Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Perspective of emergency medical services (EMS) professionals on changes in resources, cardiac arrest care and burnout in Texas during the COVID-19 pandemic

Beyond traditional obstacles associated with providing care in the prehospital setting, EMS clinicians now face a novel series of challenges resulting from the SARS-CoV-2 (COVID-19) pandemic [1,2]. Resource constraints and concern regarding risks associated with aerosolizing procedures resulted in rapidly changing protocols [3-5]. Out-of-hospital cardiac arrest (OHCA) activations increased substantially and survival outcomes worsened [3,6-11]. Collectively, these new strains on EMS clinicians have led to increased burnout and potential for attrition [12-16]. Understanding how prehospital care practices and EMS professional well-being have been affected by the COVID-19 pandemic is important to mitigate negative patient outcomes and improve workforce well-being and stability. The objective of this study was to assess how the COVID-19 pandemic affected EMS clinicians in the state of Texas through structural factors (resource availability, operational protocols), process measures (clinical care, prehospital time intervals) and wellness (burnout).

In this cross-sectional study we surveyed all licensed EMS providers in Texas who provided patient care during the beginning of the COVID-19 pandemic (April 2020–June 2020). We excluded those who did not provide care during this timeframe and those younger than 18 years. The authors developed survey items designed to assess EMS clinicians' perceptions of resource availability and the influence on patient care, changes in prehospital time intervals, process measures and burnout. After serial review and testing with a small pilot group of EMS professionals, the final survey instrument consisted of 23 items and was self-administered using Research Electronic Data Capture (REDCap) (Appendix 1). We report descriptive statistics. Analyses were conducted with STATA, version 16.1, (StataCorp LLC, College Station, TX).

There were 72,567 licensed EMS professionals on the list provided by Texas Department of State Health Services. Of these, 11,488 were excluded because of incomplete or invalid email addresses. Responses were collected from February 15 to March 10, 2022. Out of the 61,079 invited EMS clinicians, completed surveys were received from 1924 (3%) clinicians. We excluded 245 participants who did not provide care during the initial pandemic, for an analysis sample of 1675 EMS providers (Fig. 1). Half of participants were between the ages of 30–49 years of age and 70% were male. Most (79%) identified as white and 80% identified as non-Hispanic. Survey respondents reported a median 13 years (IQR 6–22 years) of EMS experience and 62% were paramedics (Table 1).

With regards to PPE, during the beginning of the pandemic (April – June 2020), 50% of respondents reported that shortages of N95 masks affected their ability to provide patient care. Nearly three-fourths (71%) of EMS professionals reused N95 masks during the initial period of the pandemic, followed by 45% who reused surgical masks. Within the three months preceding the survey (December 2021 – February 2022), approximately one-third of providers were still reusing N95 masks (39%) or surgical masks (31%). More than 60% of respondents reported that a lack of ambulance availability influenced patient care (Table 2). Most respondents reported an increase in wall times (68%) and return to service time (74%) in addition to increased call volume (63%) (Table 3).

With regards to practice changes during the pandemic, most EMS clinicians (78%) reported their employer either provided modified protocols or specific training for care of patients with COVID-19. For OHCA care, compared to before the pandemic, 11% of respondents reported decreased likelihood of continuing a resuscitation during the pandemic. Over 20% reported an increased likelihood of terminating resuscitation in the field during COVID-19. Only 17% reported being less likely to perform intubation in the field during the pandemic (Table 4). As for workforce well-being, most participants reported feeling burdened by the pandemic-related shortage of work colleagues

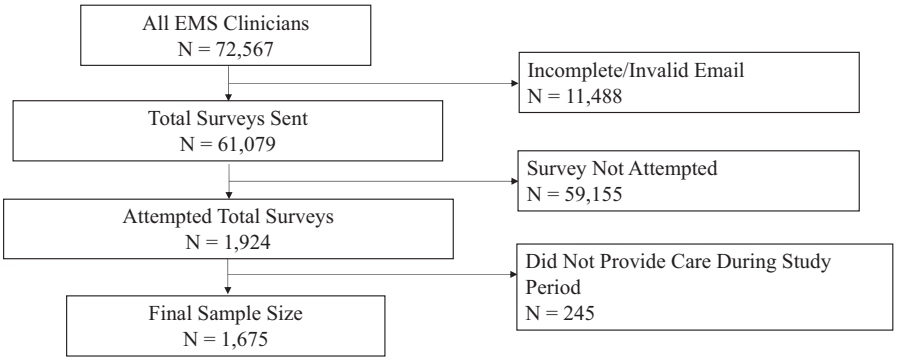

Fig. 1. Exclusions.

