The Experiences of Critical Care Physicians Caring for COVID-19 Patients Across the Country

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Introduction

Intensive care units (ICUs) across the country have borne the brunt of caring for patients with COVID-19. ICU physicians are a key source of information about ICUs and the ways that shortages caused by the pandemic impact care and consequentially impact physician stress. We describe the results of a national survey of critical care physicians conducted during the first surge of the COVID-19 pandemic. Two previous surveys of ICU personnel had very low participation by physicians[1,2]. In contrast, our study provides policy makers and other decision makers a better understanding of the challenges faced by ICU physicians across the US experiencing new surges in COVID-19 cases and subsequent hospitalizations.

Methods

Survey Sample and Data Collection

We invited physicians age 70 years and younger with current or prior Board Certification in Critical Care Medicine by the American Board of Internal Medicine to complete the survey. The survey was conducted between April 23 and May 3, 2020.

Survey Instrument

Physicians who had treated COVID-19 patients in the prior two weeks were asked to complete a 34-item survey covering 4 domains: 1) adequacy of staffing, 2) availability of medications, equipment, and PPE, 3) timeliness of COVID-19 testing; and 4) physician stress experienced while treating COVID-19 patients. Physicians were also asked to report the ZIP code where they treated COVID-19 patients (see eSupplement for Survey).

We categorized physicians as caring for patients in a "COVID-hotspot" if their county COVID-19 population death rate between 4/12/2020 and 4/26/2020 was greater than 2 per 10,000 [3].

The research protocol was deemed exempt from review by the Committee on Clinical Investigations at Beth Israel Deaconess Medical Center. Analysis was performed using Stata 14.

Results

We received responses from 2,882 physicians of 14,141 emailed (response rate 20%) with 2,765 (96%) reporting that they treated COVID-19 patients in the last two weeks (see Appendix for all results). The item non-response was low (<1.5%) and there were no significant differences between the share of respondents and the surveyed population by gender, international medical

school attendance and census region (Table 1). We observed small differences in the response rate by age and COVID-hotspot and certification status.

Staffing

Just under half of respondents (48%) reported that at least one category staffing in the ICU was inadequate or only adequate when including non-ICU trained staff (Table 2). About one-third of these respondents reported inadequate staffing even when considering non-ICU trained staff. In particular, 21% reported inadequate attending physician staff and 32% reported inadequate nursing staff.

Medication, equipment, PPE, and testing

About half of physicians also reported shortages for at least one class of medication typically used in the ICU (43%) or type of PPE (52%) that resulted in changes in clinical protocols. Medication shortages (i.e., requiring changes in protocols) were most pronounced for sedatives (29%) and the most commonly reported PPE shortage was for N95 masks (45%). Also, 42% of physicians reporting that they retained their N95 mask until soiled. Equipment shortages were less pronounced with 7% of respondents reporting shortages of ventilators that impacted clinical protocols.

Physician stress

About 70% of physicians reported at least moderate levels of emotional distress or physical exhaustion from treating COVID-19 patients, including 26% who reported high levels of physical exhaustion (i.e., a lot or extreme) and 29% who reported high levels of emotional

distress (Table 2). Risk of contracting COVID-19 or infecting their family/friends were the most frequently reported contributors to both moderate and high levels of emotional distress. A qualitative analysis of 728 fill in responses indicates that caring for the emotional needs of patients isolated from their families, high mortality of COVID-19 patients, and lack of knowledge about COVID also contributed to emotional distress.

Physician stress (emotional distress/physical exhaustion) was significantly higher among physicians experiencing shortages of staff, medication, equipment or PPE (Table 2; difference ps<.001 for any staff, medication, equipment, PPE categories). For example 61.2% of physicians reporting shortages across any staff category either resulting in use of non-ICU trained or inadequate staff also reported that they were experiencing a lot or extreme levels of emotion stress or physical exhaustion compared to just 32% who did not report these staff shortages (p<.001).

