

# Association between knowledge and attitude towards COVID-19 and utilization of emergency department care in Texas, United States: A hospital-based study

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## Abstract

**Objective:** To examine whether patients' COVID-19 knowledge and concern of contracting COVID-19 in healthcare facilities were associated with decreased utilization of and attitude towards ED care during the initial months of the pandemic.

**Methods:** This was a cross-sectional study of patients from an urban academic ED in Texas, the United States. Patient-level data were collected for the number of ED visits during the initial pandemic months, the likelihoods to seek care for respiratory symptoms vs. pain-related conditions, changes in perceived need for ED care measured by changes in pain threshold to seek ED care, COVID-19 knowledge and concern of contracting COVID-19 in healthcare facilities. Bivariate and multivariate analyses were performed.

**Results:** In March, April and May, the ED volume decreased by 11%, 42%, and 26%, respectively. The average number of ED visits in these 3 months was 1.25. About 45% indicated that they were less likely to visit ED for respiratory symptoms and 32% were less likely to visit ED for any pain-related symptoms. Only about 19% reported that they thought it was more likely to contract COVID-19 in healthcare facilities than in crowded public places. A better COVID-19 knowledge, but not the concern of contracting COVID-19, was found to be significantly associated with fewer ED visits. Heavy users continued to be heavy users despite the presence of COVID-19, controlling for other factors.

**Discussion and Conclusion:** Patients' knowledge of COVID-19 was a contributing factor to their utilization of ED care during the initial COVID-19 pandemic months. However, its effect may not be as prominent as previously thought. Stay-at-home orders likely had an unintended negative impact on the missed critical ED care. Heavy users continued to be heavy users despite the presence of the pandemic.

**KEY WORDS:** Attitude; COVID-19; knowledge; emergency department utilization.

## INTRODUCTION

It has been noted worldwide that during the COVID-19 pandemic, the utilization of medical care significantly decreased in many regions of the US. Hospitals reported lower rates of admissions for medical emergencies such as myocardial infarcts and strokes, and surgical emergencies, such as appendicitis [1–7]. In particular, many emergency departments (EDs) experienced decreased volumes. Hospitals in several major US cities reported a decrease in ED volumes, with estimates ranging from 10% to 60% [8–13]. At the national level, CDC reported a 42% decrease in ED volume in April 2020 [4]. A similar pattern was found in Europe. In Italy, a 73–88% decrease was observed in pediatric ED visits in March 2020 [14]. In England, the ED volume decreased by 49% in the last week of February and 25% in the last week of March, after the lockdown [15]. It was believed that the key reason for the dramatic decrease in ED volumes was a concern of contracting COVID-19 after visits to healthcare facilities

based on public polls [16, 17]. American College of Emergency Physicians (ACEP) and several other medical associations encouraged the public not to delay emergent care [18]. Several healthcare organizations and companies started an ad campaign to ‘stop medical distancing’ [19]. However, there were no studies to directly associate patients’ concern of COVID-19 with their actual ED care seeking behavior; instead, it was an observation made at an aggregated level.

Decrease ED utilization may also have stemmed from patients’ lack of understanding of COVID-19 epidemiology and disease prevention strategies. Data from studies in outpatient settings and surveying healthcare workers suggested that significant percentages of adults could not correctly identify symptoms of COVID-19 and how to prevent infection [20, 21]. In particular, lower health literacy was associated with less concern about COVID-19 and greater confidence in the federal government response [21]. Although these studies may have suggested an association

### TAKE-HOME MESSAGE

*Better COVID-19 knowledge, but not the concern of contracting COVID-19, was found to be significantly associated with fewer emergency department visits in an urban hospital in Texas, United States. Stay-at-home orders likely had an unintended negative impact on the missed critical emergency department care.*

**Competing interests** - none declared.

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between the knowledge of COVID-19 and health behaviors, it is still unknown whether the relationship exists between patients' COVID-19 knowledge and their ED utilization to explain the widely observed decrease in ED volumes using patient-level data.

Furthermore, it is unclear whether the decrease in ED volumes was the result of a general reduction across all ED users, or disproportionately in the visits by existing heavy users. One study estimated that heavy users represented approximately 8% of ED users but 28% of all ED visits [22]. This group tends to have more serious illness thus have higher rates of hospital admission and mortality [23]. Many heavy users do not have access to other forms of medical care because of limited and financial means [24, 25]. In addition, these patients tend to have lower levels of health literacy and knowledge [26].

