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Table of Content

July-September, 2024 *Number 7*

RESEARCH REPORTS

The Effect of Fentanyl Compared to Morphine on Pain Score and Cardiorespiratory Vital Signs in Out-of-Hospital Adult STEMI Patients 10
Gallagher AM, Micalos P, Ahern L, & Maria SJ

Prehospital use of Ketamine Versus Midazolam for Sedation in Acute Agitation 23
Johndro CW, Caffyn S, Chen J, Bailey D, Burak M, Perriello E, & Yongstrom DW

Demonstration of Doppler Ultrasound Pulse Detection by Trained Prehospital Personnel: A Feasibility Study 31
Martin DCK

The State of Emergency Medical Services Clinician Mental Health in Virginia 39
Valeriano VP, Owens K, & Rosner J

Sonographic Cardiac Activity Correlates with End-Tidal Carbon Dioxide and Cardiac Rhythm in Out-of-Hospital Cardiac Arrest 61
Spigner M, Garcia C, Welle L, Braude D, Cluff S, LaPrise R, & White J

Cross-Sectional Six-Year Retrospective Epidemiological Analysis of 9-1-1 EMS Calls to the El Paso, Texas and Ciudad Juárez International Border Crossing 72
Baker S, Baker R, & Martinez A

Paramedics' Anxiety and Concerns Towards Attending Traumatic Events: A Delphi Study 83
Alshamrani A, Gosling C, Khasawneh E, Alzobaidi S, & Williams B

Factors Associated with Increased Use of Cognitive Aids 94
Harmer B, Ivey M, Hoyle Jr. JD, & Fogarty K

The Role of Emotional Intelligence in Turnover Intention Among EMS Providers 106
Kaplan E & Markenson D

REVIEWS

Use of Buprenophine in the Prehospital Setting 125
Spadaro A, Huo S, & Bar J

Influence of Rurality when Accessing Emergency Healthcare During Exacerbation of Asthma: A Scoping Review 131
Stoneley A, Anderson J, & Sutton C

CASE REPORTS

Assessment and Empirical Treatment of Chronic Abdominal Pain from Suspected *Helicobacter pylori* Infection in a Remote Setting: A Case Study **146**

Ferguson S

CONCEPTS

Supporting Families and Our Own: Strategies to Minimize the Emotional Burden of Families and First Responders During and After a Prehospital Cardiac Arrest Rescuscitation **153**

Tillett Z, Spruce A, Jacobs S, Granville S, Martel J, & Crispo M

SPECIAL REPORTS

Vocational and University Paramedicine Education: Implications for Professionalism **163**

Weber A, Devenish S, & Lam L

LITERATURE SURVEILLANCE

Paramedicine Contents: March-May 2024 ..... **172**

Buck B & McAdams J

Paramedicine Literature Search: March-May 2024 ..... **180**

Maxwell S & Morrissey BM

Guidelines for Authors **230**

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RESEARCH REPORTS

THE EFFECT OF FENTANYL COMPARED TO MORPHINE ON PAIN SCORE AND CARDIORESPIRATORY VITAL SIGNS IN OUT-OF-HOSPITAL ADULT STEMI PATIENTS

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ABSTRACT

Objective: ST-elevation myocardial infarction (STEMI) is a leading cause of mortality in Australia. Paramedics treating adults with STEMI in the out-of-hospital environment can use fentanyl or morphine to manage the patient's pain, although there is little research comparing the efficacy and safety of these drugs. Therefore, the objective of this study was to compare the effects of fentanyl to morphine on cardiac chest pain and cardiorespiratory vital signs in adult STEMI patients in the out-of-hospital environment.

Methods: We conducted a retrospective analysis of records of 1902 STEMI cases attended by Queensland Ambulance Service paramedics during the 4-year interval from 2013 to 2016. We compared pain score, blood pressure, respiratory rate, and pulse rate between patients administered intravenous fentanyl and intravenous morphine. We used a two-way mixed effects model (drug, time) to assess for main and interaction effects, and where the interaction effect was significant, applied Mann-Whitney U tests to further analyze between-group differences at each time point.

Results: We observed a significant main effect of time on pain score ($p < 0.001$), respiratory rate ($p < 0.05$), and pulse rate ($p = 0.025$), such that these variables all decreased over time. Additionally, we observed a significant drug-time interaction for systolic and diastolic blood pressures (both $p < 0.01$), such that blood pressures decreased over time in the morphine, but not fentanyl, group.

Conclusion: We compared the effects of fentanyl to morphine on cardiac chest pain and cardiorespiratory vital signs in out-of-hospital adult STEMI patients and observed differences in blood pressures only. Morphine appeared to have a depressive effect on systolic and diastolic blood pressure, whereas fentanyl did not. An unanticipated behavioural finding of this research is that, in the absence of a definitive guideline, paramedics appear to use fentanyl when patients may be at risk of developing hypotension.

INTRODUCTION

Acute coronary syndrome including ST-elevation myocardial infarction (STEMI) was the leading cause of death in Australia in 2021, accounting for approximately 11% of all deaths (Australian Bureau of Statistics, 2021). The predominant cause of STEMI is a disruption to epicardial blood flow, with associated chest pain

being a key diagnostic feature (Baruah & Hartley, 2023). When attending a patient with STEMI, the paramedics' primary goal is to ensure early access to thrombolytic therapy while controlling the patient's pain and reducing their likelihood of experiencing adverse effects from myocardial hypoxia until their transition to definitive care (Chew et al., 2016). To achieve this goal, current Australian ambulance protocols recommend treatment with aspirin, oxygen, nitroglycerine, thrombolytic drugs, and either fentanyl or morphine for analgesia (Chew et al., 2016).

Fentanyl and morphine are both opioid analgesics. While previous research has investigated the efficacy and safety of each drug (Fleischman et al., 2011; Galinski et al., 2005; Huang et al., 2022; Stoeckel et al., 1982; Thompson et al., 1995; Watso et al., 2022; Weldon et al., 2016), much of this research has used healthy volunteers (Huang et al., 2022; Stoeckel et al., 1982; Thompson et al., 1995; Watso et al., 2022). Comparatively few studies have directly compared these two drugs that are the mainstay of analgesia in paramedicine. For example, a study by Fleischman et al. (2011), compared the efficacy and safety of fentanyl and morphine in the out-of-hospital setting, but this study faced limitations due to the lack of standardized patient conditions. Treating a patient with STEMI presents a unique challenge for paramedics because the pathology can create hemodynamic instability leading to an increased risk of adverse events. As such, it is particularly problematic that research has not yet investigated whether fentanyl or morphine is more appropriate for use in adult STEMI patients. A 2016 study (Weldon et al.) investigated the effects of fentanyl and morphine on individuals experiencing suspected ischemic chest pain. Importantly, this study did not require confirmation of the specific underlying pathology. Additionally, there are concerns about the study's statistical power, and it remains uncertain whether the study excluded patients who received treatments that could potentially introduce confounding variables. This existing literature underscores the need to compare fentanyl and morphine more comprehensively and with attention to detail. Particularly, assessing their safety and efficacy in adult STEMI patients is likely to be crucial for guiding drug selection and enabling paramedics to confidently choose the best analgesic for this haemodynamically vulnerable population.

The limited information available suggests that both fentanyl and morphine offer comparable analgesic effects (Fleischman et al., 2011; Galinski et al., 2005; Weldon et al., 2016). While morphine has been shown to be associated with decreases in blood pressure in healthy volunteers (Watso et al., 2022), fentanyl does not seem to produce the same effect (Huang et al., 202). However, both fentanyl (Stoeckel et al., 1982) and morphine (Thompson et al., 1995) have been reported to produce respiratory depression in healthy adults. Given these findings, the lack of research investigating the suitability of fentanyl versus morphine for adult STEMI patients is concerning, given the specific challenges posed by this medical condition.

The aim of this research is to compare the effects of paramedic-administered fentanyl and morphine on cardiac chest pain and cardiorespiratory vital signs in out-of-hospital adult STEMI patients. Building upon the limited existing research, our central hypothesis is that we will observe no differences in pain score between fentanyl and morphine groups. Based on the data reported for healthy volunteers, we anticipate that the morphine but not fentanyl group will exhibit decreases in systolic and diastolic blood pressures, and there will be no difference in the change in respiratory rate between groups.

By comparing the efficacy and safety of fentanyl and morphine in adult STEMI patients in the out-of-hospital paramedicine environment, this research aims to contribute key data to support paramedics in selecting the most appropriate analgesia for adult STEMI patients and inform the future development of clinical guidelines.

METHODS

Study Design and Setting

We conducted a retrospective observational analysis of a state-wide (Queensland Ambulance Service) sample of STEMI patient case data recorded by registered paramedics while providing patient care during the 4-year interval from 1 January 2013 to 31 December 2016 inclusive. This was a unique time period, during which both fentanyl and morphine were preferred analgesic options for acute coronary syndrome, allowing a direct comparison in the one study. Each case in the dataset represented 1 STEMI patient. No cases of non-cardiac ST elevation were included in the dataset. All case records in the dataset were stored and maintained by the Queensland Ambulance Service. This research was approved by the Charles Sturt University Human Ethics Committee (protocol number H20058) and the Queensland Ambulance Service Research and Innovation Committee (Ref: 20/00383).

Participants

The Queensland Ambulance Service provided a preliminary dataset that included 2721 de-identified records of cases attended in the study interval where the patient was an adult (18 to 75 years) with confirmed STEMI. We applied further inclusion and exclusion criteria to the preliminary dataset, as presented in Table 1, to reduce possible bias related to confounding treatments and patient criticality.

	Inclusion	Exclusion
Age	≥18 years and <75 years	<18 years or ≥75 years
Diagnosis	Confirmed STEMI	Any comorbid pathology
Analgesic	Morphine OR fentanyl	Combination of morphine and fentanyl Any other pain relief
Administration	Intravenous only	Intraosseous or intramuscular or combination
Dose Information	Recorded	Unavailable
Contact time	≥20 minutes	<20 minutes
Sets of Observations	Recorded at ≥2 time points	Recorded at <2 time points
Confounding Treatment	None	Treated with opioid in last 24 hours Treated with regular (daily) opioid and/or drug(s) for neuralgia
Criticality		Pulse rate <40 beats per minute Pulse rate >160 beats per minute Respiratory rate <8 breaths per minute
Other		Corrupted data

Table 1. Criteria for inclusion or exclusion of adult STEMI case record in analysis.

In all cases included in the study, clinically appropriate doses of intravenous fentanyl or intravenous morphine were administered by a registered paramedic as part of providing patient care. To control for possible effects of other interventions, we excluded cases where the patient appeared to be in a hemodynamically or respiratory critical condition because of the high likelihood the patient would have been treated with adrenaline, amiodarone, atropine, or fluids, which are known to confound our variables of interest. After applying our inclusion and exclusion criteria (Table 1), 1902 cases remained for analysis. For a summary of the characteristics of each group, see Table 2.

	Fentanyl	Morphine
N (males, females)	688 (567, 121)	1214 (944, 270)
	Mean ± SD	Mean ± SD
Age (years)	59 ± 10	57 ± 10 †
Initial Pain Score (0-10)	7 ± 2	7 ± 2 †
Initial Pulse Rate (bpm)	75 ± 2	78 ± 2 *
Initial SBP (mmHg)	130 ± 26	139 ± 26 *
Initial DBP (mmHg)	88 ± 18	84 ± 18 *
Initial RR (breaths per minute)	18 ± 3	18 ± 3 †
Time from T0 to first dose (minutes)	14.9 ± 9.4	15.3 ± 10.0 †
Number of doses	3.3 ± 1.6	3.2 ± 1.5 †
Dose-dose interval (minutes)	13.0 ± 7.1	13.5 ± 7.3 †

Note: bpm, beats per minute; DBP, diastolic blood pressure; T0, 0-minute time point; mmHg, millimeters of mercury; RR, respiratory rate; SBP, systolic blood pressure; SD, standard deviation; * $p < 0.05$; † $p > 0.05$.

Table 2. Characteristics of fentanyl and morphine groups.

Measures

The outcome variables selected for analysis were pain score (0-10 numbered rating scale), pulse rate (beats per minute), systolic blood pressure (millimeters of mercury [mmHg]), diastolic blood pressure (mmHg), and respiratory rate (breaths per minute). All outcome variables were recorded by registered paramedics, according to standard practice at the time of the study, as part of providing patient care.

Statistical Analysis

All data were checked for normality using the Shapiro-Wilk statistic. Dependent data (pain score, pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate) were analyzed using a two-way mixed effects model (Factors: Time, Drug) to assess for main and interaction effects. For variables where we identified a statistically significant interaction effect, we then performed Mann-Whitney U tests to assess between-group differences at each time point. The threshold for statistical significance was set at $p < 0.05$. All analyses were conducted using Jamovi (Ver 2.3.21.0).

RESULTS

Mean age, initial pain score, and initial respiratory rate were not significantly different between the fentanyl and morphine groups (all $p > 0.05$). Initial systolic blood pressure, initial diastolic blood pressure, and initial pulse rate were lower in the fentanyl group than the morphine group (all $p < 0.001$; Table 2).

Pain Score

The change in pain score over time for the fentanyl compared to morphine groups is shown in Figure 1. The main effect of drug and the drug-time interaction effect for pain

score were not statistically significant (p = 0.210; p = 0.116). The main effect of time was significant, such that the mean pain score decreased from 7/10 at 0 minutes to 4/10 at 60 minutes (p < 0.001).

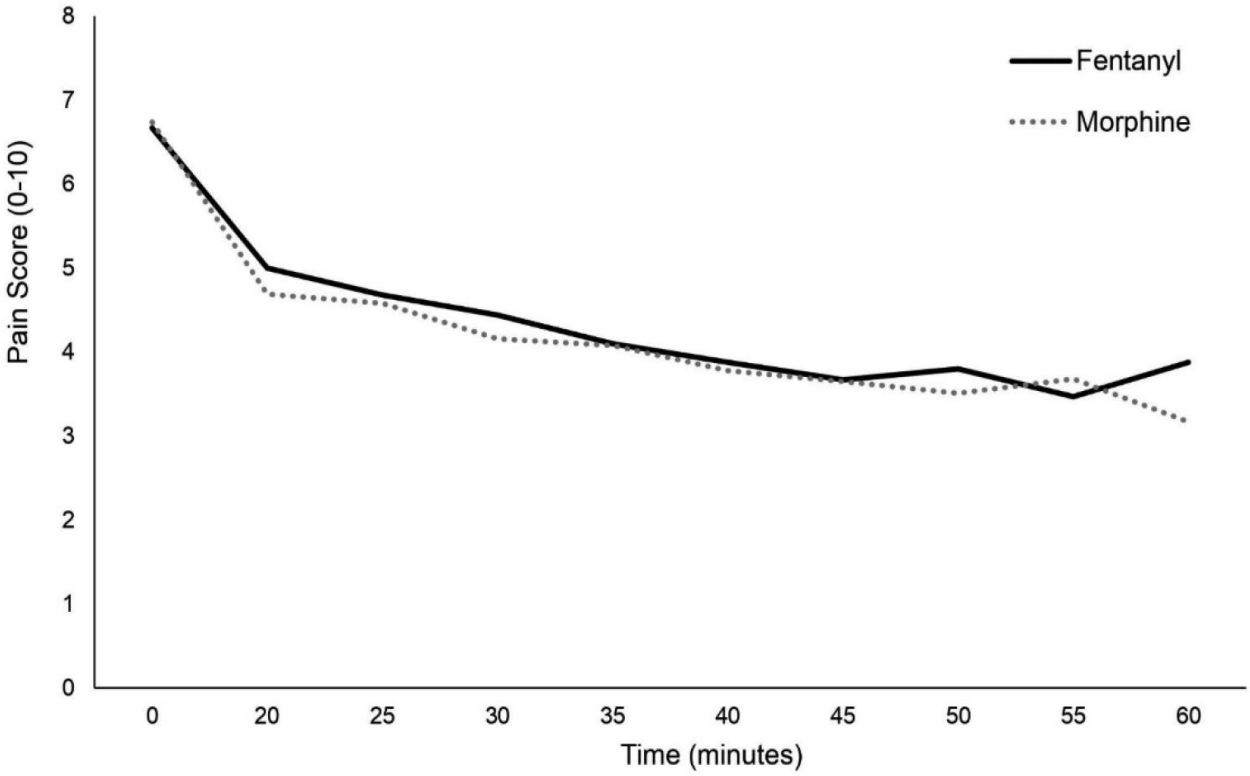

Figure 1. Change in pain score over time for adults with ST-elevation myocardial infarction administered intravenous fentanyl compared to intravenous morphine.

Blood Pressure

Figure 2 presents the change in systolic and diastolic blood pressure over time for the fentanyl and morphine groups.

Systolic Blood Pressure

The main effect of the drug, the main effect of time, and the drug-time interaction effect on systolic blood pressure were statistically significant (all p < 0.001). When analyzing between-group differences at each time point from 0 to 60 minutes, systolic blood pressure was significantly lower in fentanyl compared to morphine at 0 minutes ($\bar{x}_{fentanyl}$ = 130mmHg; $\bar{x}_{morphine}$ = 139mmHg; p < 0.001), 20 minutes ($\bar{x}_{fentanyl}$ = 132mmHg; $\bar{x}_{morphine}$ = 139mmHg; p < 0.001), and 30 minutes ($\bar{x}_{fentanyl}$ = 130mmHg; $\bar{x}_{morphine}$ = 133mmHg; p = 0.036). Systolic blood pressure at all other time points was comparable (all p > 0.05).

Diastolic Blood Pressure

The main effect of the drug, the main effect of time, and the of drug-time interaction effect on diastolic blood pressure were significant (all p < 0.001). With respect to the between-group differences at each time point from 0 to 60 minutes, diastolic blood pressure was significantly lower in the fentanyl group than the morphine group at 0 minutes

($\bar{x}_{fentanyl}$ = 83mmHg; $\bar{x}_{morphine}$ = 88mmHg; $p < 0.001$), 20 minutes ($\bar{x}_{fentanyl}$ = 83mmHg; $\bar{x}_{morphine}$ = 88mmHg; $p < 0.001$), 25 minutes ($\bar{x}_{fentanyl}$ = 83mmHg; $\bar{x}_{morphine}$ = 85mmHg; $p = 0.026$), and 30 minutes ($\bar{x}_{fentanyl}$ = 82mmHg; $\bar{x}_{morphine}$ = 85mmHg; $p = 0.003$). No other significant differences in diastolic blood pressure were observed (all $p > 0.05$).

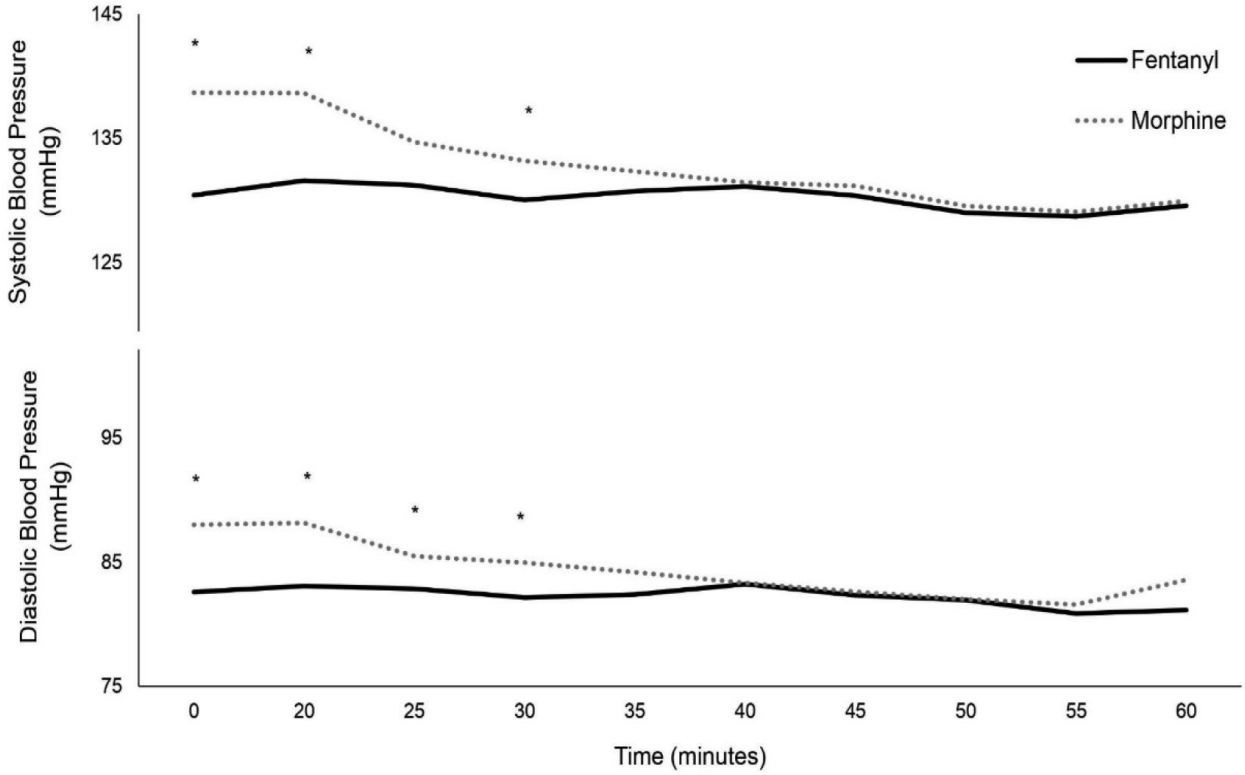

Figure 2. Change in blood pressure over time for adults with ST-elevation myocardial infarction administered intravenous morphine compared to intravenous fentanyl. Note: mmHg, millimeters of mercury; *, $p < 0.05$.

Respiratory Rate

The change in respiratory rate over time for the fentanyl and morphine groups is shown in Figure 3. The main effect of drug, and the interaction effect of drug and time on respiratory rate were not statistically significant ($p = 0.135$; $p = 0.533$). The main effect of time on respiratory rate was significant, with the respiratory rate decreasing from 18.3 breaths per minute at 0 minutes to 17.6 breaths per minute at 60 minutes ($p < 0.001$).

Pulse Rate

The change in pulse rate over time for fentanyl compared to morphine is shown in Figure 4. The main effect of the drug on pulse rate and the main effect of time on pulse rate were both significant ($p < 0.001$; $p = 0.025$, respectively). However, the drug-time interaction effect on pulse rate was not statistically significant ($p = 0.185$).

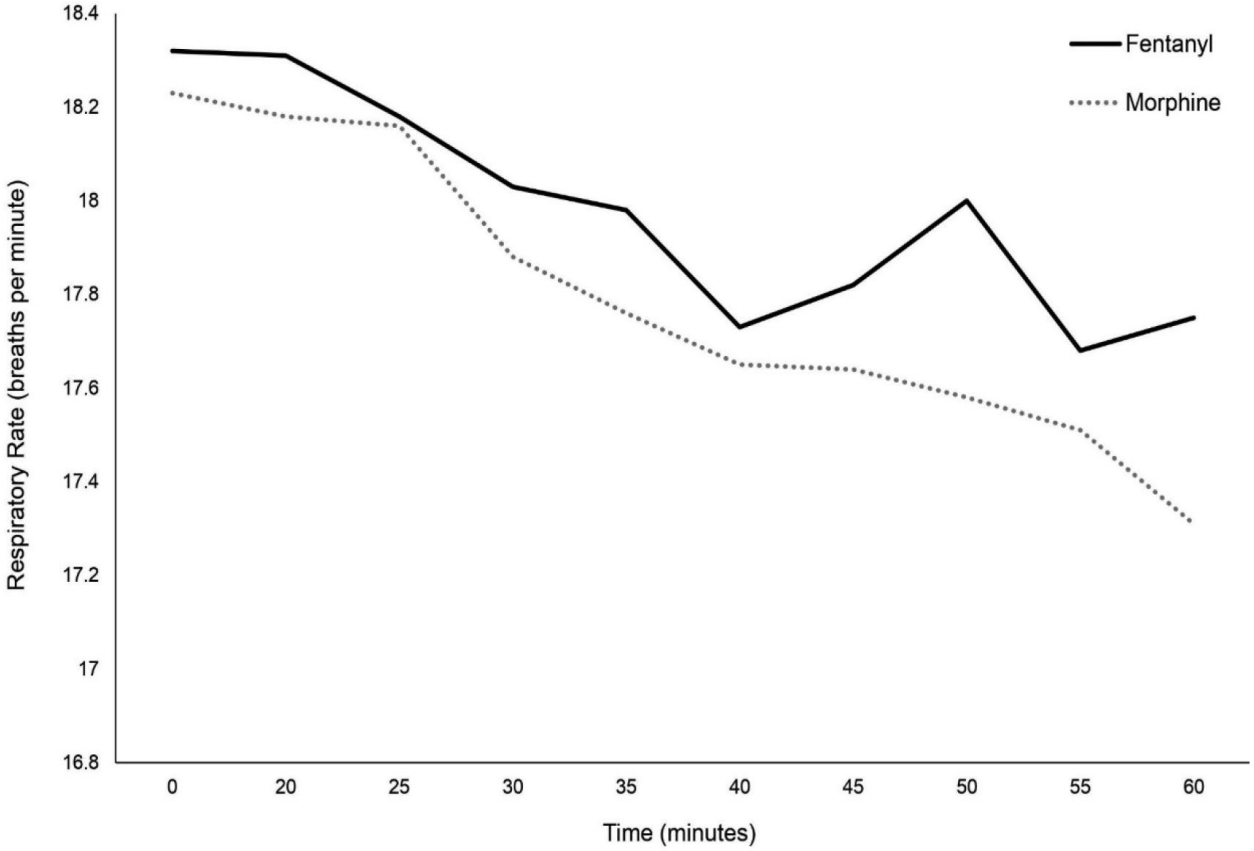

Figure 3. Change in respiratory rate over time for adults with ST-elevation myocardial infarction administered intravenous fentanyl compared to intravenous morphine.

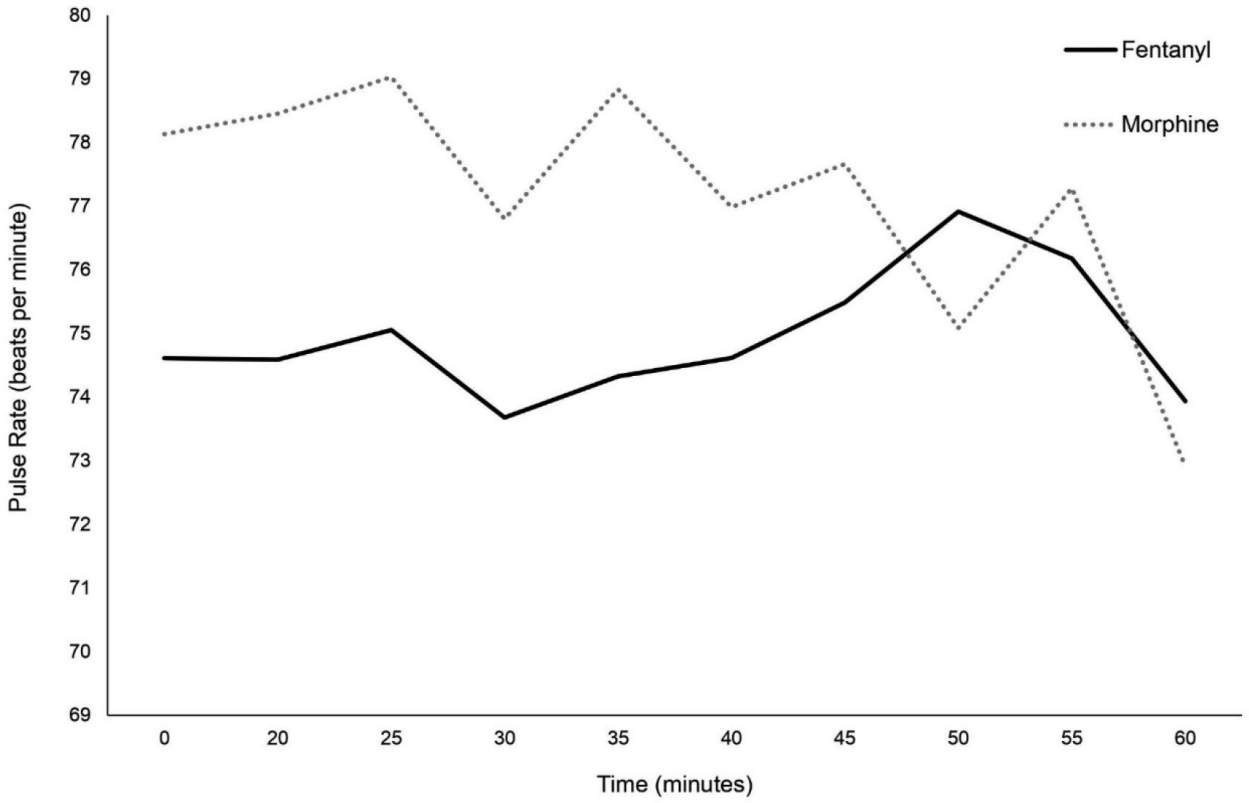

Figure 4. Change in pulse rate over time for adults with ST-elevation myocardial infarction administered intravenous fentanyl compared to intravenous morphine. Note: * $p < 0.05$.

DISCUSSION

The purpose of this research was to compare the effects of fentanyl to morphine on cardiac chest pain and cardiorespiratory vital signs in adult STEMI patients in the out-of-hospital paramedicine environment. Consistent with our first hypothesis, we found that pain score across the 0 to 60-minute study interval was comparable between the fentanyl and morphine groups. Also consistent with our second hypothesis, we observed differences in systolic and diastolic blood pressures between the two groups and decreased respiratory rate over time across both groups.

Pain Score

The decrease in pain score over time was comparable between the fentanyl and morphine groups, with pain score in both groups decreasing from 7/10 to 4/10 between 0 and 60 minutes. This finding is consistent with the small volume of previous research showing that fentanyl and morphine offer equivalent analgesic effects (Fleischman et al., 2011; Galinski et al., 2005; Weldon et al., 2015). Additionally, according to Rowbotham (2001), a decrease in pain score of 2 points or more is likely to reflect a clinically meaningful improvement in the patient's experience of pain. As such, paramedics can use either fentanyl or morphine to achieve clinically meaningful pain reduction for adult STEMI patients and analgesic effect is not a factor that would indicate the use of one drug over the other for this population.

Cardiorespiratory Vital Signs

Blood Pressure

Both systolic and diastolic blood pressures were significantly lower in the fentanyl than morphine group at 0, 20, and 30 minutes, with diastolic blood pressure also lower in the fentanyl group at 25 minutes. Most interestingly, we found that both systolic and diastolic blood pressures were 6% lower in the fentanyl (130/83mmHg) than morphine (139/88 mmHg; both $p < 0.05$) group at 0-minutes, prior to drug selection and administration. This unanticipated and novel finding suggests that paramedics may be selecting fentanyl over morphine for patients who are at risk of becoming hypotensive. Between 2013 and 2016 when data were collected, both fentanyl and morphine were preferred analgesic options for ACS (Queensland Ambulance Service, 2017) and as such, we did not expect to observe differences in blood pressures at the 0-minute time point. However, the statistical significance of these differences suggests that paramedics may be systematically selecting fentanyl over morphine when the patient's blood pressure is lower. While both groups' blood pressures were within the normal range (Gabb et al., 2016), the fentanyl group were at risk of becoming hypotensive if their blood pressures decreased. As such, our results suggest that paramedics are potentially administering fentanyl preferentially when they observe the patient is at risk of becoming hypotensive.

This novel behavioural finding, whereby paramedics appear to administer fentanyl preferentially when a patient is at risk of developing hypotension, is particularly positive. A systematic review conducted by Duarte et al. (2019) has reported that the use of morphine in patients with acute coronary syndrome is linked to an increased risk of major adverse cardiovascular events and in-hospital mortality. Considering this previous research, the use of fentanyl in patients with low-normal blood pressures that we observed

in our data likely led to patients experiencing reduced risk for adverse events associated with opioid administration. Queensland paramedic appear to be making a positive clinical decision to administer fentanyl to patients at risk of becoming hypotensive, validating the high level of trust in paramedics reported in the Australian community (Australian Government Productivity Commission, 2022). This finding also supports the importance of conducting further qualitative research into the factors that inform clinical decisions in the absence of definitive guidelines, given that, at the time of data collection, either drug was equally recommended. Such research may be crucial to inform the development of best-practice guidelines that support paramedics to continue making informed, safe, and effective clinical decisions for their patients.

We did not observe any significant differences in systolic or diastolic blood pressures between groups after the 30-minute time point. This finding is likely related to two factors: pharmacokinetic and pharmacodynamic differences between the two drugs; and paramedics' selection of fentanyl for patients at risk of developing hypotension as described above. The speed of onset for fentanyl and morphine are reportedly 4-6 minutes and 20 minutes respectively (Alexander, 2023). Therefore, given the mean administration time for both drugs was 15 minutes, we expect that any changes in blood pressure would occur by the 20-minute observation for the fentanyl group, and the 35-minute observation for the morphine group. The difference between blood pressures in the fentanyl group at the 0-minute (130/83 mmHg) and 20-minute (132/83 mmHg) time points was unlikely to be clinically significant, and blood pressures for the fentanyl group remained within the normal range across the entire 60-minute study interval (Gabb et al., 2016).

In contrast, blood pressures in the morphine group decreased between the 0-minute (139/88 mmHg) and 30-minute (133/85 mmHg) time points. While mean blood pressures in the morphine group remained within normal range (Gabb et al., 2016), a difference of the same magnitude in the fentanyl group would have resulted in mean blood pressures in the fentanyl group becoming hypotensive. These results suggest that paramedics selected the appropriate analgesic for their patients, leading to patients in both groups maintaining normotension despite the disparate effects of the 2 drugs on blood pressures.

Respiratory Rate

Despite evidence indicating that administration of intravenous fentanyl (Stoeckel et al., 1982) or intravenous morphine (Thompson et al., 1995) can cause respiratory depression in healthy adults, we observed negligible changes in respiratory rate. Respiratory rate decreased by 0.5 breaths per minute in the fentanyl group, and by 0.9 breaths per minute in the morphine group, across the study interval ($p < 0.05$). Although these differences were statistically significant, they are unlikely to have clinical significance because mean respiratory rate for both groups at all time points in the study interval was within the normal range (Braun, 1990). Our findings, therefore, suggest that, contrary to popular opinion, respiratory rate should not be the primary factor determining whether to administer fentanyl or morphine to adult STEMI patients in the out-of-hospital paramedicine environment.

Pulse Rate

Similarly, we observed that mean pulse rate for both groups at all time points during the study interval remained within normal range (Ostchega et al., 2011). Additionally, the drug-time interaction effect was not significantly different between groups, suggesting that the change in pulse rate over time for each group was comparable. Therefore, pulse rate should not be the determining factor when administering fentanyl or morphine to adult STEMI patients.

Clinical Applications

Taken together, our results suggest that blood pressure, and not respiratory rate, should be the primary factor determining whether fentanyl or morphine is to be administered for adult STEMI patients in the out-of-hospital paramedicine environment. This data is particularly valuable as it supports paramedics to have confidence in their decision to administer fentanyl to adult STEMI patients who are at risk of becoming hypotensive. Fentanyl and morphine appear to offer comparable, clinically significant reductions in cardiac chest pain for STEMI patients, and both medications result in similar, clinically insignificant reductions in the respiratory rate in this population. It appears that the key difference between fentanyl and morphine is their effect on blood pressure. We observed a 6% greater decrease in systolic and diastolic blood pressures associated with the administration of morphine compared to fentanyl. As such, when a decrease in blood pressure would cause an adult STEMI patient to become hypotensive, paramedics should preferentially administer fentanyl. While previous studies (Huang et al., 2022; Watso et al., 2022) suggested that this finding should be expected, this study has added value by confirming that results from healthy populations do translate to the hemodynamically precarious population of adult STEMI patients.

Additionally, given the unique challenge presented by STEMI pathology, it is likely to be particularly important that paramedics administer fentanyl over morphine for patients at risk of developing hypotension in this population. Hypotension can have considerable detrimental effects for patients with STEMI, further compromising myocardial perfusion and leading to decreased cardiac output, impaired organ perfusion, and an increased risk of cardiac arrhythmias (Kontos et al., 2015; Menon & Hochman, 2002). Therefore, selecting fentanyl, which has a smaller impact on blood pressure than morphine, will likely lead to improved patient outcomes by avoiding the risks associated with morphine-induced hypotension while offering a comparable reduction in pain for adult STEMI patients. We recommend that paramedics consider blood pressure as a key determining factor guiding the choice of analgesic for adult STEMI patients to minimise the risk of adverse effects.

Limitations

While we are confident in the clinical applicability of our results, it is important to note that we did not compare possible differences in the equivalent dose of analgesic received by each group. In practice, paramedics administer clinically appropriate doses of medications according to their education, relevant guidelines, and professional judgement. While it is possible that the fentanyl and morphine groups in our study did not receive equivalent doses, and this may have influenced the results, we determined that increasing experimental control by adjusting results based on possible dose differences would

reduce the practical applicability of our conclusions. We recommend further research investigates the possibility that differences in appropriate doses between the two drugs contributes to the results we observed in this study. Additionally, we were unable to control for possible differences in non-pharmacological approaches to pain reduction, such as assisting the patient to a position of comfort or providing reassurance. Given all patients were attended by registered paramedics, it is likely that these approaches were consistently applied. However, we were unable to confirm this, and acknowledge the possibility of confounding as a limitation of the study.

In conclusion, the aim of this study was to compare the effects of fentanyl and morphine on pain and cardiorespiratory vital signs in adult STEMI patients. We found that, with respect to our variables of interest, fentanyl and morphine seem to have comparable effects on all variables except blood pressures, where morphine appears to lead to a greater decrease in systolic and diastolic blood pressure over time. We also observed an unanticipated behavioural finding - that paramedics seem to selectively administer fentanyl over morphine when the patient is at risk of hypotension - and this appears to be effective in mitigating the chance of inducing hypotension in these patients. Further qualitative research into the factors paramedics consider when selecting fentanyl or morphine is worthwhile, as is research into patient outcomes when patients are at risk of developing a worsening condition. Through our analysis, we have determined that fentanyl is likely to be a more optimal choice than morphine for patients at risk of developing hypotension.

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RESEARCH REPORTS

PREHOSPITAL USE OF KETAMINE VERSUS MIDAZOLAM FOR SEDATION IN ACUTE SEVERE AGITATION

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ABSTRACT

Objective: Acute severe agitation often requires pharmacologic sedation. While benzodiazepines and antipsychotics are traditional first-line medications for this purpose, recent evidence has shown that prehospital intramuscular (IM) administration of ketamine results in rapid, effective sedation. However, ketamine may be associated with adverse clinical events including a higher intubation rate. The purpose of this study is to compare the efficacy and safety of IM ketamine versus IM midazolam as medications to achieve sedation in the prehospital setting.

Methods: This is a retrospective cohort study of agitated patients with an initial Richmond Agitation-Sedation Scale (RASS) score of at least 3, who were sedated and transported by ambulance to Hartford Hospital. The primary endpoint was incidence of endotracheal intubation occurring during transportation and within one hour after arrival to the emergency department (ED). Secondary endpoints included the percentage of patients who achieved an improved RASS score post drug administration, the use of additional sedating agents and the need for airway and breathing support, and differences in adverse events.

Results: 66 patients in the ketamine group and 68 patients in the midazolam group met inclusion criteria. While more patients in the midazolam group achieved target RASS score of -1, 0, or 1 post drug administration, patients in the ketamine group had a lower mean RASS score post drug administration. There was no difference in endotracheal intubation rates between the two groups (6.1% versus 2.9%, respectively; p = 0.383). However, upon arrival to the ED, more patients in the ketamine group required additional sedating agents as well as airway or respiratory support.

Conclusion: Both ketamine and midazolam are relatively safe and efficacious in the prehospital environment. IM ketamine resulted in deeper sedation without increasing intubation rate. However, ED providers receiving patients treated with IM ketamine should prepare for additional sedating agents and airway interventions.

INTRODUCTION

Acute agitation commonly occurs in the prehospital setting. In severe cases, patients may progress to developing life threatening agitation, a complex and incompletely understood physiologic process of autonomic dysfunction. Acute severe agitation is life threatening and may progress to include mania, delirium,

catatonia, or respiratory or cardiac arrest (Takeuchi et al., 2011). Sudden death is thought to result from profound metabolic acidosis and catecholamine surges causing cardiac dysrhythmias (Mash, 2016).

Patients with acute severe agitation can pose a significant threat to themselves and to caregivers, necessitating chemical sedation. The profile of an ideal medication would be one that is easy to administer, with a rapid onset of action, that provides adequate duration of effect, and has a wide therapeutic window (Keseg et al., 2015). Traditional first-line therapies include benzodiazepines and antipsychotics. However, there are issues with using these classes of medications for acute severe agitation: antipsychotics have a delayed onset of action, and benzodiazepines can cause over-sedation and respiratory depression at high doses (Mash, 2016). Due to these limitations, there is emerging interest in finding an alternative sedative. Recent evidence has supported the use of intramuscular (IM) ketamine (Takeuchi et al., 2011).

Ketamine is a dissociative anesthetic agent that is often utilized for procedural sedation in the hospital setting. It works by blocking N-methyl-D-aspartate receptors, inhibiting nitric oxide synthase, and interacting with opioid receptors. The onset of IM ketamine is 3-4 minutes and sedation generally lasts 5-30 minutes (Takeuchi et al., 2011 and Linder et al., 2018). Reported adverse effects of ketamine include increased heart rate and blood pressure, hypersalivation, laryngospasm, and emergence reaction (Vien and Chhabra, 2017). Connecticut Statewide Emergency Medical Services (EMS) Protocols include ketamine for chemical restraint for " extreme agitation/combativeness" at 4 mg/kg IM with a maximum initial dose of 500 mg.

Several published studies have evaluated ketamine's efficacy and safety in managing acute severe agitation in the prehospital setting. The corresponding data has shown that ketamine results in rapid effective sedation (Ho et al., 2013 and Olives et al., 2016) and is superior to haloperidol (Cole et al., 2016). However, there was a high intubation rate in patients receiving ketamine, as high as 57% (Cole et al., 2018) and 63% (Olives et al., 2016). While a recent meta-analysis revealed a pooled intubation incidence of 1% prehospitally and 19% in the ED (Lipscombe et al., 2022), additional safety and efficacy data is necessary as ketamine is increasingly used. The purpose of this study is to compare IM ketamine versus IM midazolam when used by paramedics as sedating agents for acute severe agitation in the prehospital setting.

METHODS

Study design

This was a retrospective cohort study of patients with acute severe agitation who were transported by paramedics to Hartford Hospital between February 9, 2017 and July 31, 2018. Human subjects approval was granted by the Hartford Hospital Institutional Review Board: E-HCC-2018-0190. Hartford Hospital is a tertiary care facility and Level I Trauma Center. While chart reviewers were not blinded to the study, data taken from the hospital chart was limited to objective, documented interventions or test results.

Drug administration during ambulance transport followed the Connecticut Statewide Emergency Medical Services (EMS) protocols and medication selection was made by provider judgement. Paramedics previously completed didactic education regarding

ketamine administration and were required to submit quality assurance (QA) data forms for any ketamine or midazolam administration. QA form completion was confirmed by matching controlled drug use records to data forms, and QA data forms were used to identify all eligible patients.

The Richmond Agitation-Sedation Scale (RASS) was selected to quantify medication indication and efficacy. RASS is a 10-point scale ranging from combative (4) to unarousable (-5) (Ely et al. 2003). This assessment tool is relatively novel in the prehospital field and is more pertinent to measuring the effects of sedation and analgesia than the more common Glasgow Coma Scale (GCS). Patients were enrolled if they were between 18 and 89 years old and had profound agitation with an initial RASS score of at least 3 requiring IM ketamine or IM midazolam.

RASS was assessed at patient contact and repeated at ED triage. Patients were excluded if they were transported to a hospital other than Hartford Hospital as their ED records were unobtainable. Study data was obtained from the Hartford Hospital EMS Sedation/Analgesia Quality Assurance Form and inpatient medical records. Patient demographics, ketamine and midazolam doses, use of additional sedating agents, airway and breathing supports, endotracheal intubation during transportation and within one hour after arrival at the ED, and urine toxicology screening to identify polysubstance use as a variable were collected. Patient's hospital disposition, patient's RASS before and after sedation, and reported adverse events were also obtained.

Outcomes

The primary endpoint was the incidence of endotracheal intubation occurring during transportation and within one hour after arrival to the ED. Secondary endpoints included percentage of patients who achieved an improved RASS score of -1, 0, or 1 post drug administration, the use of additional sedating agents, airway and breathing supports during transportation and within one hour after arrival at the ED, and reported adverse events.

Study analysis

Descriptive statistics were used for both study groups. Group sample sizes of 70 in the ketamine group and 70 in the midazolam group (a total sample of 140) were predicted to afford 80% power to detect a difference between the group proportions of 0.15, using a two-sided Z test with pooled variance and a significance level of 0.05. Continuous variables were reported as mean and standard deviation, or median with interquartile range, depending on distribution while categorical variables were reported as a frequency, using percentage. A Pearson chi square test was used to evaluate the primary and secondary outcomes.

RESULTS

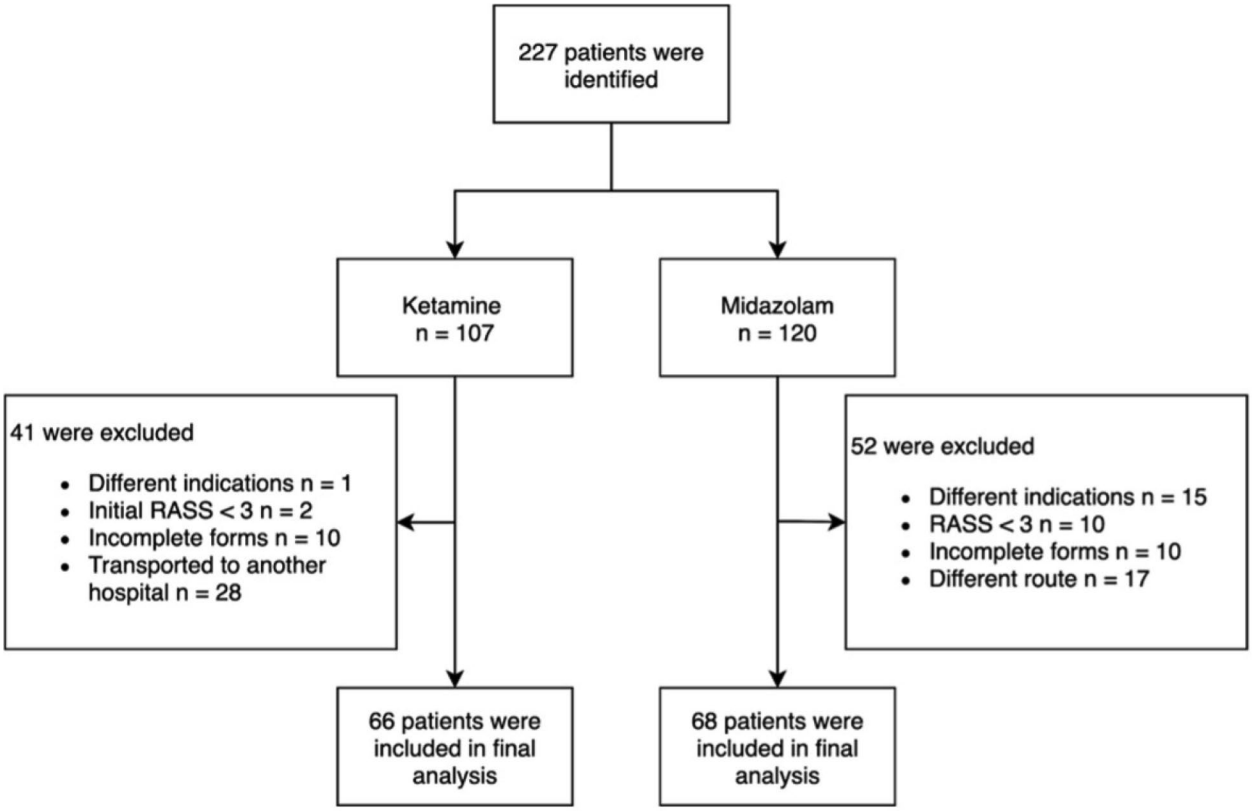

Figure 1. Results.

Patient characteristics

A total of 227 patients were identified. After applying the inclusion and exclusion criteria, 68 patients in the midazolam group and 66 patients in the ketamine group were included in the final analysis (Figure 1). The mean dose of ketamine was 288 mg (3.32 mg/kg), and the mean dose of midazolam was 5.6 mg (0.066 mg/kg). There were no statistically significant differences in baseline characteristics between two groups except for ages and RASS scores (Table 1). Patients in the ketamine group had a mean age of 35 years and patients in the midazolam group had a mean age of 44 years ($p < 0.001$). Mean initial RASS score was higher in the ketamine group (3.88 versus 3.63, $p < 0.001$).

