Critical Care Clinicians’ Experiences of Patient Safety During the COVID-19 Pandemic

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Objective: It is unknown how hospital- and systems-level factors have impacted patient safety in the intensive care unit (ICU) during the COVID-19 pandemic. We sought to understand how the pandemic has exacerbated preexisting patient safety issues and created novel patient safety challenges in ICUs in the United States.

Methods: We performed a national, multi-institutional, mixed-methods survey of critical care clinicians to elicit experiences related to patient safety during the pandemic. The survey was disseminated via email through the Society of Critical Care Medicine listserv. Data were reported as valid percentages, compared by COVID-19 workload stratified by prepandemic period. Those who took care of mostly COVID-19 patients were more likely to perceive that care was more hazardous (odds ratio, 4.89; 95% CI, 2.49–9.59) compared with those who took care of mostly non–COVID-19 or no COVID-19 patients. In free-text responses, providers identified patient safety risks related to pandemic adaptations, such as ventilator-related lung injury, medication and diagnostic errors, oversedation, oxygen device removal, and falls.

Results: We received 335 survey responses. On general patient safety, 61% felt that conditions were more hazardous when compared with the prepandemic period. Those who took care of mostly COVID-19 patients were more likely to perceive that care was more hazardous (odds ratio, 4.89; 95% CI, 2.49–9.59) compared with those who took care of mostly non–COVID-19 or no COVID-19 patients. In free-text responses, providers identified patient safety risks related to pandemic adaptations, such as ventilator-related lung injury, medication and diagnostic errors, oversedation, oxygen device removal, and falls.

Conclusions: Increased COVID-19 case burden was significantly associated with perceptions of a less safe patient care environment by frontline ICU clinicians. Results of the qualitative analysis identified specific patient safety hazards in ICUs across the United States as downstream consequences of hospital and provider strain during periods of the COVID-19 pandemic.

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The Centers for Disease Control and Prevention estimates that between February 2020 and May 2021, more than 6 million patients required hospitalization due to COVID-19 infection.1 This placed an enormous strain on healthcare systems, which instituted rapid structural changes and redeployment of providers.2 Before the pandemic, research suggested that intensive care unit (ICU) strain was associated with worse patient outcomes, such as decreased adherence to best practice guidelines and higher mortality rates.3–6 Furthermore, the ICU has long been understood as a care area with a high risk of medical error due to the complexity of the patients’ conditions and the team-based delivery of care.7

During April and May 2020, surveys of ICU clinicians both in the United States and internationally demonstrated that providers were concerned about evolving shortages of equipment and personnel8–10; however, it is unknown whether these concerns persisted over time or whether new challenges emerged as the pandemic evolved. While pandemic-associated hospital strain has been associated with higher mortality,11–13 less is known about how frontline ICU providers experienced that strain on a day-to-day basis and the direct impact of this strain on providers’ ability to provide safe, high-quality care. Voluntary reporting of adverse events decreased during the pandemic,14 and no systematic studies of patient safety during COVID-19 have been reported to date. To address these gaps, we performed a national, multi-institutional, mixed-methods survey of critical care clinicians to understand their perspectives and experience of patient safety hazards during the COVID-19 pandemic.

METHODS

Design and Participants

We conducted an anonymous survey disseminated via email through the Society of Critical Care Medicine U.S. listserv. The listserv includes nearly 14,000 critical care professionals, including physicians, registered nurses, advanced practice providers, pharmacists, and administrators. This study was reviewed and deemed exempt by the Columbia University Institutional Review Board.

Survey Instrument

Survey items were developed based on review of patient safety literature,15,16 consultation with patient safety experts, and the authors’ experiences providing frontline medical care during the COVID-19 pandemic.
TABLE 1. Respondent Characteristics

| Attribute                   | N = 335, n (%) |
|-----------------------------|---------------|
| Provider role               |               |
| Attending physician         | 170 (50.7)    |
| Fellow or resident physician| 16 (4.8)      |
| Physician assistant/nurse practitioner | 44 (13.1) |
| Registered nurse            | 32 (9.6)      |
| Respiratory therapist       | 3 (0.9)       |
| Pharmacist                  | 58 (17.3)     |
| Other                       | 12 (3.6)      |
| Hospital type*              |               |
| Teaching hospital           | 254 (75.8)    |
| Subspecialty hospital       | 17 (5.1)      |
| Public hospital             | 18 (5.4)      |
| Community hospital          | 60 (17.9)     |
| Tertiary care center        | 64 (19.1)     |
| Region                      |               |
| Northeast                   | 78 (23.3)     |
| Midwest                     | 82 (24.5)     |
| South                       | 109 (32.5)    |
| West                        | 66 (19.7)     |

*Respondents could select more than 1 hospital type; percentages add up to more than 100%.

COVID-19 pandemic. The survey contained 5 sections focused on patient safety domains: general patient safety and work environment; staffing; equipment; personal protective equipment (PPE) and patient isolation; and hospital infrastructure. The survey contained multiple-choice, yes/no, and open-ended questions. The survey was piloted by inpatient physicians; results of this pilot informed the final survey instrument. Pilot results and the survey instrument are shown in Supplemental Table 1, http://links.lww.com/JPS/A489 and Supplemental Document 1, http://links.lww.com/JPS/A490.