The objective of the current study was to examine whether patient's knowledge of COVID-19 and concern of contracting COVID-19 in healthcare facilities were associated with decreased utilization of and attitude towards ED care during the initial months of the COVID-19 pandemic.

## METHODS

### *Study design and setting*

This cross-sectional study was conducted in an urban county and academic hospital ED in Texas, the United States, with an annual volume of 80,000, including adults and pediatrics.

### *Study participants and data collection*

A convenience sample of ED patients was collected in a 6-week period from 05/25/2020 to 07/05/2020 to investigate their ED utilization pattern. The initial power analysis indicated a minimal sample size of 220 with a power of 99% and alpha of 0.01 for a 5% reduction in ED visits and a 0.5 increase in perceived pain threshold that would trigger an ED visit. The final sample consisted of 252 participants who completed the surveys. The inclusion criteria were 1) currently seeking ED care; 2)

18-89 years of age; and 3) GCS of 15. Pediatric patients aged 17 years or younger were excluded. Also excluded were trauma activations and psychiatric patients. Potential participants were presented with a brief verbal description of the study and a one-page flyer. Participants could complete the online survey on their own at any time during the study period. They could also choose to complete the survey in the ED room with the help of the data collector using a tablet provided by the ED. The data were collected using an online survey tool processed by a commercial platform, Qualtrics<sup>SM</sup>.

### *Study instruments*

The utilization of ED care was measured by the reported number of ED visits during the initial pandemic months in the region, March, April, and May 2020. Two questions were asked about whether patients were more or less likely to seek care for specific symptoms in these months compared to the same time last year. The first was for respiratory symptoms: 'fever, cough, shortness of breath, sore throat, runny nose, or earache'. The second question asked about the most frequently presented complaint to ED, pain, including pain in chest, abdomen, back, or pelvis. In addition, to quantitatively elucidate the perceived need to use ED care, in contrast to the actual utilization measured by the number of ED visits, the participants were asked "At what level of pain on the scale of 0-10 would you go to an emergency room/center?" before the pandemic and during the initial pandemic months. The difference was calculated to approximate the aversion to ED visits during the initial pandemic months and measure the change in their perceived need to visit an ED. Patients' knowledge of COVID-19 was measured by the agreement to 10 statements that described the basic epidemiology, prevention, diagnosis, treatment, and prognosis of COVID-19:

1. "COVID-19 or the novel coronavirus is a bacterial infection" (item 1).
2. "You can get COVID-19 through contact

- with an infected person” (item 2).
3. “Face masks, and frequent hand washing or use of hand sanitizer can prevent getting COVID-19” (item 3).
  4. “You don’t have COVID-19 if you don’t have any symptoms” (item 4).
  5. “Fever, cough, and shortness breath are the most likely symptoms of COVID-19” (item 5).
  6. “People with chronic health problems, such as high blood pressure, diabetes, heart disease and kidney disease, are more likely to get COVID-19 and die” (item 6).
  7. “All COVID-19 patients require treatment of antibiotics” (item 7).
  8. “COVID-19 vaccine is available now in the US” (item 8).
  9. “More than half of people who had COVID-19 died” (item 9).
  10. “COVID-19 is more deadly among young persons and children” (item 10).

The COVID-19 knowledge score was measured by the sum of the total number of correct answers. Because studies of COVID-19 knowledge were extremely limited in the early months of the pandemic, a questionnaire used for healthcare workers about COVID-19 was modified for our survey [27]. We added the most up-to-date (May 2020) information to the questionnaire, and face validity was confirmed by all research team members and external physicians. If a participant chose “I don’t know” as the answer to a question, it was treated as an incorrect answer for these 10 statements. To directly gauge their concern of contracting COVID-19 in healthcare facilities, the participants were also asked “Do you agree that you are more likely to catch COVID-19 in health care facilities, such as doctors’ offices, urgent care centers, hospitals, dialysis centers, and emergency rooms, than in a restaurant or a bar where there usually are a lot of people in a crowded space?”