Study outcomes

More patients in the ketamine group had an incidence of endotracheal intubation within one hour of transport to the hospital, but the result was not statistically significant (6.1% versus 2.9%, $p = 0.383$). A total of 41 patients achieved an improved RASS score of -1, 0, or 1 post drug administration. Thirteen patients (19.7%) were in the ketamine group and 28 patients (41.2%) were in the midazolam group ($p = 0.007$). Patients in the ketamine group had a deeper mean RASS score post drug administration as compared to patients in the midazolam group, overshooting target RASS of -1, 0, or 1 (-2.38 versus -0.62, $p < 0.001$). There was no statistically significant difference between the two groups concerning the use of additional sedating agents during transport. However, upon arrival to the

	Ketamine	Midazolam	p-Value
Baseline Characteristics			
Female sex - no. (%)	29 (43.9)	32 (47.1)	0.717
Age (yr)- mean ± SD	35 ± 10.4	44 ± 17.1	< 0.001
Urine toxicology collected - no. (%)	44 (66.7)	33 (48.5)	0.034
Discharged from the ED - no. (%)	42 (63.6)	49 (72.1)	0.296
Initial RASS- mean ± SD	3.88 ± 0.33	3.63 ± 0.49	< 0.001
Primary Outcome			
Endotracheal intubation- no (%)	4 (6.1)	2 (2.9)	0.383
Secondary Outcomes			
RASS of -1, 0, 1 post drug administration - no.(%)	13 (19.7)	28 (41.2)	0.007
Additional sedating agents during transport - no.(%)	19 (28.8)	19 (27.9)	0.913
Additional sedating agents within 1 hour of ED arrival - no.(%)	24 (36.4)	12 (17.6)	0.015
Additional airway supporting devices - no.(%)	30 (46.2)	10 (14.7)	< 0.001
Adverse events- no.(%)	6 (9.1)	0 (0)	0.011

Table 1. Patient Characteristics.

ED, more patients in the ketamine group required additional sedating agents and airway supporting devices as compared to patients in the midazolam group (36.4% versus 17.6%, p = 0.015 and 46.2% versus 14.7%, p < 0.001 respectively). There were also more reported adverse events in the ketamine group (9.1% versus 0%, p = 0.011), including apnea and increased oral secretions. One patient experienced a suspected emergence reaction: a complication providers should consider in the context of ketamine pharmacokinetics (Perumal et al. 2015).

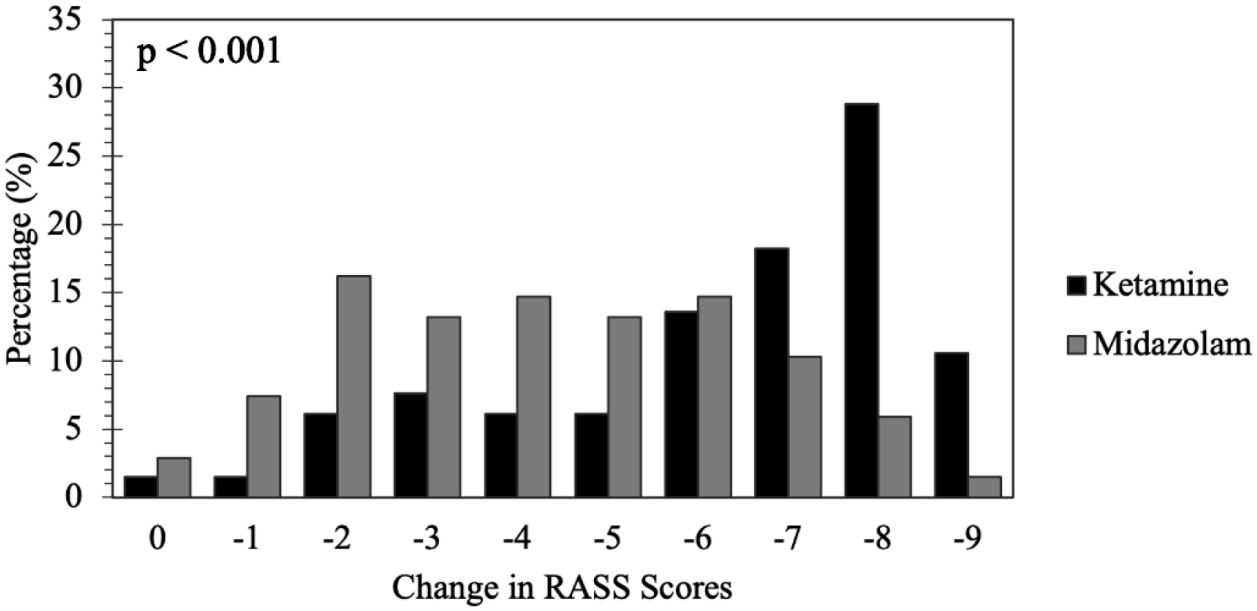

Figure 2. Change in RASS following sedative administration.

DISCUSSION

The rate of intubation was not statistically different between IM ketamine and IM midazolam, though a small absolute increase of intubation in the ketamine arm was noted (6.1% and 2.9%, respectively). This is a significantly lower intubation rate than most previous reports, which may be related to the overall lower mean dose of ketamine used in our study participants (3.3 mg/kg). Early literature on this topic correlated airway compromise with higher ketamine dose (Burnett et al. 2015). Guidance provided to paramedics was to err on the lower side of the dosing range given the inherent difficulty in prehospital weight estimation (Wells et al. 2023) and the dangers of excessive ketamine dosing. This practice may have been the key to a lower intubation rate than previous studies and may represent an effective dose for single administration sedation while avoiding negative effects.

Four different providers were involved in the four cases of intubation associated with ketamine, suggesting a low likelihood of variation in individual practice. Due to the nature of retrospective chart review, specific details on indications of intubations and the use of additional airway support were not available. Further review into the intubated patients showed that one patient was in respiratory distress prior to ketamine administration, two patients experienced hypoxemia and poor airway protection following ketamine administration, and one patient was intubated to facilitate computed tomography (motion control) after significant trauma.

In terms of efficacy, more patients in the midazolam group achieved a goal RASS of -1, 0, or 1 compared to patients in the ketamine group. When the changes in RASS scores were analyzed individually, the data showed that ketamine resulted in deeper sedation (Figure 2). Upon arriving to the ED, patients in the ketamine group were more likely to receive additional sedating agents. This may be due to ketamine having a shorter duration of action than midazolam, or it could be due to patients in the ketamine group experiencing emergence reactions that required additional sedation. Furthermore, while urine toxicology screen was performed on a subset of patients to determine confounding effects of polypharmacy, it was not performed with enough regularity to gain insight as to the effects of polypharmacy/intoxicants.

Acknowledging that an age difference was identified between groups, there may be confounding biases or variables in clinical presentation that may warrant future study. No explicit instructions were given to paramedics regarding medication selection, except to "consider dose reduction in the frail or debilitated patient." In contrast to prior literature (Holland et al. 2020), a difference in medication selection by gender was not identified.

LIMITATIONS

This was a single site retrospective chart analysis that reviewed the use of ketamine and midazolam for prehospital treatment of acute severe agitation, performed as a surveillance measure after the addition of ketamine to the regional protocols. Thus, both groups are considered standard of care and group selection was made by provider preference without randomization or resource limitation. This project is limited in capturing the total usage of ketamine or midazolam in the region, as there are several receiving facilities within close proximity. More patients in the ketamine group were transported to a different tertiary care facility, which was geographically closer for one of the enrolled

services. While our study was just shy of meeting the enrollment goal, a post-hoc sample size calculation with our data predicts n=658 patients per group would be required to meet statistical significance for intubation incidence with α=0.05, β=0.20, and 80% power.

CONCLUSION

In this study of 134 patients with acute severe agitation, the rate of endotracheal intubation between prehospital use of IM ketamine and IM midazolam was not statistically significant. Ketamine resulted in deeper sedation compared to midazolam, and more patients in the ketamine group required additional sedating agents and airway support in the ED. While these data suggest ketamine may be safer than previously reported, there are lingering challenges with dose and duration of action that infrequently require airway management. Furthermore, additional investigation is warranted to compare a larger population of patients in a prospective fashion.

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RESEARCH REPORTS

DEMONSTRATION OF DOPPLER ULTRASOUND PULSE DETECTION BY TRAINED PREHOSPITAL PERSONNEL: A FEASIBILITY STUDY

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ABSTRACT

Background and Aim: Data suggests that finger palpation of the carotid and/or femoral pulses is significantly less sensitive than 100%. In some cases, a patient who does, in fact, have organized cardiac function, may be identified as being in Pulseless Electrical Activity (PEA). Chest compressions performed as indicated by these circumstances may not provide significant therapeutic benefit to those patients and may, in fact, distract from better directed therapies. Doppler Ultrasonography (DUSG) has been shown to be more sensitive than human fingers. This research aims to assess whether EMT-Basics and Paramedics can be quickly and inexpensively trained to use DUSG as a tool for pulse detection.

Methods: Participants viewed a recorded video 4 minutes 18 seconds in length which detailed an anterior-to-posterior fanning technique for assessing presence of a carotid pulse using a doppler ultrasound device. The participants were given a period of time for coached practice and familiarization with the device. Participants were then timed while demonstrating application of ultrasound-conducting gel to a volunteer and using the device to detect a carotid pulse. The time recording ceased when the participant verbalized confirmation of the pulse, and their success or failure was annotated.

Results: Credentialed EMT-Basics and Paramedics, with minimal training, consistently demonstrated the ability to accurately and rapidly assess a carotid pulse using a doppler ultrasound device.

Conclusions: This demonstration suggests that prehospital personnel can be efficiently trained to use available and inexpensive doppler ultrasound devices to determine cardiac pulse status. Furthermore, it suggests that the technique itself can be used to detect the carotid pulse quickly and accurately. Further research in patient care settings should be undertaken to evaluate the utility of doppler ultrasound devices in distinguishing PEA from pseudo-PEA.

BACKGROUND

A replete body of research had been published over the last three decades, including adult and pediatric populations in multiple settings, and has largely found manual palpation of both peripheral and central pulses is non-specific and unreliable (Brearley, et al., 1992; Tibballs & Russell, 2009; Mather, C.,

& O'Kelly, S.,1996). A more recent, and rapidly expanding, body of evidence comparing manual palpation techniques to the use of Doppler ultrasonography (DUSG) and uses of Point-of-Care Ultrasound (POCUS) has further reinforced this notion. Comparative research between the use of technologies has generally found both DUSG and POCUS to be more sensitive and specific for confirmation of the presence of a pulse than manual palpation (Kang et al., 2022; Zengin et al., 2018; Cohen et al., 2022; Badra et al., 2019; Schwartz et al. 2021; Smith et al. 2021; Gaspari et al. 2023; Özlü et al. 2023).

In the context of the potential cardiac arrest victim, the central pulse is checked as a substitute biomarker for direct observation of the presence of cardiac function. When a patient on cardiac monitoring is seen to have organized cardiac electrical activity other than ventricular tachycardia or ventricular fibrillation yet is not found to have a central pulse, clinicians are trained to recognize and categorize this as Pulseless Electrical Activity (PEA) (Oliver, T. I., Sadiq, U., & Grossman, S. A., 2023). The American Heart Association Advanced Cardiac Life Support algorithm suggests chest compressions, positive-pressure ventilations, and directed therapies to reverse the underlying etiology if possible (Panchal et al., 2020).

As tools more sensitive and specific in dynamically describing cardiac function in the peri-arrest patient have become available and validated, the term "pseudo-PEA" has come to describe the ostensibly pulseless patient in whom cardiac function is actually present (Cheung, J. C., & Yip, Y. Y., 2021; Rabjohns et al., 2020; Van den Bempt et al., 2021). A patient wrongly determined by a clinician to be pulseless following a manual pulse check, when more sensitive methods would have detected a pulse, is experiencing pseudo-PEA. Several physiologic states could result in pseudo-PEA, including severe distributive shock during which, for some period of time, relatively normal cardiac activity could be present though extremely low pulsatile pressures in the carotid arteries (Smith et al., 2023). Currently, no specific literature has established that chest compressions are capable of meaningfully improving the cardiac output in the presence of such pathologically diminished preload and afterload. Distributive shock states are typically treated with infusion of fluids or blood products to reduce relative hypovolemia and appropriate vasopressors or reversal agents for the particular pathophysiology involved (Smith et al., 2023). For a distributive shock patient in a state of pseudo-PEA, it may be that correct assessment has the potential to steer the patient's treatment down wildly divergent paths one of which may be completely ineffective and therefore counterproductive in the compressed timeframe available for intervention.

POCUS provides direct visualization of cardiac activity by bedside transthoracic cardiac ultrasonography. The use of a color-flow doppler mode also provides the direct real-time visualization of flow in the carotid artery when a probe optimized for superficial vascular viewing is applied to the neck. The disadvantages of POCUS in the EMS context include its expense, as well as the burden of training prehospital clinicians and maintaining continuing skills proficiency. In the context of the peri-arrest victim, the duration of time required to power on and boot up the associated hardware and software also may present a disadvantage.

Doppler ultrasound units appropriate for DUSG are comparatively inexpensive, with units available to consumers and professionals for less than $200. Operation is simple, as they lack images. For basic units, the only operator-influenced mechanisms are a power

button, a volume knob/rocker, and the positioning of the probe, while the only outputs are a single LED indicating that the unit is on and the speaker for producing audio signals. Doppler ultrasound units are small, light, and generally boot to full operation status instantly with the press of one button.

Current practices in vascular medicine take for granted the higher sensitivity of DUSG as it is routinely used to check for non-palpable pulses in the dorsalis pedis and posterior tibialis during assessments for peripheral arterial disease, as well as in the fingertips. In the context of cardiac arrest resuscitation, DUSG has consistently shown more sensitive and at least equally specific for the detection of central pulses compared to manual palpation (Kang et al., 2022; Zengin et al., 2018; Cohen et al., 2022; Badra et al., 2019; Schwartz et al. 2021; Smith et al. 2021). Given the previously mentioned advantages of DUSG over POCUS relevant to EMS clinicians, this research seeks to evaluate whether EMT-Basics and Paramedics can be inexpensively and quickly trained to use DUSG for pulse detection.

METHODS

Two populations were specified for study: credentialled EMT-Basics and Paramedics. Inclusion required holding current, unexpired certification or licensure from the National Registry of Emergency Medical Technicians or the Texas Department of State Health Services at the relevant level. No exclusion criteria beyond failing to meet the inclusion criteria were established. In-person solicitation of participation at EMS stations and training events was used to gather a convenience sample. Given the descriptive nature of this effort, convenience sampling strategy, and logistical limitations, no minimum number of participants was determined to be necessary.

After consenting to participation, all participants viewed a training video 4 minutes 18 seconds in duration. It explained the operation of the doppler ultrasound unit, as well as the A-P fanning technique for the detection of the pulse by doppler ultrasound, aided by video demonstration. After viewing the video, participants immediately transitioned to a coached practice and familiarization period totalling no more than 10 minutes per participant.

At the conclusion of the practice and familiarization period, the participants immediately completed a timed demonstration of the technique which they had just been trained to perform. The demonstration began with a supine adult volunteer positioned as a simulated patient and the doppler ultrasound unit turned off with its probe stowed in storage configuration. A stopwatch was started simultaneous to the giving of a start signal to the participant. Participants were required to immediately apply a portion of water-based lubricant functioning as ultrasound-conducting gel to the simulated patient's neck anterior to the sternocleidomastoid. They then immediately picked up the doppler unit, powered it on, and placed the probe on the neck to begin an A-P fanning technique scan for a carotid pulse. The participants were directed to verbalize confirmation of a detected pulse when they believed they had done so. At the participant's verbal confirmation, the stopwatch was stopped.

It must be noted that for the purposes of this research, specification of a particular approach to the use of DUSG at the carotid site was assessed to be necessary. Given that doppler ultrasound probes "listen" in a linear fashion aligned with the long axis of the

probe, variability of the initial alignment of the probe presents significant possibility of missing the carotid artery when placed in the notch anterior to the sternocleidomastoid. This possibility is complicated by variances in patient anatomy and body habitus. Since the technique to be applied for a peri-arrest patient must be both sensitive for the presence of, and specific for the absence of, pulsatile flow in the carotid artery in a limited time frame, the technique employed must be optimized to quickly include and exclude a pulse. Rather than choosing a random initial probe position, this research trains participants in the use of an anterior-to-posterior (A-P) fanning technique.

This technique begins with the probe placed initially into the notch anterior to the sternocleidomastoid and oriented roughly parallel to the coronal plane. In this initial position, the probe is "listening" toward the tracheal rings. While keeping the probe tip in contact with the same point on the skin, fanning the probe from its coronal plane position rearward toward a position parallel to the sagittal plane adjusts the target of its "listening" toward directly posterior. If this fanning motion is continued past its posterior target parallel to the sagittal plane, the target of "listening" becomes lateral. Though this technique has not been previously described or independently validated, this research assumes that an A-P fanning technique of scanning for the carotid pulse is likely more sensitive and specific than a less-directed, non-systematic method of searching for a pulse in the area.

The doppler ultrasound unit employed for the trial was equipped with a 4Mhz probe selected as most appropriate for superficial vascular scanning according to the manufacturer's recommendation. No other equipment variations were assessed.

A data recording instrument recorded a sequentially assigned participant number, the participant's credential, the duration of their demonstration rounded to the nearest second, and "success" or "failure" as determined by the evaluator's corroboration of the detection of a pulse by DUSG at the time the participant confirmed detection. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Expedited approval and institutional activation were obtained from the University of Texas Health Science Center at San Antonio Institutional Review Board as protocol 20220843HU prior to the initiation of research activities and recruitment of participants. Requirement of informed consent was waived due to the low-risk nature of the research, but an approved participant information sheet was made available to all participants to review before participation and keep a copy as desired.

RESULTS

A total of 23 participants, including 10 paramedics and 13 EMT-Basics, were enrolled. All of them were employees of either Acadian Ambulance or San Antonio Fire Department. All participants viewed the video and were given no more than 10 minutes of coached practice time. The specific amount of time spent by each participant was not recorded.

All 23 participants accurately identified a pulse. The mean duration of the timed demonstration by the EMT-Basics was faster than the paramedics at 13.3 seconds compared to

15.2 seconds. The fastest recorded time was an EMT-Basic at 7.0 seconds while the fastest paramedic was 9.0 seconds. The longest time was an EMT-Basic at 31.0 seconds, with the slowest paramedic taking 23.0 seconds.

Partcipant Count	23
Success Rate	100%
Mean Duration (seconds)	14.1
Standard Error	1.3
Median	12.0
Mode	8.0
Standard Deviation	6.3
Sample Variance	41.7
Range	24.0
Minimum	7.0
Maximum	31.0
Coefficient of Variation	0.446758211

Table 1. Summary of results from all participants.

Partcipant Count	10
Success Rate	100%
Mean Duration (seconds)	15.2
Standard Error	1.5
Median	14.5
Mode	#N/A
Standard Deviation	4.6
Sample Variance	23.5
Range	14.0
Minimum	9.0
Maximum	23.0
Coefficient of Variation	0.302631579

Table 2. Summary of results from paramedic participants.

Partcipant Count	13
Success Rate	100%
Mean Duration (seconds)	13.3
Standard Error	2.1
Median	11.0
Mode	8.0
Standard Deviation	7.3
Sample Variance	57.1
Range	24.0
Minimum	7.0
Maximum	31.0
Coefficient of Variation	0.545378097

Table 3. Summary of results from EMT participants.

DISCUSSION

It appears feasible to inexpensively and rapidly train EMT-Basics and Paramedics in the use of DUSG at the carotid site for pulse detection/confirmation. This contention rests upon the highly successful, relatively rapid employment of DUSG during the timed demonstrations. Even in the absence of a comparison standard or a pre-determined benchmark for feasibility, with respect to a success rate of 100%, *res ipsa loquitur*. These findings are novel as no previous attempt to characterize the efficiency of educating paramedics and EMT-Basics in the use of DUSG could be identified during literature search, but the results are consistent with previous literature concerning the actual utilization of DUSG.

It is unlikely that further research concerning the efficiency of training EMS personnel in DUSG use is of high utility. Appropriate further research should evaluate the actual use of peri-arrest DUSG carotid pulse checks themselves in clinical settings. Integration of carotid DUSG into care of actual peri-arrest patients should contend mostly with the patient plausibly in PEA where its benefit is most likely to present. An algorithmic approach to use of DUSG by EMS providers might prioritize its use for a patient whose initial or most recent pulse and rhythm check revealed apparent PEA. In following high-performance principles, a user should be trained to power on the unit, apply the lubricant/gel, and place the probe in its initial position while compressions are ongoing such that when the pause is called, only an A-P fanning scan need be performed. Additional protocolized guidance for actions to be taken in the case of identified pseudo-PEA should be provided.

Though it was not formally assessed in the structure of this research, rather was assumed reasonable as described in the methods, the results of this research imply feasibility of the A-P fanning technique of carotid DUSG as a method of employment for DUSG. This implication is limited in strength by the lack of comparison. It may also be that an entirely different form of DUSG technology would optimize the provided advantages while eliminating the drawbacks of clinician operation of the probe. Using a soft collar device to attach a doppler transducer puck device with a broader field of "listening" to the neck may have potential to provide immediate and high-quality "hands-off" feedback less susceptible to minor variations in position. A study looking at porcine models have shown promise with a similar device paired with computerized assessment of the produced signal capable of indicating status of pulselessness or return of spontaneous circulation (ROSC) to an Automated External Defibrillator, while another has shown promise using a doppler puck for feedback during compressions (Yu et al. 2008; Faldaas et al. 2024). Further research would be appropriate to compare undirected scanning efforts and/or alternative scan patterns, such as a posterolateral-to-anteromedial scan or a diverging circular scanning pattern, as well as hands-off probe technology.

With respect to the timed demonstrations, a comparison standard was not formally selected, though a reasonable comparison standard for discussion does exist as this research is centered around the peri-arrest victim. The commonly accepted time interval given for manual palpation of the pulse during a pause in, or in determining the necessity of, chest compressions for a peri-arrest patient is 10 seconds. The mean and median elapsed time to complete the timed demonstration does exceed 10s in the aggregate sample of both populations, as well as in each evaluated population. It should be noted that comparison is being made to a demonstration which includes tasks which could be completed before the pause window in actual clinical practice. During the timed trial, the participants were assigned to complete all the tasks necessary for DUSG, including the application of the lubricant/gel.

Given that this feasibility study does not compare two different interventional arms, it is not immediately apparent what standard against which to compare the data to establish "success" or "failure" of the training given to the participants. During planning, low participation rates and small sample size were considered likely, thus resulting in the choice to employ a convenience sampling strategy with no pre-set minimum. It is also assessed that use of documented sensitivity or specificity rates for manual palpation determined in a setting of actual uncertainty would be an inappropriate comparison for a trial in which DUSG is tested on obviously living volunteers. For this reason of absence of a meaningful available comparison, the data collected is descriptive rather than comparative in nature.

This research acknowledges that the small sample size and convenience sampling are technical limitations to the generalizability, as is the single point of determination of success by corroborative declaration of the evaluator. Additionally, there is no mechanism for blinding participants or the evaluator to the status of the volunteer simulated patient, who was absolutely known in all cases to have a pulse. These limitations were found to be impractical or impossible to mitigate without serious impact to feasibility.

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RESEARCH REPORTS

THE STATE OF EMERGENCY MEDICAL SERVICES CLINICIAN MENTAL HEALTH IN VIRGINIA

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ABSTRACT

Background: In the United States, research has found that emergency medical service (EMS) clinicians contemplate and attempt suicide at a rate approximately 10 times higher than the general population. However, prior to this study, no comprehensive data existed on the mental health status and needs of Virginia's EMS clinicians.

Objective: To evaluate mental health conditions, substance use, COVID-19 stress, and job satisfaction among Virginia's EMS clinicians, and to assess the perceived mental health cultures, services, and barriers to seeking help within clinicians' agencies.

Methods: The Virginia Office of EMS (OEMS) constructed a comprehensive EMS clinician mental health cross-sectional survey during the spring of 2022. The survey was sent to every certified EMS clinician over the age of 18 with a working email address within the Commonwealth (N=36,376) as of April 15, 2022.

Results: A total of 2,930 EMS clinicians who actively served in EMS within the past 12 months responded to the survey. On average, clinicians reported 9.9 days of perceived poor mental health out of a 30-day period, with 9.1% of clinicians seriously contemplating suicide within the past year. Almost 60% of respondents reported heavy alcohol consumption at least once in the year prior to the survey, while 6.5% had taken prescription drugs for non-medical reasons and 3.7% had used illegal drugs. Approximately 66% of clinicians felt the coronavirus pandemic increased workplace stress. More than half of respondents (57.3%) indicated they had intentions to quit working in EMS. Finally, 31.1% of clinicians disagreed or strongly disagreed that EMS clinician mental health is important to their agency.

Conclusion: Virginia's EMS clinicians experience a greater number of perceived poor mental health days, higher levels of suicide contemplation, and increased substance use as compared to the general population. Further health promotion actions are needed to address these disparities among Virginia's EMS clinicians.

INTRODUCTION

The emergency medical services (EMS) profession is rife with occupational hazards and injuries (Reichard et al., 2017; Bentley & Levine, 2016; Taylor et al., 2015). Common adversities experienced by EMS personnel include muscle strains/tears, back problems, fatigue leading to increased risk of injury, being struck by a motor vehicle, ambulance crashes, violence from patients or bystanders, and exposures to harmful chemicals or pathogens (Reichard et al., 2017; Bentley & Levine, 2016; Taylor et al., 2015;

Reichard et al., 2018; Maguire & O'Neill, 2017; Weaver et al., 2015; Lin et al., 2020; Donnelly et al., 2019; Patterson et al., 2011; Watanabe et al., 2019; Maguire et al., 2018; Gormley et al., 2016; Pourshaikhian et al., 2016; Thomas et al., 2017; Alhazmi et al., 2017). However, even with a high risk of workplace injuries and death, research reveals that first responders are more likely to die by suicide than any other occupational cause of death (Heyman et al., 2018). Significantly, a survey of EMS clinicians in the United States discovered that clinicians contemplate and attempt suicide at a rate ten times higher than the general population (Abbott et al., 2015).

On a regular basis, emergency responders are exposed to significant levels of traumatic incident stress that may have negative impacts on mental health (Traumatic incident stress, 2013). Traumatic incident stress can result from EMS clinicians responding to a variety of tragic events, such as natural disasters, terrorist attacks, deaths and abuse of children, murders, severe injuries and decapitations, and suicides (Centers for Disease Control and Prevention [CDC], 2013; Behnke et al., 2019; Reti et al., 2022). EMS clinicians who experience traumatic incident stress may manifest negative physical, cognitive, and emotional symptoms, including burnout, anxiety, depression, post-traumatic stress disorder (PTSD), and suicidality (CDC, 2013; Behnke et al., 2019; Reti et al., 2022; Bentley et al., 2013; Donnelly, 2012; Martin et al., 2017). Recently, these effects have been seen among healthcare workers responding to the coronavirus disease 2019 (COVID-19) pandemic, who have been at particularly high risk for poor mental health outcomes because of close work with potentially infected patients, limited supplies of protective equipment, and the need to remain separated from loved ones due to possible exposure (Vujanovic et al., 2021). Indeed, studies have shown that COVID-19 has exacerbated stress and sleep disturbances and has increased depressive and anxiety symptoms for frontline emergency and healthcare staff (Yu et al., 2022; Wild et al., 2022; Wright et al., 2021; Marczewski et al., 2021; Blanchard et al., 2022). Adverse mental health outcomes among EMS clinicians are also associated with organizational and operational forms of chronic stress (e.g., fatigue from shift work, paperwork, bullying in the workplace, lack of supervisor support, poor communication within the organization) (Reti et al., 2012; Cydulka et al., 1997; Sterud et al., 2008).

Unfortunately, many EMS clinicians do not have access to help for mental health issues within their workplace. A 2016 national survey on EMS mental health services conducted by the National Association of Emergency Medical Technicians found that less than half of EMS clinicians (46%) reported having access to mental health services within their agency (Goodwin & Lane, 2016). Further, high levels of mental health stigma (i.e., negative views of, and discrimination towards, individuals who have mental health issues) within EMS culture is a significant barrier to EMS clinicians accessing care (Corrigan & Penn, 1999, as cited in Haugen et al., 2017). Stigma surrounding mental health has been associated with poor health outcomes and avoidance of seeking help among persons with mental health concerns (Corrigan, 2004, as cited in Haugen et al., 2017; Haugen et al., 2017). A 2017 systematic literature review and meta-analysis found that 33.1% of first responders experienced mental health stigma and 9.3% experienced barriers to care (Haugen et al., 2017). In 2015, Reviving Responders, an organization dedicated to the research and education of mental health issues in the first responder and EMS communities, conducted a national survey of EMS clinicians and found that only 15% of participants reported working in cultures where peers and management supported those with

mental health issues and encouraged clinicians to use existing supports for help (Abbott et al., 2015). Additionally, the prevalence of suicide ideation and attempts were greater among respondents who did not have support and encouragement from peers or management for mental health issues (56% ideation and 12% attempts) compared to those who were fully encouraged and supported (23% ideation and 4% attempts) (Abbott et al., 2015). Research has also demonstrated that mental health stigma among first responders may lead to increased alcohol use as a method for coping with workplace stress (Gulliver et al., 2018; Gulliver et al., 2019; Martin et al., 2017; Bacharach et al., 2008; Paulus et al., 2017; Meyer et al., 2012; Karnick et al., 2022). Notably, alcohol use rates are higher among first responders than the general population (Gulliver et al., 2018; Gulliver et al., 2019; Meyer et al., 2012; Piazza-Gardner et al., 2014).

A strategic initiative of the Virginia Office of Emergency Medical Services (OEMS) is to develop, implement, and promote programs that emphasize the health and safety of clinicians (Virginia OEMS, 2017). As part of this commitment to Virginia's first responders, the OEMS launched the "Make the Call" initiative in late 2018, a statewide mental health awareness campaign with the goals of destigmatizing mental health issues and encouraging first responders to seek mental health support (Virginia OEMS, 2018). As an extension to the "Make the Call" campaign, the Virginia OEMS conducted its first statewide mental health survey among Virginia's clinicians in the summer of 2019. Due to the high prevalence of poor mental health outcomes discovered from the 2019 survey and the reports of increasing stress related to the COVID-19 pandemic, the OEMS conducted a new statewide survey of EMS clinician mental health in the spring of 2022 (Yu et al., 2022; Wild et al., 2022; Wright et al., 2021; Marczewski et al., 2021; Blanchard et al., 2022). The goal of the survey was to assess the mental health status of Virginia's EMS clinicians, as well as the perceived mental health culture and services within the clinicians' agencies. Additionally, clinicians were asked questions regarding substance use and the impact of job satisfaction, the COVID-19 pandemic, and workplace violence on clinician mental health. The Virginia OEMS' long-term goal is for these data to be used to create evidence-based interventions that improve EMS clinician mental health, reduce the stigma and barriers associated with first responders seeking mental health support, and improve resiliency within the EMS field.

METHODS

Objectives

The OEMS developed a survey instrument to determine:

1. The mental health status of Virginia's EMS clinicians;
2. Substance use prevalence, frequency, and relationship with EMS service;
3. Perceived barriers that prevent EMS clinicians from seeking help;
4. Existing mental health support and services available to clinicians;
5. Attitudes and beliefs surrounding mental health within EMS agencies;
6. The impact of job-related verbal abuse and physical assault on mental health;
7. The pandemic's impact on clinician mental health; and
8. Clinicians' job satisfaction and intentions to quit.

Data Collection/Data Source

As no survey existed that met the research needs of the Virginia OEMS for this project, a unique survey tool was developed. Several questions were selected from existing government questionnaires, including the 2018 and 2020 Behavioral Risk Factor Surveillance Surveys, the Health-Related Quality of Life 14 questionnaire, the 2019 National Survey on Drug Use and Health, and the National Institute on Drug Abuse's Drug Use Screening Tool (CDC, 2018; CDC, 2021; CDC, n.d; Substance Abuse and Mental Health Services Administration [SAMHSA], 2018; National Institute on Drug Abuse [NIDA], n.d.). Additionally, questions regarding EMS clinician mental health, mental health barriers and stigma, and existing available resources were inspired from national surveys conducted by Reviving Responders and the National Association of Emergency Medical Technicians (Abbott et al., 2015; Goodwin & Lane, 2016); however, modifications were made to create unique questions to fit the context of this project. One question concerning the impact of COVID-19 on stress and mental health was developed based on a coronavirus impact poll published by the Kaiser Family Foundation in 2020, though it was revised to ensure applicability to the current study (Kirzinger et al., 2020); other COVID-19 questions were written by the Virginia OEMS staff. Questions assessing intention to quit were developed internally by the OEMS, while the job satisfaction question used was inspired by Paul Spector's psychometrically validated Job Satisfaction Survey (Spector, n.d.). Lastly, unique questions were created by Virginia OEMS staff to assess clinicians' employment history, certification level, employment and volunteer status, and involvement with a fire suppression agency.

Research Electronic Data Capture (REDCap), a web-based tool fully compliant with Health Insurance Portability and Accountability Act criteria that is used for gathering data, was utilized to deliver the survey in an online format (REDCap, n.d.). Survey logic was applied in the survey so only relevant questions were presented to clinicians (e.g., questions on EMS clinician outcomes occurring in the 12 months prior to the survey were only asked of respondents who indicated they had ever experienced the outcome). The final instrument contained 92 questions (see Appendix, Table 8).

Institutional Review Board (IRB) Review

The Virginia Department of Health's IRB reviewed the current study to ensure protection of the rights and welfare of the study subjects. IRB exemption approval was received for this project in February 2022.

Selection of Participants

The final survey tool was emailed to all certified EMS clinicians over the age of 18 within the Virginia OEMS database (n = 36,376) as of April 15, 2022. The survey closed on May 17, 2022. Clinicians who did not provide patient care in the past 12 months were excluded from the analyses.

Statistical Analysis

Frequencies, proportions, and 95% confidence intervals were calculated for categorical data. Means, standard deviations (SD), and 95% confidence intervals were calculated for continuous data. Respondents were able to skip any question for which they did not

wish to provide an answer. As such, the number of responses varied by question. Missing values were considered randomly missing. Survey results were analyzed using Microsoft Excel 2016, StataBE 17, and Tableau version 2022.2.0.

RESULTS

Of the 36,376 EMS clinicians who were sent the online survey, 3,760 responses were received. A total of 320 records were excluded from analyses because the EMS clinician had not been employed or volunteered in EMS in the prior 12 months, while 510 were excluded because the survey was incomplete. A total of 2,930 responses were included in the analysis. Demographic and occupational characteristics of respondents are summarized in Table 1.

Impact of the COVID-19 Pandemic

The impact of the COVID-19 pandemic on the work of Virginia EMS clinicians was assessed with several questions. The majority (66.1%, 95% CI [64.4, 67.9]) of survey respondents indicated that they had experienced additional EMS job-related stress attributable to the coronavirus pandemic, with 22.5% (n=658) of all respondents reporting the stress had a major negative impact on their mental health and 34.2% (n=1,002) relaying a minor negative mental health impact. Further, 85.3% (95% CI [84.0, 86.6]) of clinicians reported that their agency had experienced staffing shortages because of the pandemic, with 24.3% of

Characteristic	Number of clinicians (%) (n=2,930)
Age	
< 30	526 (18.0)
30 – 39	613 (20.9)
40 – 49	614 (21.0)
50 – 59	585 (20.0)
60 – 69	283 (9.7)
> 69	73 (2.5)
Missing	236 (8.1)
Sex	
Male	1,959 (66.9)
Female	871 (29.7)
Other	19 (0.6)
Missing	81 (2.8)
Associated with a Fire Department	
Yes	1,819 (62.1)
No	1,094 (37.3)
Missing	17 (0.6)
Certification Level	
Emergency medical responder	12 (0.4)
Emergency medical technician	1,469 (50.1)
Advanced emergency medical technician	227 (7.7)
Intermediate	249 (8.5)
Paramedic	966 (33.0)
Missing	7 (0.2)
Employment / Volunteer Status	
Full-time	1,348 (46.0)
Full-time and volunteer	288 (9.8)
Full-time and part-time	133 (4.5)
Part-time	96 (3.3)
Part-time and volunteer	138 (4.7)
Volunteer (unpaid)	696 (23.8)
Stipend/paid volunteer	35 (1.2)
Taking a break	104 (3.5)
Retired	39 (1.3)
Quit	31 (1.1)
Other	20 (0.7)
Missing	2 (0.1)
Years of EMS experience	
Less than 1 year	131 (4.5)
1-2 years	238 (8.1)
3-5 years	315 (10.8)
6-10 years	424 (14.5)
11-15 years	394 (13.4)
16-20 years	409 (14.0)
> 20 years	1,016 (34.7)
Missing	3 (0.1)

Table 1. EMS clinicians' demographic and employment characteristics, Virginia, 2022.

total respondents indicating the shortages had been temporary and 61.1% reporting the shortages were ongoing. The most frequently reported reasons for experiencing staffing shortages included people leaving the organization or quitting (56.7%, 95% CI [54.9, 58.4]), issues related to hiring, training, and recruitment (48.5%, 95% CI [46.7, 50.3]), the need for quarantine or isolation (40.4%, 95% CI [38.6, 42.2]), and people cutting back hours (28.6%, 95% CI [27.0, 30.2]). A total of 1,912 (65.3%, 95% CI [63.5, 67.0]) EMS clinicians felt the staffing shortages resulted in increased levels of EMS work-related stress.

Job Satisfaction

When EMS clinicians were asked whether they agreed with the statement "I feel appreciated by my agency when I think about what they pay me," 41.6% reported they agreed to some extent (i.e., agreed slightly: 14.5.%, 95% CI [13.3, 15.8]; agreed moderately: 16.8%, 95% CI [15.4, 18.1]; or agreed very much: 10.3%, 95% CI [9.2, 11.4]). However, 36.2% disagreed that they felt appreciated (disagreed slightly: 7.8%, 95% CI [6.9, 8.8]; disagreed moderately: 11.1, 95% CI [10.0, 12.2]; disagreed very much: 17.3%, 95% CI [16.0, 18.7]). Almost 22% were unpaid volunteers for whom the question was not applicable.

Importantly, most (n=1,680, 57.3%) survey respondents reported intentions to quit working as an EMS clinician at some point in the year prior to the survey compared to 42.2% who responded that they had never seriously thought about quitting. Specifically, 1,073 (36.6%, 95% CI [34.9, 38.4]) respondents relayed that they had seriously thought about quitting but had not taken actions to quit, 500 (17.1%, 95% CI [15.7, 18.4]) indicated they had taken action towards quitting (e.g., updating their resume, looking or applying for a new job, reducing EMS service hours), and 107 (3.7%, 95% CI [3.0, 4.3]) had quit practicing as an EMS clinician altogether. Reasons for experiencing intentions to quit were also assessed and are described in Table 2.

Reason for intention to quit	Number of clinicians (%)*	95 % CI
Work-related stress, burnout, or other mental health concerns	1,233 (42.1)	[40.3, 43.9]
Lack of sleep / chronic fatigue	898 (30.6)	[29.0, 32.3]
Low wages	785 (26.8)	[25.2, 28.4]
A desire for better work-life balance	765 (26.1)	[24.5, 27.7]
Concerns over physical health and safety	644 (22.0)	[20.5, 23.5]
Job negatively impacts partner / family relationships	582 (19.9)	[18.4, 21.3]
Heavy workloads / over-worked	558 (19.0)	[17.6, 20.5]
Conflict with leadership / coworkers	488 (16.7)	[15.3, 18.0]
Little to no chance for career growth	441 (15.1)	[13.8, 16.3]
Retirement	235 (8.0)	[7.0, 9.0]
I am a volunteer and no longer have the time	162 (5.5)	[4.7, 6.4]
New career interest	148 (5.1)	[4.3, 5.8]
Other	94 (3.2)	[2.6, 3.8]
*Proportions are calculated out of 2,930 total respondents. CI = confidence interval		

Table 2. Reasons why EMS clinicians thought about quitting, took action to quit, or quit working in EMS, Virginia, 2022.

Health-related quality of life indicator	No. missing responses	Mean (SD)	95% CI
Poor physical health	119	4.4 (7.5)	[4.2, 4.7]
Poor mental health	99	9.9 (10.2)	[9.5, 10.2]
Sad, blue, or depressed	115	8.8 (10.1)	[8.4, 9.1]
Worried, tense, or anxious	105	12.6 (11.3)	[12.2, 13.1]
Insufficient sleep or rest	98	16.1 (10.5)	[15.7, 16.5]
SD = standard deviation			

Table 3. Average number of days in the past 30 days clinicians perceived experiencing health-related quality of life indicators, Virginia, 2022.

Health-Related Quality of Life

Most EMS clinicians reported their perceived general health to be good (38.7%) or very good (34.8%), while 16.1% reported their general health to be fair (13.8%) or poor (2.3%). Table 3 displays the average number of days in the past 30 days clinicians experienced health-related quality of life indicators.

Hours of Sleep & Shift Length

Overall, EMS clinicians reported receiving an average of 6.1 hours (SD 1.3; 95% CI [6.0, 6.1]) of sleep in a 24-hour period. As shift length increased, the average hours of sleep a clinician received within a 24-hour period decreased. Clinicians who worked shifts greater than 24 hours in duration (3.7%) reported the lowest average amount of sleep, at 5.3 hours (SD 1.3; 95% CI [5.1, 5.6]). Clinicians who worked 24-hour shifts (40.5%) slept 5.7 hours (SD 1.2; 95% CI [5.6, 5.8]), those with 12- to 23-hour shifts (30.3%) reported 6.3 hours of sleep (SD 1.3; 95% CI [6.2, 6.4]), clinicians working 8- to 11-hour shifts (12.4%) slept 6.5 hours (SD 1.2; 95% CI [6.3, 6.6]), and clinicians who worked less than 8-hour shifts (3.7%) reported 6.8 hours of sleep (SD 1.2; 95% CI [6.5, 7.0]).

Mental Health Outcomes

Overall, 2,392 (81.6%; 95% CI [80.2, 83.0]) clinicians believed they experienced at least one poor mental health outcome (i.e., burnout, traumatic stress, depression, PTSD, verbal abuse causing emotional or psychological harm, physical assault causing emotional or psychological harm, or suicidal ideation) at some point during their careers associated with their work as EMS clinicians (vs. 70.7% during past 12 months; 95% CI [69.1, 72.4]). Table 4 displays the proportions of EMS clinicians who responded 'yes' to each mental health indicator question.

Mental health outcome	Ever during career		Past 12-months	
	Number of clinicians (%)*	95 % CI	Number of clinicians (%)*	95 % CI
Burnout due to stress of the job	2,089 (71.3)	[69.7, 72.9]	1,828 (62.4)	[60.6, 64.1]
Work-related traumatic stress that was bad for their mental health	1,678 (57.3)	[55.5, 59.1]	1,212 (41.4)	[39.6, 43.1]
Work-related depression	1,435 (49.0)	[47.2, 50.8]	1,161 (39.6)	[37.9, 41.4]
Work-related PTSD	1,313 (44.8)	[43.0, 46.6]	1,021 (34.8)	[33.1, 36.6]
Verbal abuse causing emotional or psychological harm	497 (17.0)	[15.6, 18.3]	385 (13.1)	[11.9, 14.4]
Physical assault causing emotional or psychological harm	374 (12.8)	[11.6, 14.0]	220 (7.5)	[6.6, 8.5]
Seriously contemplated suicide	476 (16.2)	[14.9, 17.6]	267 (9.1)	[8.1, 10.2]
EMS service contributed to suicide contemplation	337 (11.5)	[10.3, 12.7]	182 (6.2)	[5.3, 7.1]
Made plans to kill themselves	202 (6.9)	[6.0, 7.8]	100 (3.4)	[2.8, 4.1]
Tried to kill themselves	70 (2.4)	[1.8, 2.9]	17 (0.6)	[0.3, 0.9]
Known a clinician who had suicidal thoughts	1,771 (60.4%)	[58.7, 62.2]	974 (33.2)	[31.5, 34.9]
Known a clinician who attempted or died by suicide	1,492 (50.9%)	[49.1, 52.7]	443 (15.1)	[13.8, 16.4]
*Proportions are calculated out of 2,930 total respondents.				

Table 4. Number of EMS clinicians who experienced negative mental health outcomes, Virginia, 2022.

Substance Use

A total of 1,979 (67.5%; 95% CI [65.8, 69.2]) EMS clinicians reported using either alcohol, tobacco, prescription drugs for non-medical reasons, or illegal drugs in the 12 months prior to completing the survey. Table 5 shows the frequency of substance use among Virginia EMS clinicians. The definition of heavy alcohol use (i.e., drinking five or more alcoholic beverages per day for men or four or more per day for women) employed for this study was established by the National Institute on Alcohol Abuse and Alcoholism (Glossary, 2023).

Substance	Frequency of Use	Number of clinicians (%)*	95% CI
Heavy Alcohol Use • For men, 5 or more drinks a day • For women, 4 or more drinks a day	Never	1,174 (40.1)	[38.3, 41.8]
	Once or twice	716 (24.4)	[22.9, 26.0]
	Monthly	379 (12.9)	[11.7, 14.2]
	Weekly	461 (15.7)	[14.4, 17.1]
	Daily or almost daily	186 (6.3)	[5.5, 7.2]
Tobacco products	Never	2,097 (71.6)	[69.9, 73.2]
	Once or twice	154 (5.3)	[4.4, 6.1]
	Monthly	56 (1.9)	[1.4, 2.4]
	Weekly	70 (2.4)	[1.8, 2.9]
	Daily or almost daily	527 (18.0)	[16.6, 19.4]
Prescription drugs for non-medical reasons	Never	2,719 (92.8)	[91.9, 93.7]
	Once or twice	94 (3.2)	[2.6, 3.8]
	Monthly	22 (0.8)	[0.4, 1.1]
	Weekly	11 (0.4)	[0.2, 0.6]
	Daily or almost daily	63 (2.2)	[1.6, 2.7]
Illegal drugs	Never	2,770 (94.5)	[93.7, 95.4]
	Once or twice	64 (2.2)	[1.7, 2.7]
	Monthly	22 (0.8)	[0.4, 1.1]
	Weekly	14 (0.5)	[0.2, 0.7]
	Daily or almost daily	9 (0.3)	[0.1, 0.5]
*Proportions are calculated out of 2,930 total respondents.			

Table 5. Frequency of past-year substance use among EMS clinicians, Virginia, 2022.

Agency Mental Health Services and Culture

The majority of respondents (67.5%; 95% CI [65.8, 69.2]) reported their agency offered mental health services. However, 32.2% of clinicians reported limited or no access to care through their agency (i.e., the clinician did not know whether mental health services were offered: 15.2.%, 95% CI [13.9, 16.5]; the agency did not offer any mental health services: 14.0%, 95% CI [12.7, 15.2]; or the agency had services in development, but none were available at the time of the survey: 3.0%, 95% CI [2.4, 3.6]). Table 6 displays respondents' perceptions of their agencies mental health culture. Most clinicians held positive views of their respective agencies' mental health culture, including the importance of clinician mental health.

Perceived Barriers to Seeking Help for Mental Health Issues

Of the 2,413 (82.4%; 95% CI [80.9, 83.7]) clinicians who reported an adverse mental health outcome (i.e., burnout, traumatic stress, depression, PTSD, verbal abuse causing emotional or psychological harm, physical assault causing emotional or psychological harm, or suicidal thoughts) or substance use felt to be related to working or volunteering as an EMS clinician, 1,508 (62.5%; 95% CI [60.5, 64.4]) did not seek help. Table 7 displays the reasons why clinicians did not obtain assistance for EMS-related mental health issues they had ever experienced. For all mental health issues identified, the most frequently perceived barriers to care included not having time and not wanting a mental health problem documented in the employment record. For every mental health issue except one (i.e., seriously contemplating suicide), not feeling help was needed was among the

Perceptions of agency culture	Agree or strongly agree		Disagree or strongly disagree	
	Number of clinicians (%)*	95 % CI	Number of clinicians (%)*	95 % CI
EMS clinician mental health is important to my agency	1,980 (67.6)	[65.9, 69.3]	912 (31.1)	[29.4, 32.8]
My agency provides sufficient mental health support and services for EMS clinicians	1,566 (53.4)	[51.6, 55.3]	1,305 (44.5)	[42.7, 46.3]
If needed, I know where to find help within my agency for mental health issues	2,090 (71.3)	[69.7, 73.0]	799 (27.3)	[25.7, 28.9]
If needed, I would feel safe discussing mental health issues with my coworkers	1,667 (56.9)	[55.1, 58.7]	1,225 (41.8)	[40.0, 43.6]
If needed, my coworkers would encourage me to get help for mental health issues	2,280 (77.8)	[76.3, 79.3]	603 (20.6)	[19.1, 22.0]
If needed, I would feel safe discussing mental health issues with my supervisor or upper leadership	1,540 (52.6)	[50.8, 54.4]	1,344 (45.9)	[44.1, 47.7]
If needed, my supervisor or upper leadership would encourage me to utilize mental health services	2,139 (73.0)	[71.4, 74.6]	730 (24.9)	[23.3, 26.5]
*Proportions are calculated out of 2,930 total respondents.				

Table 6. EMS clinicians' perceptions of their respective agencies' mental health culture, Virginia, 2022.

top reasons clinicians reported not pursuing care. Additionally, leading reasons for not seeking help among clinicians who experienced burnout, traumatic stress, depression, PTSD, or substance use included that they felt that they possessed the coping skills necessary to handle the situation and that they did not think obtaining care would be useful. Clinicians who contemplated suicide expressed fear about what others might think of them, and that obtaining support would threaten their employment, as main factors for not pursuing treatment.

DISCUSSION

The survey revealed worse physical health among first responders than the general population. In a 30-day period, clinicians reported an average of 4.4 days of perceived poor physical health, which was more than the general population of Virginia (3.7 days in 2022) (Robert Wood Johnson Foundation, n.d.). The survey also identified several areas of concern related to clinician mental health and access to care. Specifically, participants reported an average of 9.9 days of poor mental health in a 30-day timeframe, more than twice as high as the general population of Virginia in 2022 (4.2 days) (Robert Wood Johnson Foundation, n.d.). Similarly, clinicians reported a concerning average number of days of experiencing symptoms of depression (8.8 days) and anxiety (12.6 days) in a 30-day period.

