

The Influence of the COVID-19 Pandemic on ICU Organization, Care Processes, and Frontline Clinician Experiences

A Qualitative Study



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BACKGROUND: The COVID-19 pandemic resulted in unprecedented adjustments to ICU organization and care processes globally.

RESEARCH QUESTIONS: Did hospital emergency responses to the COVID-19 pandemic differ depending on hospital setting? Which strategies worked well to mitigate strain as perceived by intensivists?

STUDY DESIGN AND METHODS: Between August and November 2020, we carried out semi-structured interviews of intensivists from tertiary and community hospitals across six regions in the United States that experienced early or large surges of COVID-19 patients, or both. We identified themes of hospital emergency responses using the four S framework of acute surge planning: space, staff, stuff, system.

RESULTS: Thirty-three intensivists from seven tertiary and six community hospitals participated. Clinicians across both settings believed that canceling elective surgeries was helpful to increase ICU capabilities and that hospitals should establish clearly defined thresholds at which surgeries are limited during future surge events. ICU staff was the most limited resource; staff shortages were improved by the use of tiered staffing models, just-in-time training for non-ICU clinicians, designated treatment teams, and deployment of trainees. Personal protective equipment (PPE) shortages and reuse were widespread, causing substantial distress among clinicians; hands-on PPE training was helpful to reduce clinicians' anxiety. Transparency and involvement of frontline clinicians as stakeholders were important components of effective emergency responses and helped to maintain trust among staff.

INTERPRETATION: We identified several strategies potentially to mitigate strain as perceived by intensivists working in both tertiary and community hospital settings. Our study also demonstrated the importance of trust and transparency between frontline staff and hospital leadership as key components of effective emergency responses during public health crises.

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FOR EDITORIAL COMMENT, SEE PAGE 1585

ABBREVIATIONS: PPE = personal protective equipment

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Take-home Points

Study Questions: Have hospitals' responses to the COVID-19 pandemic differed depending on hospital setting? Which strategies have worked well to mitigate strain on intensivists?

Results: This qualitative study included interviews with 33 intensivists at tertiary and community hospitals across six US regions. We identified several components of emergency responses perceived to be effective, including canceling elective surgeries, providing hands-on personal protective equipment training, involving frontline clinicians as key stakeholders, and maintaining trust between hospital leadership and frontline staff through transparency and communication.

Interpretation: We identified several modifiable strategies to mitigate strain and to optimize emergency responses during ongoing and future public health crises as perceived by frontline intensivists.

Health care systems across the world have experienced unprecedented strain because of increased volume and acuity of patients hospitalized with COVID-19, coupled with reductions in patient care resources caused by disrupted supply chains.¹⁻⁶ In particular, the United States has led the world in the number of recorded cases

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and deaths resulting from COVID-19, with more than 33 million cases and nearly 600,000 deaths as of May 19, 2021.⁷

Acute surge events related to the COVID-19 pandemic⁸ have prompted adjustments to ICU organization, staffing, and care processes to meet the increased care demands of critically ill patients with COVID-19.^{2,3,5,7,9} Although previous studies have described hospital emergency responses during the pandemic (eg, cohorting of patients with COVID-19, use of tiered staffing models), little is known about the context for these responses and how they vary depending on hospital setting and available resources.^{2,5,9-13} Furthermore, an in-depth understanding of how these responses were experienced and perceived by frontline ICU clinicians—including what worked well and what did not—is lacking.

To address these knowledge gaps and inform ongoing and future pandemic responses, we qualitatively evaluated the influence of the COVID-19 pandemic on ICU organization and care processes as perceived by intensivists at tertiary care and community hospitals across the United States. We used the four S theoretical framework of emergency preparedness—space, staff, stuff, and system¹—to evaluate whether hospital responses varied depending on setting and available resources. We also sought to provide context for hospitals' emergency responses and to evaluate their impact on mitigating strain as perceived by intensivists.

Methods

Hospitals

We purposively selected hospitals located in six regions across the United States that reported early or large surges, or both, of patients with COVID-19 compared with other parts of the country between April and June 2020 based on publicly available county-level case rates.^{7,14} We included hospitals located in Arizona, California, Louisiana, Michigan, New York, and Washington state. Within each region, we included ≥ 1 tertiary care academic medical center and ≥ 1 community hospital that were in the same or adjacent hospital referral regions.¹⁵ Tertiary care centers were defined as hospitals that provide highly specialized care, typically are affiliated with a university, serve as referral centers, and represent primary sites for graduate medical education and biomedical research. In contrast, community hospitals focus on providing essential care for patients in their communities, rather than medical training and research.^{16,17}

Participants

Using both key informant and snowball sampling,¹⁸ we recruited two ICU directors (one tertiary, one community) and four additional intensivists (two tertiary, two community) from each region by

e-mail to help us reach the goal of approximately 36 interviews across 12 hospitals. This goal was based on prior literature demonstrating that 20 to 40 interviews are needed to reach saturation across multisite qualitative studies.¹⁹ We included ICU directors to gain additional insights into ICU organization. All participants verbally consented and were provided remuneration. The study was approved by the joint VA Portland Health Care system and Oregon Health & Science University institutional review board. We report details of our methods using the Consolidated Criteria for Reporting Qualitative Research²⁰ guidelines (e-Appendix 1).