Coincidentally, a 2<sup>nd</sup> surge of COVID-19 cases occurred halfway into the survey period. A binary variable was created to indicate the 2<sup>nd</sup> surge. The cutoff date was set at 1 week after

the first significant increase in the daily new case count with continued increasing trend in the days that followed to account for the possible delay in the public’s exposure to and awareness of the new trend. Additional information collected included a patient’s age, gender, race, education level, employment status, household income, and whether he/she had a primary care provider (PCP). Comorbidities of hypertension, hyperlipidemia, diabetes, heart diseases, chronic kidney disease, stroke, and liver diseases were also recorded. Lastly, the reported total number of ED visits in 2019 were recorded as “0-2, 3-5, or 5+” to indicate whether a patient was a frequent user of ED care at the baseline.

### *Statistical analyses*

Descriptive statistics of the dependent variables, 1) the number of ED visits during the initial pandemic months, 2) the change in the pain threshold to seek ED care during the initial pandemic months from baseline, 3) the likelihood of seeking ED care for respiratory symptoms during the initial pandemic months and 4) the likelihood of seeking ED care for pain during the initial pandemic months, were first obtained. Descriptive statistics for patients’ sociodemographics, comorbidities, whether they had PCPs, and the frequency of ED care utilization at baseline were also calculated.

The 4 dependent variables were dichotomized for bivariate and multivariate analyses. The number of ED visits during the initial pandemic months was dichotomized into ‘heavy user’ ( $\geq 3$  visits in the 3 months) and ‘non-heavy user’ ( $< 3$  visits). The change in pain score was dichotomized into ‘a higher pain threshold to seek ED care’ (change in pain score  $> 0$ ) and ‘a lower pain score or no change in pain score’. The likelihoods to visit ED for respiratory and pain-related symptoms, respectively, were dichotomized to ‘less likely’ and ‘the same or more likely’. Bivariate analyses between each dependent variable and the COVID-19 knowledge score and whether a participant agreed that he/she was more likely to contract COVID-19 in health

care facilities than in public places, respectively, were conducted. For the dependent variables that showed statistical significance in the bivariate analyses, multivariate logistic regressions were then performed to control for the confounding of patient characteristics. Statistic software Stata (StataCorp, College Station, TX) was used for all analyses.

### *Ethical aspects*

This study was conducted in tandem with the ethical principles of the Declaration of Helsinki. An informed consent along with each health questionnaire was administered to all participants, who were fully aware of their right to withdraw their participation prior to the completion of the questionnaire. The consent explained the aim of the study with clarification about the voluntary participation and confidentiality. The local Institutional Review Board approved the study (L20-167).

## **RESULTS**

Descriptive statistics of the sample characteristics are reported in Tables 1 and 2. About half of the surveys were completed during the 2<sup>nd</sup> surge of COVID-19 cases. Among the participants, about 16% were 65 years of age or older, 58% were females, 59% were of racial and ethnic minorities, 15% did not complete high school, 42% were employed full-time and 32% unemployed, 60% had a household income < \$25 K, and 30% did not have a PCP. Approximately 56% had at least one chronic comorbidity. About 12% had 3-5 and 13% had > 5 ED visits annually in 2019.

In the initial pandemic months of March, April and May 2020, the volume decreased by 11%, 42%, and 26%, respectively, as compared to the same months in 2019 in the local hospital ED. The average reported number of ED visits during the 3 initial pandemic months was 1.25. About 41% did not have any ED visits, 32% had only 1 visit, 15% had 3 or more visits. The average change in the pain threshold to seek ED care was 0.30 ( $p < 0.01$ ), with 69% reporting no change, 7% reporting a decrease and 24% reporting an increase. Slightly less than a quarter reported that they

were *more* likely to visit ED for respiratory and pain-related symptoms during the initial pandemic months. About 45% indicated that they were *less* likely to visit ED for respiratory symptoms and 32% were *less* likely to visit ED for any pain-related symptoms, with the difference between these two significant at  $P < 0.01$ .

The average COVID-19 knowledge score was 7.09 on the scale of 0-10. Only about 19% reported that they thought they were more likely to contract COVID-19 in healthcare facilities than in crowded public places.