Sleep was identified as another major area of concern among participants. On average, clinicians reported sleeping only 6.1 hours within a 24-hour period, less than the 7 or more hours of sleep per night recommended for adults (Hirshkowitz et al., 2015). Further, reported sleep duration decreased as shift length increased. Research demonstrates that inadequate sleep is not only associated with accidental death, injuries, and a multitude of chronic diseases, but also poor mental health and burnout (Hirshkowitz et al., 2015; Grandner et al., 2015; Kecklund & Axelsson, 2016; Medic et al., 2017; Barger et al., 2015; Krystal, 2012; Wolkow et al., 2019).

Resons for not seeking help	All outcomes	Burnout	Traumatic stress	Depression	PTSD	Verbal abuse	Physical assault	Suicidal thoughts	Substance use
	(n=1,508)	(n=1,260)	(n=911)	(n=737)	(n=644)	(n=246)	(n=159)	(n=111)	(n=1,017)
	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI	EMS α (%) 95% CI
I didn't want it on my employment record	**311 (20.6) [18.6, 22.7]**	**288 (22.9) [20.5, 25.2]**	**225 (24.7) [21.9, 27.5]**	**231 (31.3) [28.0, 34.7]**	**186 (28.9) [25.4, 32.4]**	**104 (42.3) [36.1, 48.4]**	**78 (49.1) [41.3, 56.8]**	**65 (58.6) [49.4, 67.7]**	**239 (23.5) [20.9, 26.1]**
I didn't have time	**371 (24.6) [22.4, 26.8]**	**349 (27.7) [25.2, 30.2]**	**256 (28.1) [25.2, 31.0]**	**261 (35.4) [32.0, 38.9]**	**204 (31.7) [28.1, 35.3]**	**95 (38.6) [32.5, 44.7]**	**65 (40.9) [33.2, 48.5]**	**52 (46.8) [37.6, 56.1]**	**278 (27.3) [24.6, 30.1]**
I didn't feel it was needed	**768 (50.9) [48.4, 53.5]**	**624 (49.5) [46.8, 52.3]**	**436 (47.9) [44.6, 51.1]**	**306 (41.5) [38.0, 45.1]**	**267 (41.5) [37.7, 45.3]**	**79 (32.1) [26.3, 37.9]**	**57 (35.8) [28.4, 43.3]**	19 (17.1) [10.1, 24.1]	**509 (50.0) [47.0, 53.1]**
I already possess sufficient coping skills	**525 (34.8) [32.4, 37.2]**	**436 (34.6) [32.0, 37.2]**	**323 (35.5) [32.3, 38.6]**	**231 (31.3) [28.0, 34.7]**	**204 (31.7) [28.1, 35.3]**	74 (30.1) [24.4, 35.8]	45 (28.3) [21.3, 35.3]	26 (23.4) [15.5, 31.3]	**339 (33.3) [30.4, 36.2]**
I was concerned about what others might think of me	256 (17.0) [15.1, 18.9]	239 (19.0) [16.8, 21.1]	185 (20.3) [17.7, 22.9]	202 (27.4) [24.2, 30.6]	160 (24.8) [21.5, 28.2]	78 (31.7) [25.9, 37.5]	53 (33.3) [26.0, 40.7]	**57 (51.4) [42.1, 60.6]**	198 (19.5) [17.0, 21.9]
I didn't think it would be useful	**296 (19.6) [17.6, 21.6]**	**273 (21.7) [19.4, 23.9]**	**213 (23.4) [20.6, 26.1]**	**215 (29.2) [25.9, 32.5]**	**173 (26.9) [23.4, 30.3]**	76 (30.9) [25.1, 36.7]	52 (32.7) [25.4, 40.0]	42 (37.8) [28.8, 46.9]	**222 (21.8) [19.3, 24.4]**
I was afraid it would threaten my employment	225 (14.9) [13.1, 16.7]	210 (16.7) [14.6, 18.7]	167 (18.3) [15.8, 20.8]	174 (23.6) [20.5, 26.7]	142 (22.0) [18.8, 25.3]	**87 (35.4) [29.4, 41.3]**	**64 (40.3) [32.6, 47.9]**	**55 (49.5) [40.2, 58.9]**	173 (17.0) [14.7, 19.3]
Getting help costs too much money	287 (19.0) [17.1, 21.0]	264 (21.0) [18.7, 23.2]	201 (22.1) [19.4, 24.8]	203 (27.5) [24.3, 30.8]	169 (26.2) [22.8, 29.6]	**88 (35.8) [29.8, 41.8]**	**66 (41.5) [33.9, 49.2]**	**45 (40.5) [31.4, 49.7]**	218 (21.4) [18.9, 24.0]
My agency doesn't offer help	115 (7.6) [6.3, 9.0]	105 (8.3) [6.8, 9.9]	82 (9.0) [7.1, 10.9]	79 (10.7) [8.5, 13.0]	73 (11.3) [8.9, 13.8]	38 (15.4) [10.9, 20.0]	24 (15.1) [9.5, 20.7]	24 (21.6) [14.0, 29.3]	87 (8.6) [6.8, 10.3]
I didn't know where to get help	116 (7.7) [6.3, 9.0]	109 (8.7) [7.1, 10.2]	77 (8.5) [6.6, 10.3]	89 (12.1) [9.7, 14.4]	69 (10.7) [8.3, 13.1]	33 (13.4) [9.2, 17.7]	24 (15.1) [9.5, 20.7]	23 (20.7) [13.2, 28.3]	87 (8.6) [6.8, 10.3]
Other	73 (4.8) [3.8, 5.9]	62 (4.9) [3.7, 6.1]	49 (5.4) [3.9, 6.8]	36 (4.9) [3.3, 6.4]	30 (4.7) [3.0, 6.3]	11 (4.5) [1.9, 7.1]	3 (1.9) [0.0, 4.0]	3 (2.7) [0.0, 5.7]	45 (4.4) [3.2, 5.7]

EMS α = Number of EMS clinicians.

Note: Top five reasons for not seeking help for each adverse mental health outcome are in bold font

Table 3. Reasons why EMS clinicians did not seek help by EMS-related mental health outcome ever experienced, Virginia, 2022.

This study revealed that 59.5% of Virginia EMS clinicians reported heavy alcohol use at least once in the past year, with 35.0% drinking heavily on at least a monthly basis. This greatly exceeds the rate of monthly heavy alcohol use (6.3%) reported by U.S. civilians 18 years of age and older participating in the 2022 National Survey on Drug Use and Health (Alcohol Use in the United States, 2023). Further, 3.7% of EMS clinicians indicated they had used illegal drugs in the past year, with 1.5% reporting use at least monthly. These proportions are lower than the past-year and past-month estimates of illicit drug use (22.7% and 15.0%, respectively) reported by adult participants of the 2021 National Survey on Drug Use and Health (SAMHSA, 2021).

A total of 81.6% of clinicians reported experiencing at least one poor mental health outcome they believed was associated with their EMS service over the course of their careers (vs. 70.7% during the past 12 months). In other words, more than four out of every five EMS clinicians perceived experiencing burnout, traumatic stress, depression, PTSD, suicidal tendencies, verbal abuse or physical assault causing emotional or psychological harm, or a combination of these outcomes, related to EMS work. In regard to suicidality, the percent of participants experiencing suicidal ideation during the past 12 months (9.1%) was approximately two times higher than that reported among Virginians (4.2%) and the U.S. general population (4.6%) in 2022 (Mental Health America, 2022). This is

similar to the 2019 Virginia Public Safety Mental Health Pilot Survey, which found suicide ideation among fire and rescue personnel to be 7.8% in the year prior to the survey (Fairfax Coalition of Police Local 5000, n.d.). However, national surveys have identified greater levels of suicide ideation among firefighter and EMS practitioners than proportions reported from these Virginia-specific studies (Abbott et al., 2015; CDC, 2022).

Of the 2,413 clinicians who experienced a negative mental health outcome or substance use related to their EMS service, the majority (62.5%) did not seek help. Specifically, not wanting the mental health concern documented in their employment record was one of the most frequently reported reasons for not obtaining assistance across all mental health issues. This finding is consistent with similar studies (Abbott et al., 2015). A total of 32.2% of respondents reported limited or no access to care through their agency, compared to 54% nationally (Goodwin & Lane, 2016). While most clinicians (67.5%) reported having access to mental health services through their agencies, 44.5% of respondents did not feel the resources supplied were sufficient. Additionally, 31.1% of clinicians reported a perception that mental health was not important to their agency, and a large proportion of clinicians reported that they would feel unsafe discussing mental health issues with their supervisors (45.9%) or coworkers (41.8%). Hence, agencies may have mental health services that clinicians are unaware of or hesitant to access because treatment is not encouraged or for fear of being stigmatized (Abbott et al., 2015; Goodwin & Lane, 2016).

A strength of this study was that it was a statewide comprehensive mental health survey of EMS clinicians in Virginia. Additionally, the survey had a large response rate and had representation from every region throughout Virginia. Moreover, the survey provides decision makers with baseline information surrounding the status of EMS clinicians' mental health and the perceived mental health cultures, services, and barriers to seeking help within clinicians' agencies. Lastly, the survey can be easily adapted to federal, state, and local contexts.

Several limitations of this study exist. First, the study relied on a convenience sample of clinicians with valid email addresses who were willing to take the survey. While the large sample size of this study potentially mitigates selection bias, it is possible that self-section and non-response bias occurred. Further, due to the sensitive nature and stigma surrounding mental health issues, it is possible that social desirability bias occurred, resulting in underrepresentation of the prevalence of mental health issues among clinicians. However, an anonymous online survey tool with limited personal identifiers was used to encourage the clinicians to answer honestly. Another possible limitation is that the mental health outcomes reported (e.g., depression, PTSD) were based on clinicians' self-perceptions and not clinical diagnoses. Lastly, while extensive work went into building and pre-testing the surveillance instrument used to collect the data, validation and reliability testing were not performed.

In summary, this survey identified that Virginia's EMS clinicians experience disproportionate burdens of poor mental health compared to the general population of Virginia. While many EMS agencies offer mental health resources, some clinicians lack access to life-saving services, or the services are viewed as inadequate. Troublingly, many EMS practitioners do not utilize available support due to mental health stigma, such as the fear of threatened employment. Leadership should play a key role in prioritizing and

normalizing seeking care for mental health issues within an agency's culture. Further investments in providing first responder-specific resiliency and mental health resources, as well as continued interventions to eliminate the stigma surrounding mental health issues, are needed to improve the health and safety of Virginia's EMS clinicians.

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APPENDIX

Selected questions for analysis from the 2022 Virginia EMS clinician mental health survey

- Job Satisfaction
  - How strongly do you agree with this statement: "I feel appreciated by my agency when I think about what they pay me"? A. Agree very much B. Agree moderately C. Agree slightly D. Disagree slightly E. Disagree moderately F. Disagree very much G. Not applicable/unpaid volunteer. Source: Spector, Job Satisfaction Survey
  - Within the past 12 months, which statement best describes your thoughts and intentions about quitting being an EMS provider (this does not include switching to a new EMS agency or EMS provider role)? A. I have never seriously thought about quitting B. I have seriously thought about quitting but have not taken any actions to quit C. I have actively taken action and made plans to quit (looking for a new career or job, updating resume, volunteering less, applying for jobs, etc.) D. I have quit practicing as an EMS provider
  - Select the reason(s) you thought about quitting, are taking action and making plans to quit, or quit being an EMS provider: (Select all that apply) A. Work-related stress, burnout, or other mental health concerns B. Concerns over physical health and safety C. A desire for better work-life balance D. Lack of sleep/chronic fatigue E. Heavy workloads/overworked F. Job negatively impacts partner/family relationships G. Low wages H. Little to no chance for career growth I. Conflict with leadership/coworkers J. I am a volunteer and no longer have the time K. New career interest L. Retirement M. Other
- COVID-19 Impact
  - Have you personally experienced any additional EMS job-related stress that can be attributed to the coronavirus pandemic? A. Yes B. No
  - Do you feel that the stress related to the coronavirus pandemic has had a negative impact on your mental health? A. Yes – Major impact B. Yes – Minor impact C. No. Source: Kirzinger, Kearney, Hamel, & Brody, 2020

    - Due to the COVID-19 Pandemic, has your agency experienced staffing shortages? A. Yes – Temporary B. Yes – Ongoing C. No D. Unsure
    - Select the primary cause(s) of the staffing shortages (select all that apply): A. Quarantine or isolation B. People needing to cut back hours for personal/family-related reasons C. People leaving the organization/quitting D. Issues related to hiring, training, and recruitment E. Provider(s) dying from COVID F. Other
    - Have staffing shortages during the COVID-19 pandemic caused you an increase in EMS work-related stress? A. Yes B. No
- HRQoL
    - Would you say that, in general, your health is†: A. Excellent B. Very Good C. Good D. Fair E. Poor F. I don't know/not sure Source: 2018 BRFSS Questionnaire, 2018; 2020 BRFSS Questionnaire, 2020; CDC HRQOL–14 "Healthy Days Measure"
    - Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good? Source: 2018 BRFSS Questionnaire, 2018; 2020 BRFSS Questionnaire, 2020; CDC HRQOL–14 "Healthy Days Measure"
    - Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good? Source: 2018 BRFSS Questionnaire, 2018; 2020 BRFSS Questionnaire, 2020; CDC HRQOL–14 "Healthy Days Measure"
    - During the past 30 days, for about how many days have you felt you did NOT get ENOUGH REST or SLEEP? Source: CDC HRQOL–14 "Healthy Days Measure"
    - During the past 30 days, for about how many days have you felt SAD, BLUE, or DEPRESSED? Source: CDC HRQOL–14 "Healthy Days Measure"
    - During the past 30 days, for about how many days have you felt WORRIED, TENSE, or ANXIOUS? Source: CDC HRQOL–14 "Healthy Days Measure"
- Sleep Hours
    - On average, how many hours of sleep do you get in a 24-hour period? Source: 2018 BRFSS Questionnaire, 2018; 2020 BRFSS Questionnaire, 2020
- EMS Mental Health Indicators
    - Have you ever felt burned-out due to the stress from working or volunteering as an EMS provider? Burnout may result from regular workplace stress that has not been successfully managed. Symptoms of burnout may include feeling depleted of energy or exhausted; increased feelings of negativity, cynicism, and mental distance toward one's job; or decreased workplace productivity or performance. A. Yes B. No C. I don't know Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018; QD85 Burn-out
    - During the past 12 months, have you ever felt burned-out due to the stress from working or volunteering as an EMS provider? A. Yes B. No C. I don't know

- Have you ever experienced traumatic stress due to working or volunteering as an EMS provider that you believe has been bad for your mental health? Traumatic stress may happen when you are exposed to a tragic event, severely injured children or adults, dead bodies or body parts, or loss of a coworker. A. Yes B. No C. I don't know. Source: Traumatic incident stress, 2013
- During the past 12 months, have you ever experienced traumatic stress due to working or volunteering as an EMS provider that you believe has been bad for your mental health? A. Yes B. No C. I don't know
- Have you ever felt that you have suffered from post-traumatic stress disorder (PTSD) due to working or volunteering as an EMS provider? PTSD may include signs and symptoms of constantly replaying a traumatic event in your head, avoiding places that remind you of a traumatic event, feeling numb or hyperaware to your surroundings, withdrawing from family and friends, or experiencing nightmares, sleeplessness, anxiety, difficulty concentrating, or startling easily. A. Yes B. No C. I don't know Source: PTSD, 2023
- During the past 12 months, have you ever felt that you have suffered from post-traumatic stress disorder (PTSD) due to working or volunteering as an EMS provider? A. Yes B. No C. I don't know
- Have you ever felt that you have suffered from depression due to working or volunteering as an EMS provider? Depression may include signs and symptoms of feeling sad or anxious often or all the time; not wanting to do activities that used to be fun; having trouble falling asleep or staying asleep; feeling tired (even after sleeping well); feeling irritable, easily frustrated, or restless; having difficulty concentrating, remembering details, or making decisions; or thinking about suicide or hurting yourself. Source: Mental health conditions: Depression and Anxiety, 2022
- During the past 12 months, have you ever felt that you have suffered from depression due to working or volunteering as an EMS provider? A. Yes B. No C. I don't know
- Since becoming an EMS provider, did you ever SERIOUSLY THINK about trying to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
- Do you believe your experiences as an EMS provider contributed in any way to you SERIOUSLY THINKING about trying to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
- BEFORE becoming an EMS provider, did you ever SERIOUSLY THINK about trying to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
- At any time in the past 12 months, did you SERIOUSLY THINK about trying to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
- During the past 12 months, do you believe your experiences as an EMS provider contributed in any way to you SERIOUSLY THINKING about trying to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018

    - Since becoming an EMS provider, have you ever MADE ANY PLANS to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
    - During the past 12 months, did you MAKE ANY PLANS to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
    - Since becoming an EMS provider, did you ever TRY to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
    - During the past 12 months, did you TRY to kill yourself? A. Yes B. No Source: 2019 National Survey on Drug Use and Health (NSDUH), 2018
    - Have you ever known an EMS provider who had suicidal thoughts?17 A. Yes B. No
    - Do you know any EMS providers who have had suicidal thoughts within the past 12 months? A. Yes B. No Source: Abbott et al., 2015
    - Have you ever known an EMS provider who attempted or died by suicide? A. Yes B. No Source: Abbott et al., 2015
    - Do you know any EMS providers who have attempted or died by suicide within the past 12 months? A. Yes B. No Source: Abbott et al., 2015
- Verbal and Physical Assault
    - Have you ever been verbally abused by a patient or bystander while serving as an EMS provider? Verbal abuse is defined as extremely critical, threatening, or insulting words meant to demean, belittle, or frighten you. A. Yes B. No Source: Violent Crime
    - Did the verbal abuse cause you any emotional or psychological harm? A. Yes B. No
    - During the past 12 months, how many times were you verbally abused by a patient or bystander while serving as an EMS provider? A. 0 B. 1 C. 2—3 D. 4—5 E. 6—10 F. 11+
    - Did the verbal abuse in the past 12 months cause you any emotional or psychological harm? A. Yes B. No
    - Have you ever been physically assaulted by a patient or bystander while serving as an EMS provider? Physical assault is defined as an attack, attempted attack, or threat of attack with or without a weapon, regardless of whether an injury occurred. A. Yes B. No Source: Violent Crime
    - Did the physical assault(s) cause you any emotional or psychological harm? A. Yes B. No
    - Did the physical assault(s) cause you any physical harm or injury? A. Yes B. No
    - During the past 12 months, how many times were you physically assaulted by a patient or bystander while serving as an EMS provider? A. 0 B. 1 C. 2—3 D. 4—5 E. 6—10 F. 11+
    - Did the physical assault(s) in the past 12 months cause you any emotional or psychological harm? A. Yes B. No
    - Did the physical assault(s) cause you any physical harm or injury? A. Yes B. No

- Alcohol, Tobacco, and Substance Use
  - In the past 12 months, how often have you used the following? Never Once or Twice Monthly Weekly Daily or Almost Daily Source: NIDA Drug Use Screening Tool NIDA-Modified ASSIST
    - Alcohol consumption: for men, 5 or more drinks a day; for women, 4 or more drinks a day.
    - Tobacco Products
    - Prescription Drugs for Non-Medical Reasons
    - Illegal Drugs
  - Do you believe your experiences as an EMS provider contributed in any way to your use of any of the substances listed above? A. Yes B. No
- Mental Health Support and Services
  - Did you ever seek help for burnout, traumatic stress, PTSD, depression, suicidal thoughts or actions, emotional or psychological harm from verbal abuse or physical assault, or substance use (alcohol, tobacco, prescription drugs for non-medical reasons, illegal drugs)? A. Yes B. No
  - If you experienced burnout, traumatic stress, PTSD, depression, suicidal thoughts or actions, emotional or psychological harm from verbal abuse or physical assault, or substance use (alcohol, tobacco, prescription drugs for non-medical reasons, illegal drugs) that you believe was associated with your experience in EMS but DID NOT get help, what stopped you? (Select all that apply) A. I didn't feel it was needed B. I already possess sufficient coping skills C. My agency doesn't offer help D. I didn't think it would be useful E. I didn't have time F. Getting help costs too much money G. I didn't want it on my employment record H. I was concerned about what other people might think of me I. I was afraid it would threaten my employment J. I didn't know where to get help K. Other Source: Abbott et al., 2015
- Perceived Agency Mental Health Culture
  - Does your agency offer EMS providers mental health services? A. Yes B. No C. No, but they are in development D. I don't know Source: Goodwin & Lane, 2016
  - Does your agency allow you to use mental health services while working or volunteering? Services may include peer support programs, critical incident stress management/debriefing, employee assistance programs (EAP), chaplaincy programs, mental health hotlines, etc. A. Yes B. No C. I don't know Source: Goodwin & Lane, 2016
  - Please rate how strongly you agree or disagree with the following statements: Strongly disagree Disagree Agree Strongly Agree Source: Goodwin & Lane, 2016
    - EMS provider mental health is important to my agency.
    - My agency provides sufficient mental health support and services for EMS providers.
    - If needed, I know where to find help within my agency for mental health issues.
    - If needed, I would feel safe discussing mental health issues with my coworkers.

- If needed, my coworkers would encourage me to get help for mental health issues.
- If needed, I would feel safe discussing mental health issues with my supervisor or upper leadership.
- If needed, my supervisor or upper leadership would encourage me to use mental health services.

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RESEARCH REPORTS

SONOGRAPHIC CARDIAC ACTIVITY CORRELATES WITH END-TIDAL CARBON DIOXIDE AND CARDIAC RHYTHM IN OUT-OF-HOSPITAL CARDIAC ARREST

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ABSTRACT

Most cardiac arrests that occur in the United States are treated by EMS, which has stimulated interest in the use of prehospital ultrasound as a prognostic tool. Though end-tidal carbon dioxide ($EtCO_2$) and cardiac rhythm have demonstrated prognostic value in out-of-hospital cardiac arrest (OHCA), few studies of ultrasound in the prehospital setting have attempted to address the same question. This retrospective study assesses the association between sonographic cardiac activity and contemporaneous measurements of $EtCO_2$ and cardiac rhythm. Sixty-six cases of paramedic-performed cardiac sonography for OHCA were reviewed and clinical data for each case was abstracted directly from the monitor/defibrillator record. The mean timing of the initial ultrasound was 21 minutes (95% CI [18.7,23.3]) into the resuscitation. Organized cardiac activity was associated with higher mean $EtCO_2$ than absence of organized activity (49.7mmHg (95% CI [44.4,55.0]) versus 28.3mmHg (95% CI [24.3,32.3]), $p<0.001$). Organized sonographic activity was also associated with contemporaneous cardiac rhythm ($p=0.018$) and was most frequently observed in pulseless electrical activity with a sinus rhythm. Paramedics interpreted intra-arrest cardiac ultrasound with 95.7% agreement with physicians ($\kappa = 0.940$). Mean pause in compressions to acquire ultrasound was 14.9 seconds (95% CI [13.3,16.6]).

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a condition that carries high mortality. Pooled survival after OHCA has been estimated to be 7.6% (Sasson, 2010). There are several patient and system factors that have been associated with survival after OHCA, including initial cardiac rhythm (Sasson, 2010), performance of bystander cardiopulmonary resuscitation (CPR) (Sasson, 2010), emergency medical services (EMS) response time (Holmén, 2020; Huang, 2021), rapid access to automated external defibrillators (AEDs) (Valenzuela, 2000; Caffrey, 2002), witness of the cardiac arrest (Sasson, 2010), end-tidal carbon dioxide ($EtCO_2$) level (Levine, 1997), and duration of CPR (Kim, 2014).

Current data supporting the use of intra-arrest cardiac sonography for prognostication is heterogeneous (Berg, 2020). The presence of organized cardiac activity during resuscitation has been associated with a sensitivity and specificity of survival to hospital discharge of 67-100% and 51-89%, respectively (Atkinson, 2019; Flato, 2015). In contrast, the absence of organized cardiac activity has been associated with a sensitivity and specificity of survival to hospital discharge of 6-91% and 49-94%, respectively (Gaspari, 2016; Varriale, 1997; Zengin, 2016). This wide variability has made it difficult to recommend the use of cardiac ultrasound as the sole criterion to terminate resuscitative efforts. In addition, concerns exist about the impact of ultrasound on CPR pause duration and the potential for disagreements in interpretation.

Since most out-of-hospital cardiac arrests occurring annually in the United States (US) are treated by EMS (Rosamond, 2008), there has been growing interest in the prehospital applications of ultrasound. Of the studies examining cardiac ultrasound in the prehospital setting, most have been primarily focused on feasibility and interrater reliability, though some have demonstrated a correlation between prehospital cardiac activity and patient outcomes (Reed, 2017; Rooney, 2016; Aichinger, 2012; Beckett, 2019).

The primary objective of this study was to assess for associations between sonographic cardiac activity and contemporaneous measurements of end-tidal carbon dioxide and cardiac rhythm in a system where paramedics perform prehospital cardiac sonography for cardiac arrest. The secondary objectives of this study were to assess interrater reliability between paramedic and physician interpreters, and to assess the impact of prehospital sonography on CPR continuity.

METHODS

In Albuquerque, New Mexico, prehospital cardiac sonography has been performed by Albuquerque Fire-Rescue (AFR) paramedics since 2018. When a cardiac arrest is dispatched, a paramedic supervisor in a non-transporting vehicle is included on the initial response alongside first-line units. This small cohort of supervisors has been equipped with a portable ultrasound (Philips Lumify® or GE Vscan®) and special credentialing to perform intra-arrest cardiac sonography. AFR serves a jurisdiction of approximately 189 square miles, and a single EMS supervisor is assigned to each duty period. As such, it is common for the EMS supervisor to arrive on-scene after the arrival of the initial responding units. The use of ultrasound in this system has been investigational, and sonographic assessment is not incorporated into protocols that inform patient care or endpoint of resuscitation. EMS supervisors have been directed to utilize cardiac sonography at their discretion, when doing so would not otherwise impede resuscitation. To limit pause duration, EMS supervisors have been trained to identify an acoustic window with the ultrasound prior to pausing compressions. During the pause, a brief recording is obtained, which can then be reviewed after resuming compressions. The subxiphoid view is customarily used, as this view does not require displacement of plunger-type mechanical CPR devices for image acquisition.

The prehospital medical record was queried to identify all adult, non-traumatic, EMS-treated OHCA during the study period from July 2018 to April 2021. Of this population, records without an attached ultrasound recording were excluded. Patients were

also excluded if they were known to be incarcerated, pregnant, or enrolled in the University of New Mexico prehospital extracorporeal CPR program (Marinaro, 2020).

Once the study population was defined, three physician abstractors systematically populated an a priori designated data collection instrument using data from three sources. The data was collected in the Utstein style, except for categories of cardiac rhythm (Nolan, 2019). While the Utstein style describes one category of PEA, this study attempted to discriminate differences between subgroups of pulseless electrical activity (PEA). While there are many possible ways to subcategorize PEA, the decision was made to differentiate subgroups of PEA in this study by the presence of absence of P waves. Patients with an idioventricular rhythm were defined comparably to the Cardiac Arrest Registry to Enhance Survival (CARES), as having a rate less than 40 beats per minute, absent P waves, with a wide (>120ms) or unmeasurable QRS complex.

Demographic data, prehospital interventions, and narrative data were abstracted from the prehospital medical record (ImageTrend, Lakeville, MN). Clinical parameters, including temporal data, vital sign data, and cardiac rhythm were abstracted directly from the resuscitation record stored on the LifePak Monitor/Defibrillator (®Stryker, Kalamazoo, MI) using CODE-STAT™ software. The monitor record was favored over the prehospital medical record for these variables since it enabled abstractors to review objective data to produce a dataset of higher fidelity and completeness. The interval from the start of resuscitation to the initial ultrasound was determined by comparing timestamps from the monitor record and the prehospital medical record. CPR pause durations were calculated by measuring interruptions in the impedance waveform in the monitor record.

Two of the abstractors performed the review of all monitor records using standardized criteria to reduce variation. Ultrasound recordings and paramedic interpretations were stored with the prehospital medical record. All ultrasound recordings were reviewed by the third abstractor, a physician board-certified in Emergency Medical Services.

The study population was characterized using descriptive statistics. The variables chosen to include were those that appear to be associated with OHCA outcomes (Al-Dury, 2020). Categorical variables were reported as proportions and continuous variables were reported as means with 95% confidence intervals. Population differences between subgroups of sonographic activity were assessed by univariate analysis. Proportions of categorical variables were compared with the 2-sided Fischer's exact test. Means of continuous measures were compared with the t-test.

Interrater reliability between the paramedic performing the ultrasound and the physician reviewer was assessed using Cohen's kappa. The timing of the initial ultrasound and length of CPR pause duration was reported as a mean with 95% confidence intervals.

Study data were collected and managed using REDCap electronic data capture tools hosted at the University of New Mexico. All data analysis was performed in SPSS (IBM SPSS Statistics for Windows, version 28.0). The study protocol was approved by the University of New Mexico's Institutional Review Board.

RESULTS

Study Population

During the study period, 70 cases were available for review (Figure 1). Four cases were excluded because of technical limitations in the recorded clips which precluded categorization of sonographic activity. The characteristics of the study population are described in Table 1.

		Overall n=66	Sonographic Activity		p
			Organized n=23	Absent Organized n=43	
Age Mean [95%CI]		57.7 [43.2,62.2]	52.9 [46.3,59.5]	60.0 [54.0,66.0]	.150
EMS Response Interval Mean [95%CI]		7.5 [6.7,8.3]	7.3 [6.2,8.4]	8.0 [6.2,9.8]	.617
Male %(n)		59.1 (39)	60.9 (14)	58.1 (25)	.830
Witnessed %(n)		42.4 (28)	39.1 (9)	44.2 (19)	.473
Bystander CPR %(n)		51.5 (34)	39.1 (9)	58.1 (25)	.115
Bystander Defib. %(n)		3.0 (2)	0 (0)	4.7 (2)	.539
Initial Presenting Rhythm %(n)	PEA	43.9 (29)	56.5 (13)	37.2 (16)	.381
	Asystole	31.8 (21)	21.7 (5)	37.2 (16)	
	VF	21.2 (14)	21.7 (5)	20.9 (9)	
	VT	3.0 (2)	0 (0)	4.7 (2)	

PEA = Pulseless Electrical Activity, VF = Ventricular Fibrillation, VT = Ventricular Tachycardia

Table 1. Characteristics of the study population.

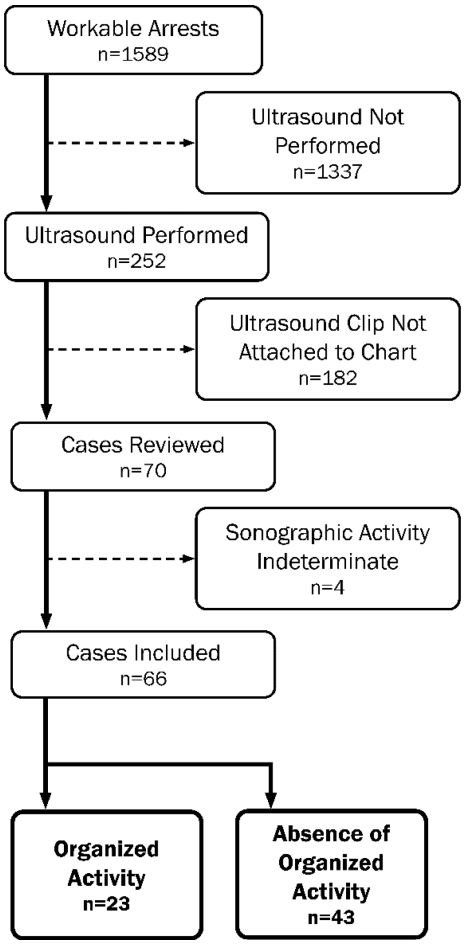

Figure 1: Selection of the study population.

Timing and Duration of Ultrasounds Performed

The mean timing of the initial ultrasound was 21 minutes (95% CI [18.7,23.3]) into the resuscitation. When ultrasounds were obtained, 80.0% (n=53) of them were obtained during a pause in compressions, while 12.1% (n=8) were obtained during a period of ROSC and 7.6% (n=5) were obtained at the time of termination of resuscitation. The mean pause duration when obtaining an ultrasound during resuscitation was 14.9 seconds (95% CI [13.3,16.6]). 34.0% of pause durations were 10 seconds or shorter. In some instances, multiple ultrasounds were performed on a single patient. When only considering the first ultrasound that was performed, the mean pause duration was 14.0 seconds (95% CI [10.3,17.8]). The mean compression fraction and compression rate in the study population were 0.92 (95% CI [0.91,0.93]) and 102.2 (95% CI [102.0,103.0]), respectively.

Interrater Agreement

Interrater agreement between paramedics and physicians was 95.7% for the initial ultrasound ($\kappa = 0.940$).

Association Between Initial Sonographic Activity, End-Tidal Carbon Dioxide, and Cardiac Rhythm

The association between initial sonographic activity and contemporaneous end-tidal carbon dioxide is depicted in Figure 2. Organized cardiac activity was associated with higher mean $EtCO_2$ than absence of organized activity (49.7mmHg (95% CI [44.4,55.0]) versus 28.3mmHg (95% CI [24.3,32.3]), p<0.001).

The association between initial sonographic activity and contemporaneous cardiac rhythm was significant (p=0.018) and is depicted in Figure 3. Pulseless electrical activity with a sinus rhythm was most associated with organized cardiac activity (65% of cases), and asystole and ventricular fibrillation were least associated with organized cardiac activity (0% of cases for each rhythm). All of the cases of PEA with a sinus rhythm exhibited a narrow QRS interval (<120ms) in the study population.

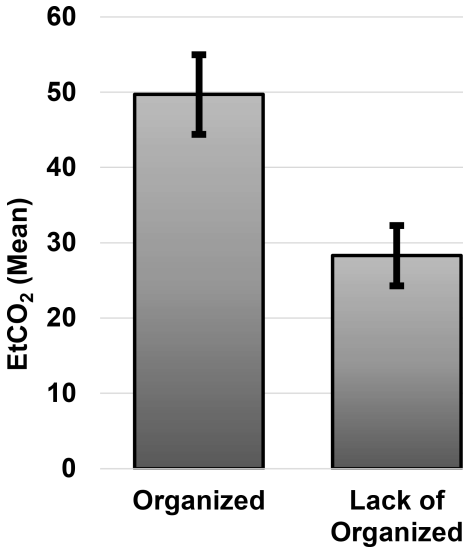

Figure 2: Mean $EtCO_2$ (95% CI) by sonographic activity at time of initial ultrasound.

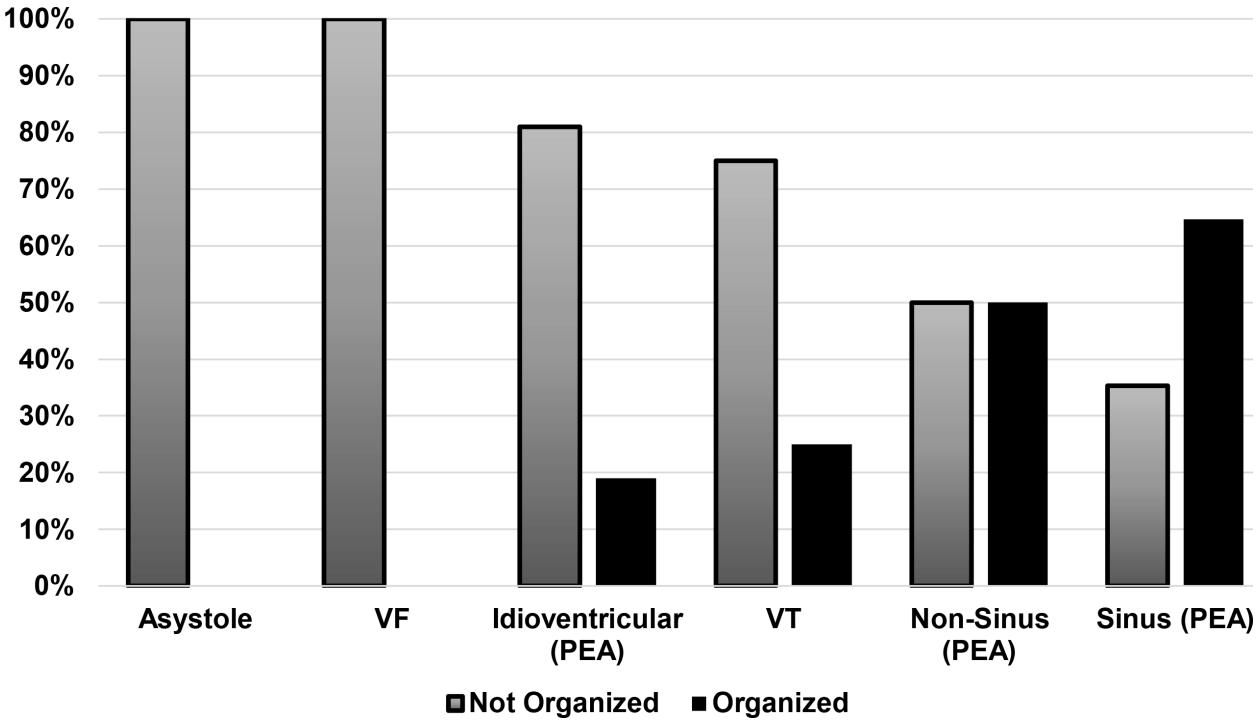

Figure 3: Sonographic activity by cardiac rhythm at time of initial ultrasound. PEA = Pulseless Electrical Activity, VF = Ventricular Fibrillation, VT = Ventricular Tachycardia.

DISCUSSION

In this study, initial sonographic findings correlated with contemporaneous $EtCO_2$ and cardiac rhythm. Though this study was not designed to assess the prognostic value of prehospital sonography due to its retrospective design and non-protocolized inclusion

criteria, $EtCO_2$ and cardiac rhythm have demonstrated prognostic value in multiple studies of OHCA (Sasson, 2010; Touma, 2013; Crickmer, 2021; Pokorná, 2010). As such, the observed relationship between sonographic findings and these other variables supports the hypothesis that prehospital sonography may have some prognostic value, although there is a conspicuous absence of prehospital literature that specifically investigates this question. Such studies would be valuable to assess the added utility of prehospital sonography when end-tidal capnography and electrocardiography are already ubiquitous.

When examining the relationship between sonographic findings and PEA, we found that organized cardiac activity was more prevalent when the morphology of the PEA approximated a normal sinus rhythm (defined as having a QRS duration less than 120ms with visible P waves), and less prevalent when the PEA assumed an idioventricular pattern (defined as having a rate less than 40 beats per minute, absent P waves, and a wide and unmeasurable QRS complex). Physiologically, this observation might be explained by the progressive degeneration of both cardiac conductivity and myocardial contractility that occurs in low-flow states. There has been significant heterogeneity in defining PEA in cardiac arrest research, which likely reflects acknowledgment of a phenotypic and prognostic spectrum of disease, which has not been fully typified. Our data support the assertion that more granular definitions of PEA may be useful when attempting to design studies pertaining to OHCA.

We found that organized cardiac activity was associated with higher contemporaneous $EtCO_2$ values. Though the relationship between intra-arrest sonographic findings and $EtCO_2$ has not previously been reported, several studies have indicated that cardiac output directly correlates with $EtCO_2$ (Skulec, 2019; Shibutani, 1994; Weil, 1985; Ornato, 1990; Jin, 2000). Our findings support the supposition that underlying cardiac activity may help explain the observed relationship between $EtCO_2$ and outcomes after cardiac arrest (Sasson, 2010; Touma, 2013; Crickmer, 2021; Pokorná, 2010).

In our system, cardiac sonography for OHCA is successfully performed and interpreted by paramedics with a high degree of physician agreement. In the rare cases in which sonographic activity could not be determined, this was usually related to a four-second limit on recordings imposed by the device. Of the few other studies examining paramedic-performed cardiac sonography, Rooney et al. (2016) reported 100% agreement between US paramedics and physicians board-certified in Emergency Medicine. Of note, there were instances in which sonography was performed without generating a recording. This practice imposes a risk of inflating interrater reliability by biasing the quality of recordings included in the study towards less ambiguous images. Our study also did not measure variation in interpretation between the cadre of EMS supervisors, although there were a small number of individuals in this group.

In our study, the mean elapsed time until the initial ultrasound was performed was 21 min (95% CI [18.7,23.3]). The elapsed time observed in this study is likely a reflection of the need to perform priority resuscitative measures and may also be related to the prolonged response time of the EMS supervisor. Due to small sample sizes, this study did not examine relationships between contemporaneous clinical variables and the timing of the ultrasound, which might be useful when attempting to discriminate a niche for ultrasound.

Eighty percent of ultrasounds were obtained intra-arrest and the mean pause duration associated with the use of ultrasound was 14.9 seconds (95% CI [13.3,16.6]). It is not known whether these durations were significantly different from pauses in which ultrasound was not used, though the overall chest compression fraction and compression rates in this population were excellent. When ultrasound was performed, 34.0% of pause durations were 10 seconds or shorter. In comparison, in the population studied by Reed et. al. (2017), 44% of pause durations were 10 seconds or shorter.

Although there were 1589 workable cardiac arrests occurring during the study period, only 4.4% (n=70) received cardiac sonograms by the EMS supervisor. There are multiple potential explanations for this observation. In addition to the challenges of operating a single vehicle for such a large response area, EMS supervisors do not attend to all dispatched cardiac arrests. In the absence of strict protocolization for ultrasound use, there is also a likely selection bias imposed by the EMS supervisor, whereby ultrasound is employed on certain patients in whom there is a perceived benefit. Though this limits the usefulness of the data for assessing patient outcomes, there is still value in exploring these potential biases. For example, the percentage of patients presenting with PEA in our study population was 43.9%, as compared to 12-30% in other studies (Väyrynen, 2008; Bergström, 2018). Similarly, only 31.8% of patients in the study population presented with asystole. It is reasonable to surmise that cardiac sonography would have limited utility in a patient presenting with asystole, which may have been reflected in patient selection.

Strengths of our study include abstraction of data directly from the monitor record, the use of a small cadre of trained physician reviewers, and a standardized data abstraction process, all of which improved the fidelity of the data. Several limitations of this study are related to its retrospective design. Most notably, because the application of ultrasound was not protocolized, the study population was impacted by selection bias by the ultrasound operators. This bias prohibited the use of these data to draw conclusions about patient outcomes. Additionally, only a small percentage of eligible cardiac arrest cases had an ultrasound recording performed. Though selection may play a role, there is also the potential for exclusion bias. For example, if an ultrasound operator attempted to acquire an ultrasound image and the image quality was poor, they might elect not to save the recording. The decision to place ultrasound onto the paramedic supervisor units may also have impacted enrollment. Though these units are dispatched to all cardiac arrests in the city, their response times are often lengthy compared to first-line units. As such, it is common for first-line units to cancel the response of the paramedic supervisor when ROSC has already been achieved or the patient is determined to be non-viable. This practice imposes a survivorship bias on the study population, whereby early survivors are often excluded from the dataset.

Future studies would ideally employ a prospective design with strict protocolization of ultrasound use to limit selection and exclusion biases. The decision to place ultrasound on first-line units may help minimize survivorship bias, but the cost of interference with resuscitation must be considered. Future studies might also benefit from the study of a particular subgroup of patients in cardiac arrest, especially those with PEA.

CONCLUSIONS

Among patients with out-of-hospital cardiac arrest, organized cardiac activity is associated with pulseless sinus rhythms and higher $EtCO_2$. Paramedics can perform and interpret intra-arrest cardiac ultrasound with a high degree of agreement with physicians. The performance of intra-arrest cardiac ultrasound is associated with modest prolongation of compression pause duration beyond 10 seconds.

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RESEARCH REPORTS

CROSS-SECTIONAL SIX-YEAR RETROSPECTIVE EPIDEMIOLOGICAL ANALYSIS OF 9-1-1 EMS CALLS TO THE EL PASO, TEXAS AND CIUDAD JUÁREZ INTERNATIONAL BORDER CROSSING

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ABSTRACT

The El Paso-Juárez metroplex comprises one of the world's busiest international land border crossings. Although prior studies have described prehospital responses along the U.S.-Mexico border, the epidemiology of 9-1-1 calls to the El Paso-Juárez border crossings has not been previously reported. Investigators sought to evaluate responses by emergency medical services at El Paso-Juárez ports of entry.

Methods: This cross-sectional, retrospective study evaluates call volume, patient population, patient complaint, diagnosis, and unit out-of-service time at three international bridges in El Paso. The El Paso Fire Department provided data for all encounters between February 2017 and January 2023. This included date, ports of entry, patient demographics, chief complaint, computer-aided dispatch, provider impression (diagnosis), and time out-of-service.

Results: Over the study period, 8407 encounters occurred at one of the three El Paso-Juárez ports of entry, averaging 1680 per year or 116 emergency 9-1-1 calls per month. The busiest month was July, with a median of 132 encounters. 45% of calls were at the Paseo Del Norte port of entry. The study population comprised 59% Hispanics, 4129 (49%) male, and 4266 (51%) female, from 0 to 103 years of age. The most common diagnosis included neurological (1908, 22.7%), GI/GU (1,263, 15%), and injury or trauma (1117, 13%). 6420 work hours were spent responding to ports of entry calls, with the average call resulting in a unit out-of-service time of 46 min.

Conclusion: By understanding and evaluating the epidemiology of EMS calls at the El Paso-Juarez ports of entry, the researchers hope to improve protocols, optimize training, adjust staffing, and adequately equip emergency medical service personnel to serve these high-traffic areas better.

INTRODUCTION

The Texas-Mexico border covers 1255 miles. It includes 28 international border crossings and bridges. Seven ports of entry (POE) are available for pedestrians and personal vehicles in the El Paso region. Of those seven ports, three major border crossings are located within El Paso, Texas, the second largest metropolitan area along the United States-Mexico border, second only to San Diego. (United States Department of Transportation, n.d.)

These three ports of entry include the Paseo Del Norte Bridge, the Bridge of the Americas, and the Ysleta Bridge. These POE connect the region's 2.7 million residents living in Ciudad Juárez (Chihuahua, Mexico) and El Paso (Texas, USA). According to the Texas Department of Transportation, in 2019 approximately 3.3 million pedestrians, 7 million passenger vehicles, and 17 thousand buses crossed northbound from Juárez to El Paso through one of these bridges in 2020 (International Trade and Border Planning, n.d.). Approximately 9000 pedestrians, 17,000 passenger vehicles, and 48 buses cross into El Paso daily. The El Paso Fire Department (EPFD) is the only available agency that responds to all 9-1-1 calls at these three ports of entry. With such a significant confluence of people entering the United States at the ports of entry, there is the potential for increased emergency medical services (EMS) involvement and resource utilization. Comparative research has examined the epidemiology of prehospital care provided at the San Diego and Tijuana POE (Farah et al., 2019). Prior studies have not explicitly described the epidemiology of emergency medical services (EMS) response and prehospital care at the El Paso-Juárez International POE. In this cross-sectional study, researchers aimed to describe and investigate the epidemiology of prehospital EMS response provided by emergency medical services at the El Paso-Juárez ports of entry.

METHODS

Setting

El Paso is home to approximately 678,000 residents in the westernmost part of Texas (U.S. Census Bureau quickfacts, n.d.). It shares its borders with New Mexico to the west and Mexico to the south. The city has four international POE bridges: the Paseo Del Norte Bridge, also known as the Santa Fe Street Bridge; the Bridge of the Americas; the Ysleta Bridge, also known as the Zaragoza Bridge; and the Good Neighbor Bridge, also known as the Stanton Bridge. This research excludes the Good Neighbor Bridge, a minor POE dedicated solely to southbound traffic traveling from El Paso into Juárez.

The El Paso Regional Communication Center's public safety answering point (PSAP) receives all 9-1-1 calls in the region. The El Paso Fire Department (EPFD) is the single municipal-run fire department that provides paramedic-level care and transportation for all 9-1-1 calls in El Paso. On average, the PSAP center receives 140 monthly calls requesting emergency responses at one of the three POEs. The primary and most frequent source of these calls are individuals requesting assistance either for themselves or others who are with them. Other sources of calls come from Customs and Border Protection (CBP) agents working at the POE. CBP agents receive requests from individuals at the POE or when a Mexican-based ambulance presents at the POE with a patient requiring treatment in the U.S. At present, Mexican ambulances cannot give pre-arrival notification in a coordinated manner. Mexican ambulances arrive at the POE where CBP will activate 9-1-1 then EPFD can evaluate and transfer the patient to a U.S. hospital (Salgado, et al., 2017).

Patient Selection

The El Paso Fire Department supplied de-identified, retrospective electronic data generated for all patient encounters at the three POE between February 2017 and January 2023. The six-year time frame reflects EPFD's initiation of its electronic patient care program ImageTrend™. The data included the date the call was placed, POE, an initial computer-aided dispatch (CAD) complaint, patient age, gender, race (if noted), stated complaint,

provider impression (diagnosis), transport code, and responding unit time-out-of-service. Data on who contacted 9-1-1 or how the patient presented to the POE was not documented. Though CAD diagnoses are discussed, this study's diagnosis classifications were based on provider impressions, not CAD or patient-stated complaints. Data were analyzed using Microsoft Excel.

The Texas Tech University Health Science Center's institutional review board (IRB) assessed the study. It determined that the study design was exempt from further review as the data used in the study did not contain any identifiable patient information (IRB # E22085).