COVID-hotspot and subgroup analysis

For all staffing measures, shortages were significantly more prevalent in COVID-hotspots (Table 3) For instance, 60% of physicians in COVID-hotspots reported an inadequate supply of ICU-trained nurses versus 26% in non-hotspots (p<.001). Equipment shortages were more common in COVID-hotspots (25% versus 3% for ventilator's (p<.001)). Physicians in COVID-hotspots reported more physical exhaustion (12 percentage points difference, p<.001) but similar levels of emotional distress (2 percentage point difference, p=.305) than those in other counties.

Discussion

In this first large nationally representative survey of critical care physicians engaged in the treatment of COVID-19 patients during the first pandemic surge, we found several notable results that raise concerns about the ability of ICU physicians to deliver optimal care. These results are timely because they provide insights into issues that might arise in current hotspots such as Florida, Texas, and Arizona based on the experiences of physicians caring for COVID-19 patients in prior hotspot areas of the country. Physicians we surveyed experienced high levels of stress with 70% reported at least moderate levels of emotional distress or physical exhaustion. Key shortages of ICU-trained staff, medication, equipment, and PPE were shortages were experience by physicians with high levels of stress significantly more than those with lower levels of stress. For example, the percentage of physicians reported shortages of ICU trained nurses was two time large among physicians reporting high levels of stress than those experience no or low levels of stress (41% versus19%). Overall, shortages of staff, medication and equipment were widespread with 30% of physicians reporting that these shortages resulted in changes in protocols governing use of opioids and steroid, 32% reporting inadequate ICU-trained nurses and 44.6% reporting shortages of N95 masks that required changes in clinical protocols. With the exception of PPE, both levels of physicians stress and these shortage measures were significantly high among physicians in COVID-hotpots.

Shortages of staff were particularly acute in COVID-hotspots as were reported levels of physician stress, and to a lesser degree shortages of medication and equipment but, not PPE which was in short supply across the country. Suggesting the PPE and other safety measures may

play a role in emotional distress, by far the biggest contributor to this distress was risk to self or friends and family. Qualitative data also suggests that the isolation of hospitalized patients and lack of treatment knowledge also led to emotional distress. For example, physicians experiencing high levels of stress were more than twice as likely to be caring for patients in a COVID-hotspot then non-COVID hotpot (8% versus 29%).

As we face a new surge in the pandemic and the resulting medical shortages, our results are especially relevant as they shed light on the emotional and physical toll faced by critical care physicians around the country. It is therefore critical that policy makers redouble efforts both to contain the pandemic, improve staffing levels, elevate shortages of medication and equipment and shorten testing times or they might face the possibility that the kind of physician stress reported in this study might impact the supply and effectiveness of highly skilled critical care physicians.

References

1. Kaplan LJ, Kleinpell R, Maves RC, Doersam JK, Raman R, Ferraro DM. Critical Care Clinician Reports on Coronavirus Disease 2019: Results From a National Survey of 4,875 ICU Providers. *Critical Care Explorations.* 2020;2:e0125.

2. Society of Critical Care Medicine. SCCM COVID-19 Rapid-Cycle Survey 2 Report. Vol 20202020.

3. The Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. COVID-19 Data Repository. Vol 20202020.

Table 1: Responders versus Population Characteristics of Critical Care Medicine Physician Study Sample

Auxiliary Variable	Population (Number=14,141)	Responders (Number=2,882)	P-Value[a]
Physician age[b] [Number, (%)]			<.001
<40	3,017 (21.3)	593 (21.3)	
40-49	4,824 (34.1)	1,003 (34.8)	
50-59	3,400 (24.0)	806 (28.0)	
60-64	1,550 (11.0)	303 (10.5)	
65-70	1,350 (9.6)	177 (6.1)	
Hotspot location (>= 2 COVID-19 deaths per 10,000)[c]	2,148 (15.2)	488 (16.9)	.009
Female [Number, (%)]	3,258 (23.0)	685 (23.8)	.353
International Medical School Graduate (IMG) [Number, (%)]	5,751 (40.7)	1,220 (42.3)	.069
US Census Region[4] [Number (%)]			.719
West	2,990 (21.1)	604 (21.0)	
Midwest	2,936 (20.8)	622 (21.6)	
South	4,793 (33.9)	958 (33.2)	
Northeast	3,422 (24.2)	698 (24.2)	
Active Critical Care Medicine Certification[5] [Number (%)]	11,737 (83.0)	2,678 (92.9)	<.001

[a] Chi-squared test of significance at .05 alpha level.