Only two bivariate analyses demonstrated statistical significance at  $P < 0.05$ . The first was between heavy ED users and the COVID-19 knowledge score. The second was between higher pain threshold to seek ED care during the initial pandemic months and the belief that it was more likely to contract COVID-19 in healthcare facilities. Consequently, multivariate logistic regressions were performed for these two dependent variables. Table 3 shows the results from the multivariate analyses.

A better COVID-19 knowledge score was associated with a lower likelihood of being a heavy ED user during the initial pandemic month. Specifically, a 1-point increase in the COVID-19 knowledge score was associated with a 29% reduction of the probability of having 3 or more ED visits in those months, significant at  $P = 0.02$ . Elderly patients were nearly 16 times less likely than those 40 years of age or younger to be heavily ED users during these months, significant at  $p < 0.05$ . As compared with patients who were employed full-time, those who were employed part-time and retired were more likely to be heavy users, both significant at  $P < 0.05$ . As expected, heavy ED users at baseline showed the strongest positive association with the heavy use of ED during the initial pandemic months, significant at  $P < 0.01$ .

COVID-19 knowledge was not found to be statistically significant in reporting a higher pain threshold to seek ED care during the initial pandemic months than at baseline, an indicator of a decreased perceived need for

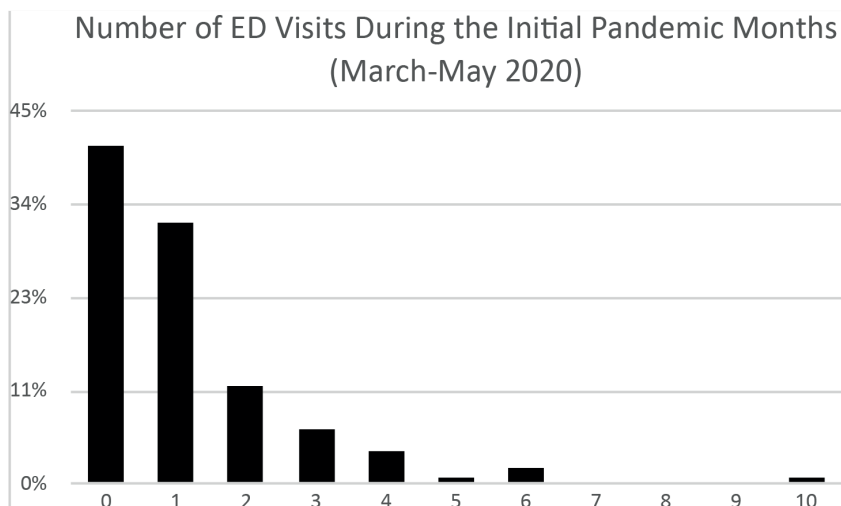


Figure 1. Number of ED visits in March-May 2020 ( $n = 252$ ).

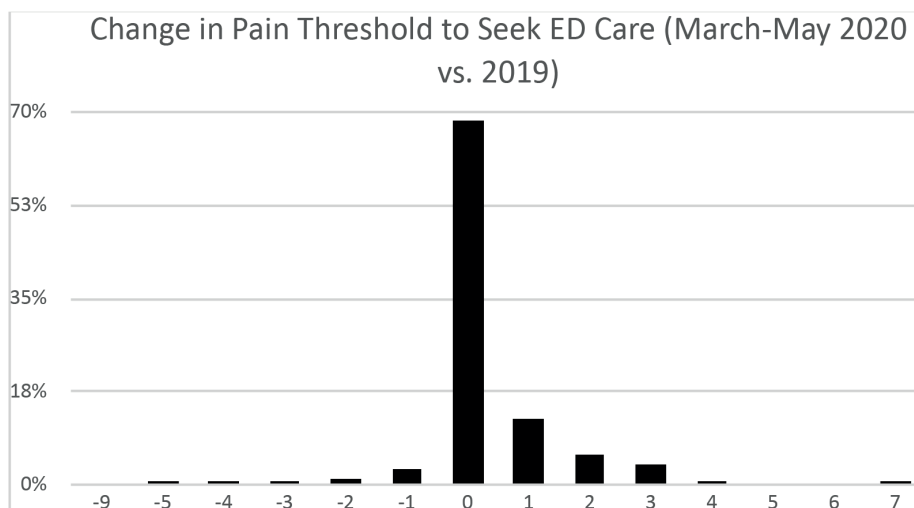


Figure 2. Change in pain threshold to seek ED care ( $n = 252$ ).