RESULTS

During the six-year study period, 8407 prehospital fire department EMS encounters occurred at one of the three El Paso-Juárez POE, averaging 116 monthly calls or 1401 per year. Of these encounters, the busiest year was 2021, with 1557 encounters, and the slowest year was 2017, with 1241 encounters (Figure 1). During the study period, July was the busiest month, with a median of 132 encounters, and April was the slowest, with a median of 105 encounters (Figure 2). Thursdays were the busiest day of the week (Figure 3).

Of the 8407 calls, 3796 (45%) took place at the Paseo Del Norte POE, 3077 (37%) at the Bridge of the Americas POE, and 1534 (18%) at the Ysleta POE. The study population consisted of 4129 (49%) males, 4266 (51%) females, and 12 encounters with unrecorded or unknown genders. Patients' ages ranged from 0 to 103 years, including 31 newborn deliveries, with an average patient age of 42.4 years. A population pyramid of age and sex distribution demonstrates that women between the ages of 16 to 25 were the most prevalent age and sex encountered during the study period (Figure 4).

The PSAP initiated an emergent lights and sirens response 8367 times, representing 99.5% of all responses to a POE, while only 1137 patients were transported with lights

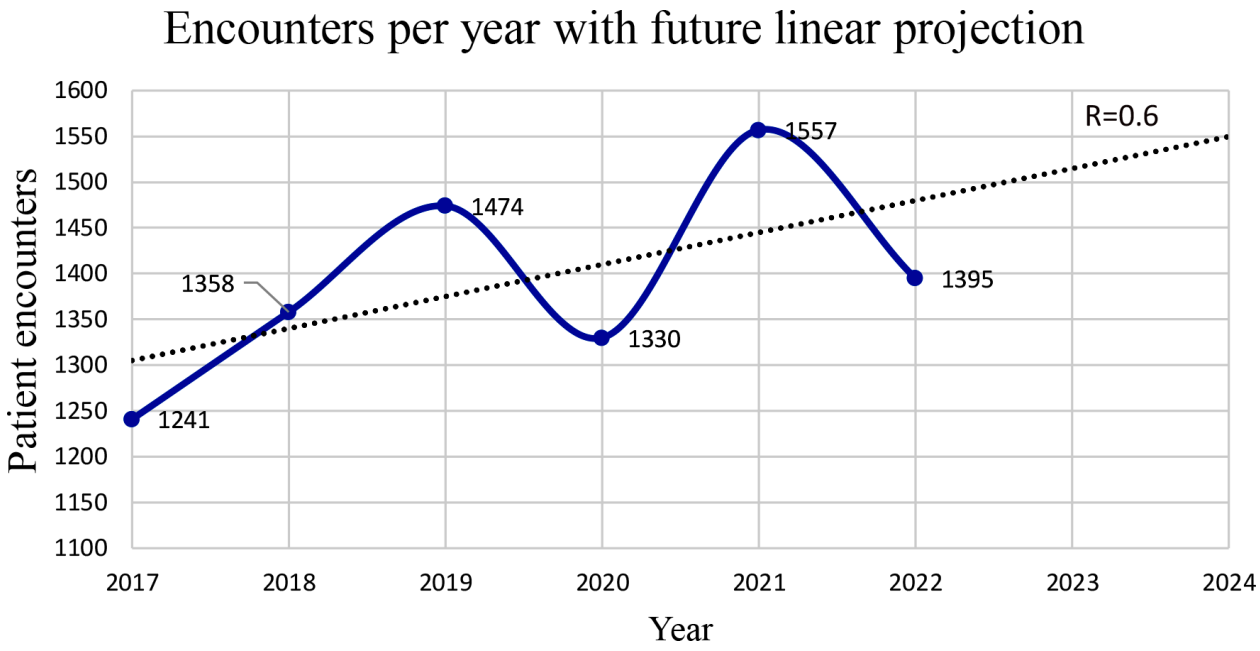

Figure 1: Encounters Per Year.

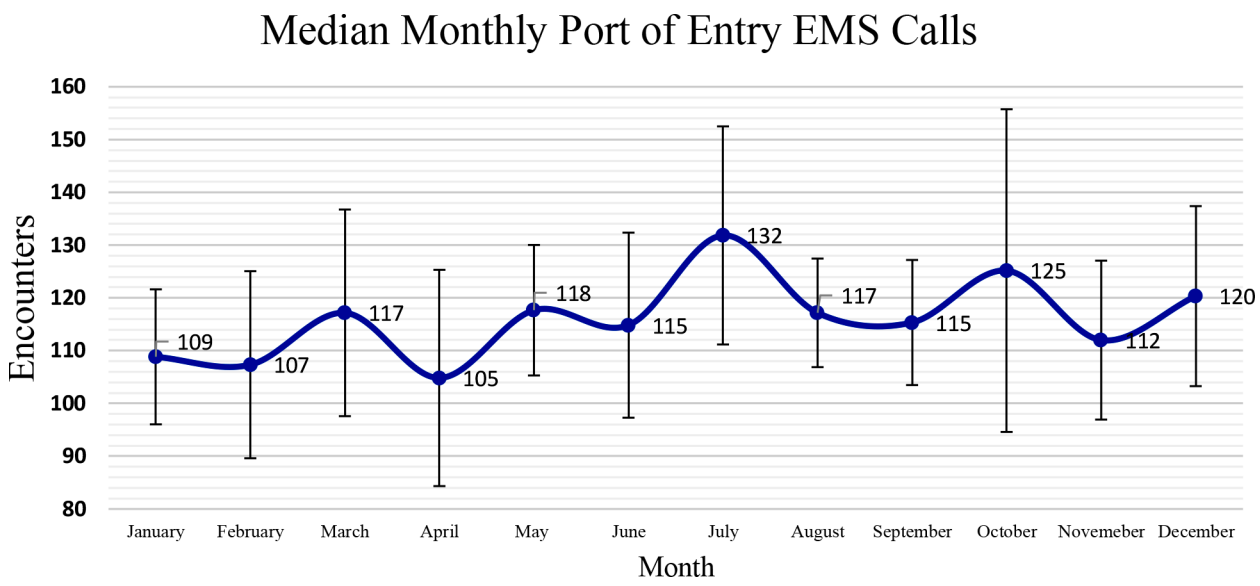

Figure 2: Median Monthly Encounters.

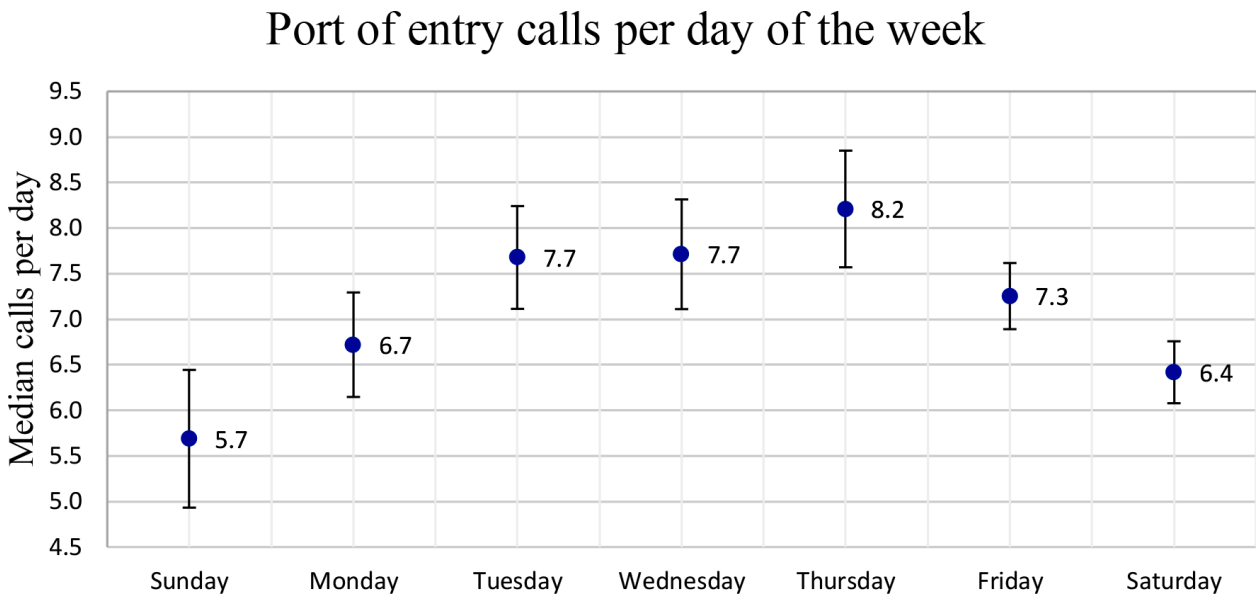

Figure 3: Average Call Per Day.

and sirens from the POE to a hospital, representing 13.5% of patient transports. A PSAP computer-aided dispatch complaint of "sick person" accounted for 2295 (27%) of all complaints. The remaining four most frequent PSAP CAD complaints account for 62.3% of all CAD complaints and include abdominal pain, pregnancy/childbirth, breathing problems, and chest pain.

When examining EMS diagnoses rather than CAD complaints, weakness was the most frequent diagnosis with 988 (11.8%), followed by abdominal pain with 873 (10.4%) of the 8407 patient encounters. Non-traumatic pain accounts for 761 (9.1%), and OB-contractions account for 464 (5.5%) patient encounters. There were 220 (2.6%) encounters with no diagnosis listed. All diagnoses were grouped into one of thirteen categories based on organ systems or complaint type to better understand and evaluate the data. These categories

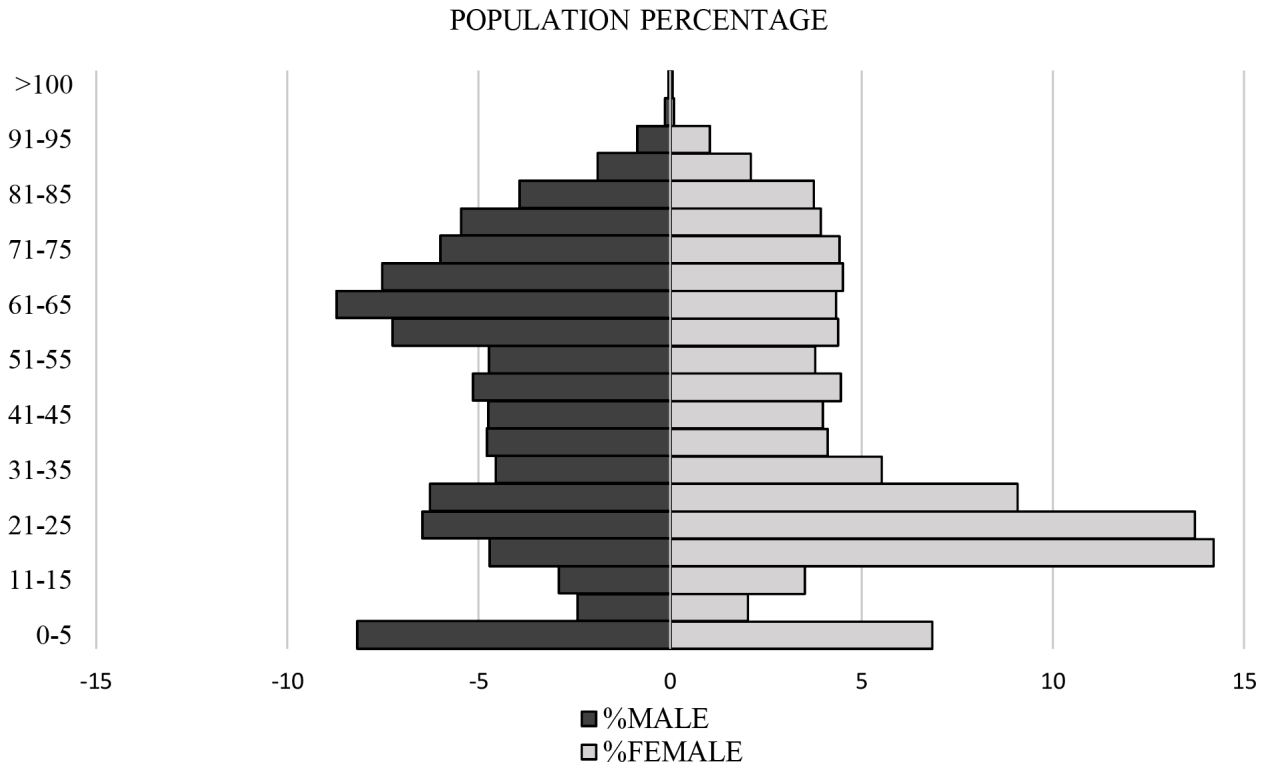

Figure 4: Population breakdown by sex and age.

included infectious, non-traumatic pain, endocrine, ENT, GI/GU, neurological, environmental, substance abuse/behavioral, cardiovascular, injury/trauma/burns, obstetrics/newborn care, respiratory, and "other." When grouped into these categories, neurological diagnoses were the most prevalent, accounting for 1908 (22.7%) of all encounters. The neurologic group included the diagnosis of weakness, seizures, stroke, syncope, headache, and altered mental status. GI/GU complaints were the second most prevalent diagnosis, accounting for 1263 (15%) encounters, and included generalized abdominal pain, constipation, diarrhea, melena, hematemesis, nausea/vomiting, pelvic pain, vaginal bleeding, and foreign bodies. The third most common category was injury or trauma, with 1117 (13%) encounters, including trauma and burns. Other common categories included non-traumatic pain with 761 (9.1%), OB with 709 (8.4%), and cardiovascular and respiratory complaints with 529 (6.3%) and 542 (5.4%) encounters, respectively (Table 1 and Figure 5).

The proportion of Hispanic or Latino patients documented was 59.8% (5030), although this number is likely significantly higher given that the race or ethnicity of 3140 patients (37.3%) was not recorded or left blank in the electronic

Neurological	**1908 (22.7%)**
Neuro - Seizure, Status Epilepticus	194
Neuro - Headache, Migraine	153
Neuro - TIA, Stroke, Hemiplegia, Paraplegia, Quadriplegia	140
Neuro - Unconscious	130
Syncope - Syncopal Episode (or near)	57
Neuro - Neuro Problem Not Otherwise Listed	46
Neuro - Vertigo	19
Neuro - Altered Mental Status	181
Weakness, Malaise	988
GI/GU	**1263 (15%)**
GI/GU - GI, GERD, Abdominal pain, appendicitis	873
GI/GU - Constipation, diarrhea	36
GI Bleed - Melena, Hematemesis, Nausea/vomiting	202
GI/GU - Foreign Body Genitourinary Tract	10
GI/GU - Vaginal Bleeding, Pelvic pain GU not otherwise listed	142

Table 1. Encounters by Category.

patient record. The remaining 237 (2.8%) patients were listed as Black, White, Asian, Pacific Islander, or Native American.

Of the total calls, 13% were classified as trauma. Males accounted for a greater proportion of trauma calls at 61%, while females accounted for 39%. For medical calls, females represented 54% of the patients and males accounted for 46% of the medical patients.

Throughout the study, 6420 hours were spent responding to POE calls, with the average call resulting in a 46-minute ambulance unit outage. The El Paso Fire Department spent a median of 90 monthly hours on POE response and transport, corresponding to a unit hour utilization (UHU) of 0.161 (SD 0.01). Considering task time, the UHU decreases to a median of 0.124 (SD 0.008), indicating that 16.1% of calls and 12.4% of the unit's in-service time would be spent responding and transporting from a U.S. entry point to a local hospital if only one 24-hour ambulance was responding to the POE. It is important to note the relative proximity of the three POE to the two closest hospitals, including the region's Level 1 trauma center. Depending on the POE, the distance to a hospital can range from 1 to 11 miles, effectively decreasing unit outages.

The U.S. POE were closed to non-essential travel during the COVID-19 pandemic from March 2020 until September 2021. Despite this, the POE continued to operate 24 hours per day, seven days per week. The median number of calls performed monthly during the pandemic closure was 116 (SD 26), while the median number of calls performed monthly during the two years prior to the closure and one year after reopening

Injury/trauma/burns	**1117 (13%)**
Injury - Lower extremity	297
Injury - Upper extremity	187
Injury - Head, Neck, Face	328
Injury - Thorax, Abdomen Pelvis	151
Injury/Burns- first, second or third	29
Injury - Not Otherwise Listed	125
Pain (non-traumatic)	**761 (9.1%)**
Pain - (Non-traumatic)	761
OB/newborn care	**740 (8.8%)**
OB- OB/GYN Complaint Not Otherwise Listed	97
OB - Preterm Labor with Delivery, complicated/uncomplicated	105
OB - Contractions	464
OB - Spontaneous Abortion (Miscarriage)	42
OB - Obstetric Trauma	1
OB - Newborn Care	31
Respiratory	**542 (6.5%)**
Respiratory - Arrest/Apnea	15
Respiratory - Asthma, COPD, Pulmonary edema, pneumothorax	308
Respiratory - FB, Smoke Inhalation, Not Otherwise Listed	219
Cardiovascular	**529 (6.3%)**
CV - Pulmonary Embolism	4
CV - Chest Pain - Angina, MI, STEMI, Presumed Cardiac	325
CV - Cardiac Arrhythmia/Dysrhythmia, CHF	54
CV - DOS/Obvious Death	5
CV - Cardiac Arrest	46
CV - Hypertension/hypotension	92
CV - Abdominal Aortic Aneurysm	3
Substance Abuse/Behavioral	**501 (6%)**
Abuse of Substance	32
Abuse of Alcohol or withdrawal	90
Behavioral - Anxiety/Depression	289
Behavioral - Suicidal/Homicidal Ideation/Attempt	17
Behavioral - Hallucination - Auditory/Visual	7
Behavioral - Disorientation/hostel/violent/strange behavior	55
Behavioral - Mental Disorder Not Otherwise Listed	11
Infectious	**435 (5.2%)**
Infectious - Encephalitis, Encephalomyelitis, Meningitis	6
Infectious - Sepsis	51
Infectious - SARS, Influenza, RSV, Pneumonia, Covid, etc.	205
Fever	173
Endocrine	**189 (2.3%)**
Endocrine - Hypoglycemia	64
Endocrine - Hyperglycemia	117
Endocrine - Disorder - Other	8

Table 1 (continued). Encounters by Category.

was 119 (SD 16), representing only three fewer calls per month during the COVID closure. During the 19 months of the COVID-related border closure, the average monthly time spent on POE calls was 90 hours, compared to 92 hours in the years before and after the COVID closure.

Other	**130 (1.6%)**
Not Applicable	1
Anemia (other)	10
Cancer (other)	26
Maltreatment - Adult or child Physical Abuse, Rape Suspected	6
Allergic Reaction	38
Bleeding or Hematoma Post Procedure/Medical Device	19
Congenital Deformity (other)	1
Dehydration (environmental heat emergency)	15
Mobility - Reduced/bedridden	14
Environmental	**56 (.7%)**
Environment - Heat Stroke/Exhaustion	14
Environment - Toxic Exposure, Poisoning	30
Environment - Stings/Venomous Bites	9
Environment - Hypothermia	2
Environment - Electrocution	1
ENT	**16 (.2%)**
ENT - non-traumatic	16
No diagnosis	**220**

Table 1 (continued). Encounters by Category.

DISCUSSION

This is the first investigation into the epidemiology of 9-1-1 EMS responses and prehospital care at the U.S.-Mexico border at the El Paso-Juárez POE. Previous research has described the epidemiology of 9-1-1 medical responses by EMS at the San Diego-Tijuana POE (Farah et al., 2019). An earlier study by Baker described the care provided by the U.S. Border Patrol (USBP) in the El Paso sector (Baker, 2017). In that study, Baker described encounters made solely by USBP EMS agents along the border, not at the POE, which U.S. Customs is responsible for. Patients were frequently discovered by USBP agents attempting to cross the desert into the United States, scaling or falling from fences, or having been involved in a motor vehicle crash. This may explain why 42% of USBP EMS calls in that study were traumatic, a stark contrast to this and other studies looking at the epidemiology of calls along the U.S.-Mexico border POE.

The study population presenting to the El Paso POE comprised roughly equal numbers of males and females at 49.1% and 50.6%, respectively. Women aged 21 to 30 accounted for 22.8% of all female encounters, while females under 20 accounted for an additional 26.6%. The male population had a much more even age distribution, with the most significant proportion belonging to those between 61 and 70 years old (16.8%), nearly twice that of the female population in the same age group (8.9%). 13.2% of the male population were between the ages of 21 and 30, and 18.8% were less than 20.

The most common diagnoses were neurologic, which included weakness, GI/GU, and traumatic pain/burns which was the same as seen in the San Diego study. Both studies showed similar rates of cardiac complaints at 6.3% in San Diego and 6.9% in El Paso. Other differences between the two study locations include increased O.B. encounters at the El Paso POE (8.8% compared to 5.5% at San Diego) and increased substance abuse and psychological encounters at 6% compared to 3.3% in the San Diego study.

Though it was not a leading diagnosis, it is important to recognize the high number of infectious disease diagnoses and how this may be due to the emergence of COVID during the study period. The San Diego-Tijuana POE saw a significantly higher proportion of respiratory complaints, with 11.1% of all encounters being respiratory versus 6.5%

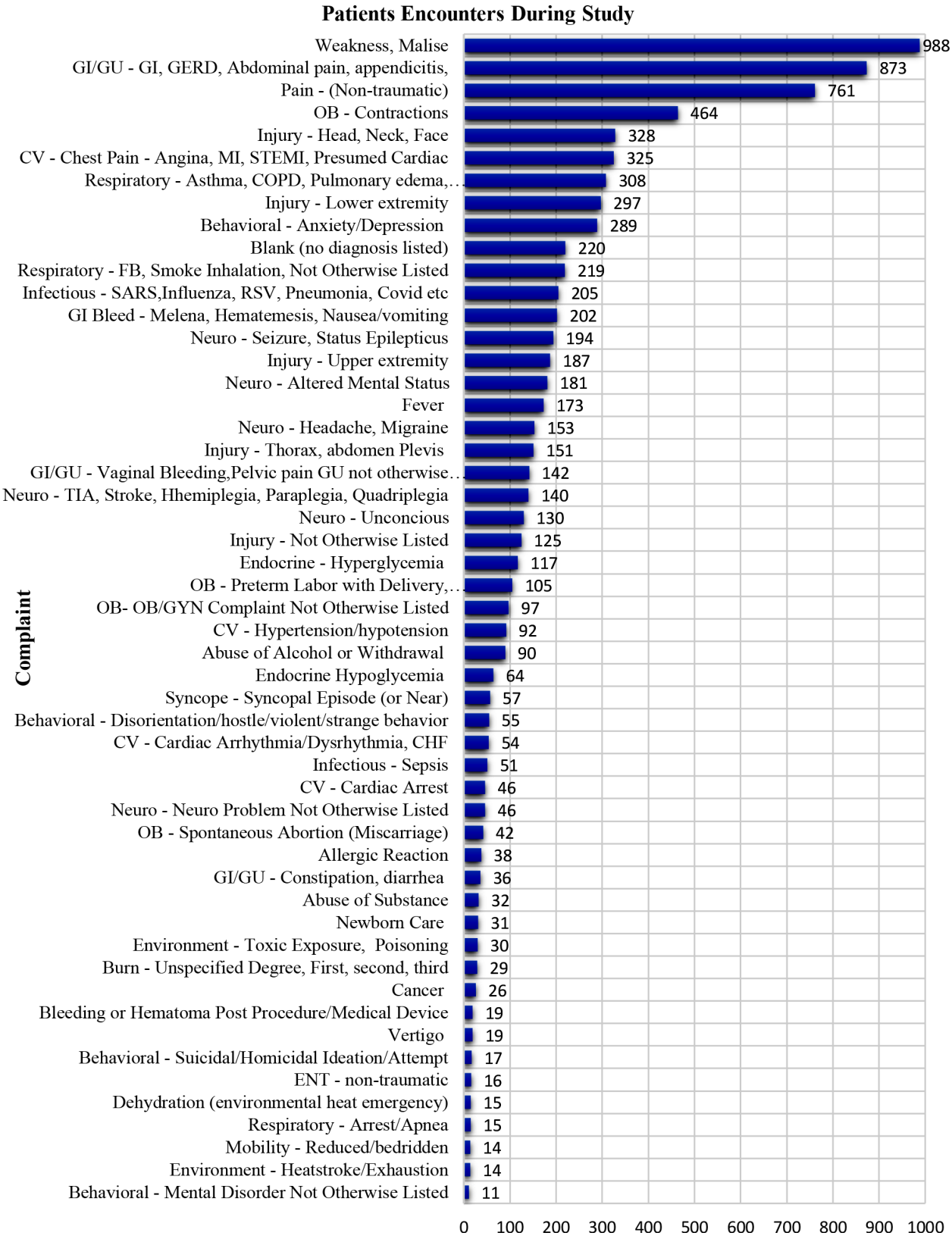

Figure 5. Diagnosis in Order of Frequency (Top 80%).

in El Paso-Juárez. The El Paso-Juárez POE saw higher rates of infectious complaints at 5.2% compared to San Diego-Tijuana at 1.9%. The increased difference in the diagnosis of infection could be due to coding variation or due to the time frame in which this study was conducted. This study was conducted between 2017 and 2023, with the first COVID diagnosis occurring in 2019 and the disease's peak prevalence between 2020 and 2021 (Centers for Disease Control and Prevention, 2023).

When we observed the number of EMS responses to the POE during the COVID-19 pandemic, the temporary border closure had little impact on the median number of calls performed by EPFD, but more variability was seen in the monthly call volume. The monthly EMS hours spent on POE calls were not significantly impacted either.

More current considerations for infectious diseases have become an issue as migrants cross into the U.S. at the El Paso POE. The movement of people across the U.S.-Mexico border, whether it be for leisure, work, or asylum-seeking purposes, may contribute to encounters of infectious diseases. Migrants, often coming from resource-constrained regions with inadequate healthcare, may unknowingly carry infectious diseases and introduce them into the United States or destination country (Greenaway & Castelli, 2019).

In recent years, the influx of migrants from Central and South America has coincided with a surge of illnesses such as tuberculosis and malaria (Agudelo Higuita et al., 2023; Centers for Disease Control and Prevention, 2023; Curry et al., 2022; Greenaway et al., 2011). EMS units that respond to the POE should have additional protocols and personal protection equipment (PPE) specific for suspected infectious and communicable diseases. EMS personnel may also require additional training to identify and treat patients with suspected infectious diseases properly.

The most common ethnicity in the study was Hispanic or Latino, and the most common language spoken by patients was Spanish. Individuals may have limited or no proficiency in English and these linguistic barriers can impair communication of medical needs and history, leading to inaccurate diagnoses and improper treatment. This has never been more significant than since the mass influx of persons who are crossing into Texas. Many of these individuals are from Central and South America and often speak an unfamiliar dialect of Spanish or other native languages. To address these linguistic challenges, various measures could be implemented at border crossings to ensure efficient EMS care despite language barriers. One solution is to include multilingual staff or translators who can assist in communications between medical professionals and patients. Having trained interpreters proficient in different languages available at POE can help the communication gap, facilitating the accurate understanding of medical issues. Additionally, technological advancements can play a significant role in overcoming language barriers in emergency medical situations. Integrating translation tools, virtual interpreters, voice recognition software, or even handheld devices capable of real-time translation could greatly enhance communication between healthcare providers and patients at POE.

The number of encounters has been increasing throughout the six-year study period. The linear regression model predicts the number of EMS responses to the POE is expected to increase by approximately 50 calls per year in 2023 and 2024. The gradual predicted increase in patient encounter volume can aid future staffing plans, resource allocation, and equipment purchasing.

Given the patient arrival distribution is highest during the week specifically on Thursday, and highest during July, staffing and ambulance models can adjust to increase unit availabilities on the busiest days and at the busiest POE.

Although not specifically addressed in the data, some patients arrive in a foreign ambulance with unfamiliar equipment and medications. EMS units responding to the POE should be familiar with comparable medications and alternate infusions or equipment that the patient may be receiving. EMS units should be ready to provide the appropriate substitute to optimize patient care. A patient may arrive in a foreign ambulance or with equipment that may not be able to transfer into a United States ambulance, such as a pediatric isolette. In these cases, a clear policy should allow the foreign ambulance to be escorted to a United States hospital. This transfer can be extremely complicated, requiring knowledge of local, state, and federal laws. A coordinated multiagency agreement between agencies is recommended to address and solve these issues.

LIMITATIONS

Our study has several limitations, including its retrospective design and the potential for data entry errors on ImageTrend TM, which may result in some vital information not being included or not attainable. It may also result in unintended biases, errors, or incorrect data in reporting and collection. While our study examines three of the most heavily trafficked international bridges in El Paso, it only includes some entry points in Texas. Consequently, our study's results may differ from those of other border regions or cities. This study did not include medical services provided by other agencies or law enforcement, such as the U.S. Customs and Border Patrol. Another factor that should be considered is that the COVID pandemic may have affected border crossings and medical encounters during the study period. The U.S.-Mexico border was closed for 19 months between March 2020- November 2021 (Travel restrictions - fact sheet, 2021).

CONCLUSION

This was the first study evaluating the epidemiology of EMS response, specifically at the El Paso-Juarez POE. By understanding and evaluating the epidemiology of call volume, patient diagnosis, unit out-of-service time, and future predictions, the researchers hope to provide EMS agencies that respond to these and other POS, with information needed to improve protocols, optimize training, adjust staffing, eliminate language barriers and adequately equip EMS personnel to serve these high-traffic areas better.

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RESEARCH REPORTS

PARAMEDICS' ANXIETY AND CONCERNS TOWARDS ATTENDING TRAUMATIC EVENTS: A DELPHI STUDY

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ABSTRACT

Introduction: Trauma is a major problem in Saudi Arabia and a leading cause of mortality and morbidity in young age groups. In 2018, road traffic injuries and trauma were the second-leading cause of death after ischaemic heart disease. There is a lack of research that explores the psychological effects on emergency medical service (EMS) professionals of providing the required pre-hospital care for trauma cases. This study aims to identify which trauma cases cause the most anxiety and concern among a group of EMS professionals.

Methods: A study using a two-round Delphi method was undertaken online with EMS professionals working for the Saudi Red Crescent Authority (SRCA) across the country.

Results: The response rate was 70% (n=14) at the end of round two. All participants were male and the majority of professionals who participated were from the capital city, representing 36%. Most of the professionals held a bachelor's degree as the highest level of education (78%). The initial round generated one item that achieved 70% of the consensus; however, the second round did not achieve any consensus. The overall top item for the trauma cases that caused the most anxiety and concern as identified by respondents was road traffic collision.

Conclusion: Road traffic collisions are a leading cause of death and based on the respondents' agreement they cause paramedics the most anxiety and concern of the cases they attend.

INTRODUCTION

Globally, trauma is a major problem and an important cause of mortality and morbidity, and death with trauma injuries represents around 10% of the global disease burden (Haagsma et al., 2016). The causes of trauma mortality and morbidity differ among nations, although injuries rank as one of the top 10 leading causes of death in developed countries (Krug, Sharma, & Lozano, 2000; Nantulya & Reich, 2002). Trauma is a major problem in the United States, which reported unintentional injuries as the third-leading cause of death in 2019 (Kochanek, Murphy,

Xu, & Arias, 2019). In some high-income countries, injuries are even closer to the top of the list of injuries related to death, such as in Saudi Arabia where injuries are the second-leading cause of death (Alghnam, Alkelya, Al-Bedah, & Al-Enazi, 2014; Vos et al., 2020).

Global trauma reports, such as the Trauma Audit and Research Network and the Australia New Zealand Trauma Registry, categorize trauma based on the cause of injuries, such as road traffic accidents, falls, and shootings (Davey et al., 2006; Fitzgerald et al., 2019; Roberts et al., 2020; Tohira, Jacobs, Mountain, Gibson, & Yeo, 2012). Furthermore, the main provider for prehospital care in Saudi Arabia responds to over 280,000 cases annually, including life threatening cases. These types of traumatic events are mostly attended by emergency medical services (EMS) professionals, who provide essential care and timely transport for injured people. EMS professionals provide care around the clock, often in unpredictable environments where rapid decision-making skills are needed to provide best-practice clinical care (Gove, Tamburlini, Molyneux, Whitesell, & Campbell, 1999). EMS personnel work primarily as dual or single responders, often with limited resources. Exposure to traumatic events is common for responders (Thompson, Rehn, Lossius, & Lockey, 2014). Traumatic events may include the death of the elderly or children, violence, and multiple casualties' events. Regular exposure to certain incidents may be psychonoxious for EMS personnel.

The physical and emotional welfare of health care providers is a significant issue. In the UK, EMS personnel have a higher rate of early retirement on the basis of mental and physical illness compared with other health care providers (Rodgers, 1998). Having experienced a distressing event within the past six months produces a significantly high level of anxiety on the 28-item General Health Questionnaire (GHQ-28) and a high score for depersonalisation (Alexander & Klein, 2001; Goldberg & Hillier, 1979). Furthermore, around 69% of EMS professionals had not had enough time to recover emotionally from most of the traumatic events they had experienced (Alexander & Klein, 2001). In Saudi Arabia emergency practitioners including paramedics, physicians, and nurses are more at risk of anxiety disorder, with 52% in moderate and severe ranges (Alharthy, Alrajeh, Almutairi, & Alhajri, 2017).

In recent years, the focus of research has shifted to the mental health challenges faced by EMS professionals, including stress, depression, and anxiety. A recent review of the literature assessing suicidal ideation and behaviours among first responders, such as police officers, firefighters and EMS personnel, shows an elevated risk for suicide (Stanley, Hom, & Joiner, 2016). Working in stressful environments with exposure to frequent and multiple trauma events could lead to anxiety among EMS personnel. Providing care during trauma and critical events has been recognised as a cause of anxiety among health care providers (Melvin, 2015). Therefore, in prehospital and less controlled settings, it is reasonable for EMS personnel to experience high levels of stress, which can lead to a variety of reactions even while providing that care (Cydulka, Emerman, Shade, & Kubincanek, 1997). The frequency of traumatic case attendance could differ from one country to another, leading to differing exposures to trauma for EMS professionals. Previous research recommended further exploration of the psychological effect of providing prehospital care on anxiety in EMS professionals during traumatic events (Guise et al., 2017).

The terms 'anxiety' and 'confidence' are related (MacIntyre & Gardner, 1991). Anxiety has been defined as "the tense anticipation of a threatening but vague event; a feeling of uneasy suspense" (Genest, 2000), while Merriam-Webster (online) defines it as "an abnormal and overwhelming sense of apprehension and fear often marked by physical signs (such as tension, sweating, and increased pulse rate), by doubt concerning the reality and nature of the threat, and by self-doubt about one's capacity to cope with it" (online, 2012). Confidence, or self-efficacy, "is defined as a person's beliefs in his/her capability to succeed in a specific situation or task" (Pajares, 2006). Previous studies have reported that high levels of practitioner anxiety resulted in a low level of confidence that may negatively impact patient safety (Fowler, Beovich, & Williams, 2018; Mason, O'Keeffe, Carter, & Stride, 2016). However, no previous studies have addressed the most common types of trauma cases that are linked to high anxiety levels or identified cases of concern, particularly in Saudi Arabia. This study aims to establish consensus on the traumatic cases that create a substantial anxiety or concern among Saudi Arabian EMS personnel.

METHODS

Design

A modified Delphi approach was used to establish consensus on paramedics' anxiety and concerns towards attending the most common types of traumatic events (Hasson, Keeney, & McKenna, 2000). A panel of EMS professionals working in the field in Saudi Arabia participated in two iterative rounds to rate traumatic cases that created substantial anxiety and concern. A quantitative survey was developed to gather expert consensus opinions from a list of common trauma cases that they believed triggered anxiety and concern. Global trauma reports were used to unifying terms such as road traffic accidents and road injuries into "road traffic collision" (Davey et al., 2006; Fitzgerald et al., 2019; Roberts et al., 2020; Tohira et al., 2012).

Setting and participants

A sample of paramedic professionals was recruited from the Saudi Red Crescent Authority (SRCA), Saudi Arabia. The SRCA is the primary EMS organization providing out-of-hospital care. An expression of interest was distributed throughout the SRCA and an expert panel was organized by SRCA representatives. The list of EMS personnel who expressed their interest and willingness to participate in the study was provided to the lead author. The experts had at least two years of on-road experience and were primarily working in prehospital settings either on the ground or in an 'air ambulance' type service. Also, experts had to be registered as a paramedic with paramedicine degree or equivalent. Participant demographic information was collected such as age, gender, qualifications, experience, geographical work region, and education level. This study was approval by The Human Ethics Low-Risk Review Committee at Monash University (Approval ID#: 20126) and The Saudi Red Crescent Authority Committee (Approval ID#: 1442/4 - 23/08/1442 Hijra).

Procedure

This study included two rounds using Delphi methods (Figure 1) and was distributed electronically using Qualtrics software (Qualtrics International, Seattle, United States). The online survey was developed using demographic information, including age, educa-

tion, experience, etc., and a list of common trauma case types. The primary survey question asked participants to rate cases from a list of the most common trauma types derived from the literature of different countries (Tohira et al., 2012). The participants were instructed to rate the trauma case types based on how much anxiety and concern they experienced when attending those types of events. The rating was on a scale from 1 to 10, where one is least anxious and concerned and 10 is the most anxious and concerned. Any selection from 7 to 10 indicates substantial anxiety and concern. Therefore, if more than 70% of respondents select a score within this range, it signifies a case that requires a consensus for further action. The participants' responses were anonymous to ensure that they responded according to their own thoughts and opinions based on their experience.

The first round of the Delphi study was sent to participants via email with two sections to complete. In the second section, the trauma case list, participants' responses for each case were calculated and the mode value correlated with the median value for each case. Any item (case) that reached a mode rating (e.g. 7-10 substantial anxious and concern) of 70% or more of the consensus was removed from the list and was not available for re-rating (Langlands, Jorm, Kelly, & Kitchener, 2008; McDermott, 2016). At least 70% of the participants should rate an item with the rating number 7-10 to be included as a standard trauma case regardless of the level of anxiety and concern. The first round was available and open to access for two weeks.

The second round was sent to participants via email with the developed list from the first round. In this round, participants were unable to see the items that reached a 70% consensus or above in the first round. The second round offered for re-rating the items that did not reach 70% in the first round. The second round was available and open to access for two weeks.

DATA ANALYSIS

The data was collected electronically in Qualtrics software and then exported for analysis. Data is reported as descriptive data using mean (standard deviation), median (IQR), and frequency data as appropriate.

RESULTS

Experienced paramedics (n=20) from the EMS field in Saudi Arabia were recruited for the study by two representatives from the SRCA. All invitees agreed to participate in the study, although only 14 (70%) completed both rounds of the survey. Responders were all male with master (n=2) and bachelor degrees (n=11) or a diploma (n=1) qualification in paramedicine. The participants were from seven provinces of Saudi Arabia, with the largest number of participants (n=5) located in Riyadh, the capital city. The mean (SD) age of participants was 32 years, having six years of experience.

For round one, the participants' agreement excluded only one item from the second round – road traffic collision. It was rated as 'substantial anxiety and concern' by 70%+ of participants.

In the second round, none of the remaining items achieved a 70%+ consensus. Table 1 shows the order of the items on the list of traumatic events with mode and median 'the most anxiety and concern' to the least.

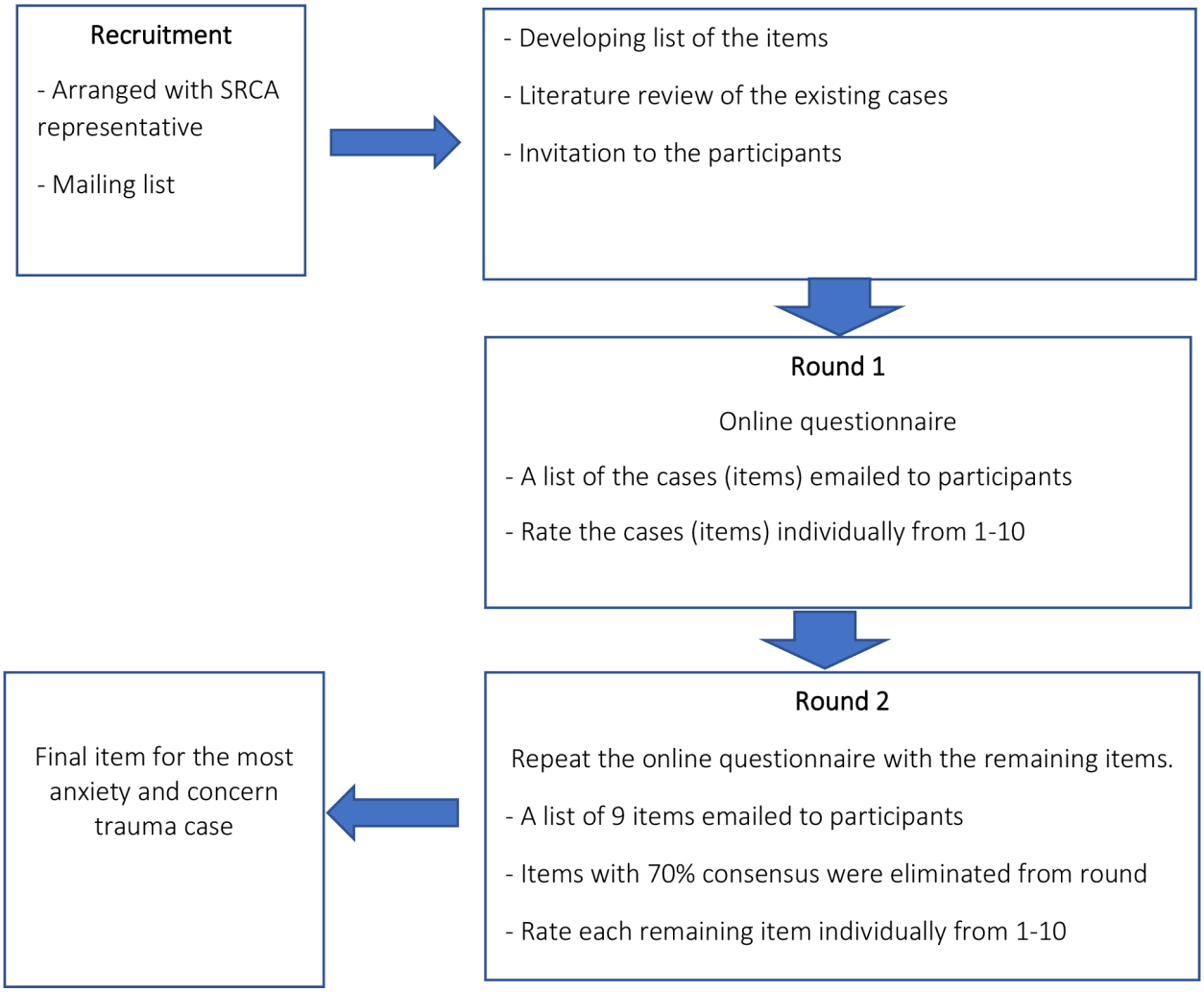

Figure 1. Two-round Delphi process.

DISCUSSION

In this study, an expert panel of participants was used to establish consensus on common trauma types that were perceived to trigger anxiety and concern among paramedics. The responses from 14 EMS professionals identified via consensus that road traffic collision was most likely to be a reason for a substantial anxiety and concern among paramedics compared to any other cases. To the best of our knowledge, no previous studies have reported and rated the most frequent trauma cases that are perceived by EMS personnel to cause the level of anxiety and concern.

Item	First Round			Second Round		
	Median	Mode	%	Median	Mode	%
Road traffic collision	9.5	10 (Substantial)	70	-	-	
Shootings	5.5	10 (Substantial)	60	4	2	50
Blast injuries	6.5	2	60	6	9 (Substantial)	60
Pedestrians	5	2	50	5	1	50
Crush injuries	5	1	50	4	3	50
Burns	5	5	50	6.5	2	50
Stabbings	4	4	50	4	3	50
Falls	5	5	50	4.5	1	50
Drowning	3	3	40	3.5	2	40
Assaults	4	2	40	3.5	3	30

Table 1. The median and mode of participants' ratings in each round of the study.

In 2015, a systematic review of existing evidence on road traffic accidents and road safety in Saudi Arabia identified 29 articles published in the past 25 years, demonstrating the commonality of these incidents (Al Turki, 2014; Mansuri, Al-Zalabani, Zalat, & Qabshawi, 2015). However, it is estimated that there are 30,179 road traffic collisions annually. Over 15% of these cases relied to fatalities (Health, 2022). Therefore, the higher proportion of road-related fatalities could be a reason for the level of consensus identified in this study.

Road traffic collision has been reported in previous studies conducted among different disciplines. A study investigating the anticipation, confidence, and fears of paramedic students and their course coordinator about paramedicine as a career reported that multiple casualties and road traffic accidents were among the events that paramedic students feared the most. Additionally, 37% of students were concerned about their personal mental well-being, which may be linked to their focus on road traffic collisions (Holmes, Jones, Brightwell, & Cohen, 2017). However, there are more than 6 million cars that actively use the roads of Saudi Arabia with more than 4 million road collisions in the last two decades (Mansuri et al., 2015; Touahmia, 2018).

Furthermore, other first responders, such as police, consider road traffic collisions to be traumatic events that stick in the memory for a long time. Police officers interviewed on their experience of exposure to traumatic events identified traffic accidents as the second most stressful event after armed threat events (Karlsson & Christianson, 2003).

There are a number of potential factors that may contribute to why road trauma is rated as the case type most likely to trigger anxiety and concern for Saudi paramedics. First, paramedics respond to road traffic collisions more often than any other type of prehospital callouts (Aljerian et al., 2018). Road trauma exposures include complex interactions with bystanders, police, and firefighters. These groups may also be seeking medical intervention from paramedics, which means Saudi paramedics could be more exposed to road trauma than in other trauma cases such as falls or shootings (Aljerian et al., 2018). This phenomenon has also been reported in a study of South African paramedic trainees. In this cohort, the most common exposure event was transport accidents (53%), although this proportion was higher (65%) among participants with post-traumatic stress disorder. Therefore, frequent exposure to road traffic collisions could lead to mental health illness.

Second, paramedics are considered front line emergency responders dealing with trauma cases in unpredictable situations. Anecdotally, the transportation of patients by a bystander or private car is common in Saudi Arabia. This could lead to paramedics only being exposed to the most critical and distressing cases. This has been reported in the U.S., where the characteristics and outcomes of injured patients transported by private, non-commercial means have been compared with EMS attendances. The result showed that responding to injured patients with ISS>15 was higher for EMS personnel compared with those transported by private vehicles. Moreover, EMS patients were more likely to die than patients who were transferred by private transportation, indicating the severity or criticality of their injuries (Johnson et al., 2013).

In this study, falls was a category of the trauma cases that did not achieve the level of consensus by participants. However, a recent systematic review and meta-analysis ex-

amining the prevalence and risk factors of falls in older adults living in the Gulf Cooperation Council countries reported only six studies, and just four of them in Saudi. In addition, the falls rate was significantly increasing and half of older people experienced falling with the majority being female (Alqahtani, Alshehri, Hoover, & Alenazi, 2019). Fall injuries have been considered a leading cause of trauma-related death in developed countries such as the UK and the U.S. Studies showed a high rate of calls and responses to falls by elderly people with a high risk of mortality (Tinetti, Speechley, & Ginter, 1988). Studies from the UK have reported that falls in elderly patients are one of the most common traumatic injuries that lead to death in the prehospital setting (Lawrence et al., 2016; Roberts et al., 2020). Similarly, in the U.S., falls are one of the four major trauma causes related to death in 16.6% of all injury deaths (Murphy, Xu, & Kochanek, 2013). In Saudi Arabia, around 49% of elderly people experience falls resulting in injuries each year. However, it is common for injured patients to arrive at hospital in private transportation (Aljerian et al., 2018; Almegbel et al., 2018). Therefore, Saudi EMS could be less exposed to falls, which could lead to less experience in the circumstances of this event. Furthermore, the lack of research on the response rate for Saudi EMS for falls could be evidence of a lack of exposure and experience of falls.

LIMITATIONS

The study had several limitations, including a small sample size with only male participants. The participation rate fell to 70% in the second round., The study was terminated at two rounds to minimise decreasing the rate of response, regardless of the number of times consensus was achieved. Lastly, the results of this study could be enriched with a qualitative study to learn more about the decisions that have been made and the differences in the selection.

CONCLUSION AND RECOMMENDATION

This paper aimed to establish consensus on traumatic cases that would cause a substantial anxiety and concern for paramedics in Saudi Arabia. Road traffic collisions were considered by consensus as a trigger for anxiety and concern. While this finding sheds light on a critical aspect of the paramedic profession, it also underscores the need for further research to delve deeper into the implications of such exposure to traumatic incidents. Future studies should aim to comprehensively investigate the long-term psychological and emotional effects on EMS personnel who regularly encounter road traffic collisions, as well as explore potential interventions and strategies to mitigate the associated stress and trauma. By expanding our understanding of the challenges paramedics face, we can develop more effective support systems and training programs to ensure their well-being while they continue to provide life-saving services to the community. This research can ultimately contribute to the enhancement of emergency medical services in Saudi Arabia and globally, thereby improving the overall healthcare system.

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RESEARCH REPORTS

FACTORS ASSOCIATED WITH INCREASED USE OF COGNITIVE AIDS

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ABSTRACT

Background: Cognitive aids are an essential aspect of patient care within emergency medical services (EMS). Despite their availability in EMS, these aids are underutilized. Understanding factors associated with increased use of cognitive aids can help guide the development of effective implementation strategies. This study examines the association between the frequency of cognitive aid use in EMS and three factors: the use of these aids in initial education programs, policies mandating their use, and clinicians' perceptions of cognitive aid usefulness.