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Table 1
Provider characteristics.

	Responses $N = 1675$
Age (Years), n (%)	
18–29	315 (18.8%)
30–39	441 (26.3%)
40–49	392 (23.4%)
50–59	256 (15.3%)
60+	84 (5.0%)
Missing	187 (11.2%)
Gender, n (%)	
Male	1178 (70.3%)
Female	301 (18.0%)
Other	5 (0.3%)
Missing	191 (11.4%)
Race, n (%)	
White	1322 (78.9%)
Black	23 (1.4%)
American Indian / Alaskan Native	16 (1.0%)
Asian / Pacific Islander	25 (1.5%)
Multi-racial / Other	85 (5.1%)
Missing	204 (12.2%)
Ethnicity, n(%)	
Non-Hispanic	1189 (80.0%)
Hispanic	271 (16.2%)
Missing	215 (12.8%)
	$N = 1418$; Missing $= 257$
Median Years of EMS Experience, IQR	13 (6–22)
Highest Level of EMS Training, n (%)	
Paramedic	1039 (62.1%)
Advanced EMT	83 (5.0%)
EMT-Basic	338 (20.2%)
Emergency Care Attendant (ECA)	18 (1.1%)
Other	8 (0.5%)
Missing	189 (11.3%)
Highest Level of Education, n (%)	
High School / GED	85 (5.1%)
Some College	587 (35.0%)
College Graduate	689 (41.1%)
Master's Degree or Higher	124 (7.4%)
Missing	190 (11.3%)
EMS Agency Location Type, n (%)	
Rural Area	291 (17.4%)
Small city or town	309 (18.5%)
Suburb near a large city	400 (23.9%)
Large City	485 (29.0%)
Missing	190 (11.3%)

Table 2
Provider Resources.

	Responses N = 1675
At the beginning of the COVID-19 pandemic (April–June 2020), changes in availability of the following resources affected my ability to provide the same level of patient care as before the pandemic, n (%)	
N95 Masks	843 (50.3%)
Surgical Masks	452 (27.0%)
Gowns	499 (29.8%)
Gloves	375 (22.4%)
Cleaning Products	611 (36.5%)
None	531 (31.7%)
At the beginning of the COVID-19 pandemic (April–June 2020), please indicate whether you reused each of the following items, n (%)	
N95 Masks	1196 (71.4%)
Surgical Masks	756 (45.1%)
Gowns	214 (12.8%)
Gloves	59 (3.5%)
None	252 (15.0%)
Within the last three months, please indicate whether you reused each of the following items, n (%)	
N95 Masks	658 (39.3%)
Surgical Masks	513 (30.6%)
Gowns	51 (3.0%)
Gloves	33 (2.0%)
None	666 (39.8%)

During the first three months of the COVID-19 pandemic (April – June 2020), how often did shortage of the following resources affect your ability to provide patient care?, n (%)				
	Always / Almost Always	Often	Sometimes	Never / Almost Never
Oxygen (Missing = 225; 13.4%)	38 (2.3%)	97 (5.8%)	220 (13.1%)	1095 (65.4%)
Airway Equipment (Missing = 222; 13.3%)	40 (2.4%)	124 (7.4%)	285 (17.0%)	1004 (59.9%)
EMS Units (Missing = 208; 12.4%)	230 (13.7%)	359 (21.4%)	428 (25.6%)	450 (26.9%)

Table 3
EMS Response Times and Call Volume.

