number of EMS personnel in relation to the population as well as the number of EMS agencies per population. In Australia, there were approximately 13 125 EMS personnel in 2010-2011.⁶³ Australia's population during that time was 22 342 000, which translates to 0.6 EMS personnel per 1000 persons in the population. While in the United States, there were an estimated 826 111 EMS personnel in 2011.⁶ With a total population of about 312 million,⁶⁴ this means there are about 2.6 EMS personnel per 1000 population. The estimated 21 000 EMS agencies in the United States⁶ is in contrast to the eight state and territory-based agencies in Australia.⁶³ Somewhere between 50%⁶ and 80%⁵ of the US EMS workforce are estimated to be volunteers, as compared to the 25% in Australia.⁶³ Over the past few decades in the United States, many fire departments have begun providing emergency medical services; therefore, it is possible that injuries occurring to some non-firefighter EMS personnel employed by fire departments may be classified as an injury to a firefighter, thus decreasing the resulting calculations of the rate of injuries for EMS personnel and increasing the rate for firefighters. It is likely that there are many individual differences between the 21 000 EMS agencies in the United States as well as between the agencies in each country. It is possible that the search strategy missed some relevant articles.

4.3 | Next steps

Adopting a public health approach to mitigating the problem will require collaboration between EMS agencies and university researchers. These steps toward mitigation must address the CDC recommendations to specifically include data analyses, case reviews, employee interviews, focus groups and surveys, as well as, the development, implementation, and evaluation of interventions to mitigate the risk of all forms of violence.^{61,65} In addition, the publication of risk-reduction interventions in peer-reviewed journals will help ensure that effective, reliable interventions can be shared and implemented worldwide.

National averages help to identify that there is a problem; however, the rigorous evaluation needed for intervention studies can only occur when reliable and precise, numerator and denominator data are available. These data are typically available only at the agency level. Agency level data are likely to be considerably more reliable because the agency has direct access to all the injury case data, all the human resources data (including the total hours worked by each employee in the agency) and operational data (such as call volume). Those data allow researchers to calculate precise injury rates by factors such as hours worked, sex, age, job title, and call volume. A consensus on data collection and reporting guidelines should be developed in order to conduct a more precise assessment of the problem.

Furthermore, agencies planning to conduct violence related research should be using a specific definition of violence such as the United Kingdom's Health and Safety Executive (HSE) definition of work-related violence. Their definition is precise and describes violence as "Any incident in which a person is abused, threatened or assaulted in circumstances relating to their work."⁶⁶

When designing future studies researchers should consider ways to: define as well as quantify violence, intentionality, threats of violence, verbal abuse, and bullying (bullying should be included based on the WHO's finding that verbal abuse and bullying results in emotional injury leading to trauma to the worker and a negative effect on the performance and efficiency of the organization⁶⁷); examine differences among personnel such as sex, age, EMTs versus paramedics, and firefighter versus non-firefighter because differences found between different demographic types and job titles may contribute to an improved understanding of risk factors; examine and recommend uniform case definitions as well as standardized and reliable reporting policies, procedures and practices; determine the economic cost of violence against EMS personnel and the cost/benefit of risk reduction strategies⁶⁵; capture near-miss cases because near-miss incident data can be useful in incident prevention^{46,68,69}; consider utilizing a mixed-methods approach when investigating the problem^{47,70}; develop a consensus on incident reporting collection including methods to identify the perpetrators (eg, patient, patient family member, person known to victim, coworker) and outcomes to the staff (eg, amount of lost work time, need for medical care, long-term disability, career termination); design and evaluate interventions to reduce the risk of violent incidents because reducing the risk of assaults has the potential to save lives, prevent injuries, reduce agency costs, reduce personnel turnover, improve morale,⁶⁶ and may ultimately improve the delivery and quality of ambulance services; implement ongoing monitoring to determine if the intervention solved the problem and to ensure widespread adoption⁶¹; and determine if the intervention created unintended consequences such as an increase in heat emergencies among EMS personnel after deploying bullet-proof vests.

5 | CONCLUSION

This systematic review of the literature identified the peer-reviewed articles on the topic of violence against EMS personnel. The

evidence demonstrates that occupational violence is a risk for EMS personnel in at least nine countries. Of concern is the lack of peer-reviewed research on any interventions, with the result that any existing or proposed intervention programs have no reliable evidence base. In addition, there is a paucity of published research on critical questions such as how risks vary by demographic factors that might guide intervention strategies. The available data from both the United States and Australia indicate a potentially 10-fold difference in findings between national and local sources which emphasizes the importance of having agency-level numerator and denominator data.

This review illustrates the need for EMS personnel and administrators to work collaboratively with researchers to determine the extent of the problem for the agency and their personnel, and then to develop and test interventions to mitigate the risk of violence against EMS personnel.

AUTHORS' CONTRIBUTIONS

BJM conceived of the paper and began the design and writing. POM and BJO conducted independent analyses and all authors contributed to the writing of the manuscript and revising it critically for important intellectual content. All authors have given final approval of the version to be published and all agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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The authors declare no conflicts of interest.

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Steven Markowitz declares that he has no competing or conflicts of interest in the review and publication decision regarding this article.

DISCLAIMER

None.

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