Methods: This study used a cross-sectional survey examining the use, previous training, policy, and perceived usefulness of 15 selected cognitive aids. The survey was emailed to 136,093 EMS clinicians in six participating states (TX, ME, MI, LA, SC, and AR). Descriptive statistics were used to describe the examined factors. Bivariate analysis was used to examine the relationship between the use of each cognitive aid and previous training with the aid, requirements for use, and perceived usefulness.

Results: A total of 2,251 respondents met inclusion criteria and were included in the study. The length-based tape was the most common aid used during initial education programs (n=1724, 77.0%) and to have policy requiring its use during patient care (n=1194, 53.0%). Aids associated with pediatric medication administration were perceived as most useful. Clinicians were more likely to use a specific aid if there was policy requiring its use, if they used the aid during their initial education programs, or if they perceived it to be useful.

Conclusions: The results of this study suggest that integrating a cognitive aid into EMS initial education programs, having policy requiring its use, and the aid being perceived as useful are all associated with increased use the aid during patient care. These results may provide valuable insights for devising more effective implementation strategies for cognitive aids.

INTRODUCTION

Cognitive aids are tools commonly used during patient care in emergency medicine. These include checklists, references, and aids used to limit the need for calculations during patient care (Keebler, 2017). Aids are typically designed to reduce cognitive load when performing a task, ultimately increasing the efficiency of the clinician (Corazza et al., 2020; Hall et al., 2020). Several cognitive aids have been found to reduce the incidence of error

associated with some medical procedures in EMS (Hall et al., 2020; Haynes et al., 2009; Hoyle et al., 2020), and are recommended by national EMS organizations (Counts et al., 2022; National Association of State EMS Officials, 2022).

Although many cognitive aids are available in EMS, their use appears limited. In our previous study, we used a cross-sectional survey to examine the frequency that 15 cognitive aids were used in EMS during their related procedures or patient encounters. The survey found that only one of the listed cognitive aids, the length-based tape (LBT), was used "often" when its use was indicated. Almost half of the aids were reported as being used "rarely" (Harmer et al., 2024), which included aids that are recommended by national organizations (Counts et al., 2022).

Increasing the use of cognitive aids by clinicians during certain procedures or patient encounters can be difficult, and challenges have been reported in other areas of healthcare (Levy et al., 2012; Paugam-Burtz & Guerrero, 2011). The World Health Organization (WHO) developed the WHO Surgical Safety Checklist in 2008 to combat safety issues during surgery. However, the WHO faced serious resistance during early phases of implementation, with many surgeons refusing to use the aid. Much of this was due to unfounded concerns among clinicians such as significant delays in care, increased anxiety in the patient, and that the checklist was not valuable (Jain et al., 2018). These issues led to the WHO establishing the WHO Patient Safety Checklist Implementation Manual (World Health Organization, n.d.) to increase the frequency and appropriateness of its use.

Appropriate implementation strategies for cognitive aids in EMS may result in more effective adoption and increased use during patient care. Common strategies used when implementing a change in practice (such as introducing a new aid) include training and policy development, among others (Klaic et al., 2022). Some models highlight the value of perceived usefulness of technology and tools. The Technology Adoption Model posits that there are several factors that influence a person's decision about how and when they use technology (Bagozzi et al., 1992). Among these include perceived usefulness of the technology, which refers to the person's belief that it will enhance their job performance (Davis, 1989).

Strategies to increase cognitive aid use in EMS have not been identified, as the factors associated with the increase use of these aids are not well known. This study examined the relationship between cognitive aid use in EMS and three factors: training with cognitive aids during initial education programs, policy requiring the use of cognitive aids, and clinicians' perceived usefulness of cognitive aids.

METHODS

Study Population and Instrumentation

This was a planned subsequent analysis from the survey described in (Harmer et al., 2024). This was an online cross-sectional survey with six participating state EMS departments (TX, MI, AR, SC, ME, and LA). All licensed or certified EMS clinicians in these states were sent an email link to the survey, totaling 136,093 clinicians. Clinicians who were less than 18 years of age or do not work as an EMS clinician in an emergency response setting in the United States were excluded from the study.

This survey was developed using a modified Delphi method with 6 subject matter experts. An initial draft of the survey was pilot tested with subsequent cognitive debriefing. The survey was refined and a final draft of the survey was developed consisting of 80 items that focused on the use of 15 cognitive aids (Table 1). Participants were asked to rate how often they use each aid during its associated procedure or patient encounter, if they trained with the aid during their initial education program, if there was policy requiring them to use the aid, and their perceived usefulness of each aid. The survey was open from January 3, 2022 to January 16, 2022.

Protection of Human Subjects

Approval for this study was obtained through the Western Michigan University Institutional Review Board (reference number: 21-08-05). Prior to starting the survey, participants received information about the study's objectives and were informed of their freedom to exit the research whenever they chose. Informed consent was obtained at the beginning of the survey. The study did not gather any data that could personally identify participants, and their answers were directly uploaded to the SurveyMonkey (SurveyMonkey Inc., Menlo Park, CA) database. Upon completion of the response collection, the data was transferred to a distinct server safeguarded by a password. All ethical and regulatory protocols were strictly followed.

MEASURES

Initial education and policy

For each cognitive aid, participants were asked if they used them during their initial education program (e.g., paramedic program). Additionally, they were asked if there was a policy requiring them to use the aid during the associated procedure or patient encounter. Participants had the option to either select yes or no for each aid.

Perceived usefulness - Participants were asked to rate their perceived usefulness of the 15 cognitive aids, using a five-point Likert scale, during each aid's associated procedure or patient encounter. Participants could select "not applicable" if they were not familiar with the aid.

Frequency of cognitive aid use - Participants rated the frequency they use each cognitive aid using a five-point Likert scale. The frequency of cognitive aid use was compared to reported use of that aid during initial education, policy requiring its use, and the participants' perceived usefulness of the aid.

ANALYSIS

Data was exported to Stata IC 15.1 (StataCorp LP, College Station, TX) and descriptive statistics were used to examine demographic, employment data, and the frequency of cognitive aid use. Use of cognitive aids during participants' initial education program, requirements for use of cognitive aids, frequency of use during associated procedure or skills, and perceived usefulness of each cognitive aid were described using frequency and proportions or medians and interquartile ranges. Bivariate analyses exploring the relationship between frequency of use of each of the 15 cognitive aids and reported use during participants' educational programs, requirements for use, and perceived usefulness were also conducted using Mann-Whitney U tests and Spearman correlation

coefficients. Multivariate analysis was then performed using ordered probit regression to determine which of the significant variables in bivariate analyses retained their significance when considering all other factors.

RESULTS

Of the 136,415 EMS clinicians who received the survey, a total of 3,929 responses were collected, resulting in a response rate of 2.88%. A total of 1678 (42.7%) responses were excluded from the survey, resulting in a final sample size of 2,251. Responses were excluded due to the survey being incomplete (751, 19.1%), participant was not actively working as an EMS clinician in the U.S., participant was less than 18 years of age (614, 15.6%), participant did not provide consent (306, 7.8%), and concerns over validity of the data (7, 0.2%). Demographic and employment characteristics were significantly different between the included and excluded responses. Further details of these demographic differences can be found in Harmer et al., 2024.

Use of Cognitive Aids During Initial Education Program

Table 1 shows the cognitive aid use during initial education, requirements for cognitive aid use and perceived usefulness of cognitive aids. The most frequently used cognitive aids during initial education programs (i.e., EMR, EMT, AEMT, or paramedic programs) were the LBT, protocol referencing, the Glascow Coma Score (GCS) scoring template, pocket guides for cardiac arrest algorithms, pediatric color-based medication reference cards, the trauma score template, and paper templates for note taking during treatment. The least frequently used cognitive aids during educational programs were phone or tablet applications designed to calculate medications for adults and pediatrics.

Requirements to Use Cognitive Aids

Only one aid was reported as required by more than half of participants, the LBT. The GCS scoring template (46.5%), protocol referencing (42.2%), color-based medication reference cards (39.6%), and trauma score template (36.6%) were the next most required aids as reported by participants. The least frequently required cognitive aids were phone or tablet applications for calculating medications for adults (13.3%) and pediatrics (18.3%), and calculators for medication administration for adults (14.2%) and pediatrics (16.6%).

Perceived Usefulness of Cognitive Aids for Associated Skills

LBT, phone or tablet applications for pediatric medications calculations, and color-based medication reference cards were reported, to be “very useful” during associated skills for patient care (Med = 4.0, IQR: 2.0 – 4.0). Most other cognitive aids were rated as “mostly” useful, although checklists and mnemonics were rated as only “somewhat” useful (Table 1).

Relationships Between Frequency of Use, Training and Policy

All cognitive aids demonstrated a significantly greater frequency of use during patient care if participants used them during their initial education program and if an organizational or medical control policy or protocol required its use (p=<.001). Table 2 describes the median frequency of use with the interquartile range. These values are compared

Cognitive Aid	Use of Cognitive Aids During Initial Education Programs		Requirements to Use Cognitive Aids		Perceived Usefulness of Cognitive Aids During Associated Procedures/Encounters		
	N	%	N	%	Median	IQR	Correlating Usefulness
Phone or tablet application, specifically designed to calculate medications, for adult medication calculation	593	26.5	299	13.3	3.0	2.0 – 4.0	Mostly
Phone or tablet application, specifically designed to calculate medications, for pediatric medication calculation	652	29.1	413	18.3	4.0	3.0 – 4.0	Very
Calculator (handheld calculator device or a calculator on a phone or tablet) for adult medication administration	999	44.7	319	14.2	3.0	2.0 – 4.0	Mostly
Calculator (handheld calculator device or a calculator on a phone or tablet) for pediatric medication administration	1,032	46.1	374	16.6	3.0	2.0 – 4.0	Mostly
Pocket guides to reference treatment algorithms when managing patients in cardiac arrest.	1,245	55.6	504	22.4	3.0	2.0 – 4.0	Mostly
Length-based tape (e.g., Broselow tape) when treating pediatric emergencies	1,724	77.0	1,194	53.0	4.0	3.0 – 4.0	Very
Color-based medication reference cards when treating pediatric emergencies	1,233	55.1	891	39.6	4.0	3.0 – 4.0	Very
Checklist (paper or digital) when performing procedures (e.g., endotracheal intubation, supraglottic airway placement, medication administration)	1,010	45.2	617	27.4	2.0	1.0 – 4.0	Somewhat
Checklist (paper or digital) for managing patients in cardiac arrest (e.g., CPR checklists, defibrillation checklists)	1,019	45.5	556	24.7	2.0	1.0 – 4.0	Somewhat
Protocol referencing (paper or digital) when treating patients (any condition or age)	1,564	70.0	950	42.2	3.0	2.0 – 4.0	Mostly
Paper templates for note taking when treating patients (any condition or age)	1,183	52.8	528	23.5	3.0	2.0 – 4.0	Mostly
Medication recording feature on a cardiac monitor when administering medications (adult or pediatric)	1,043	46.6	582	25.9	3.0	2.0 – 4.0	Mostly
Trauma score template (paper or electronic) when managing critical trauma patients.	1,230	55.0	823	36.6	3.0	2.0 – 4.0	Mostly
GCS scoring template (paper or electronic) when treating patients (any condition or age).	1,510	67.5	1,046	46.5	3.0	2.0 – 4.0	Mostly
Mnemonic (paper or electronic) for communication when performing a patient handoff	1,028	45.9	579	25.7	2.0	1.0 – 4.0	Somewhat

Table 1. Initial education use, requirements, and perceived usefulness of cognitive aids.

between participants responses describing if they used each aid during their initial education program and if a policy was present requiring their use.

Frequency of Use and Perceived Usefulness of Cognitive Aids

Table 3 shows the relation between perceived usefulness and frequency of use. Perceived usefulness of all 15 cognitive aids demonstrated a moderate positive correlation with the frequency of use among participants during patient care. As perceived usefulness of a cognitive aid increased, so did its frequency of use.

Cognitive Aid	Use During Education Program		Required to Use	
	Yes	No	Yes	No
Phone or tablet application, specifically designed to calculate medications, for adult medication calculation	2.0 (2.0 – 3.0)	1.0 (0.0 – 2.0)	3.0 (2.0 – 3.0)	1.0 (0.0 – 2.0)
Phone or tablet application, specifically designed to calculate medications, for pediatric medication calculation	3.0 (2.0 – 4.0)	1.0 (0.0 – 3.0)	3.0 (2.0 – 4.0)	1.0 (0.0 – 3.0)
Calculator (handheld calculator device or a calculator on a phone or tablet) for adult medication administration	2.0 (1.0 – 3.0)	1.0 (0.0 – 2.0)	3.0 (2.0 – 3.0)	1.0 (0.0 – 2.0)
Calculator (handheld calculator device or a calculator on a phone or tablet) for pediatric medication administration	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)	3.0 (2.0 – 4.0)	2.0 (0.0 – 3.0)
Pocket guides to reference treatment algorithms when managing patients in cardiac arrest.	2.0 (1.0 – 3.0)	0.0 (0.0 – 1.0)	2.0 (1.0 – 3.0)	1.0 (0.0 – 2.0)
Length-based tape (e.g., Broselow tape) when treating pediatric emergencies	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)	3.0 (2.0 – 4.0)	2.0 (0.0 – 3.0)
Color-based medication reference cards when treating pediatric emergencies	3.0 (2.0 – 4.0)	0.0 (0.0 – 2.0)	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)
Checklist (paper or digital) when performing procedures (e.g., endotracheal intubation, supraglottic airway placement, medication administration)	2.0 (0.0 – 3.0)	0.0 (0.0 – 1.0)	3.0 (2.0 – 4.0)	0.0 (0.0 – 1.0)
Checklist (paper or digital) for managing patients in cardiac arrest (e.g., CPR checklists, defibrillation checklists)	2.0 (0.0 – 3.0)	0.0 (0.0 – 1.0)	3.0 (2.0 – 4.0)	0.0 (0.0 – 1.0)
Protocol referencing (paper or digital) when treating patients (any condition or age)	2.0 (2.0 – 3.0)	2.0 (0.0 – 2.0)	3.0 (2.0 – 3.0)	2.0 (0.0 – 2.0)
Paper templates for note taking when treating patients (any condition or age)	2.0 (1.0 – 3.0)	0.0 (0.0 – 2.0)	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)
Medication recording feature on a cardiac monitor when administering medications (adult or pediatric)	3.0 (2.0 – 3.0)	1.0 (0.0 – 2.0)	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)
Trauma score template (paper or electronic) when managing critical trauma patients.	3.0 (2.0 – 4.0)	0.0 (0.0 – 2.0)	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)
GCS scoring template (paper or electronic) when treating patients (any condition or age).	3.0 (2.0 – 4.0)	1.0 (0.0 – 2.0)	3.0 (3.0 – 4.0)	1.0 (0.0 – 2.0)
Mnemonic (paper or electronic) for communication when performing a patient handoff	2.0 (1.0 – 4.0)	0.0 (0.0 – 1.0)	3.0 (2.0 – 4.0)	0.0 (0.0 – 1.0)

Table 2. Medians and interquartile ranges representing frequency of use of cognitive aids by use during education program and requirements to use.

Multivariate Analysis

Ordinal probit regression models were assessed with and without inclusion of demographic and employment characteristics; inclusion was determined to improve model fit and R^2 values. Thus, the statistics reported in Table 4 were based on models that controlled for age, gender, race, EMS provider level, level of education, primary work location, EMS employment type, and primary community type. Years of experience was not included, as it did not show statistical significance in bivariate analysis.

Use during initial education programs, requirements for use per an organizational or medical control policy or protocol, and perceived usefulness of cognitive aids all retained statistical significance after controlling for demographic and employment characteristics. Generally, high levels of perceived usefulness (i.e., "mostly" or "very" useful) demonstrated the largest effect on frequency of use, followed by requirements to use the cognitive aid, and, as the least influential factor, use during education programs.

Cognitive Aid	Correlation Coefficient
Phone or tablet application, specifically designed to calculate medications, for adult medication calculation	0.41
Phone or tablet application, specifically designed to calculate medications, for pediatric medication calculation	0.46
Calculator (handheld calculator device or a calculator on a phone or tablet) for adult medication administration	0.47
Calculator (handheld calculator device or a calculator on a phone or tablet) for pediatric medication administration	0.49
Pocket guides to reference treatment algorithms when managing patients in cardiac arrest.	0.44
Length-based tape (e.g., Broselow tape) when treating pediatric emergencies	0.55
Color-based medication reference cards when treating pediatric emergencies	0.51
Checklist (paper or digital) when performing procedures (e.g., endotracheal intubation, supraglottic airway placement, medication administration)	0.54
Checklist (paper or digital) for managing patients in cardiac arrest (e.g., CPR checklists, defibrillation checklists)	0.53
Protocol referencing (paper or digital) when treating patients (any condition or age)	0.49
Paper templates for note taking when treating patients (any condition or age)	0.55
Medication recording feature on a cardiac monitor when administering medications (adult or pediatric)	0.50
Trauma score template (paper or electronic) when managing critical trauma patients.	0.53
GCS scoring template (paper or electronic) when treating patients (any condition or age).	0.53
Mnemonic (paper or electronic) for communication when performing a patient handoff	0.61

Table 3. Spearman Correlation Coefficient and P value between Frequency of Use and Perceived Usefulness of Cognitive Aids.

Cognitive Aid	Use during Education Programs	Required to Use	Perceived usefulness			
			Slightly	Somewhat	Mostly	Very
Digital application for adult medication calculation	0.76	0.82	0.92	1.28	1.76	2.07
Digital application for pediatric medication calculation	0.64	0.71	0.56 α	0.86	1.19	1.78
Calculator for adult medication administration	0.61	0.77	0.56	0.95	1.38	1.82
Calculator for pediatric medication administration	0.49	0.66	0.38 α	0.73	1.10	1.72
Pocket guides for cardiac arrest	0.58	0.81	0.68	1.01	1.32	1.70
Length-based tape	0.57	0.86	0.78	1.09	1.48	2.28
Color-based medication reference cards	0.69	0.86	0.71	1.01	1.25	1.96
Checklist when performing procedures	0.39	1.39	0.57	0.97	1.38	1.74
Checklist for managing patients in cardiac arrest	0.43	1.22	0.69	1.11	1.47	1.89
Protocol referencing	0.44	0.75	0.49 α	0.89	1.32	1.81
Paper templates for note taking	0.49	0.88	0.61	0.95	1.44	1.89
Medication recording feature on cardiac monitor	0.64	0.95	0.68	0.95	1.52	1.87
Trauma score template	0.64	1.11	0.66	0.88	1.37	1.78
GCS scoring template	0.55	1.17	0.92	1.00	1.43	2.03
Mnemonic for communication during patient handoff	0.75	1.24	0.59	0.92	1.45	1.96

* Controlled for age, gender, race, EMS provider level, level of education, primary work location, EMS employment type, and primary community type.

± Reference category = Not at all useful

α Significant at the $p < .05$ level. All other coefficients were significant at the $p < .001$ level.

Table 4. Coefficients from Ordinal Probit Regression Predicting Frequency of Use.

DISCUSSION

Use During Initial Education

Six cognitive aids were reported as being used by more than half of the participants during their initial education programs (table 1). The most common aid used during initial education was the LBT (n=1724, 77.0%). This was an expected finding as the use of these aids are commonly part of EMS training programs (R. L. Lammers et al., 2022). Although the National Highway and Traffic Safety Administration EMS Education Standards do not specifically reference LBTs, they do mention the use of resources and tools for safe administration of weight-based medication (National Highway and Traffic Safety Administration, 2021). These tapes, specifically the Broselow-Luten tape, have been used for many years to assist with pediatric medication dosing (DeBoer et al., 2005).

The use of resources and tools to promote safe weight-based medication dosing did not extend to digital technology during initial education. We found that digital cognitive aids for pediatric or adult medication calculations were the least likely to be used during EMS initial education programs. There is little research on why these types of aids are not used in this setting. This may be due to limited availability of this technology. Additionally, there is limited research on the efficacy of such aids compared to others (Luten et al., 2007). Programs may choose traditional paper aids as they are more commonly found in ambulances (Hoyle et al., 2017). Additionally, a stigma of mobile application use during educational sessions (O'Bannon & Thomas, 2014) may contribute to this.

All 15 cognitive aids were more likely to be used during patient care when the provider trained with the aid during initial education. This was expected as integrating these aids when clinical skills are first taught could result in a habit formation where it becomes automatic to use it when the skill is being performed (Smith & Graybiel, 2016). Additionally, training with the aid would increase familiarity and allow clinicians to experience the benefits of use, such as simplifying a task and reducing cognitive load (Corazza et al., 2020; Hall et al., 2020). This is an important finding as it supports that having clinicians practice with these aids during initial education is an essential cognitive aid implementation strategy.

Required Cognitive Aid Use

We anticipated that a large percentage of participants (53.0%) would report policy or protocol requirements for LBT use. This aid is often stipulated in protocols due to its accuracy estimating weight in pediatric patients (Michigan Department of Health and Human Services, 2017). The prevalence of this aid's requirement underscores its perceived value to EMS care. We did not expect a significant number of participants reporting requirements to use other cognitive aids, such as protocol references, as reported by 42.2% of participants. Given that EMS protocols can be extensive and multifaceted, clarity is needed regarding the specific information these references provide. This raises questions about the items within the protocol references that are deemed essential enough to require their use, and if there is a more effective way to help clinicians reference that information during patient care.

The relationship between policies or protocols and the frequency of cognitive aid use was evidenced in our study. All 15 cognitive aids we examined showed a statistically

significant increase in use when mandated by such policies. This supports the premise that formal requirements bolster the implementation of tools and procedures. EMS clinicians typically operate without direct supervision (Ericsson et al., 2022), and the absence of systematic record-keeping for the use of cognitive aids makes it difficult to confirm adherence to policy requiring the aid use. Our findings indicate compliance among EMS personnel with mandated cognitive aid use, a practice that can enhance patient care.

Perceived Usefulness

Cognitive aids associated with pediatric medication administration were reported as the most useful aids. These included the LBT, phone or tablet application for calculating pediatric medications, and pediatric color-based medication references. Medication dosing errors in EMS have long been cited in research (Hobgood et al., 2006; Misasi & Keebler, 2019; Patterson et al., 2014), especially pediatric dosing errors (Hoyle et al., 2020; Kaji et al., 2006; R. Lammers et al., 2012). In our previous study, we found that pediatric cognitive aids were among the most frequently used (Harmer et al., 2024). This is likely due to providers' awareness of pediatric medication dosing errors and being uncomfortable with pediatric emergency care (Fowler et al., 2018). Additionally, many of these aids are included in policies and protocols, meaning they are essentially endorsed by regulating bodies (Michigan Department of Health and Human Services, 2017).

We further found that perceived usefulness of all 15 cognitive aids demonstrated a positive correlation with the frequency of use during patient care. This was an expected finding as it aligns with the Technology Acceptance Model. This model is widely used to predict and explain user behavior associated with tools and technology (Chuttur, 2009). It suggests that perceived usefulness and ease of use determine an individual's likelihood to use the system or tool (Davis, 1989).

LIMITATIONS

This study has the typical limitations of survey research. The survey carried a low response rate of 2.88% and may involve self-selection bias. Some demographic information differed between those who participated in the survey and demographic characteristics of the EMS workforce, suggesting that the results from survey participants may not generalize to the broader population of EMS clinicians and systems. Recall bias may be present due to the infrequent use of many aids we examined. Recalling use during initial training may be difficult for those who have been practicing for an extended time. We surveyed six states with four of them located in the southern region of the country. The results of cognitive aid use in these states may not generalize to other areas.

CONCLUSION

This study demonstrates a significant relationship between the perceived usefulness of cognitive aids, training with these aids during initial education programs, institutional policies mandating their use, and use by practicing EMS clinicians. These findings can inform strategies to enhance EMS implementation and adoption of cognitive aids. Practical utility, familiarity through training, and regulatory guidelines are key drivers to increase their use. Further studies are needed to identify additional factors that can encourage use of cognitive aids in EMS, and how that use impacts patient outcomes.

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RESEARCH REPORTS

THE ROLE OF EMOTIONAL INTELLIGENCE IN TURNOVER INTENTION AMONG EMS PROVIDERS

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ABSTRACT

The Emergency Medical Services are strained in the face of high workforce turnover and substantial cost pressures. Voluntary workforce turnover exacerbates direct and indirect cost pressures including training, productivity loss, loss of talent, and covering vacancies. Further, high turnover rates are associated with decreased quality of care and increased likelihood of medical errors. Reduction of voluntary turnover is therefore of practical interest for worker retention and cost reduction. While a robust body of literature is dedicated to exploring precursors of turnover, few studies have explored affective factors leading to turnover in emergency medical service clinicians. Key questions investigated are (1) the relationship between trait emotional intelligence (EI) and turnover intention (TI) and (2) the relationship between EI and TI controlling for known predictors of turnover intention. A convenience sample (n=446) was obtained through an online survey created with validated EI, turnover, stress and other instruments and distributed to EMS providers via agencies and online forums. Analytic methods include t-tests, Pearson correlations, and linear regression. Higher trait EI was found to result in decreased turnover intention both at the global ($r = -.31$, $p < 0.001$) and factor levels (Wellbeing, $r = -.22$, $p < 0.001$; Self-Control $r = -.19$, $p < 0.001$; Emotionality, $r = -.35$, $p < 0.001$; Sociability, $r = -.17$, $p < 0.001$). While EI is found to predict turnover intention, other factors such as physical health, perceived stress, and income may be better predictors of turnover intent. Among the important implications of this study is that trait EI should be included in discussions of job turnover of EMTs and paramedics, especially in human resource planning. In addition, it highlights that the mental and physical health of EMS clinicians deserves closer attentiveness by researchers, clinicians, policymakers and EMS managers.

INTRODUCTION

The Emergency Medical Services industry is experiencing unprecedented demand amidst lean operating margins, escalating cost pressures including voluntary turnover, and limited financial reimbursement as a result of archaic federal reimbursement standards (Avesta Systems & the American Ambulance Association, 2018; Mobile Integrated Healthcare and Community Paramedicine (MIH-CP) 2nd National Survey, 2018; Panel, 2019; Rehkopf & Chamberlin, 2019). A high rate of voluntary turnover results in recurrent costs which may be preventable. Reduction of preventable costs is particularly desirable in the EMS industry where narrowing operating margins are the norm. The rate of

voluntary turnover, while having wide distribution, among EMS professionals is exceptionally high (20%-30%) (Avesta Systems & the American Ambulance Association, 2018) and exceeds that of other similar emergency service and healthcare occupations.

Further, elevated rates of voluntary turnover have been found to reduce the quality of patient care and results in a less efficient workforce. High turnover results in a workforce comprised of novice-level healthcare providers as opposed to experienced providers. In related medical professions, novice providers are more likely to incorrectly identify a patient's clinical presentation, fail to intervene appropriately, fail in task management, and commit medication delivery errors, as compared to experienced providers (Hruska et al., 2016; Lowe, Ireland, Ross, & Ker, 2016; Saintsing, Gibson, & Pennington, 2011).

OBJECTIVES

Understanding the antecedents of voluntary turnover may provide opportunities to intervene, such as development of training programs, and altering hiring practices to reduce voluntary turnover, its associated costs, and medical errors. A variety of antecedents of turnover have been studied both in EMS and similar professions including compensation (Avesta Systems & the American Ambulance Association, 2018; Blau, Chapman, Gibson, & Bentley, 2011; Chapman, Blau, Pred, & Lopez, 2009), tenure (Chapman et al., 2009), and an employee's commitment to an organization (Chapman et al., 2009). Quitting intention, also known as Turnover Intent (TI), is a well demonstrated as an antecedent of actual turnover (Lambert, Lynne Hogan, & Barton, 2001) and therefore selected for study as a predictor of turnover among EMS professionals. Turnover intent, an individual's intended likelihood to separate from an organization, is distinct from actual turnover (e.g. an employee leaving) and from employee retention (e.g. an employer's ability to prevent turnover). Actual turnover may occur for voluntary or involuntary reasons (e.g. employee separation from an organization following disciplinary action). Voluntary turnover may be due to preventable organizational (e.g. job characteristics) or individual (e.g. job satisfaction) characteristics. Voluntary turnover may also be due to non-preventable causes (e.g. following a spouse due to job relocation). An employee electing to leave an organization, or 'voluntary turnover', is the intersection where organizational strategies meet individual intention and behaviors (Holtom, Mitchell, Lee, & Eberly, 2008). Voluntary turnover is a multiform construct reflecting various components of an individual's work-related attitudes, organizational commitment, social alignments, personal characteristics, and economic needs (Abelson, 1987; Berry, 2010; Bothma & Roodt, 2013; Kaplan, 2021; Lum, Kervin, Clark, Reid, & Sirola, 1998). The decision to leave employment is a decision which is not typically taken lightly and involves significant deliberation. Turnover intention therefore is a good predictor of subsequent leaving behavior (Kaplan, 2021; Mobley, Horner, & Hollingsworth, 1978). Turnover intention is demonstrated to be the most proximal antecedent of turnover (Hom, Lee, Shaw, & Hausknecht, 2017), and to be a strong predictor of actual turnover (Doede, 2017; Griffeth, Hom, & Gaertner, 2000). This study investigates the roles of individual antecedents to turnover intention among EMS clinicians.

Among variables demonstrated to have a relationship with turnover and turnover intent in professions similar to EMS, such as nursing (Hong & Lee, 2016), is an aspect of personality termed Emotional Intelligence (EI) (Kostantinos V. Petrides, 2010; K. V. Petrides &

Furnham, 2000; K. V. Petrides, Pita, & Kokkinaki, 2007; K. V. Petrides, Pérez-González, & Furnham, 2007).

Emotional Intelligence is a term coined by Peter Salovy and John Mayer (Mayer & Salovey, 1997) and popularized by Daniel Goleman (Goleman, 1995) through his well-received book Emotional Intelligence. The term emotional intelligence is used popularly to describe a social intelligence. Somewhat enigmatically, the term emotional intelligence, from a construct validity perspective, is used to refer to two distinct constructs. Emotional intelligence meets the specific criteria of an Intelligence (I) through tests of maximum performance abilities often termed 'ability EI.' Separately, EI may refer to a specific group of traits (e.g. sociability) within the domain of Personality (P) factor space that are typically evaluated using self-report measures. Other conceptualizations, such as the Emotional Quotient Inventory (EQ-I) developed by Bar-On (Bar-On, 1997) blend, as measured via self-report questionnaires, information pertaining to both constructs. These blended conceptualizations tend to have low construct validity though are demonstrated to predict work-related outcomes. This research investigates the role of Emotional Intelligence (EI), within the domain of personality factor space, and its relationship to work-related outcomes.

Higher emotional intelligence, within personality factor space, can predict work outcomes such as decreased intent to leave and negative work-related behaviors (Miao, Humphrey, & Qian, 2017a, 2017b) as well as other known antecedents of turnover intention such as stress (Mikolajczak, Roy, Luminet, Fillée, & de Timary, 2007; O'Connor, Nguyen, & Anglim, 2017), mental health, and physical health (Baudry, Grynberg, Dassonneville, Lelorain, & Christophe, 2018; Martins, Ramalho, & Morin, 2010). Emotional Intelligence and its relationship to turnover has not been studied in relation to EMS providers. EI may also be enhanced through tailored training and coaching activities (Nelis, Quoidbach, Mikolajczak, & Hansenne, 2009; Ruttledge & Petrides, 2012). EI, as measured with the Trait Emotional Intelligence Questionnaire, may be assessed both at the global level and for discrete components (K. V. Petrides, 2009; K. V. Petrides & Furnham, 2000). Investigation of EI in relationship to turnover is therefore both of academic interest and practical application. The objective of this investigation is to examine (1) whether a relationship between emotional intelligence and turnover intent exists among practicing EMS professionals and (2) to explore the role of health and demographic variables in a potential relationship. Depression, stress, anxiety, and poor physical health, prevalent among EMS clinicians (Bentley, Crawford, Wilkins, Fernandez, & Studnek, 2013; Huang et al., 2022; Khan, Conduit, Kennedy, & Jackson, 2020), are investigated as each are demonstrated predictors of turnover intention. The role of demographic variables demonstrated to be predictors of turnover and turnover intention in EMS, and similar healthcare professions, are also explored (e.g. tenure and income) (Avesta Systems & the American Ambulance, 2018; Griffeth et al., 2000). Race is included as there is mixed evidence as to the effect of race on turnover intention (Griffeth et al., 2000; J. R. Jones & Harter, 2005; McKay et al., 2007). Factors which mediate the relationship between race and turnover intent, (e.g. supervisor – employee parings) (J. R. Jones & Harter, 2005), were excluded due to length considerations of the survey instrument. Of note, national data pertaining to race among EMS clinicians is likely to be underreported (National

Association of State, 2020). Emotional Intelligence, at the factorial level, is demonstrated to correlate with gender and therefore clinician gender is of specific interest in this study (Petrides, 2009).

METHODS

Participants

Participants in the study are currently practicing EMS professionals. There were 446 submitted responses to the survey of which (289) were complete and utilized in analysis. There were 182 (38.6%) EMTs, 10 (2.1%) AEMTs, 242 (51.4%) Paramedics, 4 Advanced Practices Nurses or Physician Assistants (1.0%), 22 Registered Nurses (4.8%), and 9 (2.0%) providers listing "other" certification. Only those respondents noting certification level as an EMT, AEMT, or paramedic were included in the study resulting in 191 (44.0%) EMTs and 242 (56.0%) paramedics. Respondents were 70.0% male, 91.0% White, 7.0% Hispanic or Latino). EMTs were primarily female (56%) while paramedics were primarily male (68%).

Procedure

A national sample of participants were recruited via adaptation of snowball sampling to include use of internet forums (Baik et al., 2019), as there is no national database of EMS providers and there is no standard methodologies for accessing EMS professionals. Approximately one-third of professionals belong to the professional association National Registry of EMTs, however, use of this registry for the intended work had limited applicability due to oversampling concerns. Participants were recruited via internet forums where the target population was likely to participate, and via email distributed by EMS agency administrators. Forums were identified via Facebook and LinkedIn groups with the search terms "EMS", "Emergency Medical Services", "EMT", "paramedic," "fire EMS," and "prehospital." EMS administrators were identified via a request to State EMS officials and regional EMS offices following the work of prior researchers (Sporer, 2016). Permission to post to the public forum was obtained from forum administrators. Use of internet sites where target populations frequent, respective of potential limitations of a non-representative sample, is a well-accepted method of internet sampling techniques when access to small hard-to-reach, unique, or underrepresented populations are sought (Best, Krueger, Hubbard, & Smith, 2001; Bradley, 1999; S. Jones, 1998; Nosek, Banaji, & Greenwald, 2002), as is adaptation of snowball sampling to include use of social media (Sadler, Lee, Lim, & Fullerton, 2010). Prior work pertaining to coping mechanisms among EMS providers utilizing similar methodology was found to have produced a sample representative of EMS providers in the United States (Bentley, Crawford, Wilkins, Fernandez, & Studnek, 2013). A link to a publicly available survey hosted in a secure environment was made available from June until August 2020.

Participation in the survey was voluntary, a waiver of consent obtained, and the study received IRB approval. Participants in the survey were able to elect to stop taking the survey or elect not to complete the survey at any time. Data were collected and managed in REDCap electronic data capture tools at New York Medical College and was exported to Stata/IC version 16.1 for analysis in a .csv file. Five ($20) gift cards were raffled as a financial incentive to increase response rates as financial incentives have been found to be a cost-effective method among healthcare providers to improve response rates (Y. I. Cho, Johnson, & VanGeest, 2013). A power analysis, conducted using G*Power version 3.1.9.7,

indicated that 87 participants were required to detect a small linear regression effect size at 80% power and alpha = .05.

DATA

Survey Measures

The survey included prior validated measures: Trait Emotional Intelligence Questionnaire - Short Form (TEIQue-SF) (Andrei, Siegling, Aloe, Baldaro, & Petrides, 2016; Mikolajczak, Luminet, Leroy, & Roy, 2007; Petrides, 2009; Petrides & Furnham, 2000; Petrides, Pérez-González, et al., 2007); Turnover Intention Scale - 6 item (Bothma & Roodt, 2013), Perceived Stress Scale - 10 item (PSS-10) (Baik et al., 2019; Cohen, Kamarck, & Mermelstein, 1983), General Anxiety Disorder - 7 item (GAD-7) (Alharthy, Alrajeh, Almutairi, & Alhajri, 2017; Jordan, Shedden-Mora, & Löwe, 2017; Loewe et al., 2008; Spitzer, Kroenke, Williams, & Löwe, 2006); Patient Health Questionnaire - 9 item (PHQ-9) (Kroenke, Spitzer, & Williams, 2001; Kurt Kroenke et al., 2009; MacGregor, Funderburk, Pigeon, & Maisto, 2012; Thibodeau & Asmundson, 2014); Maslach Burnout Inventory (Christina, Susan, & Michael, 1996; Enzmann, Schaufeli, & Girault, 1995); and questions from the Behavioral Risk Factor Surveillance System (BRFSS) (Pierannunzi, Hu, & Balluz, 2013). Questions from prior surveys of EMS professionals were used for EMS specific, e.g. shifts worked (Sporer, 2016), questions.

The TEIQue-SF is the most widely used instrument to measure trait EI (Siegling, Saklofske, & Petrides, 2015). The TEIQue-SF yields a global score (α = .87, M = 5.07, SD = .34) and subscale scores including emotionality (α = .66, M = 5.02, SD = .9), wellbeing (α = .81, M = 5.09, SD = .87), self-control (α = .63, M = 4.49, SD = .59), and sociability (α = .65, M = 5.08, SD = .89) (Petrides, 2009). The Turnover Intention Scale – 6 (TIS-6). The TIS-6 is a short form version of the TIS-15 (Bothma & Roodt, 2013). The TIS-6 is a six-item self-report measure. The TIS-6 is target specific, meaning, respondents provided scores when asked to reflect specifically on their attitudes towards their primary agencies. Perceived stress was measured via the Perceived Stress Scale. The perceived stress scale is a 10-item measure (α = .89, M = 15.1, SD = 7.2). A total score that describes overall perceived stress is derived by summing the scale items (Cohen, Kamarck, & Mermelstein, 1994). Anxiety was measured via the General Anxiety Disorder (GAD 7) 7-item self-report questionnaire which is a commonly utilized screening tool for generalized anxiety disorder. (α = .91, M = .89, SD = .77). A single global score is created from a sum of the response scores (Pfizer). Following the work of previous researchers GAD-7 was treated as a continuous variable and use of a mean score was utilized (Barzilay et al., 2020; Singh, Cumberland, Ugarte, Bruckner, & Young, 2020). For screening purposes, the PHQ-9 scores range from 0-27. Each of the item responses are scored from (0 = "not at all" to 3 = "nearly every day; α = .89, M = .68, SD = .62)." Scores are summed resulting in a 0-27 global severity score. The MBI is a copyright 22-item self-report measure which is therefore not reprinted here. It is a widely utilized tool to measure burnout including EMS professionals (Boudreaux, Mandry, & Brantley, 1997; Edwards & Tindle, 2020). Respondents are directed to respond to a series of statements on a 7-point Likert scale from (0) Never to (6) Every day in response to a series of statements such as "I feel emotionally drained from my work." The responses are summed, and an average generated to create three scores reflecting the components of occupational burnout; Emotional Exhaustion (scores range from 0-54; α = .92, M = 2.04, SD = 1.40), Depersonalization (scores range from 0-30; α = .77, M = 1.74,

SD = 1.33), and Personal Accomplishment (scores range from 0-48; α = .77, M = 4.39, SD = 1.03). A row mean was utilized in order to include cases with missing responses. The construct of occupational burnout exists along a continuum. Following prior researchers, the MBI is treated as a continuous variable and linear regression utilized for analysis (Firth & Britton, 1989; Leiter & Maslach, 2009).

Transformation of variables

Several variables were transformed for analyses.

A tenure variable was created using five-year increments as most providers leave EMS within their first period of certification typically 3 years or 5 years (the majority of States utilize 5-year certification periods). Difference in turnover intention by categories of years in EMS with and without first year turnover intention broken out was evaluated via Tukey's test. The difference in means were found not be significant for all categories. Therefore, the categories were collapsed into $0 \leq 4$, $5 \leq 10$, $10 \leq 20$, and 20 years or more.

The survey originally included multiple provider levels. For the preliminary analysis, retention of all provider levels was kept in order to provide a descriptive analysis of respondents. Emotional intelligence, regardless of certification level, was presumed to be correlated with turnover intention (Miao et al., 2017a). Certification level was transformed into a dichotomous variable for the main analysis.

Emergency Medical Responders (EMRs) were excluded from the survey as the primary role of an EMR is to provide a level of care similar to first aid and to activate the EMS response system, including higher levels of care. The intermediate certification AEMT was collapsed into EMT in order to treat EMT and paramedic certification as a dichotomous variable for the purpose of analysis. The dichotomous variable of EMTs = 0 and paramedics = 1 was retained for descriptive purposes.

For the purpose of the main analysis EMTs and paramedics were combined into a single category under a new variable. T-tests were run to assess whether there was a difference in global emotional intelligence or turnover intention between EMTs and paramedics, and no significant difference in mean turnover intention or global emotional intelligence was found. Box and whisker plots were generated for the factor-level emotional intelligence between EMTs and paramedics revealing mean factor EI of participants is consistent with TEIQue EI norms.

Additional demographic variables were included and subject to transformation. Gender was recoded as a binary variable; all respondents indicated either male or female. A t-test was run to assess difference in means by EI demonstrating no significant difference in global EI or turnover intention between males and females. Gender was included as prior research has yielded mixed results regarding the effect of gender on leaving behaviors and turnover intention (Bruyneel, Thoelen, Adriaenssens, & Sermeus, 2017; S. Cho, Johanson, & Guchait, 2009; Y. J. Cho & Lewis, 2012; Xu, 2008). Gender was included in the linear regression analysis as a control variable.

Geographic regions were created following Bureau of Economic Analysis regions for descriptive purposes (Bureau of Economic Analysis, 2020; U. S. B. o. L. S. U.S. Department

of Labor, 2020). Providers were categorized by state(s) in which they indicated certification for descriptive purposes.

Income was collapsed into a binary variable reflecting household incomes less than $50,000/year and greater than $50,000/year, following the work of previous researchers, and included in the linear regression analysis.

For the main analysis, education was collapsed into a binary variable of obtainment attainment versus no attainment of a four-year college degree and included as a control variable in the linear regression analysis. An expansive body of literature addresses social, health, and economic outcomes of attainment of a college degree (Hout, 2012). T-tests were run prior to collapsing the variable. No difference in turnover intention or emotional intelligence were found between attainment of two-year degree versus a four-year degree among study participants. Attainment of a four-year college degree was therefore retained as a binary variable.

The variable of age was included in the linear regression analysis. There was no transformation of the age variable. Age is included as a control variable as it is demonstrated to be positively correlated with stress and anxiety, and the association is well studied (Osmanovic-Thunström, Mossello, Åkerstedt, Fratiglioni, & Wang, 2015; Welzel et al., 2019). Further, generational differences may impact turnover intention and was included following the work of previous researchers (Leiter, Jackson, & Shaughnessy, 2009; LeVasseur, Wang, Mathews, & Boland, 2009).

Employment related variables were included both for analysis and descriptive purposes. Employee primary role was included for descriptive purposes. Employment status was included following the BFRSS (2013) survey instrument. A binary variable was created including employed for wages = 1 and not employed for wages = 0, as turnover intention is dependent on attachment to an entity and providers currently working with an EMS agency were sought. Volunteer EMS clinicians were excluded from study as reasons for volunteers leaving may differ substantially from those of individuals employed for wages (Patterson, Moore, Sanddal, Wingrove, & LaCroix, 2009).

Employment as a firefighter was included as a dichotomous variable representing employed versus not employed as a firefighter following the work of previous researchers (Chapman et al., 2009). Concurrent employment as a firefighter is negatively related to turnover intention among EMS employees (Chapman et al., 2009). Employment as a firefighter is included as a control variable in the linear regression analysis.

Type of agency was evaluated for descriptive purposes and subsequently excluded from the main analysis due to changes in the categories utilized in research by Federal EMS governing bodies (National Association of State EMS Officials, 2020).

T-tests were run to assess the variables employment outside of EMS, current occupation as a student, participation in EMS as a steppingstone to a new degree or to a new career, and were omitted from the main analysis having found no significant difference in turnover intention for the respective variables.

A variable was generated and coded to reflect average hours per week worked at the employee's primary agency with the cut points of less than 40 hours per week, 40- 59 hours

per week, 60-79 hours per week, and eighty or more hours per week. While EMS agencies may recognize 36 hours as full-time status, to remain consistent with prior literature (Sporer, 2016; U.S. Department of Labor & Statistics, 2020), the preceding noted cut points were selected as 40 hours per week is typically considered full time status. There was no significant difference in turnover intention found in part time versus full time employed clinicians. Employer determined status as part-time, per diem, or full-time status was not included in the survey instrument.

Pearson correlations were run to assess average hours worked at the primary agency and hours per week worked and were found to not have a significant relationship with turnover intention. Both variables were excluded from the main analysis. The number of agencies at which a provider works is included for descriptive purposes. A Pearson's correlation was run on number of agencies on turnover intention and was found not to be significant. It was therefore excluded from the main analysis.

Variable	Description and metrics	N	%
Certification level	0 = EMT	191	44
	1 = Paramedic	242	56
Race	0 = Other	34	9.2
	1= White Caucasian	334	90.8
Country	1 = United States	354	96.2
	0 = All other countries	14	3.8
Primary service area	0 = City	133	40.2
	1 = Non-city	198	59.8
Gender	0 = Male	265	69.9
	1 = Female	114	30.1
Marital status	0 = All other relationships	101	43.4
	1 = Married	207	56.25
Highest level of education	0 = Does not have 4-year college degree	159	45.4
	1 = Has 4-year college degree	191	54.6
Income	0 = Below $50,00	61	16.7
	1 = $50,000 or more	305	83.3
Hours per week	0 = Part time	80	24
	1 = Full time	325	76
Number of agencies	0 = 1 Agency	196	60
	1 = 2 Agencies or more	131	40
Shift worked	0 = Works set shifts	165	52.2
	1 = Works various shifts	151	47.8
Has occupation outside of EMS	0 = No	193	55.5
	1 = Yes	155	44.5
Participant is also an employed firefighter	0 = No	279	83.8
	1 = Yes	54	16.2
Participant is a student	0 = No	268	77.9
	1 = Yes	76	22.1
History of Chronic Disease	0 = No	213	67
	1 = Yes	105	33

Table 1. Transformed variables.

Sample Description

Study participants were paramedics (56%) and EMTs (44%). Most study participants were male (69.9%), worked full time (75.4%), and held a four-year college degree or above (54.6%). EMTs were primarily female (56%) while paramedics were primarily male (68%). 89.6% of respondents indicated they were employed for wages, and most indicated they work for only one EMS agency (56%), with no particular shift dominating their work schedule (47.7%).

ANALYSIS

Preliminary Analysis

Several one-sample t-tests were run. We looked to see whether EMTs and paramedics were similar in EI and in TI prior to deciding whether EMTs and paramedics could be collapsed into a single category for analysis. Further, EMTs and paramedics have been demonstrated to have different turnover rates. No significant differences were found in emotional intelligence between EMTs (M = 5.00, SD = .62) and paramedics (M = 5.12, SD

= .65) t(304) = .-1.64, p = .68, d = -.19, or in TI between EMTs (M = 2.69, SD = .88) and paramedics (M = 2.85, SD = .97) t(282) = .-1.28, p = .20, d = -.15.

A significant difference was found in number of hours worked between EMTs (M = 39.35, SD = 21.62) and paramedics (M = 52.28, SD = 1.31) t(316) = -6.0, p < .001, d = -.68. However, there was no significant difference in turnover intent between full-time and part-time providers. For this reason, hours worked was excluded from the main analysis.

No significant relationship between race and turnover intention was found in preliminary analysis. While race is of interest due to different turnover patterns, in the presence of underrepresentation in the workforce (Griffeth et al., 2000), there was insufficient variability in the sample to test and draw inference.

Tenure and age predict leaving intentions both in other professions and in EMS. Both were considered for inclusion in the main analysis. A significant small correlation was found between age r(284) = -.12, p < .05 and turnover intention. No significant correlation was found between overall tenure and turnover intention r(287) = .01, p = .93. Both were selected to be included in the main analysis.

We also investigated whether there was a difference in global emotional intelligence between males and females. Although secondary, this could be informative because if differences exist between men and women in EI, more effective training could be created. In other populations, global trait emotional intelligence is found to differ at the factor level. We investigated whether the same finding occurred in this population to determine whether gender should be included as control variable in the mediation analyses. No significant difference, as anticipated, was found in global emotional intelligence between males (M = 5.08, SD = .67) and females (M = 5.05, SD = .55) t(308) = .40, p = .69, d = .05. At the factor level, sociability was found to significantly differ between males (M = 5.178, SD = .89) and females (M = 4.84, SD = .85) t(306) = 3.01, p < .01, d = .38 as did emotionality between males (M = 4.92, SD = .94) and females (M = 5.27, SD = .76) t(307) = -3.14, p = .01, d = -.40.

Using Pearson's correlations, we also looked for relationships between EI, the mental health variables (perceived stress, anxiety, and depression) physical health, and component scales of occupational burnout. This was done to provide a more detailed understanding of how all the key variables relate to each other. In addition, it is possible that these correlations may provide insight to advancing and understanding provider health. EI had a significant relationship with each of the main variables of interest, therefore, each were subsequently included in the main analysis. Emotional Exhaustion of the MBI subscale is demonstrated to be similar to the construct of perceived stress. Significant and large correlations were found between the two presented in Table 1.

