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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National analysis of COVID-19 and older emergency physicians

Emergency physicians (EPs) have played a critical role in the response to coronavirus disease 2019 (COVID-19). While public health efforts (e.g., statewide stay-at-home orders) had initially flattened the curve [1], COVID-19 spread in the U.S. has once again begun to accelerate. On October 23, 2020, the U.S. reached a new pandemic record of 83,010 daily cases [1], and all signs point toward an impending "second wave" or "third surge." Given the association between advanced age and COVID-19 severity [2], our objective was to compare the geographic distribution of U.S. EPs age ≥ 60 years to the cumulative distribution of confirmed COVID-19 cases, to highlight the potential risks faced by this vulnerable population of clinicians.

Demographic information on practicing EPs age ≥ 60 during 2018 was extracted from State Physician Workforce Reports published by the American Association of Medical Colleges (AAMC) [3]. Information recorded included the number of EPs age ≥ 60 per state, proportion of EPs age ≥ 60 per state, total number of EPs per state, and state population per EP. Coordinate data (i.e., latitude and longitude) on the cumulative distribution of COVID-19 cases as of October 22, 2020 were obtained from a disease-specific data repository published by the Environmental Systems Research Institute [4]. We integrated both datasets into QGIS geospatial analysis software (version 3.12.1), superimposing them onto state boundary files published by the U.S. Census Bureau [5]. States were grouped into color-coordinated quintiles based on proportion of EPs age ≥ 60, and a logarithmic scale was used to adjust coordinate data points of cumulative COVID-19 cases, resulting in a heatmap depicting the proportion of EPs age ≥ 60 and COVID-19 disease burden for each state. This study was deemed IRB exempt due to the use of deidentified and publicly available data.

The AAMC identified a total of 43,311 clinically active EPs in 2018, of whom 10,804 (24.9%) were age ≥ 60 years [3]. The 10 states in the highest quintile of older EPs were West Virginia, New Mexico, Vermont, Hawaii, Maine, Oklahoma, Montana, Alabama, Arkansas, and Arizona (Table 1). The proportion of EPs age ≥ 60 ranged from 16.0% in Rhode Island to 40.6% in West Virginia. The five states with the highest number of cumulative COVID-19 cases as of October 22, 2020 were California (889,375 cases), Texas (871,078 cases), Florida (768,091 cases), New York (490,134 cases), and Illinois (363,740 cases). Among the states with the highest proportion of older EPs, Arizona (234,906 cases), Alabama (177,064 cases), Oklahoma (112,483 cases), and Arkansas (102,798 cases) have had a particularly high COVID-19 disease burden (Fig. 1).

Fig. 1 provides a geospatial representation of the risk faced by older EPs during the COVID-19 pandemic. Given the 2.5-fold difference in the proportion of older EPs across states (16.0% to 40.6%), and in light of reported personal protective equipment (PPE) shortages among major

Table 1
Emergency physician workforce profile and confirmed COVID-19 cases by state, as of October 22, 2020