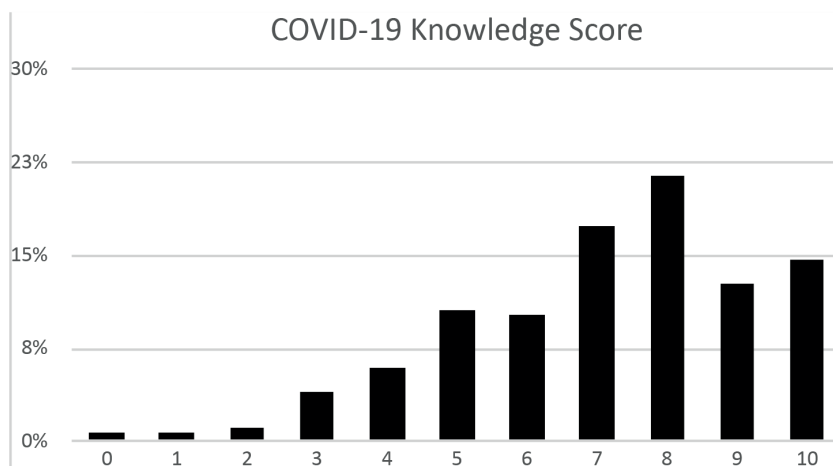


Figure 3. COVID-19 knowledge score ( $n = 252$ ).

**Table 1.** Descriptive statistics of study participants ( $n = 252$ ).

Characteristics		<i>n</i>	%
Age	<= 40 years	102	40.48%
	41-64 years	109	43.25%
	65+ years	41	16.27%
Gender	Male	106	42.06%
	Female	146	57.94%
Race and Ethnicity	Non-Hispanic White	102	40.48%
	Hispanic	113	44.84%
	Other races	37	14.68%
Education	< High School	38	15.08%
	High School	134	53.17%
	> High School	80	31.75%
Employment	Full Time	107	42.46%
	Part Time	28	11.11%
	Retired	37	14.68%
	Unemployed	80	31.75%
Annual Household Income	>= \$25,000	150	59.52%
	< \$25,000	102	40.48%
Have Primary Care Provider	No	76	30.16%
	Yes	176	69.84%
Chronic Comorbidities	Hypertension	107	42.46%
	Hyperlipidemia	63	25.00%
	Diabetes	56	22.22%
	Heart Diseases	54	21.43%
	Chronic Kidney Disease	31	12.30%
	Stroke	22	8.73%
	Liver Diseases	19	7.54%
	Any of the above	140	55.56%
Annual ED Visits in 2019	0-2	190	75.40%
	3-5	30	11.90%
	>5	32	12.70%

**Table 2.** Knowledge and attitude of participants towards COVID-19 (*n* = 252).

Characteristics	n/Mean	%/SD
Number of ED visits during the initial pandemic months (March-May 2020)	1.25	1.72
Changes in pain threshold to seek ED care (March-May 2020 vs. 2019)	0.30	1.48
Likelihood of visiting ED for respiratory symptoms during the initial pandemic months (March-May)		
More Likely	57	22.62%
About the Same	81	32.14%
Less Likely	114	45.24%
Likelihood of visiting ED for any pain-related symptoms during the initial pandemic months (March-May)		
More Likely	60	23.81%
About the Same	111	44.05%
Less Likely	81	32.14%
COVID-19 Knowledge Score	7.09	2.17
Agree that it is more likely to get COVID-19 in healthcare settings than in crowded public settings		
No	203	80.56%
Yes	49	19.44%
2 <sup>nd</sup> surge (after 06/18/2020)	131	51.98%

Note: N= Cell size and %, proportion, for categorical variables. Mean and Standard Deviation (SD) are shown for continuous variables.