[b] Age is calculated based on physician date of birth in American Board of Internal Medicine registration data as of January 1, 2020.

[c] Calculated based on reported county in American Board of Internal Medicine registration data; 14 missing values in population, 2 missing values in responders. Sample percentages based on ZIP code question in survey were as follows: Non-hotspot location: 83.8%, Hotspot location: 16.2%.

[d] Region is calculated based on reported address in American Board of Internal Medicine registration data. Sample percentages based on ZIP code question in survey were as follows: West: 20.6%, Midwest: 21.3%, South: 33.6%, Northeast: 24.5%

5. Physician has an active certification as of May 1, 2020

Table 3, Comparisons Across Physician Stress Categories of:
COVID-hotspots, Shortages of Staff, Equipment, Personal Protective Equipment (PPE)

	Overall, No. (%) (2,745)[a]	Physician stress categories, Number (%)			Percentage point difference across physician stress categories (95% Confidence Interval), P-value	
		Not much or Not at all (549) [a]	Moderate[b] (1,178) [a]	A Lot or Extreme[c] (1,023) [a]	Moderate[b] minus Not Much or Not at all	A Lot or Extreme[c] minus Not Much
COVID-19 Hotspot county	16.2	8.1	17.1	19.5	9.0 (5.8 to 12.1), p<.001	11.4 (8.0 to 14.7), p<.001
Staff: None-ICU trained or inadequate						
Attending physicians	20.5	8.8	18.4	29.5	9.6 (6.3 to 12.8), p<.001	20.7 (17.1 to 24.4), p<.001
Nurse	31.8	19.3	29.5	41.4	10.2 (6.0 to 14.4), p<.001	22.1 (17.6 to 26.6), p<.001
PA/NP	27.5	14.0	25.9	36.9	11.9 (8.0 to 15.8), p<.001	22.9 (18.7 to 27.1), p<.001
Respiratory therapist	23.7	12.6	20.5	33.9	7.9 (4.3 to 11.5), p<.001	21.2 (17.2 to 25.3), p<.001
Any staff category	**48.2**	**32.2**	**44.8**	**61.2**	**12.6 (7.8 to 17.5), p<.001**	**29.0 (24.1 to 33.9), p<.001**
Medication: Change protocols or unavailable						
Paralytics	22.0	15.2	20.1	27.7	4.8 (1.1 to 8.6), p=0.01	12.5 (8.4 to 16.6), p<.001
Sedatives	29.1	18.1	28.4	35.8	10.2 (6.1 to 14.4), p<.001	17.7 (13.3 to 22.0), p<.001
Opioid analgesics	25.9	15.4	25.7	31.6	10.3 (6.4 to 14.3), p<.001	16.2 (12.0 to 20.3), p<.001
Anti-antibiotics	2.2	1.3	2.2	2.5	0.9 (-0.3 to 2.2), p=0.15	1.2 (-0.2 to 2.5), p=0.09
Bronchodilators	15.5	12.6	15.9	16.5	3.3 (-0.2 to 6.7), p=0.07	3.8 (0.2 to 7.4), p=0.04
Any medication	**43.5**	**32.1**	**42.5**	**50.4**	**10.5 (5.7 to 15.3), p<.001**	**18.3 (13.4 to 23.3), p<.001**
Equipment						
Ventilator	6.9	2.8	5.9	10.5	3.1 (1.2 to 5.0), p=0.002	7.7 (5.4 to 10.1), p<.001
Renal therapy	14.1	7.5	13.2	19.0	5.6 (2.7 to 8.6), p<.001	11.4 (8.2 to 14.7), p<.001
Any equipment	**16.8**	**9.0**	**15.5**	**22.7**	**6.6 (3.4 to 9.7), p<.001**	**13.7 (10.2 to 17.3), p<.001**
PPE: Change protocols or unavailable						
Surgical masks	26.3	15.9	24.8	33.3	8.9 (5.0 to 12.9), p<.001	17.4 (13.2 to 21.6), p<.001
N95 masks	44.6	34.3	42.3	52.7	7.9 (3.1 to 12.8), p=0.001	18.4 (13.4 to 23.5), p<.001
Shield	29.9	21.3	27.6	37.4	6.3 (2.0 to 10.6), p=0.004	16.1 (11.5 to 20.6), p<.001
Gown	26.1	18.9	23.1	34.0	4.2 (0.1 to 8.2), p=0.05	15.1 (10.7 to 19.5), p<.001
Gloves	3.4	1.5	2.6	5.4	1.2 (-0.2 to 2.5), p=0.09	3.9 (2.2 to 5.7), p<.001
Any PPE category	**51.4**	**40.2**	**48.6**	**60.9**	**8.3 (3.3 to 13.3), p=0.001**	**20.6 (15.6 to 25.7), p<.001**
Test: 3 days or more	**35.7**	**27.8**	**35.6**	**39.8**	**7.8 (3.2 to 12.5), p<.001**	**12.0 (7.2 to 16.8), p<.001**