State	EPs age ≥ 60 years; *n* (%)	Total EPs per state	State population per EP	Confirmed COVID-19 cases by state
West Virginia	95 (40.6)	236	7652	21,061
New Mexico	108 (33.9)	319	6569	39,377
Vermont	41 (33.3)	123	5092	1987
Hawaii	91 (33.1)	275	5165	14,335
Maine	95 (32.9)	290	4615	6063
Oklahoma	110 (32.5)	342	11,529	112,483
Montana	54 (32.0)	169	6286	25,640
Alabama	128 (31.9)	401	12,189	177,064
Arkansas	80 (31.3)	256	11,773	102,798
Arizona	274 (29.9)	917	7821	234,906
Mississippi	90 (29.5)	305	9792	112,123
Tennessee	203 (29.4)	690	9812	237,907
Idaho	67 (29.1)	231	7594	55,650
New Hampshire	68 (29.1)	234	5797	9994
Florida	764 (29.0)	2641	8065	768,091
Kentucky	149 (28.7)	520	8593	92,299
Wyoming	23 (28.0)	84	6878	10,119
Washington	296 (27.4)	1082	6965	100,525
Indiana	208 (27.3)	763	8770	155,246
Pennsylvania	498 (27.3)	1832	6991	193,401
Missouri	196 (27.1)	725	8450	163,275
South Carolina	194 (26.9)	720	7061	167,485
California	1418 (26.1)	5445	7265	889,375
Ohio	434 (25.8)	1681	6954	190,430
Iowa	62 (25.1)	251	12,574	111,578
Colorado	268 (25.0)	1074	5303	90,199
Georgia	285 (25.0)	1139	9236	345,535
Kansas	63 (24.7)	256	11,373	73,968
Wisconsin	196 (24.6)	798	7285	186,100
Oregon	190 (24.5)	778	5387	40,443
Michigan	393 (24.4)	1621	6167	170,076
Virginia	283 (24.4)	1158	7356	169,566
Massachusetts	303 (24.3)	1247	5535	147,215
Connecticut	123 (23.9)	515	6937	65,373
New Jersey	241 (23.9)	1010	8820	224,385
Illinois	425 (23.8)	1787	7130	363,740
Louisiana	150 (23.5)	637	7316	178,171
Nevada	88 (23.0)	384	7902	92,853
South Dakota	19 (22.9)	83	10,629	36,017
Alaska	30 (22.1)	136	5422	11,835
North Dakota	19 (21.8)	87	8737	35,052
Maryland	198 (21.7)	915	6604	137,979
North Carolina	284 (20.7)	1375	7552	252,992
Minnesota	157 (20.4)	770	7287	128,152
New York	542 (19.6)	2777	7037	490,134
Delaware	24 (19.4)	124	7800	23,528
Utah	83 (19.4)	427	7403	99,549
Texas	635 (19.1)	3334	8609	871,078
Nebraska	29 (18.1)	160	12,058	60,308
Rhode Island	30 (16.0)	187	5654	29,594
U.S. (total)	*10,804 (24.9)*	*43,311*	*N/A*	*8,392,628*

Abbreviations: COVID-19, coronavirus disease 2019; EP, emergency physician.

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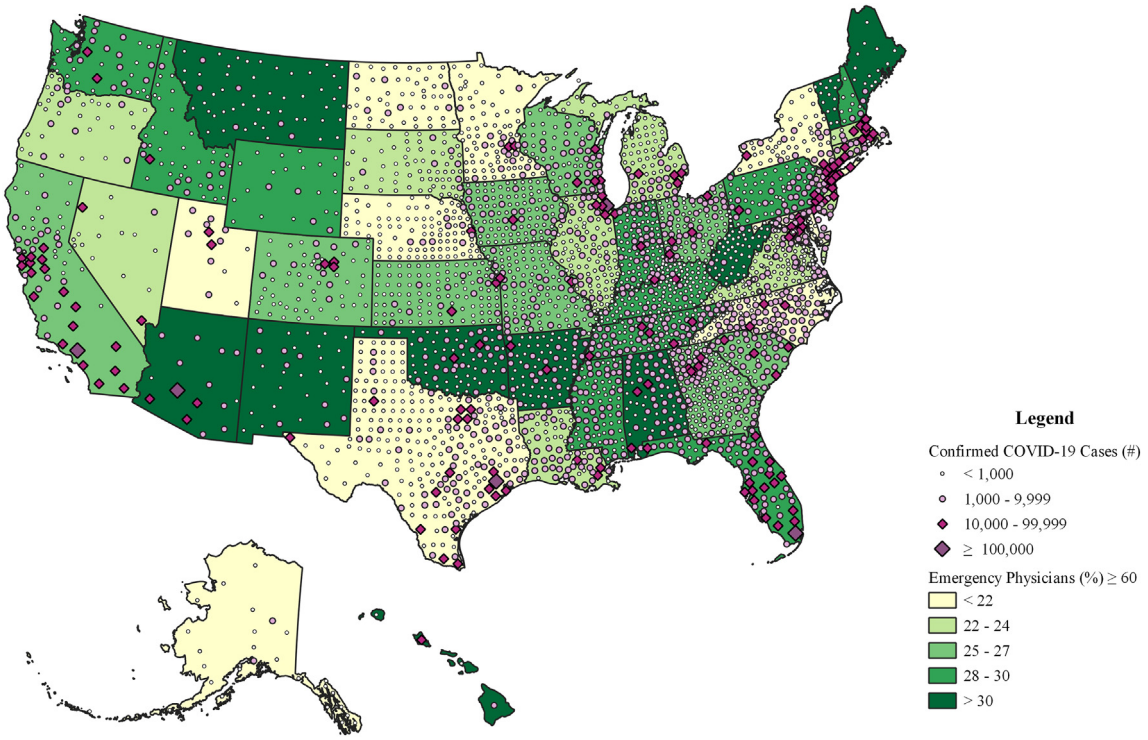