Data Collection

We used two similar semistructured interview guides for ICU directors and frontline physicians (e-Appendix 2). Both interview guides used the four S theoretical framework of emergency preparedness: space (ie, bed capacity), staff (ie, personnel required for patient care and hospital operations), stuff (ie, equipment needed to deliver care), and system (ie, leadership to operationalize response efforts).¹ The interview guide for ICU directors contained additional structured questions about ICU organization.²¹ We elicited all participants' perceptions of which ICU organizational changes were effective components of pandemic responses. The multidisciplinary research team, including intensivists (K. C. V., K. S. M., T. S. V., A. D., K. P. S., S. Y. C., and C. L. H.), health services researchers (S. N.), and sociologists (A. S. and S. E. G.), iteratively revised the interview

guide during six pilot interviews, which were used to generate a preliminary codebook, but otherwise were not included in analyses. A. S. conducted one-on-one interviews over a secure web-based platform or telephone. Interviews ranged between 45 and 90 minutes and were recorded digitally, transcribed professionally, de-identified, and verified.

Data Analysis

We used the four S theoretical framework with deductive analysis methods²² to develop our preliminary codebook and organize our findings. We then applied the framework method²³ for qualitative analysis, using inductive thematic analysis²² to identify emergent themes within each four S domain. K. C. V. and S. E. G. independently coded data from pilot interviews, then jointly created a preliminary codebook. Next, K. C. V. and S. E. G. coded the first four study transcripts together, iteratively refining the codebook. They then split the remaining transcripts and independently coded them, creating framework matrices to aid in final data interpretation and meeting frequently to review data, collapse themes, and reach consensus. The multidisciplinary research team iteratively reviewed the codes and performed analytic triangulation to ensure analyses remained well grounded in data. We created an audit trail to track analytic decisions using ATLAS.ti8 (Berlin, Germany) to organize data.

Results

We contacted 36 intensivists to participate, and 33 (92%) agreed. Interviews were conducted between August 6 and November 4, 2020. We interviewed seven ICU directors and 13 intensivists from seven tertiary hospitals and five ICU directors and eight intensivists from six community hospitals. Twelve of 33 participants were women, and all completed fellowship in critical care (Table 1). Thematic saturation occurred after reviewing 26 transcripts. Main findings are shown in Figure 1; Table 2 lists exemplary quotations.

Space

To increase bed capacity, all hospitals canceled elective surgeries early in 2020, which most participants across both tertiary and community hospitals found helpful. Elective surgeries had resumed across all sites by August 2020 and continued despite subsequent surges of COVID-19 hospitalizations. Physicians from both settings described their desire to cancel or limit the number of elective surgeries during ongoing or future surges to increase hospital capacity and reduce strain on clinicians. One participant said, "Continuing . . . elective surgery the second go-around was probably not the best thing because we had such a high surge . . . I don't know if people outside our department . . . realized how stretched thin we were" (quotation 1).

Several clinicians perceived that hospitals' financial losses drove decisions to continue performing elective

surgeries throughout subsequent surges. Particularly among intensivists at tertiary hospitals, these decisions led to increased strain on staff and compromised trust in their institutions. One suggested that "[hospital administrators] are being wildly irresponsible with wanting to recapture some lost funds . . . at a time [when] . . . we are [at] 100% capacity, plus finding every nook and cranny to put a patient in . . . they are talking about doing elective knee replacements" (quotation 2).

Staff

Before the pandemic, three hospitals had in-house intensivists 24 h/day. At the peak of their initial surges, 10 hospitals had in-house intensivists 24 h/day; the three without were all community hospitals (Table 1). When elective surgeries were canceled during spring 2020, tertiary hospitals repurposed anesthesiologists and surgeons to create treatment teams responsible for performing specific procedures (eg, intubation, prone positioning, vascular access), which improved workflow efficiency, reduced strain on intensivists, and enabled them to focus on medical decision-making (quotation 3). In contrast, community hospitals did not create such teams (Fig 2).

After elective surgeries resumed, hospitals often experienced staff shortages, particularly among ICU nurses and respiratory therapists (quotations 4-7). Tiered staffing models, in which critical care-trained physicians or nurses oversaw non-ICU clinicians,²⁴ were

TABLE 1] Participant and Hospital Characteristics

Characteristic	No.	%
Participant characteristics	N = 33	
Sex		
Female	12	36%
Fellowship training		
Pulmonary and critical care medicine	29	88%
Internal medicine/critical care medicine	3	9%
Emergency medicine/critical care medicine	1	3
Role		
ICU director	12	36
Frontline ICU physician	21	64
Hospital type		
Tertiary	20	61
Community	13	39
Hospital characteristics	N = 13	
Hospital type		
Tertiary	7	54
Community	6	46
House staff in medical ICU (ie, residents, fellows)		
Internal medicine residency and pulmonary and/or critical care fellowship	8	62
Family medicine residency and/or transitional internship program	2	15
Nonteaching	3	23
Staffing model in medical ICUs		
High-intensity ICU ^a	8	62
Low-intensity ICU ^b	5	38
Intensivist in-house 24/7		
Before COVID-19	3	23
During COVID-19	10	77

^aClosed ICU refers to a staffing model in which ICU patients are under the full responsibility of a trained intensivist.²¹

^bOpen ICU refers to a staffing model in which ICU patients are admitted under the care of another attending physician with intensivists potentially available for consultation.²¹

frequently used among nurses across both tertiary and community hospitals and were considered helpful to maximize their reach (Fig 1). Among physicians, tiered staffing models were common at tertiary hospitals, which frequently deployed just-in-time training for non-ICU clinicians being reassigned to work in the ICU (quotation 8). In contrast, community hospitals rarely

used physicians from other specialties to help care for ICU patients, instead relying on their current staff to work longer hours, hiring locums intensivists to help during surges, or both (Fig 2).

Physicians across both hospital settings noted how shortages in ICU nurses and respiratory therapists negatively impacted the ability to care for critically ill patients. One physician explained that “the allocation of nursing . . . and respiratory therapy time was very high on my list of rationing We were rationing care because we had to pick who was going to get this trial today, who is going to get this done today If I saw an ICU nurse [who] I knew from our own unit, I could pick 3 to 4 things for them to do that day But someone who didn’t have that training? Then I would just pick 1 to 2 things” (quotation 7).