Respondents provided their location at the state level, clinical role, and hospital type. They were asked to identify the “peak” month of the COVID-19 pandemic from March 2020 to January 2021, defined as the most challenging month at work for the respondent regardless of case count, and to answer each question in relation to the peak. Respondents reported their COVID-19 caseload, categorized as mostly COVID-19 patients, mostly non–COVID-19 patients, or a combination, during the peak of the pandemic they identified. The survey also asked respondents to rate the level of “stress or strain” at the hospital level during the peak, defined as a hospital taking care of more patients, sicker patients, or a combination of both, compared with usual circumstances.

Respondents were asked whether they observed or heard about more patient safety events and whether they felt conditions were more hazardous for patients than prepandemic. A patient safety event was defined as “an event, incident, or condition that could have resulted or did result in harm to a patient. This can be the result of a defective system or process design, a system breakdown, equipment failure, or human error.” Finally, respondents were asked open-ended questions focused on how select areas impacted by the pandemic may have jeopardized patient safety, for example, equipment and staffing shortages.

Data Collection

The survey instrument was input into a web-based password-protected survey platform (Qualtrics, Provo, UT), and an anonymous survey link was disseminated via email in January 2021. The initial email was followed by one reminder. Data were collected from January 6 to February 19, 2021.

Data Analysis

The reported peaks were operationalized into 3 periods that corresponded to 3 waves of increased COVID-19 case counts in the United States: “wave 1” (March through May 2020), “wave 2” (June through October 2020), and “wave 3” (November 2020 through January 2021). Location was operationalized into 4 regions based on U.S. Census convention. Frequencies of responses to structured questions were calculated with missing data excluded from the denominator for each question. For questions with “yes,” “no,” or “I’m not sure” answer options, responses were dichotomized as “yes” or “no”/“not sure” combined. The frequency of patient safety events and respondents’ perception of hazardous conditions were compared across the 3 waves and by providers’ COVID-19 caseload. Comparisons were performed by calculating odds ratios (ORs) with 95% confidence intervals (CIs). Statistical analyses were conducted using SAS On Demand (SAS Studio, Cary, NC).

For open-ended questions, we conducted a thematic analysis using directed (deductive) and emergent (inductive) approaches to coding free-text responses. A set of a priori codes were developed based on the key patient safety domains addressed in the survey. Additional codes were identified after initial transcript review and during the coding process. Two authors (A.R., D.C.) independently coded all free-text responses and compared codes; disagreements were discussed until consensus was reached. Codes were added and removed in an iterative fashion. After coding was complete, code usage was analyzed and common themes across narratives were identified.

RESULTS

A total of 335 respondents answered at least 1 question in the survey, and 320 respondents answered greater than 50% of questions. Respondent characteristics are shown in Table 1. Of 335 respondents, 170 (51%) were physicians, 254 (76%) worked at teaching hospitals, and all U.S. regions were represented (Table 1, Supplemental Fig. 1, http://links.lww.com/JPS/A491).

Quantitative Results

Overall, 53% reported their peak (most challenging month at work) was during wave 3, representing the Midwest, West, and South (Supplemental Fig. 2, http://links.lww.com/JPS/A492); 36% reported their peak was during wave 1, with the largest proportion of these respondents from the Northeast. During their peak, 34% of the respondents cared for mostly patients with COVID-19, 45% cared for both COVID-19 and non–COVID-19 patients, and 19% cared for mostly non–COVID-19 patients. Almost all respondents (98%) indicated that their hospitals were under more stress or strain during their respective peaks as compared with prepandemic times (Supplemental Table 2, http://links.lww.com/JPS/A489).

On general patient safety, 47% observed more patient safety events and 61% felt that conditions were more hazardous compared with prepandemic times (Table 2). Those who took care of mostly COVID-19 patients were significantly more likely to observe patient safety events (OR, 5.88; 95% CI, 2.84–12.19), hear about patient safety events (OR, 3.79; 95% CI, 1.94–7.39), and perceive that patient care was more hazardous (OR, 4.89; 95% CI, 2.49–9.59) compared with those who took care of mostly non–COVID-19 patients or no COVID-19 patients (Fig. 1A).
Patient safety events did not differ by wave of the pandemic (Fig. 1B).

Regarding staffing, 86% reported a staffing shortage during the pandemic. The most commonly identified shortage was nurses (77%), followed by respiratory therapists (61%). Among those who identified any staffing shortage, 42% felt that these shortages jeopardized patient care or caused harm. Regarding equipment, 67% reported an equipment shortage. The most commonly reported equipment shortage was high-flow nasal cannula devices (42%), followed by noninvasive positive pressure ventilation (29%), and dialysis machines (29%; Table 2).

Shortages of PPE at any point during the pandemic were reported by 78% of the respondents, and 64% were instructed to limit patient interaction to conserve PPE. A total of the 238 respondents (82%) reported that their hospital had to expand its ICUs to accommodate the volume of critically ill patients. Of these, 51% felt that patients in these expanded units did not receive the same quality of care compared with patients in standard ICUs (Table 2).