During the beginning of the pandemic (April – June 2020), on average, how did the following change in your system?, n (%)			
	Increased	No Change	Decreased
Wall times (waiting at the emergency department to transfer patient care) (Missing = 210, 12.5%)	1, 136 (67.8%)	299 (17.9%)	30 (1.8%)
Return to service time (time from patient turnover to return to service) (Missing = 207; 12.4%)	1236 (73.8%)	210 (12.6%)	22 (1.3%)
Total call volume (Missing = 215; 12.8%)	1056 (63.0%)	162 (9.7%)	242 (14.5%)

Table 4
Provider Practice Variation.

During the beginning of the pandemic (April – June 2020), on average, how did the following change in your system?, n (%)	
My employer provided specific training or modified protocols for care of COVID-19 patients during the first three months of the COVID-19 pandemic (April – June 2020)	
Yes	1305 (77.9%)
No	169 (10.1%)
Missing	201 (12.0%)
Compared to before the pandemic to now, my likelihood of continuing a "code" or cardiac arrest case has	
Increased	126 (7.5%)
No change	1172 (70.0%)
Decreased	184 (11.0%)
Missing	193 (11.6%)
Compared to before the pandemic, how much more likely are you to terminate resuscitations in the field?	
Much more likely or somewhat more likely	354 (21.1%)
Neither more likely nor less likely	1085 (64.8%)
Somewhat less likely or much less likely	38 (12.3%)
Missing	198 (11.8%)
Compared to before the pandemic, how much more likely are you to intubate in the field?	
Much more likely or somewhat more likely	225 (15.3%)
Neither more likely nor less likely	961 (57.4%)
Somewhat less likely or much less likely	283 (16.9%)
Missing	206 (12.3%)

Table 5
Provider Burnout.

I am burdened by the pandemic-related shortage of colleagues/staff at work, n (%)	N = 1675
Disagree or Strongly Disagree	355 (21.2%))
Agree or Strongly Agree	1114 (66.5%)
Missing	206 (12.3%)
On a scale of 1 to 10, with 1 being the best and 10 being the worst, rate your level of burnout, median (IQR)	7 (4–8); Missing = 214 (12.8%)
My workload has increased due to the COVID-19 pandemic	
Disagree or Strongly Disagree	251 (14.9%)
Agree or Strongly Agree	1223 (73%)
Missing	201 (12.0%)

(67%) and increased workload (73%) (Table 5). Over half of respondents had the highest levels of self-reported burnout (7–10: 53%), followed by 27% of providers endorsing moderate (4–6) levels of burnout (Fig. 2).

In this statewide survey of the effects of COVID-19 in EMS, we identified important changes in prehospital practice, resource shortages that influenced patient care, and a high rate of occupational burnout. The

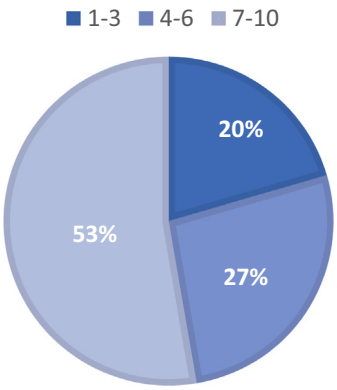

Fig. 2. Distribution of EMS Clinician Reported Burnout Level.

influence of changes in prehospital care delivery on patient outcomes warrant further exploration, while the potential for burnout among EMS clinicians to lead to additional workforce shortages is concerning. While some pandemic-related effects were reported more frequently during the initial phase of the pandemic, others, including shortages of key PPE items continue for a substantial proportion of EMS clinicians. Collectively, the findings of this study may serve to inform initiatives to improve the safety and well-being of patients and EMS clinicians.

Prior presentations

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CRediT authorship contribution statement

Summer Chavez: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Remle Crowe:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Ryan Huebinger:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Hei Kit Chan:** Writing – review & editing, Writing – original draft, Formal analysis. **Joseph Gill:** Writing – review & editing, Writing – original draft, Conceptualization. **Normandy Villa:** Writing – review & editing, Writing – original draft. **Micah Pancyzk:** Writing – review & editing, Writing – original draft. **Jeff Jarvis:** Writing – review & editing, Writing – original draft, Data curation. **Bentley Bobrow:** Writing – review & editing, Writing – original draft, Conceptualization.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2022.08.028.