A power analysis, conducted using G*Power version 3.1.9.7, indicated that 87 participants were required to detect a small linear regression effect size at 80% power and alpha = .05. Therefore, we generally assume that all analyses going forward had sufficient power to detect the desired effects. In order to focus on the target population, of EMS providers working primarily in an EMS role, cases which included licensure other than EMT or paramedic were excluded from the analysis. It would have been preferable to exclude providers working as a firefighter, as working as a firefighter is negatively related to turnover intention. However, due to the small sample of responses that indicated status

Variable	1	2	3	4	5	6	7	8	9
1. Emotional Intelligence	-								
	309								
2. Turnover Intention	-.34***	-							
	287	287							
3. Perceived Stress	-.70***	.43***	-						
	284	303	307						
4. Anxiety	-.47***	.32***	.70***	-					
	304	287	291	307					
5. Depression	-.58***	-.34***	.74***	.73***	-				
	302	287	291	305	305				
6. MBI Subscale Depersonalization	-.37***	.42***	.45***	.33***	.36***	-			
	295	287	298	298	298	208			
7. MBI Subscale Emotional Exhaustion	-.50***	.60***	.66***	.55***	.58***	.62***	-		
	296	287	290	299	298	208	299		
8. MBI Subscale Personal Accomplishment	.31***	-.16**	-.39***	-.17***	-.22***	-.18**	-.19***	-	
	296	287	290	299	299	208	299	299	
9. Physical Health	-.26***	.26***	.28***	.28***	.31***	.14*	.25***	-.17**	-
	300	280	282	208	294	289	290	290	395
Note: MBI = Maslach Burnout Inventory *p < .05. ** p < .01. ***p < .00									

Table 2. Pearson's correlations of turnover intention, mental health, and physical health variables.

as both an EMS provider and as a firefighter (57) there was not sufficient power to parse out firefighters. Therefore, firefighters were included in the population of EMTs and paramedics.

Main Analyses

Question 1: Does trait emotional intelligence predict turnover intention?

To investigate the relationship between emotional intelligence and turnover intention a Pearson correlation was performed. Pearson correlation was selected for analysis following the work of Petrides & Furnham (2006). The results showed a moderate negative correlation between global trait emotional intelligence and turnover intention, $r(287) = -.34$, $p < 0.001$.

Question 2: Which of the emotional intelligence subscales are correlated with turnover intent?

EI is demonstrated to negatively correlate with turnover intention as a result of the prior finding. We subsequently sought to understand whether the four sub-scale factors of EI account for the relationship with turnover intention among EMS providers. Given the four subscales, it may be possible that interventions to reduce turnover are tailored to specific factors of EI.

A Pearson correlation was chosen to identify if any of the emotional intelligence subscales (emotionality, wellbeing, self-control, and sociability) are correlated with turnover intention. A linear regression was not selected for use due to the subscale factors being closely related within emotion-laden aspects of personality. Each of the subscales was found to significantly correlate with TI. Results are presented in Table 2.

Variable	1	2	3	4	5
1. Turnover Intention	-				
	287				
2. Wellbeing	-.23***	-			
	287	307			
3. Self-control	-.19***	.33***	-		
	286	305			
4. Emotionality	-.35***	.44***	.38***	-	
	287	306	306		
5. Sociability	-.17**	.34***	.11*	.27***	-
	286	308	308	306	307

Note: Degrees of freedom are listed immediately below the r value for the variable of interest

*p < .05. ** p < .01. ***p < .00

Table 3. Pearson's correlation matrix among turnover intention and emotional intelligence subscales.

Question 3: Does perceived stress, mental health, or demographics predict turnover intention?

We investigated whether EI, perceived stress, anxiety, depression, physical health, and demographics, independent of each other, were correlated with turnover among EMS providers. Identifying which factors predict turnover may allow for development of human resource practices or tailored interventions to support providers thereby reducing turnover.

A multiple linear regression was conducted to predict turnover based on: emotional intelligence; mental health variables including perceived stress, anxiety, and depression; physical health (absent days from work due to poor health); and demographic variables including gender, tenure, employment as a firefighter, having completed tertiary education and income. Race was excluded from analysis due to participants primarily being white (95%) which did not present sufficient variability to test.

A One-way ANOVA was conducted to compare the effect of emotional intelligence on turnover intention. The results demonstrated the effect of the considered variables was significant $F(14, 254) = 5.24$, $p < 0.001$, adjusted $R^2 = 0.18$. It was found that perceived stress significantly predicted turnover intention as did physical health and income. Additionally, tenure predicted turnover intention only among providers holding EMS licensure for more than 10 and less than 15 years. Results are presented in Table 4.

LIMITATIONS

This study garnered responses from providers across a wide geographic area and exceeded the minimum necessary sample size. However, the present research, like all research, is not without its caveats. One such caveat is the sample. First, the sample size may

Variable Type	Effect	B	t	SE	p	95% CI	
						LL	UL
Emotional intelligence	Global emotional intelligence	-.14	-1.14	.11	.25	-.37	.10
Mental health	Perceived stress	.29*	2.18	.13	.03	.03	.59
	Anxiety	.06	.60	.10	.55	-.14	.28
	Depression	.06	.45	.14	.65	-.21	.33
Physical health	Number of days in poor health	.02*	2.05	.04	.04	.00	.04
Years in EMS	5 ≤ 10	.22	1.16	.19	.25	-.15	.59
	10 ≤ 15	.07	.35	.20	.73	-.32	.46
	15 ≤ 20	.44*	2.00	.22	.05	.01	.87
	20 years or more	.20	.98	.20	.33	-.20	.60
Demographic	Female [a]	-.12	-.93	.12	.35	-.36	.13
	Age	.00	-.29	.01	.77	-.01	.01
	Employment as a firefighter [b]	-.02	-.11	.14	.91	-.29	.26
	Has a four-year college degree [c]	.10	.97	.11	.34	-.10	.31
	Income [d]	-0.35*	-2.14	.16	.03	-.67	-.03
Constant		3.00	4.13	.73	0.00	1.57	4.43

Note: [a] Male = 0 Female = 1, [b] Employed as a firefighter = 1 Not employed as a firefighter = 0, [c] Does not have a four-year college degree = 0 Has a four-year college degree = 1, [d] Income less than $50,000 = 0 Income $50,000 or greater = 1.

*p < .05. **p < .01. ***p < .001

Table 4. Linear Regression Including Coefficients with the Dependent Variable Predicting Turnover Intention.

have been insufficient to make definitive inferences about the broader EMS populations. EMS professionals and EMS/Firefighter professionals were included in the main analysis due to the sample size which precludes evaluation of the results in the context of solely professional EMTs and paramedics. Second, it included only respondents who had access to the internet and who either had access to Facebook, were members of closed Facebook groups, or had received a request for completion from an administrator which may result in a non representative sample. In addition, the survey was self-report and did not allow for verification that participants were EMS providers as no personal identifying information was collected including state licensure numbers.

CONCLUSIONS

This research presents the first analysis of trait emotional intelligence and turnover intention among EMTs and paramedics in the United States. Our general conclusion is that emotional intelligence predicts turnover intention such that as EI increases, turnover intention decreases. The results support the work of prior researchers (Miao et al., 2017a). The finding was not as robust as preferred, however the findings do demonstrate the role of emotional intelligence in turnover intention.

While EI, among the studied variables, was found to predict turnover intention it was not found to uniquely predict turnover intention. We found that of the studied variables, predictors other than emotional intelligence may be better predictors of turnover intention, including perceived provider stress, income, and physical health. EI did not predict TI independent of other studied variables. In part this may be due to the strong relationships found among the mental health variables and turnover intention. Consistent with prior research we found that higher EI predicts: lower perceived stress (Mikolajczak et al., 2007), lower reported anxiety and depression (Ali, Amorim, & Chamorro-Premuzic, 2009; Mikolajczak, Luminet, & Menil, 2006; Mikolajczak, Roy, Luminet, Fillee, & de Timary, 2007), and better physical health (Andrei & Petrides, 2013; Mikolajczak et al., 2006; Mikolajczak et al., 2007). Further, the finding that EI predicts the subcomponents of occupation burnout is consistent with prior research (Mikolajczak, Menil, & Luminet, 2007).

RECOMMENDATIONS

Recognizing the role of EI in the workplace not only benefits individual providers but also may benefit the larger EMS system and employers. EMS providers are steeped in clinical education and operational aspects of EMS. Focusing on management of the emotional aspects of work and professional development in those aspects is rarely considered. Additionally, further investigation of the role of education in turnover intention outcomes is warranted. Consistent with prior work education was collapsed into a dichotomous variable in this study as an expansive body of literature addresses the economic and health outcomes of obtaining a college degree (Hout, 2012). Opportunities for future work include investigation of the role of employer determined per diem, part-time, and full-time status, in addition to consideration of provided benefits in relationship to mental health, physical health, and turnover intention. Due to sample size, respondents with dual roles as firefighters were included in analysis. Future investigation is warranted to better understand whether holding dual roles as a firefighter, versus as a solely an EMS clinician, results in different patterns of turnover intention. Also of interest, in the United States an increasing number of colleges are offering degree-granting

programs for EMS clinicians. The effects of obtaining additional education and discipline-specific education should be further explored among EMS students and clinicians. Providing a focus on the individual provides an opportunity to focus attention on the emotional aspect of personality and to promote an opportunity to engage in professional development. Emotional intelligence training may be a beneficial practice for inclusion to HR practices. As EI is a demonstrated mediator of perceived stress turnover intention relationship, inclusion of EI training may support the mental health of the workforce. Emotional intelligence may be a useful screening tool in hiring selection. While EI should not be exclusively utilized as a pass/fail for hiring decisions, it may provide additional insight in hiring decisions.

This study has highlighted the need to better understand the role of EI among EMS providers and its relationship to outcomes of interest among providers including physical health, mental health, and turnover. Future research could delve into the relationships between EI and TI exploring the role of mental and physical health. Following the COVID-19 pandemic, and a developing volume of research on health effects of EMS providers, opportunity exists for reassessment of pre- and post- pandemic effects. There is substantial opportunity to apply different and more expansive modern models of turnover including equity, job offers or shocks, and generational experiences. Once a better understanding of EI and its relationship to its respective outcomes is reached, programs can be developed to target specific aspects of EI development.

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REVIEWS

USE OF BUPRENORPHINE IN THE PREHOSPITAL SETTING

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ABSTRACT

Purpose: Buprenorphine is a lifesaving medication in opioid use disorder (OUD). Emergency Medical Services (EMS) play a crucial role in responding to opioid overdoses. The prehospital use of buprenorphine by EMS can expand access to this important medication. This article aims to provide a narrative review of the use of buprenorphine in the prehospital setting.

Methods: This is a narrative review of recent publications that describe the use of buprenorphine to treat opioid withdrawal in the prehospital setting.

Results: There are a few well done studies that describe protocols, safety, and efficacy of the administration of buprenorphine in the prehospital setting by EMS providers. The pharmacology of buprenorphine makes it advantageous in treating opioid use disorder. Proper patient selection and protocols for the administration of buprenorphine are key to the success of implementing prehospital buprenorphine programs.

Conclusions: The prehospital administration of buprenorphine for opioid use disorder should be considered by EMS agencies.

INTRODUCTION

Opioid overdoses are a major cause of mortality in the United States and around the world. Emergency Medical Services (EMS) play a crucial role in responding to opioid overdoses in the prehospital setting. Naloxone (Narcan®) is the mainstay of therapy for opioid overdose (Carrieri et al., 2006). As a competitive antagonist at the opioid receptor, naloxone reverses the effects of opioid agonists such as fentanyl and heroin (Geiger et al., 2020). Due to the antagonist effects of naloxone, its use can precipitate withdrawal in people with opioid dependence (Spadaro et al., 2022). Naloxone-precipitated withdrawal can lead to severe myalgias, diarrhea, vomiting, and anxiety (Spadaro et al., 2022). The discomfort from naloxone-precipitated withdrawal can increase patient reluctance to call EMS or lead to patients refusing transport to medical facilities (Geiger et al., 2020). This can result in a lost chance for medical providers to intervene. While naloxone is used for acute opioid intoxication, medications such as buprenorphine and methadone are used to treat opioid withdrawal and

opioid use disorder (OUD) itself (Spadaro et al., 2022). There is an increasing interest in the use of buprenorphine in the prehospital setting. The aim of this article will be to review the existing literature on the use of buprenorphine in the prehospital setting. This article will also review the pharmacology of buprenorphine and the management of opioid withdrawal to contextualize the use of buprenorphine in the prehospital setting. This article will explain why EMS medical directors should consider developing a prehospital buprenorphine program.

METHODS

This article is a narrative review of literature on the use of buprenorphine in the prehospital setting. Articles selected for review were based on consensus among the authors who had expertise in EMS (J.B.), addiction medicine (S.H. and A.S), and medical toxicology (A.S). A PubMed search of Prehospital Buprenorphine found 11 articles, of which 7 were excluded for not being relevant as determined by the authors. The remainder of the articles selected to review were based off the authors content expertise. The authors have no financial conflicts of interest to disclose.

RESULTS

Pharmacology of Buprenorphine

Buprenorphine is a partial mu-opioid receptor agonist with high affinity for the opioid receptor (Spadaro et al., 2022). Through its opioid agonist activity, buprenorphine manages opioid cravings and has some analgesic effects (Herring et al., 2019). As a partial agonist there is a ceiling effect that it can have on respiratory depression and sedation, making it an exceedingly safe drug (Spadaro et al., 2022). Because of its high affinity for the mu-opioid receptor, buprenorphine binds more tightly to the receptor than agonists such as fentanyl and heroin (Spadaro et al., 2022). This high affinity means that buprenorphine will displace any full agonists present, and therefore patients must be in withdrawal and abstain from full agonists for a period of time to avoid precipitated withdrawal when initiating buprenorphine (Spadaro 2022). Similar to naloxone-precipitated withdrawal, precipitated withdrawal from buprenorphine can be distressing to patients. Recent guidelines from the Substance Abuse and Mental Health Services Administration (SAMHSA) recommend waiting 12-24 hours from last opioid use before starting buprenorphine (SAMHSA, n.d.). Chronic fentanyl use is thought to increase the risk of precipitated withdrawal (Spadaro et al., 2022). The degree of opioid withdrawal a patient is experiencing can be quantified using the Clinical Opioid Withdrawal Scale (COWS). SAMHSA (2023) recommends starting buprenorphine when a patient reaches a COWS score of at least 13.

Buprenorphine treats the cravings and withdrawal symptoms that patients with OUD experience when they stop using full agonists (Herring et al., 2019). Use of buprenorphine leads to decreased illicit drug use, decreased opioid overdoses, and improved morbidity and mortality (Herring et al., 2019). Although traditionally used in the outpatient and inpatient settings, initiation of buprenorphine in the emergency department has been shown to improve retention in treatment (Herring et al., 2019). Buprenorphine comes in many different formulations, some are combined with naloxone as an abuse deterrent to prevent intravenous use. Suboxone is the trade name of a commonly used buprenorphine-naloxone sublingual preparation. For the remainder of this article, we

will refer to these products as just buprenorphine; though many of the protocols discussed use the combination products containing buprenorphine-naloxone, the activity of naloxone is presumed to be limited.

Management of Opioid Withdrawal

Several U.S. EMS agencies have adopted protocols to administer buprenorphine to patients who are experiencing opioid withdrawal (Wakeman, 2022; Hern et al., 2022a; Carroll et al., 2021). A case series from California reported the use of prehospital buprenorphine in three patients (Hern et al., 2022a). In this pilot study, EMS providers received a four-hour training on the use of buprenorphine and measuring of COWS scores (Hern et al., 2022a). If a patient experiencing opioid withdrawal was interested in buprenorphine, the provider on scene called a medical command physician and, if approved, administered 16mg of sublingual buprenorphine. If opioid withdrawal symptoms worsened or persisted an additional 8mg of buprenorphine could be administered (Hern et al., 2022a). Of the three cases they reported, two patients had developed withdrawal after receiving naloxone and one patient had developed withdrawal from opioid abstinence (Hern et al., 2022a). The authors of this study went on to publish a larger study of their prehospital buprenorphine program (Hern et al., 2022b). Patients were administered buprenorphine if they were in opioid withdrawal with a COWS score greater than 7, the patient was interested in buprenorphine, and the command physician approved the order (Hern et al., 2022b). All patients were followed up by the California Department of Public Health and connected to a navigator who could follow patients for clinical outcomes (Hern et al., 2022b). Of 36 patients that were treated, 17 received naloxone prior to receiving buprenorphine and 19 received buprenorphine first (Hern et al., 2022b). Three cases received 8mg of buprenorphine, 30 cases received 16mg of buprenorphine, and three cases received 24mg of buprenorphine (Hern et al., 2022b). Thirty-one of the 36 cases were ultimately discharged from the ED, and five cases were admitted to the hospital (Hern et al., 2022b). Half of the patients were engaged in treatment at seven days, and 14 out of 36 were engaged in treatment at 30 days, similar to retention in treatment in other healthcare settings (Hern et al., 2022b).

Prehospital buprenorphine has also been implemented in several EMS agencies around the U.S including Camden County in New Jersey, Buncombe County in North Carolina, San Antonio in Texas, and New Haven in Connecticut (Wakeman, 2022; Hern et al., 2022a; Carroll et al., 2021, Winkler, 2023).

Management of Naloxone-Precipitated Withdrawal

In addition to the management of opioid withdrawal that has developed from abstaining from opioid use, buprenorphine can also be used in the prehospital environment to treat precipitated withdrawal from naloxone after an overdose (Carroll et al., 2021). Naloxone-precipitated withdrawal can lead to refusal of transport to a hospital, with rates as high as 36% in one system (Carroll et al., 2022). While multifactorial, this high rate of refusal represents a missed opportunity and could be improved upon by managing precipitated withdrawal symptoms (Geiger et al., 2022). There are case reports of buprenorphine improving the symptoms of precipitated withdrawal in both the prehospital and hospital environment (Carroll et al., 2021). Due to the long half-life and high affinity of buprenorphine, it may also protect against re-sedation and repeat overdose in the acute

setting (Carroll et al., 2022). In a case study of three patients that received prehospital buprenorphine after naloxone-precipitated withdrawal, 16mg-32mg of buprenorphine was given after naloxone (Carroll et al., 2021). All three patients made it to their first outpatient addiction medicine visit, and two of the three were still engaged in treatment at 30 days (Carroll et al., 2021).

Another study from the same EMS agency based in Camden, New Jersey described a protocol for ambulances to carry buprenorphine (Carroll et al., 2022). For patients to receive buprenorphine they had to have a COWS score of at least 5 or a last use of opioid greater than 72 hours (Carroll et al., 2022). The initial dose of buprenorphine was 16mg, with an additional 8mg given if withdrawal symptoms persisted (Carroll et al., 2022). The authors reported that of the 1841 drug overdoses they responded to that required naloxone during the study period, 1230 patients were treated by an ambulance that could prescribe buprenorphine, and 611 were treated by an ambulance that could not (Carroll et al., 2022). Patients who received buprenorphine had a 12-fold increase in being engaged in treatment at 30 days (Carroll et al., 2022). Administering buprenorphine was associated with an increase in time on scene by nine minutes (Carroll et al., 2022). There are several limitations to the studies discussed above. These studies occurred in areas of high prevalence of fentanyl in the opioid supply and may not be generalizable to other regions. The protocols in these studies utilized a COWS score to determine the state of withdrawal. EMS agencies that do not see as many patients with OUD may be less accurate in determining a COWS score before initiating buprenorphine, which may also limit the generalizability of these studies.

Legal Considerations

In the U.S., the Protecting Patients Access to Emergency Medications Act (PPEMA) was passed in 2017, which explicitly allowed EMS providers to administer controlled substances (Davis et al., 2021). As part of this act, three criteria must be met by EMS organizations to provide controlled substances: 1) the EMS organization must be registered with the DEA, 2) state law must authorize EMS professionals to administer the controlled substances, and 3) the EMS personnel must act in accordance with either a standing order issued by the EMS organization s medical director or receive a patient-specific verbal order by the agency s medical director (Davis et al., 2021). Although previously a DATA-2000, or X-Waiver , was required for a provider to prescribe buprenorphine, the Mainstreaming Addiction Treatment Act of 2023 eliminated the requirement for the X-Waiver to increase access to buprenorphine (Linas & Linas, 2023). This act also eliminated the caps on the number of patients to whom a provider can prescribe buprenorphine (Linas & Linas, 2023). All providers with a DEA license can now prescribe buprenorphine. Thus, most EMS personnel in the US should be able to administer buprenorphine through a standing order or verbal order from a medical command physician.

Regulation of buprenorphine around the world is variable (Carrieri et al., 2006). In France any physician can prescribe buprenorphine making it widely available. Conversely, in Italy buprenorphine is distributed from specialized pharmacies. Further, in Russia buprenorphine is prohibited for the treatment of OUD (Carrieri et al., 2006). Thus, it is prudent to ensure new EMS protocols are compliant with state and national regulations prior to implementation (see Figure 1 for an example buprenorphine flowchart).

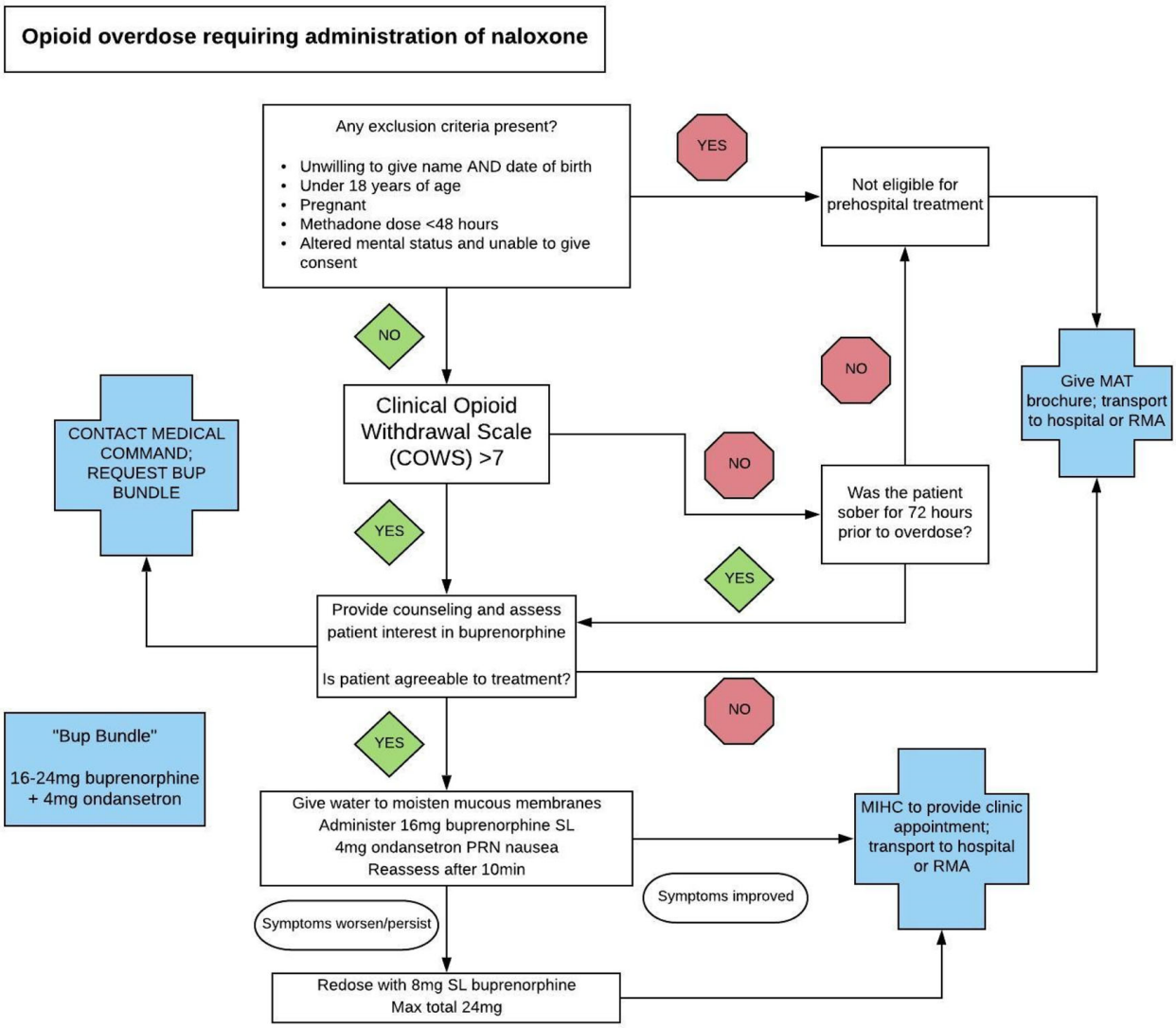

Figure 1. Example flowchart for prehospital Buprenorphine (Carroll, 2021).

CONCLUSIONS

Buprenorphine is a safe and effective medication for opioid use disorder. There is emerging but limited evidence that buprenorphine can be safely used by EMS personnel to treat patients experiencing opioid withdrawal, whether precipitated by naloxone administration or gradually developed through opioid abstinence. Overall, these studies demonstrate that administering 8mg-32mg of buprenorphine by prehospital providers was safe, could reduce symptoms of opioid withdrawal, and increase the rate at which patients remained engaged in addiction treatment without significantly increasing the length of time on scene (Carroll et al., 2021; Carroll et al., 2022; Hern et al., 2022a; Hern et al., 2022b). Agencies should develop protocols to correctly identify patients in opioid withdrawal who are appropriate for buprenorphine and connect these patients to ongoing addiction treatment. While there are some regions where EMS agencies have a lot of experience with administering buprenorphine, it is still an evolving field, but one worth considering putting into practice now.

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REVIEWS

INFLUENCE OF RURALITY WHEN ACCESSING EMERGENCY HEALTHCARE DURING EXACERBATION OF ASTHMA: A SCOPING REVIEW

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Keywords: asthma, emergencies, paramedicine, emergency medicine, rural, health inequities, emergency medical services, EMS

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ABSTRACT

Background: Asthma is a significant contributor of respiratory illness throughout Australia, taking a toll on all genders and age groups. The rural healthcare workforce is currently undersupplied, and this worsens with the degree of rurality posing disadvantages in healthcare access. Lower asthma-related mortality rates in metropolitan cities than other areas of Australia indicate a need to explore the extent of the impact that residing rurally has on access to emergency healthcare for asthma-related emergencies.

Methods: A scoping review of literature was conducted utilising the steps articulated in Peters et al. (2020) methodological approach. The databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Emcare, Medline and PubMed were searched using key words. After screening 20 articles were included.

Results: Four main themes emerged including the impact of access to resources; individual behaviours and attitudes; education and health literacy; and rural clinician adherence to guidelines.

Conclusion: Several challenges are associated with living in rural areas which may impact patients ability to access emergency healthcare during an asthma-related emergency. Further research is recommended to determine the extent to which these challenges influence access to emergency healthcare and explore strategies to break down these barriers to ensure equitable emergency healthcare.

INTRODUCTION

In Australia, asthma is a significant contributor to respiratory illness amongst all age groups and genders with 2.7 million people (11% of the population) affected (Australian Institute of Health and Welfare, 2020). There is a higher incidence in rural areas as 74.1% of asthmatics reside in regional and remote locations (Australian Institute of Health and Welfare, 2020). NSW Ministry of Health statistics (Figure 1) demonstrate there are fewer asthma-related deaths in metropolitan local health districts (LHDs) than regional LHDs per 100 000 of the population in these areas indicating there may be limitations to accessing emergency healthcare outside metropolitan LHDs (NSW Ministry of Health,

2021) . Whilst there is no agreed universal definition of the term 'rural' Bennett et al. (2019) associates rural areas with having smaller populations and land size or a greater the distance which needs to be travelled to reached the closest metropolitan town. Worley and Champion (2020) argue Australia has an undersupplied healthcare workforce worsening with the degree of rurality placing residents of these areas at a disadvantage when accessing appropriate healthcare. Research into the extent that living in rural locations impacts patients access to emergency healthcare particularly during an asthma-related emergency is scarce with limited current Australian based research available on the topic. This review explores the differences in circumstances between people living in metropolitan and rural areas in accessing emergency healthcare from an international perspective during an asthma-related emergency demonstrating the need for further research to be conducted to fully understand the extent and reason for these discrepancies.

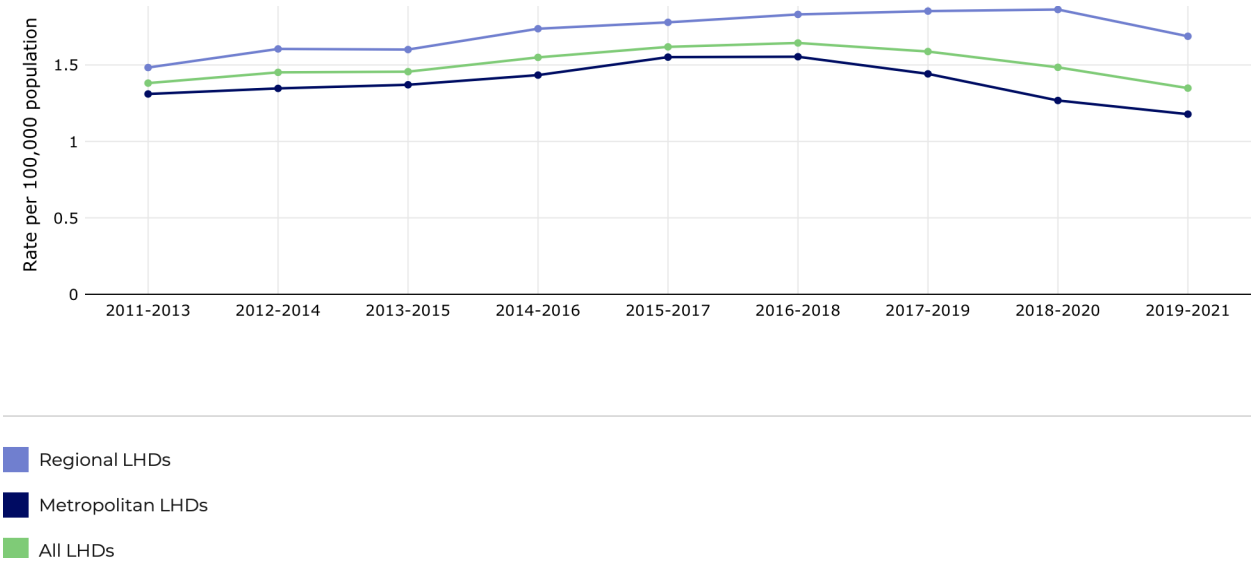

Figure 1: Asthma deaths in metropolitan LHDs compared to regional LHDs. (NSW Ministry of Health, 2021).

METHODS

The purpose of this review was to explore the influence of rurality when accessing emergency healthcare during an asthma-related emergency. To address the phenomena of interest, papers which focussed on people with asthma needing to access emergency healthcare in rural/remote/isolated areas were included. To gain a current perspective of this, papers which were older than 2005 were excluded from the search. This year was chosen based on age of literature and changing healthcare treatments over time. The main purpose of this review was to explore the how the element of rurality influences a difference in circumstances for rural asthmatics experience in accessing emergency healthcare for an asthma-related emergency. Additionally, other areas of interest included identifying any barriers causing resistance to accessing emergency healthcare during an asthma-related emergency. Sources which had minimal focus on asthma-related emergencies, or rural/remote/regional or isolated areas were excluded. As there was a limited amount of relevant literature published in Australia, the context of this study was extended to include international studies however, papers which were not written

in English were excluded. This review was inclusive of all genders and cultures. This scoping review included both qualitative and quantitative studies, however, grey literature was not included due to the possible risk of bias in documents which were not peer reviewed and author agreement that sources of this nature would not likely be of great significance in answering the review questions (Peters et al., 2020).

The search was registered through the OSF register (DOI 10.17605/OSF.IO/7RV3Y) and followed the steps articulated in Peters et al. (2020) methodological approach. This scoping review was carried out through a search of electronic databases including the Cumulative Index to Nursing and Allied Health Literature (CINAHL) Emcare, Medline and PubMed. Key words and synonyms were established, and truncations were applied to capture variations of key words and phrases. This search strategy and population, concept and context (PCC) was used to be more discriminating in selecting only relevant material (Peters et al., 2020). The search terms and an example of how this search was conducted using CINAHL can be seen in Table 1. Inclusion criteria were added to ensure the articles were relevant and related to the research question (Table 2). After the search, identified sources were uploaded into Endnote and duplicates were removed. Titles and abstracts were screened against the inclusion criteria with the full texts of selected sources assessed.

Search #	Search terms	Results
S1	asthma or asthma exacerbation or asthma attack or asthma related emergency	49, 179
S2	emergency department or emergency room or emergency healthcare or emergency medical services	139, 937
S3	paramedic or ems or emergency medical service or prehospital or pre-hospital or ambulance or emergency medical technician or emt	77, 927
S4	rural or remote or isolated or regional or small town	
	232, 021	
S5	S2 OR S3	57, 056
S6	S1 AND S4 AND S5	35

Table 1. Results from initial search of CINAHL.

PCC element	Inclusion Criteria	Exclusion Criteria
Population	Papers focused on patients who have needed to access emergency healthcare due to an asthma-related emergency.	Papers focused on patients who have not accessed emergency healthcare due to an asthma-related emergency.
Concept	To highlight any barriers for rural asthmatics access to emergency healthcare for an asthma-related emergency.	
Context	Papers which were included had a focus on rural, regional, or isolated environments. This context was extended to include international literature due to the limited amount of Australian based literature published on this topic.	Papers which were focused on metropolitan areas.

Table 2. PCC table (Joanna Briggs Institute, 2022).

Twenty sources were found to fit the criteria and publication ranged from 2005 to 2022. These sources were analysed to find key themes. The first author initially reviewed the articles to identify key themes. These were then further reviewed and discussed until agreement was reached between all authors. The data extracted can be seen in Table 3.

RESULTS

The results of the search and inclusion process can be found in Figure 2. 20 articles were selected following the full-text screening drawn from international studies as well as studies with an Australian focus. A summary of the major findings is provided in Table 3.

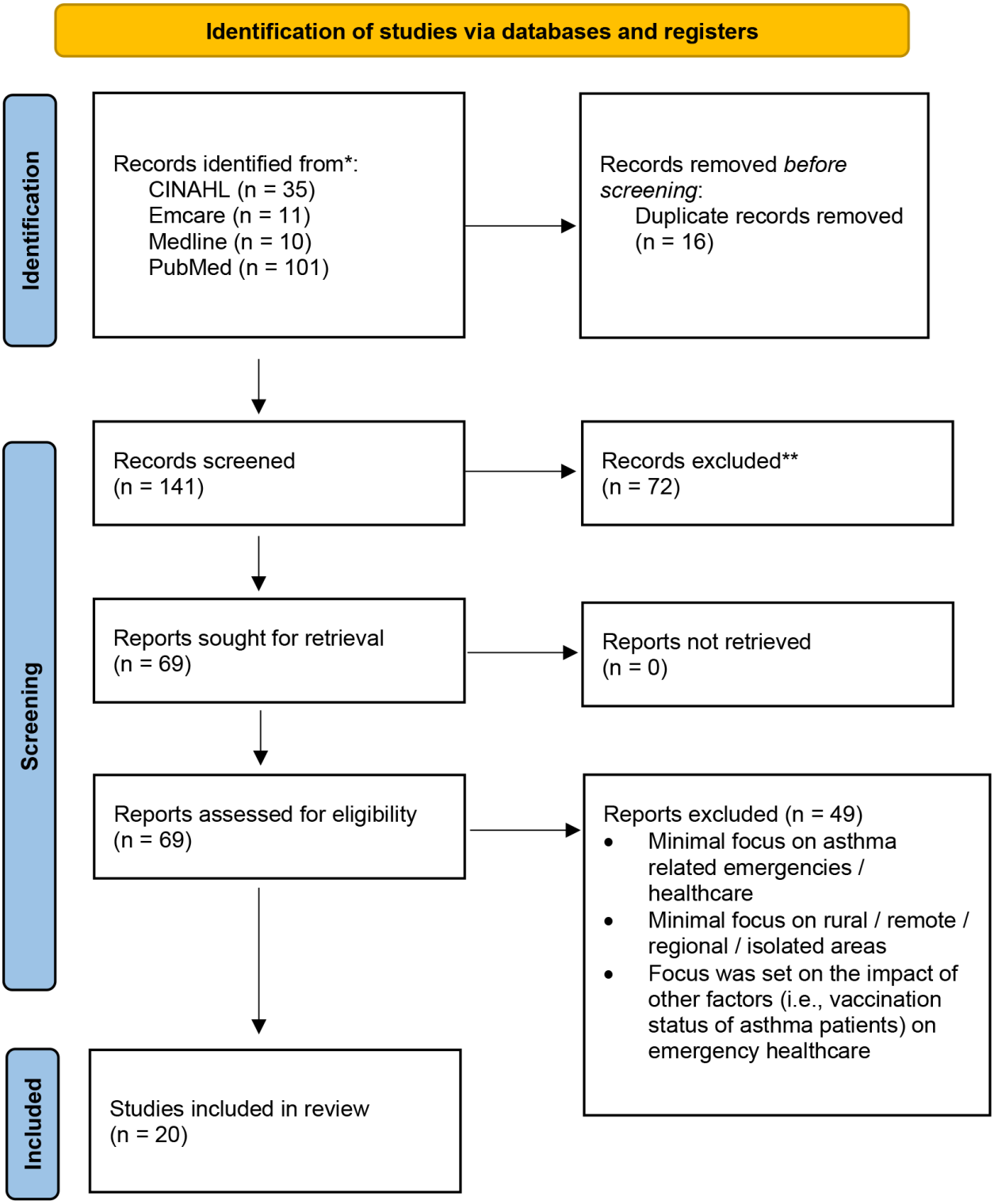

Figure 2: Prisma Diagram (Tricco et al., 2018).

Authors and year of publication	Location	Aim	Methods	Key findings
Fecho, Ahalt, Appold, Arunachalam, Pfaff, Stillwell, et al.,. (2022)	United States of America	Further develop and apply Integrated Clinical and Environmental Exposure Service (ICEES) as a tool to explore clinical and environmental data, focusing on asthma.	Queried the IECCS open application programming interface focusing on 2 primary outcomes associated with asthma exacerbations. Asthma cohort consisted of 157,410 patients.	Asthma patients residing in rural areas were more likely to have one or more hospital or emergency department visits than urban residents.
Pate, Zahran, Qin, Johnson, Hummelman, & Malilay (2021)	United states of America	Characterise asthma indicators and explore variations in emergency healthcare and asthma exacerbations by geographical area.	National health interview survey data analysis.	Rural residents typically have worse health outcomes and access to healthcare than urban areas. These residents also must travel longer distances and live in areas with hospital closures. emergency department visits for asthma were higher in urban areas however asthma mortality rates were higher in non-urban areas.
Juturu (2021)	United States of America.	Assess emergency healthcare access in the Salton Sea region of Imperial County.	Utilised the Rational Agent Access Model (RAAM) to assess travel times and access to emergency healthcare.	Average travel time to definitive care during an asthma exacerbation was 50-61 minutes. Imperial County had high asthma prevalence and a lack of resources to manage and treat complications of asthma.
Locke, Thomas, Woo, Nguyen, Tamanaha, Press, et al.,.(2019)	United States of America	Explore the impact of telehealth visits on inhaler technique and measure patient satisfaction.	Retrospective review of rural participants in a video telehealth inhaler training program.	Participants showed improved inhaler technique during the first session and 94% (n=74) participant satisfaction was recorded.
Fishe, Finlay, Palmer, & Hendry (2019)	United States of America	Describe the effects of regionalisation of paediatric inpatient asthma care on EMS operations for regional agencies.	State-wide cross-sectional EMS study.	Paediatric asthma care was concentrated in urban centres. This resulted in rural EMS crews having to travel long distances to admitting facilities for Florida's paediatric population experiencing asthma exacerbations.
Bian, Cristaldi, Summer, Su, Marsden, Mauldin, et al.,. (2019)	United States of America	Determine if there is an association between school-based telehealth programs and emergency department visits in South Carolina.	Analysis of South Carolina Medicaid claims from July 2018 – Feb 2019.	Nil associations were found between the program and emergency department visits however, the study concluded that telehealth with a focus on asthma may be beneficial to rural communities.
Braithwaite, Hibbert, Jaffe, White, Cowell, Harris, et al.,. (2018)	Australia	Establish the quality of healthcare provided to Australian children in inpatient and ambulatory care settings.	Multistage stratified sample with medical record review.	Showed an underutilisation of asthma management strategies specifically regarding written asthma plans.
Agusala, Vij, Agusala, Dasari, & Kola (2018)	United States of America	Explore the impact of asthma education in rural Texas.	Prospective study.	Asthma education was associated with reduced absences from school, and less frequent emergency department visits and hospitalisations. Education was also associated with better symptom management and confidence in understanding triggers and signs and symptoms.
Kew & Cates (2016)	United Kingdom	Assess the efficacy and safety of telemonitoring asthma at home.	Identified trials from the Cochrane airways review group.	No evidence suggested whether telemonitoring with feedback from a healthcare professional impacted the occurrence of exacerbations however, it suggested this approach may help to resolve some inequalities in healthcare associated with residing rurally.
Shaw & Siriwardena (2016)	United Kingdom	Explore attitudes of paramedics about the management of asthma prehospitally.	3 focus groups interviews.	Little research has been conducted into ambulance clinician's adherence to national asthma guidelines.
Kassean & Poordil (2011)	Mauritius	Determine 'rush hours' and identify trends of calls for the emergency medical assistance service of Mauritius (East Africa).	Evaluation research framework.	Asthma is one of the 3 most common reasons for patients to seek emergency healthcare in these regional areas. Further education was recommended for both staff (to keep up with demand) and for patients in these areas, along with improvement of emergency medical units to allow a better distribution in the regional locations.
Larson, Ward, Ross, Whyatt, Weatherston & Landau (2010)	Australia	Trial the outcomes of asthma patients when given an education session and asthma action plan.	Prospective cohort study.	Structured GP based education sessions were believed to be an effective preventative healthcare program having the potential to reduce unscheduled utilisation of health services.

Table 3. Literature review findings.

Authors and year of publication	Location	Aim	Methods	Key findings
Withy & Davis (2008)	United States of America	Investigate and compare the rates of follow up visits after emergency department visits for asthma exacerbations between rural and urban patients in Hawaii.	Retrospective review.	Patients who had a follow up visit after their initial emergency department presentation were less likely to re-present to the emergency department within the month however, rural adults were less likely to have a follow up than urban residents. There was no significant difference in follow ups for children residing in rural and urban locations.
Horner (2008)	United States of America	Identify factors impacting asthma morbidity in rural children.	Exploratory analysis.	Children experiencing more severe asthma had higher rates of school absences and hospitalisations. Families who had difficulty accessing care had higher rates of hospitalisations and emergency department visits
Boyd & Archer (2007)	Australia	Investigate barriers to optimal emergency healthcare in rural Australia.	Needs analysis.	Issues such as underestimation of the severity of asthma and delays in seeking paramedic assistance were found to be modifiable with education. This education program was found to have high user satisfaction and resulted in several participants stating they would be more likely to utilise ambulance services due to this education package.
Doherty, Jones, Davis, Ryan & Treeve (2007)	Australia	Determine if an evidence-based implementation strategy can lead to the implementation of successful guidelines for adult asthma management in a large rural emergency department.	Pre and post intervention trial.	Evidence-based implementation had a significant impact on the improvement in several areas of asthma management in the rural emergency department. These improvements were also maintained during a 12 month follow up.
Doherty, Jones, Stevens, Davis, Ryan, & Treeve (2007)	Australia	Determine if evidence-based implementation can lead to improved compliance with asthma management guidelines for children in a large rural emergency department.	Pre and post intervention trial.	Evidence-based intervention was shown to improve compliance in several asthma management guidelines in paediatric patients. These results were also maintained at a 12 month follow up.
Van der Merwe, De Klerk, Kidd, Bardin & Van Schalkwyk, (2006)	South Africa	Distinguish risk factors for severe/life threatening asthma in developing communities in South Africa.	Case control study.	Rural residence may increase the risk of severe/life threatening asthma as well as decrease access to specialised care having negative effects on asthma outcomes.
Butz, Pham, Lewis, Lewis, Hill, Walker, et al.,. (2005)	United States	Determine the effectiveness of an asthma educational intervention on improving quality of life of rural families.	Randomised clinical trial.	Interactive asthma education intervention was associated with increased knowledge and decreased symptom reports in rural children and overall improved asthma knowledge in both parents and children.
Morgans, Archer, Walker & Thuma (2005)	Australia	Explore the perceptions of the role of health services in acute asthma management and asthma health promotion.	Community based focus groups.	Rural perceptions of asthma acted as barriers to accessing emergency healthcare effectively. These misconceptions were concerning in rural areas where distance has a significant effect on response times.

Table 3 (continued). Literature review findings.

The key themes identified in the literature were the impacts of a lack of access to resources; individual behaviours and attitudes; education and health literacy; and rural clinician compliance with guidelines. These factors had an impact on how rural asthmatics were able to access and receive emergency care in an asthma-related emergency.

Access to Resources

A lack of access to resources due to challenges associated with geographical location can act as a barrier to accessing rural emergency care for asthma-related emergencies. This is highlighted by Van der Merwe et al. (2006) whose South African study concluded that rural residence may increase the risk of poor asthma outcomes. This is complimented by Kassean and Poordil (2011) another African study that recommended there needs to be improved emergency medical units to provide a better distribution of services across regional locations that have a higher number of asthma call outs. Furthermore, Fishe et al. (2019) analysed the effects of regionalisation on rural paediatric asthma patients in Florida and identified that paediatric asthma care was focused on urban specialty centres.

This resulted in Emergency Medical Services (EMS) having to travel longer distances to admitting facilities for the rural paediatric asthma population leading to more complex decisions being made, with the longer transport times also impacting EMS availability (Fishe et al., 2019). More recently, Fecho et al. (2022) explored factors which influenced asthma exacerbations in the United States. Their findings demonstrated patients residing in rural areas had higher annual emergency department (ED) presentations or inpatient visits for respiratory issues than those in urban areas. They also noted that asthma exacerbations were more significantly associated with rural residents and those who had exposure to relatively high levels of particulate matter 2.5 microns or less in width or ozone (Fecho et al., 2022).

Horner (2008) highlights asthma morbidity in rural school-aged children and indicated a higher rate of hospitalisations and ED visits in families who have difficulty accessing care emphasising the effects that geographical location can have on asthma-related health outcomes. Similarly, Pate et al. (2021) indicated that those who lived rurally had poorer health outcomes than those in urban areas and associated this with reduced access to healthcare, living in locations which had a higher prevalence of hospital closures, shortages in the healthcare workforce and increased distances to travel to receive emergency healthcare. This study which characterised asthma indicators throughout the United States found that adults had a higher number of ED visits in urban than rural areas although asthma-related mortality rates were higher in rural areas. Pate et al. (2021) speculated that ED visits may be lower in rural areas due to the difficulty accessing emergency healthcare. Meanwhile, Juturu (2021) investigated the impact of living rurally and having reduced access to health resources on asthmatics in the Salton Sea region of Imperial County (California, USA) where the average road travel time to medical attention was 50-61 mins. This area had a high asthma prevalence and lacked the resources to be able to manage asthma-related illness (Juturu, 2021). These studies suggest that difficulty accessing emergency healthcare may be preventing asthmatics in rural areas from receiving equitable healthcare during an exacerbation.

Telehealth has been mentioned throughout the literature as a tool to address barriers associated with accessing healthcare in rural areas. Kew and Cates (2016) assessed the efficacy and safety of home telemonitoring by a healthcare professional. They concluded that they were unable to find any clear evidence suggesting whether telemonitoring had an influence on the prevalence of exacerbations/ED presentations, however they did suggest that home telemonitoring may reduce inequalities in healthcare for those in rural areas by improving access to specialist services. Further evidence was provided by Bian et al. (2019) who examined the association of school-based telehealth programs with ED visits in South Carolina. Whilst there was no statistical association of this program with ED visits, they noted the potential health benefits that telehealth can provide to rural and medically underserved communities for paediatric diseases such as asthma. Meanwhile, Locke et al. (2019) reviewed the use of telehealth to improve medication compliance and inhaler technique in rural asthmatics and noticed an improvement in inhaler technique during the first session. However, whilst there was improvement in inhaler usage and high satisfaction with the program, there was no significant difference in asthma-related hospitalisations pre and post the telehealth training (Locke et al., 2019).

Overall, the literature indicates that a lack of access to resources for reasons such as geographical location can have a significant influence on the treatment and time taken to re-

ceive definitive care in patients experiencing asthma exacerbations. Fishe et al. (2019) and Van der Merwe et al. (2006) recommended further research on the impact of these factors on asthma care and a focus on reversible risk factors to reduce the effect that location has on negative asthma outcomes. The literature implies that the utilisation of telehealth services in rural areas may provide benefit to management of asthma in rural areas by making it easier to access asthma education and General Practitioner (GP) consultations. However, it does not provide a solution to the issue of difficulty accessing emergency healthcare in an asthma-related emergency. Juturu (2021) highlighted there was a need to collect and assess data on acuity levels of asthma-related emergencies to determine what emergency services were needed in rural areas.