Most tertiary hospitals with trainees initially excluded them from caring for COVID-19 patients, but over time, trainees became essential members of the treatment team (Fig 1). Many participants believed that involving trainees reduced strain and expanded ICU capabilities, while simultaneously providing trainees with exceptional hands-on training (quotations 9-11). One physician said, “One of my fellows, I asked him, ‘How many people have you intubated in the last four months?’ . . . He said it was like 30 or 40. They are going to be awesome!” (quotation 10).

Stuff

Personal Protective Equipment: Early on in the pandemic, when transmissibility of SARS-CoV-2 was understood poorly, some physicians across both hospital settings wanted to wear masks but felt “shamed” for doing so (quotations 12 and 13). One said, “At the beginning . . . I put on a procedural mask in the hallway and got ridiculed And one of the unit clerks ends up getting COVID and dies. And then they said, okay . . . if you feel uncomfortable not wearing a mask, for your own ‘social comfort,’ you can wear cloth masks that you provide yourself” (quotation 12).

Hospitals frequently changed personal protective equipment (PPE) recommendations over the course of the pandemic, and all recommended reuse of N95 masks and face shields. Across all hospitals, confusion about PPE availability and use led to distrust among clinicians because of concerns that hospitals were not prioritizing their safety (quotations 14-19). For instance, one physician questioned, “Is it okay to trust them when





"Four S" Framework			
	Key Components of Emergency Responses	Intensivists' Perceptions	Key Takeaways
Space 	<ul style="list-style-type: none"> • Canceled elective surgeries – Spring 2020 • Resumed elective surgeries – Summer 2020 	<ul style="list-style-type: none"> • Canceling surgeries increased bed capacity & reduced strain • Continuing surgeries during surges increased strain & compromised trust 	<ul style="list-style-type: none"> • Surge plans should incorporate feedback from clinicians to define thresholds at which elective surgeries are limited or canceled
Staff 	<ul style="list-style-type: none"> • Implemented 24/7 intensivist coverage • Experienced ICU staff shortages • Created designated treatment teams • Employed tiered staffing models • Included trainees on ICU teams • Developed just-in-time training for non-ICU staff 	<ul style="list-style-type: none"> • Staff shortages negatively impacted patient care • Designated treatment teams improved efficiency • Tiered staffing models expanded intensivist reach • Trainees expanded ICU^a capabilities and received exceptional hands-on training 	<ul style="list-style-type: none"> • Experienced critical care staff are the most limited resource • Community hospitals at higher risk of experiencing critical staff shortages
Stuff 	<ul style="list-style-type: none"> • Changed recommendations for PPE use over time • Experienced PPE shortages and re-use • Differed in PPE training • Maintained enough ventilators • Experienced shortages of medications and dialysis machines 	<ul style="list-style-type: none"> • Physicians felt "shamed" for wearing masks prior to universal masking • Lack of transparency and availability of PPE led to substantial distrust among clinicians • Hands-on PPE training reduced anxiety 	<ul style="list-style-type: none"> • Improve trust through prioritizing transparency, ensuring adequate PPE supplies, and providing hands-on training for PPE use
System 	<ul style="list-style-type: none"> • Cohorted COVID-19 patients • Restricted visitors • Communicated via emails and town halls • Neglected to include frontline clinicians as key stakeholders 	<ul style="list-style-type: none"> • Cohorting improved workflow efficiency & minimized PPE use • Restricting visitors compromised communication • Communication and transparency from hospital leadership were helpful to build trust • Involvement of clinicians as key stakeholders improved processes and optimized outcomes 	<ul style="list-style-type: none"> • Cohort patients with COVID-19 to streamline care • Build trust among frontline physicians through frequent communication, transparency, and involving them as key stakeholders

Figure 1 – Diagram showing the main findings stratified by the four S framework of emergency preparedness.

they said it's okay to go into the room without a mask?" (quotation 14). Another reported that staff were told explicitly not to wear masks around that hospital, causing substantial distress among clinicians. That participant explained, "You can require somebody to wear something, but demanding that somebody not wear something is a whole different scenario" (quotation 15).

Moreover, hospitals frequently advertised that they did not experience PPE shortages, despite widespread PPE reuse among staff. One participant said, "We didn't run out of PPE because we weren't *using* PPE" (quotation 18). Physicians noted their suspicion that decisions to reuse PPE might be fiscally motivated, which further exacerbated their distrust in hospital leadership. One explained, "As long as we are using the same N95s, the hospital would tell you . . . that we are in the green. But as long as we are having to use the same N95 for a week at a time, I would say . . . we have a persistent shortage of N95s . . . I get the suspicion that they are trying to save money" (quotation 16).

In addition, PPE training varied across hospitals, ranging from no training, to online videos, to frequent hands-on training. Many physicians who did not receive hands-on training reported feeling anxious and fearful about becoming infected. Those who received hands-on training found that it was helpful and gave the impression that the hospital cared about staff safety (quotation 20); others who did not receive hands-on training wished they had (Fig 3).

Medical Supplies and Equipment: Although no hospitals ran out of ventilators, several hospitals had to use unfamiliar units (eg, transport ventilators), which proved challenging (quotations 21 and 22). Many hospitals created plans to use noninvasive ventilators, to attach multiple patients to one ventilator, or both, although none had to implement them. During times of low ventilator availability, participants described instances in which they encouraged comfort measures over aggressive treatment in patients with poor prognoses (quotations 23 and 24). One physician said, "Ventilators became real close [to running out] . . . There were patients [who] had a poor prognosis [for whom we] probably more aggressively pursued palliative measures than maybe would have been done in other situations" (quotation 23). In addition, participants across all hospital settings reported running out of sedatives and paralytics intermittently, although these shortages were time limited and were not felt to impact patient care substantially. Occasional shortages of dialysis resources occurred, causing delays in receipt of renal replacement therapy (quotation 25).