References

[1] NAEMT. How COVID-19 Has Impacted Our Nation's EMS Agencies. *NAEMT. org*. (accessed Apr. 19, 2022).
[2] Ehrlich H, McKenney M, Elkbuli A. Defending the front lines during the COVID-19 pandemic: protecting our first responders and emergency medical service personnel. Am J Emerg Med. Feb. 2021;40:213–4. https://doi.org/10.1016/j.ajem.2020.05.068.
[3] Lim ZJ, Ponnapa Reddy M, Afroz A, Billah B, Shekar K, Subramaniam A. Incidence and outcome of out-of-hospital cardiac arrests in the COVID-19 era: a systematic review and meta-analysis. Resuscitation. Dec. 2020;157:248–58. https://doi.org/10.1016/j.resuscitation.2020.10.025.
[4] Masuda Y, et al. Variation in community and ambulance care processes for out-of-hospital cardiac arrest during the COVID-19 pandemic: a systematic review and meta-analysis. Sci Rep. Jan. 2022;12(1):800. https://doi.org/10.1038/s41598-021-04749-9.
[5] Merchant RM, et al. Part 1: Executive Summary: 2020 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. Oct. 2020;142:S337–57. https://doi.org/10.1161/CIR.0000000000000918. no 16_suppl_2.
[6] Handberry M, et al. Changes in Emergency Medical Services Before and During the COVID-19 Pandemic in the United States, January 2018–December 2020. Clin Infect Dis. Jul. 2021;73(Supplement_1):S84–91. https://doi.org/10.1093/cid/ciab373.
[7] Shekhar AC, Campbell T, Blumen I. Decreased pre-EMS CPR during the first six months of the COVID-19 pandemic. Resuscitation. May 2021;162:312–3. https://doi.org/10.1016/j.resuscitation.2021.03.031.
[8] Nishiyama C, et al. Influence of COVID-19 pandemic on bystander interventions, emergency medical service activities, and patient outcomes in out-of-hospital cardiac arrest in Osaka City, Japan. Resusc Plus. Mar. 2021;5:100088. https://doi.org/10.1016/j.resplu.2021.100088.
[9] Chan PS, Girotra S, Tang Y, Al-Araji R, Nallamothu BK, McNally B. Outcomes for out-of-hospital cardiac arrest in the United States during the coronavirus disease 2019 pandemic. JAMA Cardiol. Mar. 2021;6(3):296–303. https://doi.org/10.1001/jamacardio.2020.6210.
[10] Chavez S, et al. The impact of COVID-19 on incidence and outcomes from out-of-hospital cardiac arrest (OHCA) in Texas. Am J Emerg Med. Apr. 2022. https://doi.org/10.1016/j.ajem.2022.04.006.
[11] Mathew S, et al. Effects of the COVID-19 pandemic on out-of-hospital cardiac arrest care in Detroit. Am J Emerg Med. Aug. 2021;46:90–6. https://doi.org/10.1016/j.ajem.2021.03.025.
[12] Crowe RP, Bower JK, Cash RE, Panchal AR, Rodriguez SA, Olivo-Marston SE. Association of Burnout with workforce-reducing factors among EMS professionals. Prehosp Emerg Care. Apr. 2018;22(2):229–36. https://doi.org/10.1080/10903127.2017.1356411.
[13] Hutton G, et al. Out-of-hospital cardiac arrests terminated without full resuscitation attempts: characteristics and regional variability. Resuscitation. Mar. 2022;172:47–53. https://doi.org/10.1016/j.resuscitation.2022.01.013.
[14] Abir M, et al. Variation in pre-hospital outcomes after out-of-hospital cardiac arrest in Michigan. Resuscitation. Jan. 2021;158:201–7. https://doi.org/10.1016/j.resuscitation.2020.11.034.
[15] Okubo M, et al. Variation in survival after out-of-hospital cardiac arrest between emergency medical services agencies. JAMA Cardiol. Oct. 2018;3(10):989–99. https://doi.org/10.1001/jamacardio.2018.3037.
[16] Braithwaite S. Quality in EMS: Past, Present and Future. JEMS: EMS, Emergency Medical Services - Training, Paramedic. *EMT News*; Mar. 29, 2019. https://www.jems.com/operations/quality-in-ems-past-present-and-future/. accessed Apr. 22, 2022.

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