Individual Behaviours and Attitudes

Individual behaviours and attitudes were also seen to influence access to emergency healthcare for asthma exacerbations in rural areas. Results from focus groups carried out by Morgans et al. (2005) involving rural asthma patients in Victoria, Australia showed that patients were less likely to seek emergency healthcare via an ambulance service due to underestimating the severity of their asthma, thinking it was not a 'real' emergency, response time delays and the attitude that they could get themselves to hospital more quickly. However, this attitude did not account for the lifesaving treatment which can be implemented enroute to hospital resulting in patient improvement before reaching the ED. Furthermore, Morgans et al. (2005) also conducted a patient care record audit which clearly displayed that paramedic intervention for asthma was appropriate and led to immediate respiratory improvement highlighting gaps in the health literacy of the participants in their study.

Similarly, Withy and Davis (2008) looked into the rate of GP follow up visits after ED presentations for asthma in Hawaii. The data showed that an in-office follow up with a GP decreased the likelihood of another ED presentation within the same month by 10%. When comparing rural and urban areas it was found that rural adults were less likely to have a follow up visit however, there was no significant difference in follow up visits between rural and urban paediatric asthma patients. This indicates that rural adults are less likely to engage in follow up visits for themselves than for their children indicating some attitudinal issues acting as a barrier to receiving follow up healthcare ultimately highlighting how attitudes can be a barrier which hinders access to healthcare in rural areas.

Both studies highlight specific attitudes and behaviours which impact on the access to emergency healthcare for asthma exacerbations in rural environments. This can lead to suboptimal resource utilisation including the underutilisation of ambulances and delays in accessing these resources resulting in negative asthma outcomes (Morgans et al., 2005). Morgans et al. (2005) suggested the need for further public education campaigns to improve health literacy regarding the utilisation of ambulance services for treatment and transport to ED for asthma exacerbations in rural areas.

Education and Health Literacy

Another common theme in the literature was substandard levels of health education in rural and remote areas. Authors such as Boyd and Archer (2007) and Morgans et al. (2005) have uncovered gaps in health literacy which impacted on access to emergency

healthcare. Morgans et al. (2005) reported an educational barrier in asthmatics in rural Victoria around accessing emergency healthcare for asthma exacerbations. A misunderstanding of paramedic roles was highlighted in addition to not knowing when it was appropriate to call for an ambulance. Morgans et al. (2005) also found that these education gaps were evident in both patients and medical professionals which was significantly concerning when looking into the quality of access to emergency healthcare in these areas. Similarly, Boyd and Archer (2007) found that despite data showing paramedic intervention can improve asthma outcomes in rural Victoria, the utilisation of ambulance services for asthma was suboptimal and there was an underestimation of the severity of asthma resulting in delays seeking paramedic assistance. To address this, Boyd and Archer (2007) developed an asthma education strategy targeting both health professionals and their patients. They utilised a multimedia education package which was shown to have high levels of user satisfaction with 64% of participants stating they were more likely to call for an ambulance in an asthma-related health emergency as a result of the education package (Boyd & Archer, 2007).

Furthermore, this support for asthma-related education programs is found in literature throughout the world. In 2005, Butz et al. (2005) investigated the effectiveness of asthma education in rural families on improvement of self-efficacy in asthma management, quality of life and asthma knowledge. Although these interventions did not improve quality of life, they did improve participants' asthma knowledge and self-efficacy in children but not adults. In another study, Larson et al. (2010) revealed that structured asthma education delivered in GP practices was an effective way of preventing asthma exacerbations and improving asthma management. This was achieved by delivering educational sessions which covered the pathophysiology of asthma, signs and symptoms, triggers, correct use and administration of medications and the development of an asthma action plan. The findings of this study showed an increase of preventer medication use and use of a spacer, perception of improved quality of life and a decrease in unscheduled GP appointments for exacerbations. The data from this study also indicated that the educational sessions and asthma action plans may have reduced the number of asthma-related hospital presentations (Larson et al., 2010). More recently, Agusala et al. (2018) investigated the impact of asthma education for paediatrics in rural Texas and noted asthma education reduced hospitalisations, ED visits and school absences. Through educating both parents and children it was reported there was an increase in confidence in asthma management, and a better understanding of signs, symptoms, and triggers. Meanwhile, Braithwaite et al. (2018) examined the quality of healthcare for Australian children including those in rural areas and identified written asthma management plans as a significant tool in improving asthma management, resulting in fewer school absences and better relationships with health services. However, Braithwaite et al. (2018) also acknowledged that whilst 92% of children discharged from hospital following an asthma exacerbation were given an asthma action plan, only 47% of children prescribed an asthma preventer were provided with an asthma action plan.

Overall, the literature revealed that maintaining the standard of education and health literacy is vital in emergency asthma management to prevent the underestimation of the severity of the disease and suboptimal use of both self-administered medications and emergency healthcare access (Boyd & Archer, 2007; Larson et al., 2010; Morgans et al., 2005). It is imperative that education is provided in rural areas so that asthmatics have a

good level of health literacy allowing them to make informed decisions regarding their emergency asthma management. This along with comprehensive asthma action plans has the potential to decrease negative asthma outcomes in rural populations (Braithwaite et al., 2018).

Rural Clinician Compliance with Guidelines

Rural clinicians' compliance with guidelines was also found to be of relevance when examining emergency healthcare access for asthma exacerbations in rural areas. Doherty, Jones, Davis, et al. (2007) and Doherty, Jones, Stevens, et al. (2007) both evaluated the influence of implementing evidence-based interventions in improving the management of rural asthma exacerbations in adults and paediatrics in a large rural Australian ED. These studies initially found a low rate of compliance with current asthma guidelines followed by a significant improvement in the management of asthma exacerbations through the utilisation of evidence-based interventions. Important interventions included improved compliance with guidelines with seven main clinical indicators identified as significant, including pharmacological treatments, correct administration of drugs, documentation, and asthma management plans all of which were maintained after a twelve month follow up. (Doherty, Jones, Davis, et al., 2007; Doherty, Jones, Stevens, et al., 2007). To support this Shaw and Siriwardena (2014) explored attitudes and perceptions of regional paramedics about their prehospital treatment of asthma exacerbations to evaluate guideline adherence in the United Kingdom. They found limited research into prehospital adherence to guidelines and identified five themes including the relevance of the guidelines to the prehospital environment, barriers to assessment, conflicts in expectations of patients and clinicians, complexity of processes and equipment as well as opportunities for education. Overall, these studies highlight the importance of evidence-based practice in the management of asthma exacerbations. Furthermore, these studies uncovered shortfalls in the compliance with asthma guidelines. It is vital that issues with compliance are kept to a minimum in rural areas to ensure they are not acting as a barrier to accessing evidence-based emergency healthcare for asthma exacerbations in an environment where there are already several obstacles which may need to be overcome just to get to the clinician's doorstep.

DISCUSSION

The aim of this scoping review was to explore the impact that residing in rural areas has on accessing emergency healthcare for an asthma-related emergency. This review has identified access to resources; individual behaviours and attitudes; education and health literacy; as well as rural clinician compliance with guidelines as factors influencing asthmatic's access to emergency healthcare during asthma-related emergencies.

Access to resources was found to affect access to emergency healthcare and a significant part of that was due to the geographical environment specific to rural areas. Aftyka et al. (2014) and Wilde (2013) concurred, describing how issues associated with the longer distances, obscure landmarks and hostile terrains which need to be traversed in order to reach patients in rural areas impacted on response times, affecting mortality rates and hospital admission rates. Other obstacles, such as labelling of landmarks, muddy roads and poor radio and phone reception can further impact response times increasing the likelihood of requiring clinical interventions on scene to stabilise patients in rural areas

rather than common load and go tactics associated with more urban areas (Aftyka et al., 2014). Limited resources in rural areas are also discussed in Bourke et al. (2004) including workforce shortages which have led to poorer access to healthcare for rural populations. This makes services more difficult to access resulting in longer travel times and greater financial stressors. Similarly, Piggott et al. (2021) highlighted that the availability of dental services was limited in areas with low population density. Consequently, this resulted in infrequent visits from dental clinicians to rural areas acting as a barrier for rural residents to receive dental care due to a lack of access to resources. Situations like this can lead to alternative methods of assessment and management such as telehealth which has been successfully implemented for the detection of skin cancers in rural areas (Adelson & Eckert, 2020). A study in Greenland reported the effective use of telehealth in accurately diagnosing patients with respiratory conditions in remote areas allowing early emergency treatment to be initiated whilst retrieval was arranged implying that telehealth may be appropriate for the emergency management of asthma in remote areas. Health services with limited resources should work together to increase the availability of emergency healthcare in rural areas, reducing inequalities in access (Penninga et al., 2020).

Individual behaviours and attitudes can shape how and when people choose to access emergency healthcare. As a response to limited healthcare in rural areas, patients are creating their own self-management strategies to control their asthma and have been known to call friends, neighbours or even their local doctor before deciding to call for an ambulance during an asthma-related emergency (Cvetkovski et al., 2009; Morgans & Archer, 2005). However, whilst Cvetkovski et al. (2009) saw self-management strategies as an alternative to decrease the need to access emergency healthcare, Fennell et al. (2018) articulated self-reliance and control as an attitudinal barrier in accessing healthcare in rural South Australia for a mental health concern. This poses the question of whether self-management strategies are beneficial or cause further barriers to accessing essential care in potentially life-threatening situations.

Additionally, levels of education and health literacy can demonstrate gaps in knowledge which can limit access to emergency healthcare in rural areas. This is further portrayed through Franks et al. (2005) a rural pharmacy study that concluded reliever medications were over utilised while preventer medications were underutilised demonstrating poor knowledge of asthma medications by the rural participants. This highlighted a need for modification of the provision of education and health literacy by recognising that patients needed further education to develop a fuller understanding of their medications and improve asthma outcomes (Franks et al., 2005).

Finally, a healthcare system that is up to date with evidence-based guidelines and demonstrates adherence to these guidelines is significant when accessing rural emergency healthcare. Adams et al. (2019) emphasises that keeping up with education is an issue for paramedics and nurses who work in remote industrial roles with a broad scope of practice where some skills are rarely used. This sense of professional isolation inhibits further access to education and professional development opportunities foreshadowing a need for more education to alleviate stress related to professional isolation and to support practice needs. This is reiterated by Cvetkovski et al. (2009) whose findings shared the perceptions of rural pharmacists that the restricted availability of professional development opportunities were limiting their provision of asthma management in

rural areas. Furthermore, O'Meara et al. (2012) identified trends in how rural paramedic practice was evolving with paramedics becoming first line primary healthcare providers in small rural communities highlighting the need for an expansion of rural paramedics scope to be able to comply with the needs of both emergency and primary health of rural communities. Spencer-Goodsir et al. (2022) summed this up, highlighting the opportunities for paramedics in rural areas to be used to tackle identified gaps in healthcare however noted the importance of further professional development to support the clinicians working in these extended roles.

LIMITATIONS

A limitation of this study is that only articles published in English were considered. Whilst this may have resulted in some potential sources not being identified, the purpose of this study was to investigate the factors impacting decision-making of asthma patients accessing emergency healthcare in Australia so non-English publications would not have been relevant to this context. Articles published in other countries were taken into consideration due to the limited research on this topic carried out in Australia. Finally, the research from the Australian context is dated indicating a need for more contemporary research to ensure any recent changes to the service structure or delivery of rural healthcare have been accounted for.

CONCLUSION

Through the literature identified in this scoping review, it was established that there are several influences/barriers associated with living in rural areas that may impact patients ability to access emergency healthcare during an asthma-related emergency all of which are interconnected. This was shown through environmental concerns and decreased access to resources creating barriers to accessing emergency healthcare. Additionally, individual behaviours and attitudes, alongside education and health literacy and rural clinician compliance to guidelines were also seen to be influences which may impact the ability to access emergency healthcare in the rural environment during an asthma-related emergency. Due to these discrepancies in environmental concerns, access to resources, individual perceptions and rural clinical compliance, further research is recommended to establish the current extent to which these obstacles are influencing rural patients health outcomes and to explore solutions to support the delivery of equitable emergency healthcare in these locations.

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CASE REPORTS

ASSESSMENT AND EMPIRICAL TREATMENT OF CHRONIC ABDOMINAL PAIN FROM SUSPECTED *HELICOBACTER PYLORI* INFECTION IN A REMOTE SETTING: A CASE STUDY

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ABSTRACT

This is a case study that discusses the application of empirical treatment of symptomatic *Helicobacter pylori* (*H. pylori*) in a remote clinical setting with no access to primary or secondary diagnostic testing. The prevalence of *H. pylori* remains globally high, with an estimated 50% of the world's population believed to be infected. Despite the continually high incident rates of infection, 90% of those infected remain asymptomatic. *H. pylori* is a gram-negative, microaerophilic bacteria, mostly found in the stomachs of affected individuals, that causes inflammation and ulceration. Definitive routes of transmission and subsequent infection are still debated. The most likely mechanism of transmission is thought to be intrafamilial; this encapsulates fecal-oral, gastric-oral, oral-oral, and sexual vectors. Contaminated foods and water sources are also highly likely mechanisms of transmission. Therefore, developing countries with poor sanitation, potentially contaminated water sources, and regions with socio-economic hardship experience increased symptomatic cases of *H. pylori*.

INTRODUCTION

The case study pertains to a member of a security team operating in the Middle East. The patient initially presented to the role 1 medical facility (primary healthcare) complaining of a two-day history of worsening abdominal discomfort. Symptoms were not alleviated with the over-the-counter (OTC) medication Gaviscon (Sodium Alginate & Potassium Bicarbonate).

The patient reported previous episodes over several weeks prior. The patient has been self-managed and had initially responded to OTC medications.

The patient was part of a four-man armed security team employed over a range of tasks across the area of operations. The pertinent social background for this case is the patient living in close quarters with all other security personnel, sharing ablutions and gym facilities, and a single common dining facility.

The main water source is bottled local mineral water with locally sourced food that is prepared on-site. The patient partakes in a daily intense physical routine with various natural dietary supplements to support training.

As is common across these roles, the majority of personnel are military veterans who have spent significant amounts of time operating in the Middle East and other undeveloped countries.

PATIENT INFORMATION

The presenting patient is a 40-year-old male who is normally fit and well with exceptional fitness. There is no reported or documented chronic illness and no ongoing prescribed medications. The patient has a documented allergy to penicillin.

The patient initially presented with abdominal discomfort that he described as a burning sensation—also complaining of acid reflux that was not responding to OTC medications.

The patient takes regular dietary supplements including creatine, protein supplements, thermogenic supplements to further support fat loss, and multi-vitamins. All supplements support additional fat loss and muscle growth.

CLINICAL FINDINGS

Primary Clinic Attendance

The patient attended with worsening intermittent abdominal pain that was described as burning with epigastric cramps and worsening dyspepsia with nausea. The patient denied vomiting. No change in bowel habits and denied any episodes of diarrhea. He also reported a slight reduction in appetite.

Assessment Findings & Therapeutic Intervention:

Vital signs/observations all within normal range. Abdomen: No abnormalities present. Normal in appearance with no distension or bruising. On palpation, the abdomen was soft and non-tender—no palpable masses. No pain or discomfort was elicited. There was no flank, groin, chest, or back pain. Normal bowel sounds were heard.

The patient was prescribed and advised:

- 10mg Hyoscine butylbromide (Buscopan) orał TDS.
- 20mg Omperzaole oral OD. (View to increase to 40mg daily if no effect.)
- Maintain fluid intake.
- Stop all dietary supplements, including thermogenics.
- Advice was given if symptoms worsened and for clinical review in seven days.

Secondary Clinic Attendance:

Five days after the patient's primary visit, the patient reported to the role 1 facility with an exacerbation of the symptoms described in the primary attendance. On this occasion the pain was described as epigastric pain that scored 10/10 and was radiating into the left and right flank and chest/xiphoid process.

The patient complained of worsening and constant dyspepsia and feeling bloated. On this occasion, he had been experiencing symptoms constantly for five hours with a small amount of food intake due to bloating and nausea.

Assessment Findings and Therapeutic Intervention:

- Vital signs/observations:
  - Pain 10/10, reducing slightly to 8/10 during assessment and with treatment.
  - ECG: Unremarkable
  - Urine: NAD
  - Apyretic
  - BP: Normal range
  - SpO2: 100%
  - HR: 87 radial and regular at rest.
- Abdomen appeared normal in appearance with no distension or bruising.
- Epigastric Pain + on palpation, all other regions NAD. Neg palpable masses. Some relief when lying supine.
- The patient was prescribed and advised:
  - Paracetamol, 1 g, IV Stat.
  - Metronizadole, 500 mg, IV
  - Omeprazole, 40 mg, BID (TTO 14 days)
  - Clarithromyocin, 500 mg, BID (TTO 14 days)
  - Metronizadole, 500 mg, TDD (TTO 14 Days)
- The patient was given 48hrs of light duties, worsening advice, and 24hr follow-up. The patient was advised to return if symptoms worsen before review.

Timeframes

The patient experienced gastrointestinal symptoms for several months, leading up to the need for empirical treatment. The first consultation occurred following exacerbation of symptoms for one week. A follow-up was planned seven days post initial treatment.

The patient represented with worsening of symptoms five days post initial consultation. Follow-ups planned for 12hrs, 24hrs, seven days, and 14-day post treatment. He required an eradication test upon return to his home country.

The 24hr, seven, and 14 day follow-ups indicated that treatment was effective due to a reduction in symptoms and the patient feeling he had returned to normal.

Diagnostic Assessment

Despite best practice guidelines (NICE, 2014) being available and providing clarity, the required and suggested testing was not possible in the region where the patient was operating, and eradication follow-up testing was also not available. Therefore, diagnostic assessment relied on patient history, thorough questioning, and clinical examination.

Therapeutic Intervention

International and national level guidance (NICE, 2014) can vary slightly with regard to methods of detection and re-testing for eradication post-treatment. The generally accept-

ed method for testing is the Urea Breath Test (UBT), with a sensitivity of 0.80-0.95 and a sensitivity of 0.90-0.96 (Larrson et al., 2022).

In comparison, a focused physical examination with patient history yields a sensitivity and specificity of 0.25 and 0.92, respectively (Larsson et al., 2022). Thus demonstrating the difficulty in providing an accurate diagnosis in a setting where diagnostic equipment and laboratory analysis is sparse or unavailable (Osterwalder et al., 2023).

The lack of diagnostic resources and hospital-based care (Role 2) made definitive diagnosis for this patient impossible. Therefore, considering the patent's presenting complaint, history, physical assessment findings, and significant social history regarding living conditions and being exposed to potentially multiple vectors for infection (Hooi et al., 2017). In addition, considering operating in a developing region with multiple sources of transmission and prolonged employment in developing regions is an additional component to considering symptomatic *H. pylori* as a diagnosis (Aziz et al., 2013). Therefore, the decision was made to instigate empirical treatment for symptomatic *H. pylori* infection.

In order to monitor the effectiveness of treatment for this patent, follow-ups were increased to daily for the first seven days with a view to amending treatment if required, which included second-line medications. Consideration of the patient's penicillin allergy and the limited medications available to the role one medics is a factor in further planning.

If the patient saw minimal improvement or a plateau in symptoms and a secondary drug regime would be actioned, again with no testing available, this would be a case of empirical treatment. Medications planned (NICE, 2014):

- PPI (Omeprazole)
- Bismuth
- Metronidazdole
- Tetracycline

If no improvement was seen or the condition worsened, a decision would have to be made to undertake medical evacuation to a location capable of greater diagnostics and treatment.

Minimal current evidence exists to support empirical treatment of suspected *H. pylori*. Bytzer et al. (as cited by NICE, 2014) found no statistical difference in the reduction of symptoms 52 weeks follow-up post care. There was no documented difference in treatment or strategy failure.

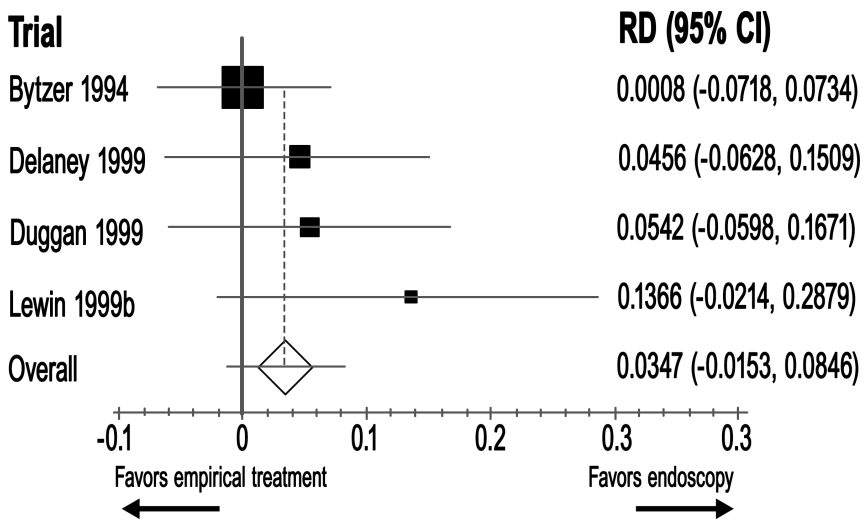

Figure 1. Empirical treatment versus endoscopy (NICE, 2014).

Follow-up & Outcomes

- 12hr follow-up: The patient stated that the 'burning' sensation had improved but was still present.
- 24hr follow-up: The patient was feeling well and noticed an improved appetite. There was no recurrence of pain, and minimal episodes of reflux—returned to normal working duty.
- 1-7 day follow-up: The patient was well with no reported symptoms, and minimal dyspepsia post food by day seven.
- 14 day follow-up: The patient was asymptomatic with no reported dyspepsia or pain, and their appetite returned to normal.

The patient was advised to attend an appointment with his primary care provider upon returning home. In keeping with best practice guidance he should undertake investigations to ensure the irradiation of *H. pylori* bacteria or to direct further treatment as needed.

DISCUSSION

According to recent studies, patients experiencing 'abdominal pain' are the 5th most frequent presentation to the Emergency Department (ED) and account for 3.6% of EMS calls. Of these, 6% required direct hospital admission and those discharged on scene under self-care (12%), and 16% presented to the ED or EMS service as representation within 96 hours (Larsson et al., 2022).

The above indicates that pre-hospital assessment of the patient presenting with abdominal pain can be difficult with regard to both assessment and determining a clear differential diagnosis (Larsson et al., 2022).

Current pedagogy relating to abdominal assessment varies between both educational institutions and levels of clinical training. This is further compounded by the individual's clinical exposure and field of work (Mansour et al., 2019). Recent studies considering the presentation of abdominal pain (AP) revealed that the most common differential diagnoses in patients under 65 years of age are gastroenteritis (15%), non-specific AP (14%), and urolithiasis (6%). The same study recognized that patients presenting with AP received more than 150 diagnoses (Osterwalder et al., 2023). This again highlights the complexity of assessing and providing a reliable differential diagnosis.

In relation to the accepted 'common diagnosis' for AP, clinicians operating in remote locations with limited access to diagnostic testing should consider alternative causes—extra-abdominal causes or "off-hour" presentations—during the course of their clinical patient interactions (Osterwalder et al., 2023).

Clinical providers and support services should consider the need for a defined, structured, and circulated abdominal assessment guidance in developed systems and by those providing off-site remote medical care. These should consider extra-abdominal presentations (Larsson et al., 2022; Osterwalder et al., 2023; Innes et al., 2018).

Additional factors also need to be considered about the working environment and social background of the patients. These include, but are not limited to, dietary supplements that can cause gastrointestinal agitation, increased incidents of potential contamination

of food and water sources, close living circumstances, and prolonged periods of work in under-developed regions (Hooi et al., 2017; Malfertheiner et al., 2023).

Previous to the primary and secondary encounter with the patient, a single consultation was found in the patient's medical record approximately eight months previously, and the patient was diagnosed with acute dyspepsia.

It is important to note that the dyspepsia is a term used to encompass symptoms such as upper abdominal pain or discomfort, heartburn, acid reflux, nausea and/or vomiting. It is not a diagnosis. In addition, dyspepsia is further defined by the above symptoms being present for a period of four weeks or more (NICE, 2014).

Patient Perspective

In discussion with the patient post-treatment and prior to writing this case study, he discussed his belief that he had probably been experiencing active symptoms for several months before he attended the clinic.

Episodes of loose stool have been atributed to stress, returning to operations, and changes in climate. In the study conducted by Osterwalde et al. (2023), somatoform disorders accounted for 1.3% of AP presentations.

The patient also added that he put several symptoms down to supplements that were high in protein, fiber, and a product that due to its thermogenic properties also could suppress appetite and cause stomach cramps.

Retrospectively, he wishes that he had sought medical advice much sooner; however, he feels that given the working environment and the competitive nature of reaching a senior position within the teams, there is a stigma attached with seeking medical help and admitting to being unwell. This point is well discussed as a factor in functioning as part of high-performance teams, military personnel, and male patients (Sharp et al., 2015).

INFORMED CONSENT

The patient gave his unreserved consent for the author to write-up this case study.

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CONCEPTS

SUPPORTING FAMILIES AND OUR OWN: STRATEGIES TO MINIMIZE THE EMOTIONAL BURDEN OF FAMILIES AND FIRST RESPONDERS DURING AND AFTER A PREHOSPITAL CARDIAC ARREST RESUSCITATION

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ABSTRACT

Out-of-hospital cardiac arrest (OHCA) can have significant adverse sequelae for the patient's families that additionally impact the responding EMS clinicians. Despite advances in medicine, 90% of OHCAs result in death. The sudden and unexpected nature of these events, adds to the complexity of grief for the surviving family members. OHCA specifically has been shown to have deleterious mental health impacts on EMS clinicians who have self-reported experiencing negative emotions after delivering bad news to families such as a death notification. Given the grim prognosis associated with OHCA outcomes and the associated emotional fallout, we must find ways to better support our patients, their families, and EMS clinicians.

The goal of this paper is to offer strategies that can be used by EMS clinicians to better address the emotional burden experienced by families during an OHCA resuscitation. Many prehospital clinicians receive limited training around the psychological and emotional consequences that accompany OHCA scenarios.

Currently no national curriculum or writings have covered the concept of how to run an emotionally supportive OHCA. The following is an expert consensus of recommendations from a multidisciplinary group of experienced EMS clinicians, child life specialists, licensed clinical social workers and physicians with backgrounds in emergency medicine, palliative care and EMS. The strategies outlined would ideally be utilized by first responders to anticipate and subsequently support the emotional needs of families. The strategies include ways to enhance communication, help combat common misperceptions from families around cardiac arrest, and prepare EMS clinicians for what to do if a resuscitation is unsuccessful. Ultimately, the goal of this paper is to provide tools to help EMS clinicians better engage with families to minimize the emotional impact on all involved.

INTRODUCTION

Cardiac arrests are some of the most emotionally fraught calls for EMS clinicians and for the families affected by them. Annu-

ally more than 350,000 OHCA occur in the US (Benjamin et al., 2019). Despite advances in medicine greater than ninety percent of these OHCA end in the patients death (Benjamin et al., 2019).

The patients are not the only victims of these tragedies; often families are left devastated by the loss of their loved one as well. The sudden and unexpected nature of these events often leads to traumatic experiences and complicated grief. A study of over 27,000 people found the unexpected death of a loved one was most likely to be rated as the worst traumatic experience by respondents, even if they had been exposed to other significant past traumas (Keyes et al., 2014). Furthermore, the unexpected death of a loved one increases one's risk for a multitude of psychiatric disorders including post-traumatic stress disorder, depression, and substance misuse (Keyes et al., 2014). This poses the question: Are EMS clinicians solely treating patients in cardiac arrest, or are they treating the families as well? In 2011, the National Association of EMS Physicians (NAEMSP) released a position statement in support of the termination of OHCA, which has led to a national shift, with many arrests being called in the field. As a result, EMS clinicians are not only the first healthcare clinicians most families interact with, but likely the only clinicians, given the low number of patients successfully resuscitated. Only a small portion of patients will be brought to the hospital, so for many families the EMS teams will be responsible for updating the family, delivering any bad news, providing emotional support, and explaining the next steps for their loved one. There is a paucity of research around how families are impacted by first responders breaking bad news, but we do know that poor communication from in hospital-based teams when delivering bad news has been associated with increased psychological distress, anxiety, and depression (Ellis & Tattersall, 2009). It is reasonable to assume that poor communication techniques would have a similar impact when utilized by EMS clinicians. EMS clinicians must work diligently to minimize the emotional impacts families experience during cardiac arrests.

The emotional impact of OHCA often extend past that of families and affects EMS clinicians as well. With the added burden of having to tell families that a loved one has died, there is likely additional emotional strain on EMS clinicians. A recent study of more than 1000 U.S. based EMS clinicians reported 86% of respondents have given a death notification within the last year (Tillett, Martell, Crispo, & Strout, 2022). That same study demonstrated greater than half of respondents reporting negative sequelae including intrusive thoughts, lost sleep or emotional difficulty related to delivering bad news, with 7% of respondents experiencing these effects "frequently" (Tillett, Martell, Crispo, & Strout, 2022). This may be adding insult to injury as first responders have also been found to have up to five times the rate of post-traumatic stress disorder and depression compared to the general public (Heyman, Dill, & Douglas, 2018). EMS clinicians specifically have been found to have rates of suicide 1.39 times that of non-EMS clinicians and firefighters, even when accounting for the dangers of firefighting and the high prevalence of suicide in the profession. It is imperative that we do all that we can to support first responders' mental health and one way we may be able to accomplish this is to adequately prepare them to support families during a cardiac arrest resuscitation. In the aforementioned study of 1000 US based EMS clinicians, 42% reported not receiving any education around the subject of breaking bad news, and 96% of respondents felt additional training would be helpful (Tillett, Martell, Crispo, & Strout, 2022). To our knowledge, no stan-

dardized national training or curriculum currently exists that prepares EMS clinicians to run an emotionally supportive OHCA or break bad news in the prehospital environment.

The goal of this paper is to address the question: how can EMS clinicians approach the family of an OHCA to decrease the emotional burden on families? Ideally by enacting some of the strategies detailed, EMS clinicians can more effectively minimize the emotional impact on families and the emotional fallout they themselves are at risk of experiencing. This paper does not address the delivery of bad news itself. Additional writings around the topic of breaking bad news exist, including the Prehospital Guide to Making Death Notifications, and we would recommend all prehospital clinicians become comfortable with the techniques of delivering bad news (Tillett, Jacobs, & Crispo, 2024). Unfortunately, there is limited data around the topic of how to support families during an OHCA. Each OHCA is unique in its location, variety of people present, and evolution. The prehospital environment is very different from a resuscitation bay in an ER with a multitude of staff and a quiet family room for family discussions, and thus requires a unique and thoughtful approach. The contents of this paper stem from the collective experiences of veteran EMS clinicians, a licensed clinical social worker, a child life specialist, and physicians with backgrounds in emergency medicine, EMS and palliative care. The intent of the following is to lay the groundwork for a thoughtful approach by EMS clinicians to address some of the most common issues that may occur and offer suggestions on how to best navigate them. Each EMS clinician should always follow their protocols and be thoughtful in tailoring their approach to the needs of each family and that of their own crews during these calls.

Strategies to minimize emotional burden.

Assign a family liaison:

Incorporate a family liaison into a pit crew approach to a cardiac arrest. The family liaison will help cognitively offload the clinician running the resuscitation while being able to focus full attention on the family. Many ERs do this with a social worker or experienced RN to keep the family informed so others can focus on the resuscitation. If no liaison is available for the family due to lack of personnel, a team member must briefly address the family and let them know you will update them shortly. An example would be "I'm Lt. X from the fire department, and we are going to do everything we can to help your husband. We need to focus on him for the next several minutes, but I promise we will answer all your questions as soon as we can." When sufficient personnel arrive, a family liaison should be assigned.

Identify Who Is Present:

Anyone present should be identified not only for information gathering purposes, but to ensure any decision making and notifications are made correctly. It may seem small, but you do not want to mistake a patient's neighbor checking in on them for their spouse. This will also help later when discussing termination of a resuscitation and determining how much information to divulge.

Ask the patient's name:

If you can, ask the patient's name and refer to the patient by name. This will help show you and your team care and will help in rapport building. "They are giving medicine to help try and restart David's heart" is much more humanizing and will resonate more with family than not using the patient's name.

Ask for their understanding:

It is important for the family liaison to ask, "What is your understanding of what is happening to David right now?" The public's understanding of cardiac arrest is quite different from medical personnel, and laypersons often have limited understanding of survival rates let alone other potential sequelae such as permanent neurologic damage. For example, one review of three medical drama TV shows found a 75% survival rate after cardiac arrest (Diem, Lantos, & Tulsky, 1996). Furthermore, the majority of older patients surveyed based their knowledge around CPR from television (Schonwetter, Teasdale, Taffet, Robinson, & Luchi, 1991). Often the media portrays people waking up and acting normal after CPR, which for most patients will be far from the case. Establishing the families' understanding may help you guide them or explain what the next steps are, and better manage expectations; a key component in preparing families for a potentially poor outcome.

Ask about code status:

This may not always be applicable but especially for elderly patients asking if a patient has a DNR or if they had ever expressed their wishes if their heart were to stop may be indicated. Sometimes in the stress of a loved one collapsing or being found down, families may not think about a DNR or wishes already laid out by a loved one. When asking about code status, avoid statements such as asking "would they want us to do everything" instead opt for statements such as "Does David have a DNR, or did he ever express his wishes if his heart were to stop? Did he ever say if he would want to die a natural death, or would he want things like what we are currently doing, such as CPR and to potentially be kept alive by machines such as a ventilator?" Often families, given their misunderstandings about CPR, don't understand that cardiac arrest patients rarely wake up unhindered and most must remain on a ventilator for a period of time, may have an extended hospital stay and may have significant permanent deficits. If the family is unsure, defaulting to full code status is appropriate. Do not delay CPR to discuss these options unless the patient is clearly a DNR.

Allow the family to be present:

Ask the family if they would like to witness the resuscitation. Asking can help them have a sense of control. Recent studies have demonstrated benefits to families who choose to be present for resuscitations in hospital-based settings, including reduced anxiety and symptoms consistent with post-traumatic stress (Jabre et al., 2013; De Stefano et al., 2016). These studies did not demonstrate increased medico-legal issues, increased stress for care teams, and did not interfere with medical efforts (Jabre et al., 2013; De Stefano et al., 2016). Allowing families to watch with their own eyes the intense efforts and

compassion of the team attempting to save their loved one may help them feel that every possible effort was exhausted. Make sure someone remains with the family to talk them through what is occurring.

Updating family and avoiding medical jargon:

Whoever is speaking to the family should provide continued updates. The high stress nature means it will be easy for family members to be overwhelmed so short simple sentences that avoid medical jargon are best. Avoid saying things like "he is in respiratory arrest, so they are intubating him" instead say "He is not breathing on his own, so the team is placing a breathing tube to breathe for him." A conscious effort to slow speech cadence and carefully choose words will help make sure you are communicating in a way family can follow.

Avoid being overly optimistic, it is ok to be honest:

When providing updates it's important to focus on what is occurring. Many clinicians instinctively want to reassure families when we see them in pain, but the majority of cardiac arrests will not survive, and we must avoid the urge to be overly optimistic or to give false hope. Being honest that a patient is not responding favorably to interventions and expressing concerns is also appropriate. An example may be "We have given several rounds of medications and shocked him several times, but his body is not responding. I worry his heart might not be able to be restarted." This may be painful for them to hear but it will help prepare the family mentally for the likely outcome of the patient's death in this situation. Put another way, it is always preferred to exceed expectations than under perform.

Address early why you are not transporting the patient:

Families may have preconceived notions about what a hospital may be able to offer and may think you need to transport the patient. Follow your local protocols and guidelines for transport during medical cardiac arrest, as resources and capabilities vary greatly, but current research supports continued on scene resuscitation over transport during most active medical cardiac arrest resuscitations (Grunau, et al., 2020). Letting families know early on why you are remaining on scene may be beneficial in helping align the families understanding of how the resuscitation is being run. Say something like "The best chance to restart David's heart is restarting it here now; we have everything we need right here, and if we try to transport him it will likely hurt his chances."

Give Tasks if family is interfering in care:

Some family or people may need to feel involved and could hinder the resuscitation. Giving them a task especially if you have limited resources may be of benefit, i.e., asking them to hold an IV bag, or flashlight. Sending them to gather a patient's medication bottles is another task that may help mitigate this issue until a clinician is available to speak with family directly.

Show respect for the person:

The physical acts of a resuscitation can be both brutal and emotionally jarring. Protecting a patient's dignity can greatly impact a family's perception of efforts and whether they

are perceived as caring or not. This includes small acts, such as protecting a patient's head as you move them to the floor to start CPR, or throwing a blanket over their private areas if they are naked or have soiled themselves.

Successful resuscitation:

If your team successfully achieved return of spontaneous circulation and the patient is to be transported, this is great! Keep in mind, the chance of survival to neurologically intact discharge is still low. It is important that someone, ideally whoever has been acting as the family liaison, explain to them the next steps, especially if the clinician running the resuscitation is still providing care. Avoid being overly optimistic, as the probability of re-arrest and permanent sequelae is still very high. Explain to the family that the patient remains critically ill and, while their heart is beating again on its own, this may not be survivable and is at risk of stopping again. Explain the next steps, such as transport to the ER. Offer to call and update any family who is not there if you are able. Arranging a ride to the hospital for a family member is also reasonable. Returning moved furniture and picking up trash, if you do not anticipate a criminal investigation, is appropriate and meaningful. Despite the initial resuscitation of the patient, this is still a traumatic experience for families, and these little steps may greatly improve their perception of the situation.

Failed resuscitation next steps:

If a resuscitation is unsuccessful and the family has been notified of the death, allow them some time to process. Make sure to let the families know you are there for them and willing to help in any way you can. It is important to give them some time to process the events, and when they are ready explain the next steps. Families are often overwhelmed and not sure what to do next. Being familiar with and explaining these steps can help keep them from spiraling emotionally. This may include a death investigation from police or contacting a funeral home. Law enforcement may handle the majority of this but being aware of your local guidelines is key. Families will often want to see their loved ones, and it is important to let them know you will let them see their loved one, but it may take some time for law enforcement to complete their investigation prior to them being allowed. Offering to call additional family members is appropriate. While it is important to return to service in a timely manner, a few extra minutes on scene may have a huge impact on the family and their perception of what has transpired.

Bereavement Packet:

This is a packet to leave behind with families after a death that includes information about the next steps for families. This is an easy thing to set up before calls and carry on each unit. It can include simple items such as pertinent phone numbers and a letter from your department expressing your condolences. These packets can provide information on local bereavement groups, contact information for the medical examiner, financial resources, and a list of local funeral homes, as well as contact information for local social services agencies. Additional items such as a memory book to place photos could also be included. Additional resources for addressing bereavement in children may be considered in cases where young children or grandchildren are affected.

Debrief with Team Afterwards:

Discussing what went well and what could be done better is important after any cardiac arrest. Including and being thoughtful about the death notification and how family was supported throughout may help improve future interactions for families. Doing so as a group can also help less experienced clinicians learn and grow from the experience as well as potentially mitigate some of the emotional impact they may also feel.

Family role in the decision to terminate resuscitation:

Inviting family to contribute to the decision to terminate resuscitation can be beneficial for family and EMS clinicians. It may help family to feel empowered in a situation in which they are otherwise helpless. . It allows EMS clinicians and family to be in on the care provided.

There are several options to allow for family involvement. One approach is to speak to the family in a separate room or area and explain the extensive resuscitation efforts that sadly have been unsuccessful. Another approach is to have family present while resuscitation is being performed, and explain that, despite the active resuscitation efforts, their body is not responding. When a decision is made to terminate resuscitation, this can be communicated as a recommendation to the family. It is also appropriate to ask families' permission to cease efforts, which helps align them with your team and give them a sense of control. If a loved one is resistant to the recommendation to terminate resuscitation, it is important to communicate in a direct but sensitive manner such as "I wish that the CPR we are doing would bring back your loved one, but it has not worked and they have died." It can be helpful to summarize the extensive resuscitation efforts in order to reinforce that everything possible has been done to try to resuscitate their loved one. If you encounter ongoing resistance, consulting an online medical command physician, in accordance with local protocol, to discuss further may help ease family concerns.

Additional Considerations

Religion:

For some families, religion may play large role in coping with loss, grief, and bereavement. A family may ask you to join them in prayer, which is your own personal decision. It is appropriate to join them or to politely decline. Regardless, it is important to remain nonjudgmental and not interject your personal religious beliefs into their moment of crisis.

For families who do seek support from religion it is okay to ask about this in a neutral way such as, "Is religion or faith something that is important to you at a time like this?" If they respond yes, offer to contact a clergy member or other religious resource (i.e., rabbi chaplain, priest, etc.) on their behalf, or recommend that they do so.

Pediatric cardiac arrests:

Pediatric cardiac arrests are often felt to be one of the most traumatic of patient exposures and carry a significant emotional burden. More detailed information on discussing a pediatric death with families can be found in the Pre-hospital breaking Bad News Guide (Tillett, Jacobs, & Crispo, 2024). A study looking at pediatric resuscitation in hos-

pitals where parents were present or nearby found that, while emotional support was appreciated, parents reported that ongoing real time updates and information was the most important thing for them and guided their perception team investment in their child (Stewart, 2019). Parents should also be asked how involved they would like to be and if they want to be present during the arrest.

Child presence during an adult cardiac resuscitation:

Supporting a child who is witnessing a cardiac resuscitation is challenging and little literature exists around this topic (Benjamin et al., 2019). A child that is present through an active resuscitation will likely require ongoing support, communication and emotional care during and after the event to help minimize the traumatic impact of that experience. The following considerations should be taken when deciding how and when to support a child.

Setting-

During an OHCA it may be best to move the child to a safe and separate location away from where their loved one is receiving care. Locating a family support person to stay with the child is helpful. Using supportive language and naming emotions can feel validating to the child, "You are doing a great job being brave while our team is here. It can be scary to see a loved one have an emergency." Explain to the child how the team is helping their loved one (see language below). Exposure to traumatic experiences without information and support creates opportunities for misunderstanding and harm.

Age-

Younger children will likely not understand why their loved one needs emergency care and what caused their loved one to become very ill. Children 3-6 years old often have "magical thinking" and believe they caused the medical emergency. It is important to provide a developmentally appropriate explanation of why their loved one has stopped talking and moving, and how EMS is helping them in a special way." Your Dad's heart is not working, and we need to help his heart pump blood to his body. You did not do anything to cause this emergency." If the child witnesses the active resuscitation, the EMS provider can offer simple information such as, "They are using their hands to push on his chest to help his heart pump blood." Some children may do better away from the emergency and benefit from an adult's comforting presence and distraction. Older children may ask to stay present through the resuscitation. They will need to be supported and talked through what they are seeing to ensure understanding. Always be conscientious of parental wishes, if expressed, as well as different expectations amongst different cultures.

DISCUSSION

OHCA occur in a wide variety of dynamic environments that are often chaotic, and are invariably unique. No document address all potential issues that arise and there is no 'one size fits all' approach or algorithm than can be successfully applied to each of these challenging calls. Large amounts of time and training are dedicated to the medical aspect of cardiac arrest, but little is focused on all those traumatized by these events. The lack of attention to the trauma that families and clinicians are exposed to during a cardiac arrest is disproportionate to the deleterious emotional burden it can leave us with.

Improving the education and training of EMS clinicians to help better support families and each other during OHCA is necessary. Training on how to run an emotionally supportive cardiac arrest, and communication of difficult news, should be incorporated into the education of all EMS clinicians. It is our hope that this paper will help lead to future research, writings, and ultimately a national curriculum to better prepare EMS clinicians for this difficult and important part of their job. If we continue to fail to support and educate our EMS clinicians on this topic, we will continue to leave them ill prepared for the inevitable calls of devastated families in a desperate time of need.

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SPECIAL REPORTS

VOCATIONAL AND UNIVERSITY PARAMEDICINE EDUCATION: IMPLICATIONS FOR PROFESSIONALISM

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ABSTRACT

This paper highlights key research areas within paramedicine education in Australia. Firstly, it discusses the need for a comparative analysis of accreditation standards, focusing on the recent shift towards a pre-employment model and its impact on program content, particularly the balance between theoretical and practical components. Secondly, it addresses the importance of exploring the influence of ethics education on paramedic practice, investigating how a robust ethical foundation acquired during education translates into ethical practices in real-world scenarios. Additionally, it suggests conducting a comparative study of international models to understand different education approaches, emphasizing the importance of identifying best practices to enhance paramedic education in Australia. Lastly, it emphasizes the significance of assessing the impact of accreditation changes in 2018, specifically the shift in accreditation responsibilities from the Council of Ambulance Authorities to the Paramedicine Board of Australia, aiming to understand its implications on the quality and consistency of paramedicine education across various institutions. Overall, this paper highlights the critical research gaps and areas of investigation essential for advancing paramedicine education and improving the quality of paramedic training in Australia.

INTRODUCTION

This review article delves into the diverse education models for paramedicine in Australia, exploring the evolution of accreditation standards and the historical transition towards a pre-employment model over the past two decades. The accreditation process for paramedicine education in Australia has been shaped by remnants of vocational education and training (VET) and accredited training packages, with ambulance services initially establishing ambulance officer training centers (AOTCs) in 1961(Brooks et al., 2018). These centers initially offered qualifications ranging from certificate level to an Associate Diploma, which expanded over subsequent decades as ambulance services became registered training organizations (RTOs). The shift towards tertiary education began in the mid to late 1990s, led by Charles Sturt University (Lord, 2003), and expanded across all

Australian states and territories in the early to mid-2000s. Accreditation of tertiary paramedic programs was initially overseen by the Council of Ambulance Authorities (CAA) and Paramedics Australasia, with responsibility later transferred to the Paramedicine Board of Australia (PBA) in 2018 (AHPRA, 2022).

While degree programs are the norm in Australia, the United Kingdom, and New Zealand, diploma qualifications still exist in countries like Canada and the USA. The Diploma of Paramedical Science in Australia is a pathway for private-sector ambulance technicians or a steppingstone towards professional registration through further university education. However, the continued offering of the Diploma of Paramedical Science by NSW Ambulance alongside degree programs raises questions about consistency in education standards and accreditation (Lazarsfeld et al., 2011).

The paper also discusses the role of education in fostering professionalism and personal growth, emphasizing the acquisition of essential skills and knowledge necessary for success in the dynamic field of paramedicine. It underlines the importance of maintaining high standards of professional competence and ethical conduct to ensure the delivery of safe and effective care by graduates.

In summary, this paper provides an insightful examination of paramedicine education in Australia, tracing its historical development and exploring the implications for professionalism within the field.

HISTORICAL TRAJECTORY OF ACCREDITATION

The establishment of Ambulance Officer Training Centers (AOTCs) in 1961 marked a significant milestone in the history of paramedic education, ushering in an era focused on providing rigorous training for aspiring ambulance officers (Brooks et al., 2018). These centers played a pivotal role in shaping the competencies and skillsets necessary for the burgeoning profession, adapting qualifications to meet the evolving demands of healthcare and emergency services (Brooks et al., 2018).

Vocational Education and Training (VET) principles influenced the development of accreditation standards, guiding the structure of paramedic education and ensuring adherence to standardized benchmarks (Brooks et al., 2018). The transition to accreditation under the Paramedicine Board of Australia (PBA) further solidified the regulatory framework, with the PBA and predecessor bodies like the Council of Ambulance Authorities (CAA) and Paramedics Australasia playing key roles in shaping accreditation standards (Brooks et al., 2018).

As conceptualized by Freiberg, regulatory theory offers a multifaceted perspective on regulation, which resonates with the pragmatic approach needed to contextualize regulation within the paramedic profession (Freiberg, 2010). The regulatory landscape for paramedics involves a hybrid model combining elements of self-regulation by the profession and legislative requirements imposed through the National Scheme by the Australian Health Practitioner Regulation Agency (AHPRA).

The National Scheme, established by the Health Practitioner Regulation National Law Act 2009, provides a unified framework for regulating health professions across Australia (AHPRA, 2022). Accreditation schemes have emerged as vital tools for ensuring

the quality of paramedic education, allowing institutions to measure their performance against established competencies or domains (AHPRA, 2022).

The journey of paramedic education from the inception of AOTCs to the current regulatory landscape reflects the profession's dedication to excellence and adaptation (Brooks et al., 2018). As paramedicine continues to evolve, ongoing research and evaluation will be essential to ensure that education remains responsive to the demands of the field, preparing graduates to excel in their roles (FitzGerald & Bange, 2015).

Within paramedicine education, the correlation between program accreditation and graduates' performance on board examinations has garnered significant attention. A thorough examination of existing literature sheds light on crucial insights into this correlation.

Initial findings suggest that program accreditation plays a pivotal role in shaping graduates' success rates on the National Registry Paramedic Certification Examination. A study investigating this correlation revealed a substantial advantage for students who underwent training in accredited programs. Specifically, attendees of accredited programs exhibited a notable odds ratio of 1.65 for passing the examination, indicating a robust positive link between accreditation status and examination performance (Dickison et al., 2006).

COMPARISON OF VOCATIONAL AND UNIVERSITY EDUCATION

The ongoing debate between vocational and university education in preparing paramedics for professionalism underscores the need for a nuanced understanding of their strengths and limitations (Hickson et al., 2015). Vocational paramedicine education, often provided by technical and vocational schools, focuses on hands-on experience and practical skills, aiming to produce work-ready paramedics efficiently (Nolan, 2023). Despite its advantages in shorter study durations and lower tuition costs, vocational education has been criticized for its perceived lack of academic rigor and theoretical knowledge, potentially hindering future safe practice (Ferm, 2021).

On the contrary, university paramedicine education prioritizes theoretical knowledge, research skills, and critical thinking, aiming to develop leaders in the field (Bell et al., 2020). Recognized as a prerequisite for professionalism, university programs offer a comprehensive curriculum and prepare students for leadership roles (Weber et al., 2024; International Organisation for Standardisation, 2020). However, concerns about the potential lack of practical experience and hands-on training in university education exist, although simulation-based education can mitigate these concerns (Miles et al., 2020; Hickson et al., 2015).