System

Intensivists appreciated efforts by their hospital administrations to establish incident command centers and to outline clearly defined emergency responses in advance of surges. Common hospital policies included cohorting COVID-19 patients and restricting visitors.

TABLE 2] Exemplary Quotations

Quotation Number, Study Participant, and Setting	Themes and Subthemes	Exemplary Quotation
Space		
Quotation 1: ICU physician, tertiary hospital	Canceling elective surgeries	"Continuing with elective surgery the second go-around was probably not the best thing because we had such a high surge that was going on, and . . . it's really hard because I don't know if the people outside of our department who aren't really taking care of these patients really realized how stretched thin we were . . . I feel like that was probably the one thing we should have fought more for, to really shut down the number of surgeries that was happening, electively at least."
Quotation 2: ICU physician, tertiary hospital	Canceling elective surgeries	"I think they are being wildly irresponsible with wanting to recapture some lost funds . . . We have all doubled our clinic effort already. I think at a time where we all said we are flirting with having to do a triage protocol for crisis centers. We are like on the line, 100% capacity, plus finding every nook and cranny to put a patient in, and they are talking about doing elective knee replacements. Or we can't do ECMO because people are getting a couple elective valves replaced and the cardiac ICU nurses are stuck taking care of those patients. That is wildly irresponsible in my opinion."
Staff		
Quotation 3: ICU physician, tertiary hospital	Designated treatment teams	"After the elective procedures were canceled . . . [Surgeons and anesthesiologists] were all reassigned to work in the medical ICU. And our surgery residents and attendings, we ceded all the procedures like central lines . . . There was also a separate trach [eostomy] team that essentially consisted of general surgeons, cardiothoracic surgeons that just went around doing our tracheostomies which usually we would have done ourselves . . . We tried as best we could to match people with their strengths."
Quotation 4: ICU physician, community hospital	Staff shortages	"We just didn't have enough nursing . . . That was a big limiting factor . . . that I think might have affected patient care . . . We were very limited in respiratory therapists because normally we don't have many patients on ventilators, and now all of our patients were on ventilators."
Quotation 5: ICU director, tertiary hospital	Tiered staffing models for nurses	"We augmented staffing by, instead of having one critical care nurse taking care of two ICU patients, we had a team that consisted of a CRNA, a non-ICU nurse who was often times taken from either the clinics or outside procedure areas that were now closed, and our critical care nurse. So the three of them would take care of six patients. And so even though the nurse to patient ratio was kept the same, we approached it in a team manner."
Quotation 6: ICU director, tertiary hospital	Tiered staffing models for physicians	"We didn't have enough attendings . . . Instead of one attending overseeing approximately 16 patients, we had one critical care attending overseeing . . . around 30 patients. . . So . . . we added other noncritical care attendings that subsequently had been pulled from areas that were now closed. And the attending intensivist would round, they would essentially manage some of the things that the non-ICU attendings just weren't comfortable with."
Quotation 7: ICU physician, tertiary hospital	Rationing care	"The allocation of nursing time and respiratory therapy time was very high on my list of rationing . . . We were rationing care because we had to pick who was going to get this trial today, who is going to get this done today . . . So, if I saw an ICU-level nurse that I knew from our own unit, I could pick three or four things for them to do that day because I knew it would be possible. But someone who didn't have that training? Then I would just pick one or two things. Like today, we are going to just decrease the sedation by 20. And it would be a very specific instruction as opposed to an ICU nurse that I'm used to, I would say, "wean the sedation."

(Continued)

TABLE 2] (Continued)

Quotation Number, Study Participant, and Setting	Themes and Subthemes	Exemplary Quotation
Quotation 8: ICU director, tertiary care	Just-in-time training	“Before they [non-critical care nurses] came in, we did have some didactic sessions for them . . . we had just a quick in-service with them . . . what the roles are expected to be and how they can help. They were also supervised by the regular critical care team, so they were not given autonomy to do everything on their own, but they had to work with some somebody in the ICU just to be a help out as opposed to a replacement.”
Quotation 9: ICU director, community hospital	Deploying trainees	“It was interesting how it evolved, because initially they wouldn’t let any residents at all see any COVID patients at all. Then they realized that that was stupid. Especially for [ED] residents not to see COVID patients meant they pretty much couldn’t see anybody. They fixed that within about a week. They just had to learn how to use PPE like everybody else.”
Quotation 10: ICU physician, tertiary hospital	Impact on trainee education	“As a critical care education, they are going to be just awesome when they finish fellowship because they have gotten more on-the-fly education in refractory hypoxemia, ARDS, coagulopathy, all that stuff than you can probably ever imagine. I mean they are going to be just awesome! I think one of my fellows, I asked him how many people have you intubated in the last 4 months? I think he said it was like 30 or 40. They are going to be awesome!”
Quotation 11: ICU physician, tertiary hospital	Impact on trainee education	“I would argue that from a fellowship perspective it was a, hopefully, once-in-a-lifetime opportunity. The number of procedures that these fellows, the number of intubations . . . as fun as intubating someone who could kill you [laughs] is, the number of intubations and procedures and central lines that the fellows got to perform was a dramatic increase in volume . . . Residents had the opportunity to see something that was generally really well accepted.”
Stuff
Personal protective equipment
Quotation 12: ICU physician, tertiary hospital	Clinician shaming	“At the beginning of this . . . I walked into the ICU service and I put on a procedural mask in the hallway. And got ridiculed for it because at the time, infection prevention and the administration had said we can’t wear masks outside of the patients’ rooms. And one of the unit clerks ends up getting COVID and dies. And then they said, okay, we can wear “social comfort” masks: that if you feel uncomfortable not wearing a mask, for your own social comfort, you can wear cloth masks that you provide yourself.”
Quotation 13: ICU physician, tertiary hospital	Clinician shaming	“When this all first started, we would get in trouble for wearing a mask . . . like in the hospital, in the hallways. If we weren’t in the patient room, we would get in trouble for wearing a mask . . . And actually, honestly, they said if you want to wear a mask all the time you have to bring your own mask . . . It was almost like they were kind of shaming you for wanting to wear a mask.”
Quotation 14: ICU physician, tertiary hospital	Distrust in institution	“Our understanding of how to work with PPE has changed. That was a little disconcerting. It almost felt like in the beginning they almost told us not to be using PPE . . . Is it ok to trust them when they said it’s okay to go into the room without a mask?”
Quotation 15: ICU physician, community hospital	Distrust in institution	“We were told not to wear masks around the hospital . . . In my opinion . . . you can require somebody to wear something, but demanding that somebody not wear something is a whole different scenario.”