Fig. 1. Geographic distribution of emergency physicians age ≥ 60 years and cumulative COVID-19 case distribution, as of October 22, 2020. States were grouped into color-coordinated quintiles based on relative proportion of older EPs, and cumulative COVID-19 case volumes were adjusted with a logarithmic scale to create proportionally-sized data points.

U.S. distributors [6], supply chain prioritization toward EPs in higher-risk states warrants consideration, especially as cases continue to surge. Emergency departments could also amend operations to prioritize reduction of nosocomial transmission risk among advanced age EPs (e.g., allocating critically limited PPE to higher-risk physicians, geographically cohorting patients with suspected or confirmed COVID-19 infection within an emergency department) [7]. Furthermore, prioritization of routine COVID-19 testing of older EPs, as well as creation of reserve pools of emergency medicine physicians (e.g., EPs from hospital systems relatively less affected by COVID-19), may facilitate the transfer of care duties from older EPs at more heavily affected emergency departments, in the event that they test positive and need to safely self-isolate [8].

Study limitations include not controlling for other individual factors associated with increased COVID-19 severity (e.g., obesity, Black race, Hispanic ethnicity) [9,10], as well as using state-level data, which precludes insights into risk differences by, for example, rural/urban status. Moreover, we acknowledge that utilizing cumulative case volumes does not account for differences in the present rate of COVID-19 spread between states (e.g., rate of COVID-19 spread and confirmed case count in New York have since stabilized from March/April 2020) [1]. Finally, we understand that COVID-19 infection among younger clinicians is a serious problem. Our hope is that the current findings will raise awareness among EPs and assist implementation of safety guidelines and workforce planning. Collectively, we need to ensure that all front-line EPs, including those at higher risk, are properly protected during the COVID-19 pandemic.

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Author contributions statement

DXZ and TKJ conceived the study and supervised data collection. EJM assisted in data collection. CAC provided advice on study design. DXZ drafted the manuscript, and all authors contributed substantially to its revision. DXZ and CAC take responsibility for the paper as a whole.

Declaration of competing interest

The authors report no conflicts of interest relevant to this work.

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David X. Zheng BA
aCase Western Reserve University School of Medicine, Cleveland, OH, USA
bDepartment of Emergency Medicine, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Tarun K. Jella MPH
aCase Western Reserve University School of Medicine, Cleveland, OH, USA

Elie J. Mitri BA
bDepartment of Emergency Medicine, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Carlos A. CamargoJr MD, DrPH
bDepartment of Emergency Medicine, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA
*Corresponding author at: Massachusetts General Hospital, 125 Nashua St., Suite 920, Boston, MA 02114, USA.
E-mail address: ccamargo@partners.org

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