**Table 3.** Results from multivariate analyses.

		≥3 EC Visits*			Higher Pain Threshold**		
		OR	95% CI	P value	OR	95% CI	P value
COVID-19 Knowledge Score		<b>0.71</b>	(0.53, 0.95)	<b>0.022*</b>	1.12	(0.95, 1.32)	0.169
Agree that it is more likely to get COVID-19 in healthcare settings than in crowded public settings (vs. Disagree and Neutral)		2.98	(0.69, 12.83)	0.143	<b>2.43</b>	(1.14, 5.16)	<b>0.021*</b>
2 <sup>nd</sup> surge (vs. prior to)		1.02	(0.32, 3.20)	0.976	1.15	(0.59, 2.23)	0.684
Age	<= 40 years						
	41-64 years	1.24	(0.34, 4.54)	0.743	0.77	(0.36, 1.62)	0.483
	65+ years	<b>0.06</b>	(0.00, 0.96)	<b>0.047*</b>	<b>3.95</b>	(1.08, 14.41)	<b>0.037*</b>
Female (vs. Male)		0.84	(0.25, 2.74)	0.767	0.80	(0.41, 1.54)	0.502
Race and Ethnicity	Non-Hispanic White						
	Hispanic	1.85	(0.44, 7.73)	0.401	0.97	(0.45, 2.08)	0.930
	Other races	0.63	(0.11, 3.58)	0.605	0.96	(0.34, 2.71)	0.942
Education	< High School						
	High School	0.60	(0.13, 2.86)	0.522	1.23	(0.45, 3.36)	0.686
	> High School	0.72	(0.11, 4.53)	0.723	0.87	(0.28, 2.74)	0.813
Employment	Full Time						
	Part Time	<b>10.49</b>	(1.32, 83.49)	<b>0.026*</b>	2.02	(0.68, 5.97)	0.204
	Retired	<b>29.82</b>	(1.98, 450.19)	<b>0.014*</b>	0.58	(0.14, 2.41)	0.457
	Unemployed	2.68	(0.50, 14.29)	0.249	<b>2.53</b>	(1.07, 5.96)	<b>0.035*</b>
Income <\$25K (vs. >=\$25K)		0.56	(0.14, 2.17)	0.399	0.78	(0.36, 1.65)	0.511
Have PCP (vs. Not)		1.97	(0.50, 7.80)	0.332	1.36	(0.62, 2.98)	0.438
Any Comorbidities (vs. Not)		0.47	(0.11, 1.91)	0.290	<b>0.31</b>	(0.14, 0.69)	<b>0.004**</b>
Annual ED Visits in 2019	0-2						



	≥3 EC Visits*			Higher Pain Threshold**		
	OR	95% CI	P value	OR	95% CI	P value
3-5	<b>119.32</b>	(20.13, 707.30)	<b>0.001**</b>	2.31	(0.92, 5.78)	0.075
>5	<b>385.96</b>	(56.06, 2657.33)	<b>0.001**</b>	0.95	(0.35, 2.62)	0.922

Note:

\*P < 0.05; \*\*P < 0.001

#: Had 3 or more ED visits during the initial pandemic months (March-May)

#: Changes in pain threshold to seek ED care > 0 (initial pandemic months vs. 2019)

ED care. However, the concern of contracting COVID-19 in healthcare facilities was found to be significantly associated with a higher pain threshold (OR = 2.43, P = 0.02). Elderly patients were nearly 4 times (P = 0.04) as likely as those ≤40 years of age to report a higher pain threshold, a result consistent with the association found between age and the probability of heavy ED use. Individuals with chronic comorbidities were about 70% (P < 0.01) less likely to report an increased pain threshold to seek ED care.

## DISCUSSION

The current study demonstrated that the concern of contracting COVID-19 in healthcare facilities was only associated with a decrease in the perceived need for ED care but not the actual utilization, after controlling for confounding factors. However, we found that a better COVID-19 knowledge was associated with a lower ED utilization. These results suggest that the concern of contracting COVID-19 in healthcare facilities was not the only factor that led to the decreased ED volumes, and it may have not been the most influential factor either.

Natural disasters and the COVID-19 pandemic share certain characteristics that could lead to decreased ED volumes, most notably, stay-at-home orders. Prior studies have demonstrated decreased ED volumes in the immediate period after a hurricane [28–30]. The implementation of stay-at-home orders during the COVID-19 pandemic has been shown to have a significant effect on ED visits and hospital admissions. CDC has reported decreased ED visits for MI, stroke, and hyperglycemic crisis immediately following

the implementation of stay-at-home orders [31]. University of California health system found a 35% decrease in ED radiology studies following the start of stay-at-home orders in California and concluded that the decline was attributable to the compliance to shelter-in-place orders [32]. This pattern was not unique to the U.S., with Italian hospitals reporting decreased admissions for acute coronary syndrome as well [33]. In addition, hospital admissions declined in concurrence with the decline in ED volumes and cancellation of elective surgeries [34].