(Continued)

TABLE 2] (Continued)

Quotation Number, Study Participant, and Setting	Themes and Subthemes	Exemplary Quotation
Quotation 16: ICU physician, tertiary hospital	Distrust in institution	"As long as we are using the same N95s, the hospital would tell you no, that we are in the green. But as long as we are having to use the same N95 for a week at a time, I would say . . . we have a persistent shortage of N95s. And now, they want to try to preserve the disposable gowns, so they have brought in these reusable plastic ones that are just a special kind of awful . . . I get the suspicion that they are trying to save money on disposable gowns."
Quotation 17: ICU physician, tertiary hospital	Clinician safety	"I was very uncomfortable with the idea of having to ration and kind of reuse PPE that we had never reuse[d] . . . There was no precedent for wiping down a gown . . . There was a feeling that well, how in the world can you expect me to now wipe down a gown when this is a very infectious organism, far more infectious than influenza? And we never did this for influenza!"
Quotation 18: ICU physician, community hospital	Distrust in institution	"The memo that we got [from the hospital saying] you never ran out of PPE in the whole pandemic . . . Well, we didn't run out of PPE because we weren't using PPE."
Quotation 19: ICU physician, community hospital	Distrust in institution	"Our infectious disease infection control person was following their own recommendations not to wear N95s in the room and caught it and came back 2 weeks later and everything changes . . . That was kind of our evolution was realizing . . . we can't perhaps rely too heavily on recommendations that were evolving as we went along. N95s became a lot more available. Health care providers were given more leeway to do what you feel you need to do to protect yourself."
Quotation 20: ICU physician, community hospital	Clinician safety	"[The hospital was] very intentional in the doffing and donning and entering and exiting the rooms with signage and cues to don and doff . . . They were more provider . . . centric in terms of just signage . . . I think there was a sense of the hospital system caring about the health care providers and their safety."
Medical supplies and equipment
Quotation 21: ICU physician, tertiary hospital	Ventilators	"I don't know even know what kind of ventilators they were, to be honest, but no one knew how to manage them. No one knew really what they meant. They were the only ventilators we had. I, at one point, had three patients on them and I had no idea how to use it. The wave forms didn't come out, so I really had no idea if the patient was okay on those settings or kind of like, we just had no idea really how to use them."
Quotation 22: ICU physician, community hospital	Ventilators	"We ran out of our good ventilators, which are the ones where we can see the wave forms and everything like that. But we always had some form of ventilator available . . . The portable ventilators are just not great for patients to be on for long periods of time; they just weren't made for that. So we had a lot of issues at times with patients because of that."
Quotation 23: ICU physician, community hospital	Ventilators	"Ventilators became real close [to running out]. We got down to our last travel vent that was on reserve. We never actually had to say, no, we don't have those ventilators, but there were patients that had a poor prognosis that were probably more aggressively pursued palliative measures than maybe would have been done in other situations."
Quotation 24: ICU physician, tertiary hospital	Resource allocation	"[Patients] basically ended up dying because we just didn't have the resources. They were already very sick. They weren't going to get better because we didn't have the resources to provide . . . We had to allocate to someone who was likely going to benefit from it. That was also very . . . that was also a tough decision to make

(Continued)

TABLE 2] (Continued)