The effectiveness of both vocational and university education lies in their emphasis on practical skills and theoretical knowledge, respectively. Vocational education provides real-world experiences, while university education offers a more comprehensive understanding of patient care. Combining both approaches or adopting a hybrid model could potentially produce well-rounded and competent paramedics capable of meeting the evolving demands of the profession (Bell et al., 2020; Munro et al., 2019).

In Australia, bridge programs do exist in paramedicine education, offering vocational paramedics the opportunity to obtain a degree. These programs are designed to facilitate the transition from a vocational level to a degree level in paramedicine. They aim to recognize the experience and skills gained through vocational training while providing additional academic coursework to meet the requirements for a degree.

Bridge programs typically offer a pathway for vocational paramedics to earn credits for their prior learning and experience, which can then be applied toward the completion of a degree. This may involve a combination of credit transfer, recognition of prior learning (RPL), and additional coursework to meet degree requirements.

LINK BETWEEN EDUCATION AND PROFESSIONALISM

Paramedicine education is pivotal in shaping future professionals and is closely intertwined with professionalism (Hill & Eaton, 2023). Educational institutions serve as the guiding force in developing a paramedic's professional identity, providing the foundation upon which professionalism is built.

Acquiring clinical knowledge is paramount to linking education and professionalism (Reed et al., 2019). Paramedicine education encompasses a thorough understanding of anatomy, physiology, pharmacology, and medical procedures, enabling paramedics to make informed decisions during emergencies and effectively assess patient needs.

Ethics and professionalism are also central to paramedicine education, with institutions emphasizing ethical conduct, empathy, and communication (Townsend, 2017). This focus on values shapes the professional identity of paramedicine graduates and contributes to the overall professionalism of the field.

The transition from classrooms to workplaces is transformative for paramedicine students, marked by a shift from theoretical knowledge to practical application (Page et al., 2021; Sandy et al., 2021). Clinical placements and simulated scenarios provide hands-on experience, bridging the gap between theory and practice and enhancing competence and confidence in paramedic roles.

Educational institutions facilitate this transition by designing curriculum structures incorporating practical training, simulation exercises, and clinical placements (Alrazeeni et al., 2021). Experiential learning enhances students' ability to apply theoretical knowledge in dynamic situations, contributing significantly to their professionalism.

Furthermore, educational institutions nurture qualities such as teamwork, communication, and adaptability—essential traits for successful paramedics (Mulholland et al., 2019). Collaborative skills enable paramedics to work effectively within multidisciplinary healthcare environments, enhancing their professionalism.

Curriculum design reflects the evolving nature of healthcare, with institutions regularly updating programs to incorporate advancements in paramedicine (O'Meara et al., 2014). This ensures graduates have the latest knowledge and skills, enhancing their professionalism and adaptability to changing healthcare landscapes.

In addition to technical competence and ethical considerations, education instils a commitment to ongoing professional development (Law & Hui, 2020). Paramedicine students

are encouraged to engage in lifelong learning, staying updated on research, protocols, and technologies to maintain professionalism throughout their careers.

ETHICAL FOUNDATION AND PROFESSIONALISM

Education is the cornerstone for fostering a culture of professionalism in any field, particularly in professions like paramedicine, where ethical conduct, integrity, and a strong work ethic are paramount (Shearer et al., 2021). Accreditation for paramedicine education in Australia provides a contextual backdrop for understanding these concepts, highlighting the various educational pathways available for aspiring paramedics.

Professionalism in paramedicine encompasses a range of attitudes, behaviors, and skills essential for competent and ethical practice (Cao et al., 2023). A baccalaureate degree in paramedicine is expected to instill a foundation in ethics, crucial for meeting the professional requirements of registered paramedics (Shearer et al., 2021). Education programs for paramedics are designed to impart technical skills while nurturing a sense of responsibility, ethical awareness, and a commitment to maintaining integrity (Townsend & Luck, 2022).

Ethical considerations are integral to paramedicine, where rapid clinical judgment often impacts patient outcomes (Shearer et al., 2021). Education equips paramedics with the ethical framework for navigating complex scenarios, emphasizing patient autonomy, beneficence, non-maleficence, and justice (Shearer et al., 2021). Paramedic students engage in case studies, simulations, and ethical discussions to develop critical thinking skills for making sound ethical decisions under pressure (Andersson et al., 2022).

A strong work ethic is fundamental in the demanding field of paramedicine, where long hours, high-stakes situations, and unpredictable challenges are routine (Diamond & Bilton, 2021). Paramedicine education programs incorporate rigorous training to prepare students for the realities of the job, instilling discipline and resilience essential for thriving in such environments. This training reinforces the importance of diligence and commitment to excellence.

The development of accreditation for paramedicine education in Australia underscores the profession's commitment to maintaining high standards. Accredited university programs and vocational education and training (VET) courses offer diverse pathways for aspiring paramedics, guided by accreditation standards that emphasize ethical conduct, integrity, and a strong work ethic. These programs play a crucial role in shaping the future generation of paramedics by fostering a culture of professionalism through comprehensive education.

INTEGRATION OF EDUCATION AND PROFESSIONALISM

The symbiotic relationship between education and professionalism is evident, as education lays the foundation for knowledge and skills, while professionalism channels these attributes into effective and ethical actions, fostering holistic personal and professional growth.

Education provides the theoretical framework and intellectual capacity to understand complex concepts, fostering continuous learning and adaptability. Professionalism en-

sures individuals apply their knowledge with integrity and responsibility, positively contributing to their workplaces and society.

Higher education emphasizes theoretical understanding, critical thinking, and research abilities, preparing individuals for diverse professional opportunities. Vocational education focuses on practical skills and hands-on training, equipping individuals with technical expertise for specific roles.

A balanced approach integrates theoretical knowledge with practical skills, preparing individuals for diverse opportunities and fostering adaptability and commitment to excellence. This integration remains crucial for personal and societal progress in an evolving global landscape.

The paper explores the changing landscape of paramedicine education in Australia, focusing on accreditation development and diverse educational pathways. Vocational programs emphasize hands-on experience, producing workforce-ready paramedics efficiently. However, criticism arises regarding academic rigor and theoretical knowledge deficiencies, impacting critical decision-making abilities.

University programs emphasize theoretical knowledge and research skills, preparing students for leadership roles. Concerns include a potential lack of practical experience addressed through simulation-based education. A balanced approach, integrating theoretical knowledge with practical skills, ensures paramedics are well-equipped for the complexities of modern practice.

CONCLUSION

In conclusion, this study underscores the profound interconnection between education and professionalism within paramedicine, delineating the nuanced distinctions between higher education and vocational training. Recognizing their associated relationship is pivotal, extending beyond academic realms to encompass critical thinking skills, research acumen, and practical competencies.

Integral to individual and societal progress in paramedicine is integrating education and professionalism, addressing contemporary demands, and acknowledging the field's evolving nature. As paramedicine advances, the need for highly educated professionals becomes increasingly paramount, requiring individuals equipped to navigate its complexities.

Considering these findings, higher education is better positioned to offer a comprehensive and balanced approach than vocational education. Integrating theoretical knowledge with practical skills seamlessly surpasses the traditional dichotomy between academic and vocational pathways. Higher education uniquely prepares individuals for diverse professional opportunities within paramedicine, instilling adaptability, ethical grounding, and a commitment to excellence.

This paper thoroughly examines paramedicine education accreditation in Australia, detailing diverse educational routes for aspiring paramedics. Emphasizing the significance of upholding professional competence and ethical conduct, it highlights the transformative potential of higher education in shaping proficient and adaptable paramedicine professionals for the complex and dynamic future of the field.

RECOMMENDATIONS

The paper identifies several areas for potential research within paramedicine education in Australia. One notable area involves conducting a comparative analysis of accreditation standards. This research would evaluate how the recent shift towards a pre-employment model influences program content, particularly in balancing theoretical and practical components. Additionally, it aims to assess the impact of accreditation standards on the overall quality of paramedic education.

Another area of investigation could focus on the impact of ethical education on paramedic practice. Researchers would explore how ethics education within paramedicine programs shapes paramedics' decision-making processes and professional conduct. This inquiry seeks to determine whether a robust ethical foundation acquired during education translates into ethical practices in real-world scenarios.

A comparative study of international models could provide comprehensive insights into paramedicine education. This research will concentrate on countries with healthcare systems similar to Australia's, examining the strengths and weaknesses of different education models, especially concerning the balance between theoretical and practical components. Identifying best practices from international models could enhance paramedic education in Australia.

Additionally, assessing the impact of accreditation changes in 2018, specifically, the shift in accreditation responsibilities from the Council of Ambulance Authorities to the Paramedicine Board of Australia is crucial. This investigation would determine how this change has influenced the quality and consistency of paramedicine education across various institutions, offering valuable insights for ongoing improvements in the accreditation process.

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International Journal of Paramedicine

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LITERATURE SURVEILLANCE

PARAMEDICINE CONTENTS: MARCH-MAY 2024

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To help paramedicine professionals keep current with the literature in our discipline, the 'Paramedicine Contents' section shares recent tables of contents of scholarly journals that are primarily focused on the paramedicine discipline.

JOURNAL OF EMS MEDICINE

https://jemsmed.org

Volume 3, Issue 2, May 2024

Video versus Macintosh laryngoscopes for prehospital tracheal intubation in Japan: a propensity score matching analysis. Nobuo Santou, Hiroki Ueta, Sinji Kusunoki, Takuma Sadamori, Hiroshi Takyu, Hideharu Tanaka. https://doi.org/10.35616/jemsm.2023.00024

Time perception in the management of out-of-hospital cardiac arrest. Gilda Bernhart, Hala Ashraf, Amir Louka. https://doi.org/10.35616/jemsm.2023.00073

Effects of the COVID-19 pandemic and the introduction of information and communication technology in emergency scenes on the emergency transport environment in Japan. Masashi Horiguchi, Hideharu Tanaka, Hiroshi Takyu, Hiroki Ueta, Ryo Sagisaka. https://doi.org/10.35616/jemsm.2023.00031

Delayed distal thoracic esophageal perforation secondary to blunt trauma: a case report. Epifanus Arie Tanot, Sri Wahyuni, Harry Soedjatmiko. https://doi.org/10.35616/jemsm.2022.00045

JOURNAL OF PARAMEDIC PRACTICE

https://www.paramedicpractice.com

Volume 16, Issue 3, March 2024

(not available)

Volume 16, Issue 4, April 2024

Going green. Aysha Mendes. https://www.paramedicpractice.com/content/editorial/going-green

ECG case series for paramedics: April 2024. Charles Bloe. https://www.paramedicpractice.com/content/ecg-case-series/ecg-case-series-for-paramedics-april-2024

Spotlight on Research. Pete Gregory. https://www.paramedicpractice.com/content/spotlight-on-research/spotlight-on-research-28

Support from advanced practitioners in critical care for ankle fracture dislocation. Craig Morrison, Linda Renfrew, Ryan McHenry. https://www.paramedicpractice.com/content/research/support-from-advanced-practitioners-in-critical-care-for-ankle-fracture-dislocation

Perceptions of establishing advanced life support for out-of-hospital cardiac arrest. Craig Wilkins. https://www.paramedicpractice.com/content/research/perceptions-of-establishing-advanced-life-support-for-out-of-hospital-cardiac-arrest

Technology commitment of emergency medical service practitioners and dispatchers. Christian Elsenbast, Vera Hagemann. https://www.paramedicpractice.com/content/research/technology-commitment-of-emergency-medical-service-practitioners-and-dispatchers

Hidden layers: neurodiversity in paramedicine. Brian Sengstock. https://www.paramedicpractice.com/content/paramedic-diversity/hidden-layers-neurodiversity-in-paramedicine

Prehospital serratus anterior plane block for rib fractures. Stuart Abel, Tom Mallinson. https://www.paramedicpractice.com/content/comment/prehospital-serratus-anterior-plane-block-for-rib-fractures

Placement expectations. Ellie Workman. https://www.paramedicpractice.com/content/student-column/placement-expectations

Prepping for practice. Alice Cochrane, https://www.paramedicpractice.com/content/nqp-perspective/prepping-for-practice

Settling into a new pace. Jennifer Green. https://www.paramedicpractice.com/content/paramedic-transitions/settling-into-a-new-pace

Volume 16, Issue 5, May 2024

On the page. Aysha Mendes. https://www.paramedicpractice.com/content/editorial/on-the-page

ECG case series for paramedics: May 2024. Charles Bloe. https://www.paramedicpractice.com/content/ecg-case-series/ecg-case-series-for-paramedics-may-2024

Ethical dilemmas: a student reflection on safeguarding in adult domestic abuse. Will Hird. https://www.paramedicpractice.com/content/education/ethical-dilemmas-a-student-reflection-on-safeguarding-in-adult-domestic-abuse

A need for national oversight in ambulance AI integration. Joe Frankland. https://www.paramedicpractice.com/content/minds-and-machines/a-need-for-national-oversight-in-ambulance-ai-integration

Prehospital management of sepsis with IV antibiotics: a UK literature review. Patryk Jadzinski, Sarah Fouch, Chris Markham, Rebecca Stores. https://www.paramedicpractice.com/content/clinical-practice/prehospital-management-of-sepsis-with-iv-antibiotics-a-uk-literature-review

JOURNAL OF PARAMEDICINE AND EMERGENCY RESPONSE

https://www.ipress.tw/J0233

2024, Issue 5

Sharing an experience of prehospital care for an extremely preterm labor with an en caul birth. Chih-Nan Wang, Shih-Tien Pan. https://www.airitilibrary.com/Article/Detail/P20210804002-N202405290012-00001

PARAMEDICINE

https://journals.sagepub.com/home/PAM

Volume 21 Issue 2, March 2024

Paramedicine education: Navigating moments for transformation through research. Walter Tavares. https://doi.org/10.1177/27536386241232670

Prehospital administration of antibiotics in addition to usual care versus usual care alone for patients with suspected sepsis – a systematic review. Maddison Jayne Poynter, Ashley Farrugia, Elisabeth Kelly and Paul M Simpson. https://doi.org/10.1177/27536386231207055

Development of an international prehospital CPR-induced consciousness guideline: A Delphi study. Jack Howard, Eystein Grusd, Don Rice, Nikiah G. Nudell, Carlos Lipscombe, Matthew Shepherd and Alexander Olaussen. https://doi.org/10.1177/27536386231215608

Chronic pain in the paramedic practice setting – a qualitative study of patients' perspective. Lucinda Peacock, Rachel Lewandowsky, Kelly Ann-Bowles, Bill Lord and Tim Andrews. https://doi.org/10.1177/27536386231220966

Volume 21 Issue 3, May 2024

Portrayals of a profession: Reflecting on media depictions of paramedics. Tania Johnston, Cheryl Cameron and Alan M. Batt. https://doi.org/10.1177/27536386241244786

Research agenda and priorities for Australian and New Zealand paramedicine: A Delphi consensus study. Robin Pap, Nigel Barr, Amy Hutchison, Peter O'Meara, Paul Simpson, Matthew Reardon, Harry Reeves, Louise Reynolds, Michelle Thomson and Linda Ross. https://doi.org/10.1177/27536386241231666

Invited commentary – A research agenda for paramedicine. Bill Lord. https://doi.org/10.1177/27536386241242814

Descriptive before-and-after study of the introduction of a 'Leave Behind' take-home naloxone dispensing/distribution program by the ambulance service in Western Australia. Hideo Tohira, Rudolph Brits, Simon Lenton, Seraina Agramunt, Deon Brink, Curtis Naylor, Jason Belcher, Stephen Ball and Judith Finn. https://doi.org/10.1177/27536386231222283

A document analysis of clinical guidelines for the paramedic management of obstetric and neonatal presentations in Australian and New Zealand ambulance services. Belinda Flanagan, Nigel Barr, James Pearce and Kathryn Eastwood. https://doi.org/10.1177/27536386231223761

PREHOSPITAL AND DISASTER MEDICINE

https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine

VOLUME 39 - ISSUE 1 – FEBRUARY 2024

"Smart Emergency Call Point" Enhancing Emergency Medical Services on University Campuses. Korakot Apiratwarakul, Lap Woon Cheung, Chatkhane Pearkao, Dhanu Gaysonsiri, Kamonwon Ienghong. https://doi.org/10.1017/S1049023X23006647

A Novel Algorithm for Improving the Prehospital Diagnostic Accuracy of ST-Segment Elevation Myocardial Infarction. Mat Goebel, Lauren M. Westafer, Stephanie A. Ayala, El Ragone, Scott J. Chapman, Masood R. Mohammed, Marc R. Cohen, James T. Niemann, Marc Eckstein, Stephen Sanko, Nichole Bosson. https://doi.org/10.1017/S1049023X23006635.

High-Flow Nasal Cannula versus Bag Valve Mask for Preoxygenation during Rapid Sequence Intubation in the Emergency Department: A Single-Center, Prospective, Randomized Controlled Trial. Muhammed Fatih Cırıl, Mustafa Akarca, Ebru Unal Akoglu, Tuba Cimilli Ozturk, Özge Onur. https://doi.org/10.1017/S1049023X23006684.

Nation-Wide Variation in Presence of Legislation or Protocols for EMS Care of Operational Canines. David W. Schoenfeld, Caroline E. Thomas, Lee Palmer, William Justice, Esther Hwang, Kate D. Zimmerman, Jeffrey M. Goodloe, Jonathan D. Shecter, Stephen H. Thomas. https://doi.org/10.1017/S1049023X24000074.

Description of the Public Safety Medical Response and Patient Encounters Within and During the Indianapolis (USA) Spring 2020 Civil Unrest. Thomas P. Arkins, Mark Liao, Daniel O'Donnell, Nancy Glober, Gregory Faris, Elizabeth Weinstein, Michael W. Supples, Julia Vaizer, Benton R. Hunter, Thomas Lardaro. https://doi.org/10.1017/S1049023X24000025.

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Using High-Fidelity Virtual Reality for Mass-Casualty Incident Training by First Responders – A Systematic Review of the Literature. Sara Heldring, Maria Jirwe, Jonas Wihlborg, Lukas Berg, Veronica Lindström. https://doi.org/10.1017/S1049023X24000049.

Redesigning Prehospital Care: Fiji's Response to the COVID-19 Pandemic. Anne Creaton, Ilikini Naitini, Lemecki Lenoa. https://doi.org/10.1017/S1049023X24000037.

Volume 39 - Issue 2 – April 2024

Emergency Medical Services Protocols for Assessment and Treatment of Patients with Ventricular Assist Devices. Emily L. Larson, JiWon Woo, Gyeongtae Moon, Kathy Liu, Matthew Vergel , Reed Jenkins, Kelly Jiang, Zachary Darby, Asa Margolis, Ahmet Kilic. https://doi.org/10.1017/S1049023X2400013X.

Comparative Analysis of META and SALT Disaster Triage in an Adult Trauma Population: A Retrospective Observational Study. Gawin Tiyawat, J. Marc Liu, Thongpitak Huabbangyang, Cesar Luis Roza-Alonso, Rafael Castro-Delgado. https://doi.org/10.1017/S1049023X24000098.

Early Vital Sign Thresholds Associated with 24-Hour Mortality among Trauma Patients: A Trauma Quality Improvement Program (TQIP) Study. Michael D. April, Andrew D. Fisher, Julie A. Rizzo, Franklin L. Wright, Julie M. Winkle, Steven G. Schauer. https://doi.org/10.1017/S1049023X24000207.

Bleeding Control Protections Within US Good Samaritan Laws. Matthew J. Levy, Christopher M. Wend, William P. Flemming, Antoin Lazieh, Andrew J. Rosenblum, Candace M. Pineda, Douglas M. Wolfberg, Jennifer Lee Jenkins, Craig A. Goolsby, Asa M. Margolis. https://doi.org/10.1017/S1049023X24000268.

Paramedics' Success and Complications in Prehospital Pediatric Intubation: A Meta-Analysis. Faisal A. AlGhamdi, Nasser A. AlJoaib, Abdulaziz M. Saati, Mishal A. Abu Melha, Mohammad A. Alkhofi. https://doi.org/10.1017/S1049023X24000244.

Adverse Effects After Prehospital Administration of Naloxone by Bystanders: A Preliminary Study. Daniel Du Pont, Rebecca Fenderson, Krystal Hunter, Alexander Kuc, Gerard Carroll. https://doi.org/10.1017/S1049023X24000128.

Components of an Updated Disaster Medicine Curriculum Included in Emergency Medicine Residency and Emergency Medical Services Fellowship in the United States. Sara P. Sandifer, Bryan J. Wexler, Avram Flamm. https://doi.org/10.1017/S1049023X24000165.

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PREHOSPITAL EMERGENCY CARE

https://www.tandfonline.com/journals/ipec20

Volume 28, Issue 4

Comparison of Intubating Conditions with Succinylcholine Versus Rocuronium in the Prehospital Setting. JT Ramsey, Killian M. Pache, Michael R. Sayre, Charles Maynard, Nicholas J. Johnson & Catherine R. Counts. https://doi.org/10.1080/10903127.2023.2285399

Evidence-Based Guideline for Prehospital Airway Management. Jeffrey L. Jarvis, Ashish R. Panchal, John W. Lyng, Nichole Bosson, Joelle J. Donofrio-Odmann, Darren A. Braude, Lorin R. Browne, Michael Arinder, Scott Bolleter, Toni Gross, Michael Levy, George Lindbeck, Lauren M. Maloney, Connie J. Mattera, Cheng-Teng Wang, Remle P. Crowe, Christopher B. Gage, Eddy S. Lang & J. Matthew Sholl. https://doi.org/10.1080/10903127.2023.2281363

Editorial: Prehospital Airway Management – the Continued Search for Evidence. Henry E. Wang. https://doi.org/10.1080/10903127.2023.2281361

Evidence-Based Guidelines for Prehospital Airway Management: Methods and Resources Document. Christopher B. Gage, Jonathan R. Powell, Nicole Bosson, Remle Crowe, Kyle Guild, Matthew Yeung, Davis Maclean, Lorin R. Browne, Jeffrey L. Jarvis, J. Matthew Sholl, Eddy S. Lang, Ashish R. Panchal & , on behalf of the Technical Expert Panel. https://doi.org/10.1080/10903127.2023.2281377

Prehospital Use of Waveform Capnography in Intubated Neonates. Krista Hartmann, Brittney Calatayud & Avram Flamm. https://doi.org/10.1080/10903127.2024.2309214

Is a Positive Prehospital FAST Associated with Severe Bleeding? A Multicenter Retrospective Study. Grace Stralec, Camille Fontaine, Sarah Arras, Keryann Omnes, Hamza Ghomrani, Pablo Lecaros, Philippe Le Conte, Frederic Balen & Xavier Bobbia. https://doi.org/10.1080/10903127.2023.2272196

The Impact of Out-of-Hospital Time and Prehospital Intubation on Return of Spontaneous Circulation following Resuscitative Thoracotomy in Traumatic Cardiac Arrest. Nada Radulovic, Morgan Hillier, Rosane Nisenbaum, Linda Turner & Brodie Nolan. https://doi.org/10.1080/10903127.2023.2285390

Hemorrhagic Shock in Isolated and Non-Isolated Pelvic Fractures: A Registries-Based Study. Amir Gottfried, Sami Gendler, David Chayen, Irina Radomislensky, Ilan Y. Mitchnik, Israel Trauma Group, Elad Epshtein, Avishai M. Tsur, Ofer Almog & Tomer Talmy. https://doi.org/10.1080/10903127.2024.2322014

Ambulance Traffic Crashes in Japan: Characteristics of Casualties and Efforts to Improve Ambulance Safety. Tatsuya Norii, Shunichiro Nakao, Tomoyuki Miyoshi, Tetsuo Hatanaka, Tasuku Miyake, Aya Okunaga, Danielle Albright, Darren Braude, David P. Sklar, MingAn Yang & Cameron Crandall. https://doi.org/10.1080/10903127.2024.2315946

The Effect of Commencing Rotating Shift Work on Diet and Body Composition Changes in Graduate Paramedics: A Longitudinal Mixed Methods Study. Angela B. Clark, Alison M. Coates, Tammie Choi, Ben Meadley, Kelly-Ann Bowles & Maxine P. Bonham. https://doi.org/10.1080/10903127.2023.2249532

Cancer Risks among Emergency Medical Services Workers in Ontario, Canada. Jeavana Sritharan, Paul A. Demers, Fanni R. Eros, Colin Berriault, Mamadou Dakouo & Tracy L. Kirkham. https://doi.org/10.1080/10903127.2023.2283079

The Female Emergency Medical Services Experience: A Mixed Methods Study. Molly McCann-Pineo, Meghan Keating, Tara McEvoy, Mikayla Schwartz, Rebecca M. Schwartz, Jonathan Washko, Elizabeth Wuestman & Jonathan Berkowitz. https://doi.org/10.1080/10903127.2024.2306248

Understanding the Role of Empathy and Gender on EMS Clinician Occupational Stress and Mental Health Outcomes. Mikayla Schwartz, Jonathan Berkowitz & Molly McCann-Pineo. https://doi.org/10.1080/10903127.2024.2319139

Wilderness Paramedic—A Practice Analysis. Jeffrey T. Thurman, Seth C. Hawkins, David Fifer, John R. Clark & Benjamin Abo. https://doi.org/10.1080/10903127.2023.2281372

Brugada Syndrome as an Underlying Diagnosis for a Prehospital Seizure Dispatch. Kristopher Bianconi, Wayne Zielinski, Scott Fischer, Jenna Ferlazzo, Matthew Steenberg & Navin Ariyaprakai. https://doi.org/10.1080/10903127.2023.2285387

Methodology for Evidence Evaluation and Reporting of the NAEMSP Trauma Compendium Position Statements. Christian Martin-Gill & John W. Lyng. https://doi.org/10.1080/10903127.2024.2329217

Position Statement: Expert Witness Qualifications and Ethical Guidelines for Emergency Medical Services Litigation. W. Ann ("Winnie") Maggiore, Ryan C. Jacobsen & Douglas F. Kupas. https://doi.org/10.1080/10903127.2024.2325634

VOLUME 28, ISSUE 5

Prehospital Shock Index Multiplied by the Alert/Verbal/Painful/Unresponsive Score as a Predictor of Clinical Outcomes in Traumatic Injury. Po-Chen Lin, Meng-Yu Wu, Chien-Hsing Wang, Tou-Yuan Tsai, Yueh-Cheng Tu, Chi-Yuan Liu, Shu-Jui Lee, Chia-Hung Tsai, Jui-Yuan Chung & Giou-Teng Yiang. https://www.tandfonline.com/doi/epub/10.1080/10903127.2024.2362921

Pharmacokinetics of Tranexamic Acid (TXA) Delivered by Expeditious Routes in a Swine Model of Polytrauma and Hemorrhagic Shock. Mallori Wilson, Sean Stuart, Brittany Lassiter, Timothy Parker Jr., Clyde Martin III, Robert Healy, Christopher Treager, Eric Sulava, Lorie Gower, Pravina Fernandez & Emily Friedrich. https://doi.org/10.1080/10903127.2024.2342025

Shock Index as a Predictor of Mortality and Hospital Admission in Prehospital Gastrointestinal Bleeding: A Retrospective Cohort Study. Joshua Lowe, Zachariah Lowe & Rachel Ely. https://doi.org/10.1080/10903127.2024.2331739

Results of a Quality Improvement Initiative to Increase the Completion Rate of Electronic Health Records for Patient Encounters at a Large Urban Fire-Based Non-Transporting EMS Agency. Rick A. Allgood, Gregory W. Faris, Michael Supples, Thomas Lardaro & Remle P. Crowe. https://doi.org/10.1080/10903127.2023.2227980

Do EMS Physicians Delay On-Scene Times for HEMS Crews? Krishna Patel, Kevin Young, Blake Miller & Timothy Lenz. https://doi.org/10.1080/10903127.2023.2266011

Transport Rates and Prehospital Intervals for an EMS Telemedicine Intervention. Renoj Varughese, Mitchell Cater-Cyker, Rupa Sabbineni, Sara Sigler, Sara Champoux, Mark Gamber, Susan J. Burnett, Gerad Troutman, Chan Chuang, Richard Sanders, John Doran, Nushin Nataneli, Derek R. Cooney, Joshua A. Bloomstone & Brian M. Clemency. https://doi.org/10.1080/10903127.2023.2266023

Elimination of Emergency Department Ambulance Divert during the COVID-19 Pandemic Was Not Associated with an Increase in the Average Number of Ambulance Arrivals per Day. Aaron M. Burnett, Kari B. Haley, Matthew F. Milder, Bjorn K. Peterson, Joey Duren, Andrew Stevens, Danielle M. Hermes, Paul Nystrom, Joseph Lippert, Jennifer L. Moberg & Kurt M. Isenberger. https://doi.org/10.1080/10903127.2023.2271567

A National Assessment of EMS Performance at the Response and Agency Level. Michael Redlener, David G. Buckler, Samuel E. Sondheim, Sai Kaushik Yeturu, George T. Loo, Kevin G. Munjal, Jeffrey Jarvis & Remle P. Crowe. https://doi.org/10.1080/10903127.2023.2283886

Prehospital Extended FAST Exams Improve Clinical Decision Making by Helicopter EMS Crews: A Retrospective Case Series. Benjamin Smith, Daniel Willner, William Roper & Christopher McGrath. https://doi.org/10.1080/10903127.2024.2320746

Rural Emergency Medical Services Clinicians' Perceptions and Preferences in Receiving Clinical Feedback From Hospitals: A Qualitative Needs Assessment. Katherine Schneider, Mimi Williams, Nicholas M. Mohr & Azeemuddin Ahmed. https://doi.org/10.1080/10903127.2024.2324970

Editorial: "Head Up CPR" Is Not Ready for Widespread Adoption. Jeffrey L. Jarvis, Michael R. Sayre, Remle P. Crowe, James J. Menegazzi & Henry E. Wang. https://doi.org/10.1080/10903127.2024.2319697

Letter to the Editor: Head Up Position CPR: A Complementary Option for Out-of-Hospital Cardiac Arrest. Keith Lurie, Johanna Moore, Jeffrey Goodloe, Joseph Holley, Randy Porter, Ross Campensa & Kerry Bachista. https://www.tandfonline.com/doi/full/10.1080/10903127.2024.2359506

Letter to the Editor: Delta Shock Index: Enhancing Prehospital Assessment of Gastrointestinal Bleeding. Yalcin Golcuk. https://www.tandfonline.com/doi/full/10.1080/10903127.2024.2341413

Letter to the Editor: In Response to Dr. Golcuk RE: Delta Shock Index: Enhancing Prehospital Assessment of GI Bleeding. Joshua Lowe. https://doi.org/10.1080/10903127.2024.2343396

SOUTH AFRICAN JOURNAL OF PRE-HOSPITAL EMERGENCY CARE

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International Journal of Paramedicine

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LITERATURE SURVEILLANCE

PARAMEDICINE LITERATURE SEARCH: MARCH-MAY 2024

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Keywords: literature search, emergency medical services, EMS, paramedicine

To help paramedicine professionals to keep abreast of the literature in our discipline, the Paramedicine Literature Search provides the results of a standardized search of the PubMed database. This search results will include articles from journals that many paramedicine professionals may already be familiar with. The search strategy is also designed to include articles in journals they may not be commonly monitoring, such as an article about ambulance care for cancer patients that appeared in an oncology journal.

The formatting of the Paramedicine Literature Search allows the reader to scan the titles of articles and click into the article link, when provided, for additional details.

The authors have made a diligent effort in designing of the search strategy to balance sensitivity (i.e., getting all relevant articles in paramedicine) with the specificity (i.e., excluding articles not relevant to paramedicine). The balance is imperfect. As a result, it should be noted that the results do not include every relevant article and includes some non-relevant articles.

The search strategy is filtered to only include articles published in a time frame listed below. This will include articles with electronic and print publication dates in that date range. Some of the publication dates may fall outside of this range due to how the article metadata was indexed by the publisher.

The following results were obtained on July 2, 2024 from the PubMed website (https://pubmed.ncbi.nlm.nih.gov) using the following search terms and Boolean logic:

"paramedic"[Text Word] OR "paramedics"[Text Word] OR "pre-hospital"[Text Word] OR "pre-hospital"[Text Word] OR "emergen-

cy medical technician"[Text Word] OR "emergency medical technicians"[Text Word] OR "Ambulance"[Text Word] OR "emergency medical services"[Text Word] OR "fire-rescue"[-Text Word] OR "fire-rescue"[Text Word]

Search Filter: Publication range of March 1, 2024 to May 30, 2024.

Global stroke statistics 2023: Availability of reperfusion services around the world. Kim J. Int J Stroke. 2024 Mar;19(3):253-270. doi: 10.1177/17474930231210448. Epub 2024 Jan 1.. https://doi.org/10.1177/17474930231210448

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International Journal of Paramedicine

Published by the National EMS Management Association (USA)

GUIDELINES FOR AUTHORS

The *International Journal of Paramedicine* (*IJOP*) is a forum for scholarly contributions and state-of-the-art research relevant to patient care and the growth and advancement of paramedicine, including the areas of paramedic leadership, management, education, operations, culture, professional and clinical practice. The *IJOP* encourages exploration of paramedicine from diverse theoretical and practical views from all disciplines, including business and economics; the natural, basic, and applied sciences; and the humanities, social sciences, and arts. Priority will be given to submissions that use sound theoretical or conceptual frameworks, strong methodological design, and relevance to the international paramedic community. All methodologies such as quantitative, qualitative, mixed methods, and knowledge syntheses will be considered.

NEMSMA is a longtime collaborator with National Association of EMS Physicians in support of *Prehospital Emergency Care*. In continuation of that relationship, IJOP and PEC have established a collaborative relationship that will the facilitate the exchange of submissions in certain circumstances based in part on which journal may be the best fit for a particular manuscript.

GENERAL GUIDELINES AND NOTES

- The *IJOP* only publishes material in English. Please use Academic English.
- The *IJOP* accepts submissions in the following categories:
  - Case Studies (2,000 words)
  - Concepts (3,000 words)
  - Correspondence / Commentary (1,000 words)
  - Education (3,000 words)
  - Empirical Investigations / Original Research (4,500 words)
  - Methodology (2,000 words)
  - Quality Improvement Project Reports (3,000 words)
  - Reviews / Synthesis (4,000 words)
  - Special Reports (2,000 words)
  - Toolbox (1,500 words)

The word limits noted above are guidelines for the various submission types. Authors are encouraged to adhere to these guidelines and to be concise in their submissions.

- Merriam-Webster's Collegiate Dictionary (11th ed.) should be consulted for spelling.
- Contributions that explore non-clinical topics such as leadership, operations, education, professional practice, and the culture of paramedicine are strongly encouraged.
- Based on the international scope of the *IJOP*, contributions should provide a degree of generalizability and transferability to global settings and should have relevance to the *IJOP's* broad readership.
- *IJOP* discourages multiple publications derived from a single study.
- All original research submissions must have received approval from an Institutional Research Board (IRB) or Research Ethics Board (REB).
- Once a submission has been assessed for suitability by the editorial team, it will undergo a double-blind peer-review by independent, anonymized reviewers.

As part of the submission process, authors will be required to confirm that their submission complies with all of the items below. Submissions may be returned that do not adhere to these guidelines:

- The submission cannot be previously published or in the submission process of another publication (or an explanation has been provided in a cover letter to the Editor).
- The Author and Funding File and the Main Submission File are both in Microsoft Word document file format.
- An ICMJE Form for Disclosure of Potential Conflicts of Interest is submitted for each author.
- All illustrations, figures, and tables should be placed within the text at the appropriate points AND submitted as separate files in a high resolution format.
- Supplemental media files (e.g., spreadsheets, slides, audio or video files) may be included for reader access. The file should be hosted by the authors unless other arrangements have been made with the Editors.
- Where available, URLs for each reference have been provided.
- The text is double-spaced in a 12-point font.
- Page numbers and line numbering are used for the 'Main Submission File'
- The text adheres to the stylistic and bibliographic requirements outlined.
- Authors are strongly encouraged to follow any EQUATOR (Enhancing the QUAlity and Transparency Of health Research) Guidelines that apply to their type of submission. These include, but are not limited to:
    - Randomized trials
        - CONSORT and its extensions
            - https://www.equator-network.org/reporting-guidelines/consort/
    - Observational studies
        - STROBE and its extensions
            - https://www.equator-network.org/reporting-guidelines/strobe/
    - Systematic reviews
    - PRISMA and its extensions
        - https://www.equator-network.org/reporting-guidelines/prisma/
    - Study protocols
        - SPIRIT and the PRISMA-P extension
            - https://www.equator-network.org/reporting-guidelines/spirit-2013-statement-defining-standard-protocol-items-for-clinical-trials/
    - Diagnostic/prognostic studies
        - STARD and the TRIPOD extension
            - https://www.equator-network.org/reporting-guidelines/stard/
    - Case reports
        - CARE and its extensions
            - https://www.equator-network.org/reporting-guidelines/care/
    - Clinical practice guidelines
        - AGREE and the RIGHT extension
            - https://www.equator-network.org/reporting-guidelines/care/
    - Qualitative research
        - SRQR and the COREQ extension
            - https://www.equator-network.org/reporting-guidelines/srqr/

- Animal pre-clinical studies
  - ARRIVE
    - https://www.equator-network.org/reporting-guidelines/improving-bioscience-research-reporting-the-arrive-guidelines-for-reporting-animal-research/
- Quality improvement studies
  - SQUIRE and its extensions
    - https://www.equator-network.org/reporting-guidelines/squire/
- Economic evaluations
  - CHEERS
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Note that there is a section in EQUATOR with guidelines specific to emergency medicine that may also be applicable to studies in paramedicine.

SUBMISSION FILES

The following describes the 'standard' submission files that should be uploaded via the *Journal* submission website for each manuscript. Please refer to the specific submission guidelines for each submission category for more specific instructions that may apply.

Author and Funding Information File

Author Information

- All authors of a manuscript should provide their full name with up to four post-nominals and up to two organizational affiliations and titles – exactly as they should appear in the publication.
- The email of all authors should also be included.
- If available, please include ORCiDs (http://orcid.org) numbers for each author.
- You also include social media handles (e.g., Facebook, Twitter, LinkedIn) for each author.
- Please ensure that everyone who meets the International Committee of Medical Journal Editors (ICMJE) requirements for authorship is included as an author (http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html).
- If an author changes their affiliation during the peer-review process, the new affiliation information can be given to the Editorial Team and will be handled as any other manuscript revision. Please note that no changes to affiliation can be made after the pre-publication galleys of the manuscript have been accepted for final publication.
- Identify one author as the corresponding author. They will be shown as such when the article is published and will be the point of contact between the editorial team and the authors.
- If the work presented in the manuscript was presented at conference or published in abstract form, identify the name of the event, location, format, and date of presentation.
- Acknowledgements, where applicable, can be provided. Brevity is strongly encouraged.

Funding Information

- Please provide the details for any funding that supported the submitted work, to include all details required by your funding and grant-awarding bodies. The following template sentences are suggested:
  - For single agency grants: This work was supported by the [Funding Agency] under Grant [number xxxx].
  - For multiple agency grants: This work was supported by the [Funding Agency #1] under Grant [number xxxx]; [Funding Agency #2] under Grant [number xxxx]; and [Funding Agency #3] under Grant [number xxxx].
  - If a funding source was not involved, please confirm with a statement such as, "External funding was not used to support this work."

Main Submission File

To provide a high level of objectivity in the peer-review process *IJOP* uses a double blind process. The identities of the authors and their institutions are not revealed to the reviewers and the identifies of the reviewers are not revealed to the authors.

Due to the double blind review process, information about the authors and their institutions should not appear anywhere in the main submission file. This should include removal of identifying information in the 'properties' of the Microsoft Word (.doc or .docx) files that are submitted.

Please do not use extensive formatting of the document. Use single spaces between sentences. Separate paragraphs with a carriage return. Do not indent the first line paragraphs with tabs or added spaces.

Unless stated otherwise in the directions for a specific manuscript category, all submissions should include the following elements in the following order as a single document file, called the Main Document File.

Title

- Provide the suggested title for the published article. Please note that the title used for publication is subject to editorial team approval.

Abstract, Keywords, Disclosures / Conflicts, Presentations, and Acknowledgements

- Unless exempted or described differently in the directions for a specific submission category, abstracts MUST be limited to 300 words or less, including the section headers (e.g., Problem, Methods, etc.). Use structured abstracts when possible.
- Unless exempted or described differently in the directions for a specific submission category, this page will also include between three (3) and six (6) keywords or short phrases that will be used for title and search engine optimization. Keywords of paramedicine, EMS, and emergency medical services will be added by default and will not count towards the keyword count requirements.
- State any disclosures or conflicts for each author. This will be in addition to completion of the ICMJE Disclosure Forms for each author as described below. If the are no conlficts, please state 'none.'

Primary Manuscript Body

- The primary body of the manuscript will come next in the main submission file. The composition of the primary body of the manuscript may vary with the category of the manuscript. Refer to specific manuscript category descriptions for details.
- The manuscript should use a minimum of formatting. If there are multiple levels of heading and sub-headings, please indicate the heading level by placing (H1) directly after the heading text for the top level heading, H2 for sub-headings, H3 for sub-sub headings, etc.
- Tables should be used to summarize large amounts of information rather than writing it out as a narrative. Tables may be created within the word processor or inserted from another program (e.g., Excel). If another program is used to create the table, please include the original source file as a supplementation media file submission. All tables should be inserted into this primary manuscript body file. They must be labelled sequentially, and referred to in the text. Table captions must include the table number and a name for the table at a minimum. Additional descriptive text may be added to the caption as needed to complement the reference to the table in the main body of the paper.
- Figures shall be inserted directly into the text at the appropriate position. These may be lower resolution images to simply show their correct placement. Figures must be labelled sequentially and referred to in the text. Figure captions must be included with the figure number and a name for the figure at a minimum. Additional descriptive text may be added to the caption as needed to complement the reference to the figure in the main body of the paper. In addition to including figures in the text, submit each figure as a supplemental media files in high resolution PDF, .jpeg, .tiff, or .png file formats, with a 300dpi minimum resolution.

References

- Where applicable, the references for the manuscript come next. Use endnotes rather than footnotes. The APA style in-text reference marks and in endnotes must be used.
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- Where applicable, any appendices to the manuscript are inserted next.

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- One form per author should be submitted.
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- If the submission includes any supplemental tables or figures, they would be each be uploaded individually for inclusion at the end of the article.
- For speadsheets used to generate tables, upload them as individual files and clear-

ly indicate which table they are associated with.
- If there are any supplemental media files (e.g., spreadsheets, slide decks, audio or video files), provide links to where readers can access them. They must be readily accessible without passwords or other restrictions.

GUIDELINES FOR CATEGORY-SPECIFIC SUBMISSIONS

Case Reports (≤2,000 words)

- These manuscripts share the experience of unusual clinical presentations, circumstances, or treatment approaches. Case reports should be structured as described in the Consensus-based Clinical Case Reporting Guideline (CARE; https://www.equator-network.org/reporting-guidelines/care/).

Concepts (≤3,000 words)

- These papers present a specific management or clinical concept, idea, or theory – and describes its practical application. If the paper presents a new concept, it may also suggest research, improvement projects, or pilot implementations of its application. Along with other standard submission file elements, the primary manuscript body pages file for Concept papers should contain:
  - Introduction - The introduction should describe the problem, issue, or circumstance that the concept is intended to address. Where applicable, address the current literature that demonstrates a gap and any pertinent background information.
  - Concept Description – Provide a description of the concept and how it can be applied. Where applicable, provide sufficient detail and clarity of any methods or procedures and the setting and population to which the concept applies.
  - Discussion - Authors are encouraged to include a critical review of related research and a fulsome discussion that highlights how the concept contributes to the field of paramedicine. Address any limitations of the concept.

Dialogues (≤1,000 words)

- The Dialogues section will publish comments and questions from readers related to previously published articles. Along with other standard submission file elements, the primary manuscript body pages file for correspondence should include:
  - Subject Paper Information - Provide the title, name of the first author, and the *IJOP* issue for the paper that is the subject of the correspondence.
  - The narrative of the correspondence.

Editorials (≤2,000 words)

- Editorials are a venue for the expression of opinion and perspective on topics relevant to the paramedicine community. They should make clear point(s) in a concise manner with a scholarly approach and tone. They should not be used for the presentation of data, findings, or research that has not been previously published.

Educational Methods and Processes (≤3,000 words)

- These submissions explore a specific educational process, approach, or method. The paper should also discuss any issues to consider in its practical application.

Along with other standard submission file elements, the primary manuscript body pages file for Education papers should contain:

- Introduction - The introduction should describe the problem, issue, or circumstance that the educational process, approach, or method is intended to address. Where applicable, address the current literature that demonstrates a gap and any pertinent background information.
- Description – Provide a description of the educational process, approach, or method and how it can be applied. Where applicable, provide sufficient detail and clarity of any methods or procedures and the setting and population to which the process, approach or method applies.
- Discussion - Authors are encouraged to include a critical review of related research and a fulsome discussion that highlights how the concept contributes to the field of paramedicine. Address any limitations of the concept.

Empirical Investigations / Original Research (≤4,500 words)

- The submission of manuscripts for empirical investigations / original research may be clinical or non-clinical. Several of the EQUATOR guidelines, described previously, may apply to any given study in this category. Please apply them as appropriate to your particular investigation.
- Authors may provide, or editors may suggest, that some information be provided as a supplemental file so that the main paper remains concise. The supplemental content may include data sets, images, video clips, and in-depth details on methodology. Along with other standard submission file elements, the primary manuscript body pages file for empirical investigations / original research should include elements as called for in the applicable EQUATOR guidelines.
- NEMSMA is a longtime collaborator with National Association of EMS Physicians in support of *Prehospital Emergency Care (PEC)*. In continuation of that relationship, *IJOP* and *PEC* have established a collaborative relationship that exchanges manuscripts in certain circumstances. Empirical investigations on clinical topics may be forwarded to *PEC* for their initial consideration with author consent.

Methodology (≤2,000 words)

- This category of submissions provides deep explorations of methods used or may be used in research studies or improvement projects. These methods should be novel in some way that makes them of significant interest in their own right, separate from the studies in which they are utilized. These papers can also provide a more detailed description of the methods than would otherwise be appropriate in the primary research or improvement project manuscript. The primary paper's methods section may direct readers to a methodology paper in this category for more detailed descriptions of the methods it utilized.
- Along with other standard submission file elements, the primary manuscript body pages file for Methodology papers should contain appropriate elements from the EQUATOR guidelines, as described for empirical investigations.

Quality Improvement Project Reports (≤3,000 words)

- *IJOP* acknowledges the importance of quality improvement activities to optimize EMS system performance and patient outcomes and welcomes manuscripts describing quality improvement projects.
- United States regulations do not require quality improvement activities to have

Institutional Review Board (IRB) or Research Ethics Board (REB) approval. The distinction between manuscripts requiring or not requiring IRB/REB approval may be subtle. Manuscripts not requiring approval will generally be those which do not apply clinical treatments or diagnostic methods that have not been previsouly established in the literature. A manuscript that explores different ways to implement a clinical treatment or diagnostic method may not require approval.

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- Authors may contact the editorial office if they are uncertain whether their work should be submitted as a quality improvement or a research manuscript. If there any dounbdt, authors are encouraged to submit QI projects to an IRB is to obtain their independent judgement of the need for IRB oversight.
- Quality improvement project reports should adhere to the Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines (http://www.squire-statement.org). With permission of the Editorial Team, authors may submit manuscripts that use other generally accepted improvement project frameworks (e.g., IHI Model for Improvement; DMAIC).
- In general, quality improvement project reports should describe the process being examined; the process change(s) that were tested; the baseline process performance level; the methods used for conducting process tests and evaluating the results; the results, including the post-intervention performance levels; any confounding variables and balancing measures; and the process change iterations as applicable.
- The manuscript discussions and conclusions should highlight what the external audience can learn from the reported experience, not just the activity's internal success or failure.
- Authors may provide, or editors may suggest, that some information be provided as a supplemental file so that the main paper remains concise. The supplemental content may include data sets, images, video clips, and in-depth details on methodology.

Reviews / Synthesis (≤4,000 words)

- *IJOP* invites the submission of reviews of all types, including those with and those without meta-analytic components. In addition to the guidelines for original research provided elsewhere in these guidelines, any submissions in this category should be consistent with the Prisma 2020 guidelines for reporting systematic reviews https://www.equator-network.org/reporting-guidelines/prisma/.

Toolbox (≤3000 words)

- These submissions will explain a tool or technique and describe its practical use. Where applicable, the articles may include a supplemental file or link that contains the tool and a data file where the reader may try out the tool.
- Along with other standard submission file elements, the primary manuscript body pages file for Toolbox papers should contain:
  - Introduction - The manuscript shall include an introduction that provides an overview of the type(s) of projects that the tool or technique could be used for

or the specifics of the project that it was actually used in.

- Description of the Tool / Technique – As the central focus on the paper, this section shall provide in an in-depth examination of the tool or technique and its mechanics. Describe how the tool or technique should be applied in context of a clinical, operational, or administrative setting.
- Discussion – Discuss the underlying rationale for the tool or technique and why it may be favored over other options.
- Provide a critique of related methods. Also include discussion of any limitations of the tool or technique.
- Exercise – Where applicable, describe how to use the tool or technique in conjunction with a sample data set or scenario.

Special Reports

- This submission category will be used for articles of a scholarly nature that do not fit into one of the other *IJOP* submission categories. Authors are encouraged to use the guidelines described in this document that seem to be most applicable to their Special Report, but consultation with the Editorial Team before manuscript submission is strongly encouraged.