[a]The total number of responses varied slightly across items because of small number of non-responses for each item (<1.5% overall all items).
[b] Moderate levels of emotional distress or physical exhaustion but not a lot or extreme levels of either, [c] A lot or extreme levels of either emotional distress or physical exaustion.

Table 2, Comparisons across COVID-hotspots of:
Shortages of Staff, Equipment, Personal Protective Equipment (PPE), Physician stress

Category	Overall, (%) (2,676 respondents)[a]	COVID-hotspot category[bc], (%)		
		Non-COVID-hotpot (2,244 respondents)	COVID-hotspot (434 respondents)	Statistical significance of difference between non-COVID- hotspot and COVID-hot spot shortage measures
Shortage measures				
Staff: None-ICU trained or inadequate[d]				
Attending physicians	20.5	16.2	43.1	p<.001
Nurse	31.8	26.3	60.2	p<.001
PA/NP	27.5	22.2	54.6	p<.001
Respiratory therapist	23.7	19.3	46.5	p<.001
Any staff category	**48.2**	**42.7**	**76.4**	p<.001
Medication: Change protocols or unavailable[e]				
Paralytics	22.0	20.8	28.4	p<.001
Sedatives	29.1	27.8	36.1	p<.001
Opioid analgesics	25.9	24.6	33.1	p<.001
Anti-antibiotics	2.2	2.0	3.0	p=0.25
Bronchodilators	15.5	15.9	13.4	p=0.17
Any medication category	**43.5**	**42.6**	**48.4**	**p=.03**
Equipment: Change protocols or unavailable[e]				
Ventilator	6.9	3.4	24.7	p<.001
Renal therapy	14.1	10.0	35.4	p<.001
Any equipment	**16.8**	**11.0**	**47.0**	**p<.001**
Personal Protective Equipment: Change protocols or unavailable[e]				
Surgical masks	26.3	26.4	25.5	p=.68
N95 masks	44.6	44.7	44.0	p=.78
Shield	29.9	30.6	26.5	p=.08
Gown	26.1	24.9	32.4	p=.002
Gloves	3.4	3.5	2.6	p=.25
Any PPE category	**51.4**	**51.0**	**53.5**	**p=.36**
Test: 3 days or more	35.7	36.9	29.4	p=.002
Emotional distress				
A lot/extreme	28.7	26.7	38.9	p<.001
Moderate	41.6	41.0	44.2	p=.22
Little or none	29.7	32.2	16.8	p<.001
Physical exhaustion				
A lot/extreme	26.0	25.6	28.0	p=.32
Moderate	41.9	40.8	47.5	p=.01
Little or none	32.1	33.5	24.5	p<.001

[a]The total number of responses varied slightly across items because of small number of non-responses for each item (<1.5% overall all items).
[b]COVID hotspot definition is greater than or equal to 2 death per 10,000 in last two weeks
[c]80 physicians did not report or reported an invalid ZIP code. The average number of deaths in the COVID-19 hotspot counties in our sample was 958 versus 81 in non-COVID-19 hotspot counties during the 4/12 to 4/26 period.
[d]Overall percent of physicians reporting that PAs, attending physicians, respiratory physicians were inadequate: 9%, 10%, 5% and 13% respectively.
[e]Overall maximum percentage of physicians reporting that an item was unavailable was less then 2%.