Quotation Number, Study Participant, and Setting	Themes and Subthemes	Exemplary Quotation
		because the decision to not offer therapy is tough when you know it's going to prolong their life. It might not save their life, but for some family members their life prolonging is important, so we might not have been able to accommodate everyone for what their wishes really were."
Quotation 25: ICU physician, tertiary hospital	Dialysis equipment	"At the height of the pandemic, we also didn't have . . . enough dialysis machines and dialysis techs. I didn't think that was ever possible, but every patient who had severe COVID needed dialysis at some point, and we weren't able to provide everyone dialysis in a timely manner."
System
Quotation 26: ICU physician, tertiary hospital	Cohorting patients	"That was the benefit of cohorting the patients so you could use less PPE. And also the patients can't infect each other but, you know, that's also why we put two patients in one room. So that was helpful."
Quotation 27: ICU physician, tertiary hospital	Cohorting patients	"[Cohorting COVID-19 patients] worked well from the standpoint of housing all the patients in the same location . . . Had the patients been scattered all over the place, that would have been really challenging for workflow. Just the simple process of donning and doffing personal protective equipment, everything takes longer with these patients. If you then had to throw on the problem of moving from unit to unit as you're trying to see your patients and examine them and round on them, it would have . . . really added to the length of the day."
Quotation 28: ICU physician, tertiary hospital	Visitor policies	"[When] we think that maybe end of life is upon this specific patient and so we need to discuss with family how to transition the patient towards end of life and have those difficult conversations, those conversations are challenging. They're arduous. They're emotional. They're frustrating. Even when they're done in person with families. And then when you take away that ability to sit down with the family member, to discuss those things, it's even more challenging."
Quotation 29: ICU physician, community hospital	Hospital leadership	"In the beginning of the whole pandemic, there were a bunch of people in mid-level management who were all kind of vying for their chance to run the show. And we would have these morning briefings that they would be arguing with each other during the briefings, and so there was no clear person in charge, and the mixed messaging that resulted from that was, (a) just a terrible look for the institution and the hospital staff clearly saw it, and (b) I think a lot of near misses of problems happened that would have been avoided if there was a clear person in charge that kind of steered the hospital's response to the pandemic . . . And so, we ended up in the ICU just kind of doing our own thing, but deviating somewhat from some of the hospital policies based on what we thought was our best judgment."
Quotation 30: ICU physician, tertiary hospital	Communication and transparency	"[Hospital leadership] started having what were initially weekly town hall meetings for all physicians and other staff to be able to listen in and participate and hear from the leadership, all different components of [this medical center] medicine: nursing, infection control, medical directors, etc., and get their perspective and have questions of concern be answered in real time. I think that communication went a long way towards tamping down anxiety and keeping people updated on what was going on."
Quotation 31: ICU director, tertiary hospital	Communication and transparency	"Some of the communication . . . is not ideal. For example, transparency about . . . how much PPE do we actually have? How many ventilators do we actually have? If we know this information, we can plan. You are not giving us accurate information."

(Continued)

TABLE 2] (Continued)

Quotation Number, Study Participant, and Setting	Themes and Subthemes	Exemplary Quotation
Quotation 32: ICU director, tertiary hospital	Communication and transparency	“I think the things that could have been done better were communicating with the frontline troops in regards to real challenges and being very transparent. And I think our leadership took—our institution leadership—took a tact of ‘We are going to be cheerful, all positive, everything is going well,’ which was oftentimes a disconnect between that messaging and what people were seeing at the bedside. And I think a little bit more honesty and transparency in regard to like, ‘Yeah, this is difficult,’ and acknowledgement of the challenges while at the same time being positive would have been an improvement.”
Quotation 33: ICU physician, community hospital	Frontline clinicians as stakeholders	“We were working with administrators who were actually clinicians and understood what we were dealing with and really got it and were really trying to remove as many obstacles as they could so that we could take care of the patients and advocate for us . . . I think we were really pretty nimble.”
Quotation 34: ICU director, community hospital	Communication and transparency	“The one thing I think could have been much better done is . . . communication to the medical staff and the nursing staff. We had a command center that was staffed by administrators and some nursing leadership, but information did not flow well from there out to the frontline workers and staff. So, if we had to do it all again, that’s the one thing I would probably push for more, that we sort of clarify those lines of communication and how those travel down and how they travel up when frontline workers have concerns about what’s going on.”
Quotation 35: ICU director, tertiary hospital	Communication and transparency	“I think a little bit more planning would be better next time if we could think of contingency plans and things sooner. It’s such a big system, it’s hard not to be clunky. You know you think you are setting up something perfectly and then you say, holy moly, we forgot to include respiratory therapy in this conversation and like, yeah, we’ve got this great new unit and it’s, like, awesome—beds and vents—but, like, no one to run it.”
Quotation 36: ICU director, tertiary hospital	Frontline clinicians as stakeholders	“We felt [hospital administration was not] . . . really listening to a lot of physicians on the ground . . . people in suits that make decisions but don’t ever actually ever see patients.”
Quotation 37: ICU director, community hospital	Frontline clinicians as stakeholders	“We [clinicians] were seeing firsthand where . . . some of the holes were, and I kind of felt like at times there was a gap between what was actually happening in the unit and what was actually discussed at meetings. There wasn’t always representation [of clinicians at those meetings].”
Quotation 38: ICU physician, tertiary hospital	Communication and transparency Frontline clinicians as stakeholders	“I would have loved to see more communication, like, from frontline workers to, like, the top hospital administrators because I would love to communicate [that]. . . your most important resource is not the ventilator or a dialysis machine, but it’s really your limited work force, which was really a limited resource of knowledge and experience . . . Why don’t you ask, like, your foot soldiers what we have learned, and how we think things could be done better? I think they have asked a lot of, like, the leadership and the people in the middle, but not all of them actually did the work. And that includes not just physicians, but respiratory therapists, nurses, even, like, the floor nurse who was pulled in. Like, there were many different things I’m sure they learned. I wish there was more of that multidisciplinary discussion, but from, like, a small potato point of view.”

CRNA = certified registered nurse anesthetist; ECMO = extracorporeal membrane oxygenation.