An unintended negative consequence of the stay-at-home orders was the missed medical care for critical illnesses. CDC reported that the US' excess death rate exceeded the confirmed COVID-19 death rate [4]. About 60% of EMS agencies nationally reported decreased call volumes [35]. The negative impact was also reported in Italy, with a 50% increase in out-of-hospital cardiac arrest over previous years after the lockdown order was put in place [36]. Community outreach programs focused on decreasing this notable avoidance of the ED by patients with true emergencies would likely be a worthwhile endeavor for hospitals and communities. The adverse outcomes of decreased ED visits for true emergencies were likely underestimated at this time and may only be fully understood years from now. It is particularly concerning to find in our study that even after controlling for other factors, elderly patients were significantly less likely to use ED care and had a decreased perceived need for ED care. This was opposite to the usual pattern observed before the pandemic that elderly patients were more likely to use

ED care [37–39]. This could be the result of the widely accepted message based on findings about COVID-19 that elderly patients were more vulnerable and had a much higher case mortality rate than their younger counterparts. National polls showed that the majority of people age 65+ were concerned about contracting COVID-19 [40]. Additionally, surveys reported that people age 65+ were more likely to abide by stay-at-home orders [41]. Elderly patients faced additional barriers to care due to their limited resources, decreased mobility and lack of transportations. All these barriers were magnified after the placement of stay-at-home orders, as their families avoided home visits and public transportations were reduced. Their access to telemedicine was likely very limited due to cognitive impairment, the lack of telemedicine equipment such as a computer or a smart phone, and the lack of skills to operate the telemedicine equipment [42, 43].

Despite the presence of the COVID-19 pandemic, heavy users of ED care continued to be heavy users, as shown in the current study. As previously discussed, heavy ED users face more barriers to care and have more serious illness. It was unlikely for them to have means to seek care using telemedicine under the stay-at-home orders. Although our study was not powered to conduct subsample analyses of heavy vs non-heavy users, in our sample, 23.08% of heavy users had concerns of contracting COVID-19 in healthcare facilities vs. 18.78% among non-heavy users. This points to the possibility that heavy users' utilization is not as sensitive as non-heavy users to changes of external factors, such as the new healthcare environment created by the COVID-19 pandemic, likely due to the lack of resources.

### *Study limitation*

There are several limitations in the current study. First, the generalizability of the results from the current study may be limited because the survey was conducted in a single urban hospital ED. Second, the utilization of

ED care was self-reported, thus has potential reporting biases. Verifying the actual number of ED visits would have been difficult, if not impossible, as patients seek ED care in multiple hospitals in the region. Third, patients' knowledge of COVID-19 was cumulative up to the time of the survey, with the majority of surveys done in June and July. In contrast, the utilization of ED the survey asked about was for March, April and May. Consequently, there was a potential mismatch between a behavior that occurred in these 3 months and the COVID-19 knowledge that patients accumulated up to June and July. Fourth, the current study examined only patients who were already seeking ED care, as a key variable of interest was the number of ED visits. Thus, selection bias may be present. Lastly, the COVID-19 knowledge questions cannot be used in its current form for future studies as new information and discoveries become available. For example, at the time of the survey, COVID-19 vaccine was not available. However, this should have no significant impact on the underlying association demonstrated between COVID-19 knowledge and health behavior as long as the questions regarding COVID-19 knowledge was up to date at the time of the survey.

### **CONCLUSION**

In our US-based study, patients' knowledge of COVID-19 was a contributing factor to their utilization of ED care during the initial COVID-19 pandemic months. However, its effect may not be as prominent as previously thought. Stay-at-home orders likely had an unintended negative impact on the missed critical ED care. Although measures and community interventions to discourage unnecessary ED visits are important as the COVID-19 pandemic has already put a significant strain on the resources in EDs, concurrent community education about the necessity of ED visits for true emergencies should be put in place to minimize the missed critical ED care that contributes to excessive non-COVID-19 mortalities.

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