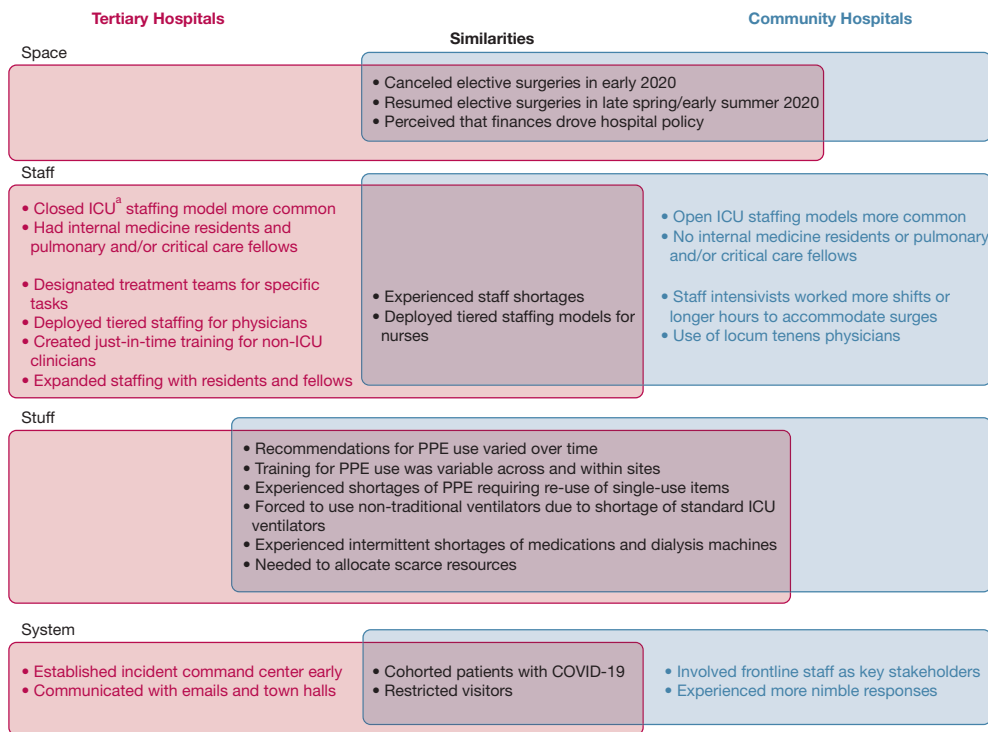


Figure 2 – Diagram comparing and contrasting characteristics and emergency responses of tertiary care and community hospitals.

Most physicians believed that cohorting was helpful regarding PPE conservation and improved workflow efficiency (quotations 26 and 27). In contrast, restrictive visitor policies were viewed negatively, because intensivists believed that these policies made communication with surrogates more challenging (quotation 28).

Given the evolving nature of the pandemic, physicians emphasized the importance of clear leadership and frequent communication from the hospital administration (quotation 29). Physicians at tertiary hospitals more frequently reported attending town hall events in which representatives from hospital leadership answered questions posed by staff in real time. Physicians at tertiary hospitals also frequently reported receiving daily e-mails with policy updates, which helped to improve their understanding and reduce anxiety (quotation 30). At the same time, physicians were frustrated by what they perceived as a lack of transparency (quotations 31 and 32). Physicians across both hospital settings also noted the importance of involving clinicians as key stakeholders in decision-making processes, a strategy that was more commonly noted among physicians at community hospitals

(quotations 33-38). For example, one community physician stated, “We were working with administrators who were actually clinicians and understood what we were dealing with . . . [They were] trying to remove as many obstacles as they could so that we could take care of patients . . . I think we were pretty nimble” (quotation 33).

Community physicians appreciated two-way communication with hospital administrators, noting that it enabled them to adapt quickly in a dynamic situation. In contrast, layers of hierarchy between administrators and frontline clinicians at tertiary hospitals reduced the control enjoyed by staff locally, unnecessarily delaying implementation of new policies. One ICU director at a tertiary hospital explained, “It’s a big system; it’s hard not to be clunky. You think you are setting up something perfectly and then you say, holy moly, we forgot to include respiratory therapy in this conversation” (quotation 35). Similarly, physicians from tertiary centers believed that their hospitals did not elicit their feedback (quotation 36). One explained how their leadership did not appreciate that their “most important resource is not the ventilator or dialysis machine, but it’s really your limited work force . . . Why don’t you ask your foot soldiers what

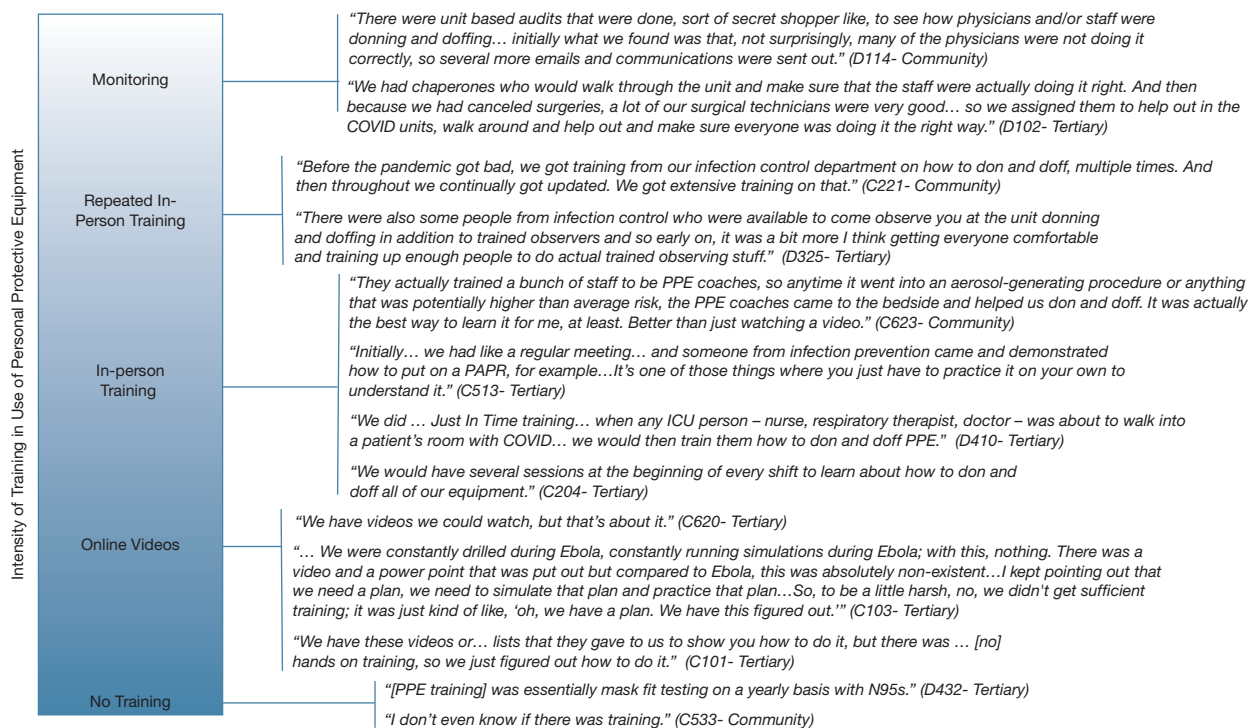


Figure 3 – Diagram showing perceptions of the intensity of training received for use of personal protective equipment among critical care physicians. PAPR = powered air purifying respirators; PPE = personal protective equipment.

we have learned, and how we think things could be done better?" (quotation 38).

Discussion

In this qualitative study of emergency responses to the COVID-19 pandemic across tertiary and community hospitals in the United States, we used the four S framework to identify several potentially modifiable components of hospital responses that influenced strain experienced by intensivists. First, canceling elective surgeries was helpful to increase hospital capacity and staff availability; however, continuing elective surgeries during subsequent surges increased strain on the critical care delivery system. Second, rather than bed capacity or medical supplies, staff trained in the care of critically ill patients was the most limited resource. Third, PPE shortages and reuse were widespread, causing substantial distress among clinicians. Fourth, transparency and involvement of frontline clinicians as stakeholders in decision-making processes were key components of effective emergency responses. Importantly, a lack of trust between physicians and their institutions emerged as a key theme across all four S categories, further

exacerbating the strain clinicians experienced during the pandemic.

Between March and June 2020, many hospitals canceled elective surgeries in anticipation of surges of COVID-19 patients.²⁵ Although intensivists considered such early action to be helpful, canceling elective surgeries resulted in steep financial losses for hospitals because they comprise up to two-thirds of hospital revenues in the United States.²⁶ Furthermore, canceling surgeries and other procedures risks patient harm because of delayed care.^{26,27} Resuming elective surgeries in the midst of subsequent surges frustrated frontline clinicians and gave some the impression that hospital finances were paramount. For this reason, health care systems should incorporate feedback from frontline clinicians in the development of comprehensive surge plans that define clear thresholds after which elective surgeries would be limited or canceled as part of efforts to mitigate strain, to preserve trust, and to optimize patient care.^{28,29}

Participants across all settings believed that ICU clinicians were the most limited resource during the pandemic and that staff shortages negatively impacted

patient care. Four strategies were deemed helpful in addressing staff shortages: (1) use of tiered staffing models,^{24,29} (2) just-in-time training for non-ICU clinicians, (3) creation of designated treatment teams, and (4) deployment of trainees in the ICU. Importantly, community hospitals rarely had staff or resources available to use these strategies, suggesting that they may be more vulnerable to critical staffing shortages during crises than tertiary centers (Fig 2). Community hospitals may benefit from alternative strategies to increase ICU capabilities as part of their emergency responses, such as proactively canceling elective surgeries, critical care regionalization,³⁰ using telemedicine technologies,²⁹ or a combination thereof.

Participants across all settings believed that hospitals' recommendations for PPE use were based on availability, finances, or both rather than science, leading to a perception of hospital leadership's disregard for their safety. These findings build on results from a recent survey of 2,700 ICU clinicians, in which insufficient access to PPE was the strongest predictor of emotional distress or burnout among US clinicians.³¹ Burnout syndrome has been associated with numerous negative professional and personal consequences among clinicians, including poor work performance, increased job turn over, depression, alcohol abuse, and suicidal ideation.^{32,33} It is important to understand factors contributing to burnout to develop interventions that mitigate its negative impacts. Our study adds to the literature by demonstrating that lack of transparency and trust related to PPE availability and use are potentially modifiable factors contributing to worsened morale among intensivists. Additionally, we found that hands-on training in PPE use was helpful to reduce anxiety experienced by staff. Although insufficient data exist to recommend one form of PPE training over another regarding infection prevention,^{29,34} hands-on PPE training represents another potentially modifiable strategy to help reduce anxiety and build trust among frontline staff.

Finally, at both tertiary and community hospitals, we found that communication and transparency were key factors in establishing trust between hospital administration and frontline staff. Prior literature demonstrated that hospital organizational culture is associated with patient outcomes³⁵⁻³⁸ and that it can be both measured and improved using strategies focused on communication and teamwork between administrators and staff.³⁹ Although hospital culture is difficult to change, hospitals with an established culture of trust and two-way communication between administration and frontline clinicians will be better equipped to respond effectively and potentially to minimize the psychological burden experienced among staff during public health crises.

Strengths of our study includes its rich perspectives from intensivists sampled from tertiary and community hospitals in geographically diverse regions of the United States. Our study also has limitations. First, given the scope of this study, we included only attending intensivists at US hospitals with variable financial models, potentially limiting generalizability. Second, we conducted the study in regions that had experienced early surges of patients with COVID-19 and whose local responses to the pandemic varied. The perceptions of intensivists may have evolved over time. Given time constraints, transcripts were not returned to participants for their review. Finally, risks of both moderator acceptance and sampling biases are present.

Interpretation

This qualitative study used the four S framework to provide an in-depth understanding of hospitals' emergency responses depending on setting and resources. We also identified several potential strategies to mitigate strain on the critical care delivery system as perceived by intensivists. Our study demonstrated the importance of trust and transparency between frontline staff and hospital leadership as key components to effective emergency responses during public health crises.

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Additional information: The e-Appendixes can be found in the [Supplemental Materials](#) section of the online article.

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