### Qualitative Results

We received 459 unique responses from 176 respondents. Figure 2 represents the interconnected nature of the various system factors discussed by the respondents: appropriate and necessary adaptations were made in response to challenges posed by the pandemic, but these adaptations frequently led to unforeseen consequences. These consequences in turn contributed to an increased risk of patient safety hazards. Table 3 includes key quotations organized by the patient safety domains discussed hereinafter, and Supplemental Table 3, http://links.lww.com/JPS/A489, includes demographic information of quoted respondents identified by case number.

#### Equipment and Medication Shortages

Ventilators were often at the center of patient safety concerns. There were no references to rationing due to a shortage, but the use of unfamiliar ventilators brought in from other hospitals or from storage made safe ventilator management challenging. Without appropriate monitoring and clinician expertise, ventilators can cause lung injury due to high airway pressures and overoxygenation, and this was a frequently mentioned concern by providers. In addition to unfamiliarity with the machines themselves, there were also concerns that less sophisticated ventilators often brought in as backup to accommodate the high volume of intubated patients did not have necessary functions for adequate management of acute respiratory distress syndrome (ARDS), again raising concern for ventilator-associated lung injury.

Shortages of common ICU medications also led to changes in usual prescribing practices. Clinicians describe how shortages of

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**TABLE 2. Percentage of the Respondents Reporting Patient Safety Issues**

| Survey Item                                                                 | Percent | No. Item Responses |
|----------------------------------------------------------------------------|---------|--------------------|
| General patient safety                                                     |         |                    |
| Directly observed more patient safety events                               | 47.1    | 303                |
| Heard about more patient safety events                                     | 50.8    | 303                |
| Felt conditions were more hazardous                                        | 60.6    | 302                |
| Staffing shortages reported                                                |         |                    |
| Any shortage                                                               | 86.1    | 303                |
| Nurses                                                                     | 76.5    | 302                |
| Respiratory therapists                                                     | 61.2    | 299                |
| Physicians                                                                 | 45.8    | 299                |
| Felt provider shortages jeopardized patient care or caused harm to patients | 42.2    | 294                |
| Equipment and medication shortages reported                                |         |                    |
| Reported any equipment shortage                                            | 67.1    | 292                |
| HFNC                                                                       | 41.7    | 290                |
| NIPPV                                                                      | 29.4    | 289                |
| Dialysis machines                                                          | 28.8    | 285                |
| Infusion pumps                                                             | 27.5    | 291                |
| Ventilators                                                                | 24.7    | 291                |
| Used less familiar equipment due to limited availability†                  | 49.7    | 195                |
| Delayed or reconsidered treatment plan due to lack of necessary equipment† | 45.6    | 195                |
| Deviated from normal prescribing practice due to medication shortage‡       | 56.9    | 202                |
| PPE, isolation, and infrastructure                                         |         |                    |
| Ever faced with limited access to PPE                                      | 77.5    | 289                |
| Ever encouraged to limit patient interactions to conserve PPE              | 64.0    | 289                |
| Felt isolation practices made it harder to see patients face to face        | 73.6    | 288                |
| Worked in a hospital that had to expand its ICUs                          | 82.4    | 289                |
| Felt patients in expanded units did not receive same quality of care       | 51.3    | 238                |

*Percent represents respondents who answered “yes”.
†Only respondents who indicated that they experienced any equipment shortage were displayed this question.
‡Responses from prescribing providers: MDs, NPs, and PAs.

HFNC, high-flow nasal cannula; NIPPV, noninvasive positive pressure ventilation.
sedatives, analgesics, and paralytics forced the use of alternative regimens. The use of different medications jeopardized patient safety, in part because of provider inexperience with the drugs. These medications are powerful and rapidly titrated based on evolving patient physiology and need. Underdosing or overdosing can lead to altered hemodynamics, uncontrolled patient pain, or other preventable adverse medication events. These medication alternatives were also sometimes perceived as suboptimal—as an example, when second- or third-line sedatives were used that did not have respiratory drive suppression, higher doses of sedation were required to achieve ventilator synchrony and prevent ventilator-associated lung injury. Oversedation can make ventilator weaning more challenging and add ventilator days to a patient’s course.

Staffing Shortages

Clinician-to-patient ratios were commonly reported as a patient safety concern. Pharmacists described covering 2- or 3-fold the number of patients compared with prepandemic times. Reported ICU nurse-to-patient ratios varied dramatically but were often felt to be inadequate for patients to receive the timely care they required. In addition, redeployed providers were frequently unfamiliar with critical care, which led to patient safety concerns from supervising ICU providers. Standard ICU procedures, such as medication titration and caring for intubated patients, are not commonplace outside of these units, and as described previously, provider lack of familiarity with powerful medications and machines can lead to error and patient harm. Another effect of the increased patient volume was the inability of clinicians to appropriately escalate care or respond to emergencies, such as cardiac arrests. Providers recounted instances of several patients decompensating at once, with only one clinician available. When this occurred, one patient inevitably received a different quality of resuscitation than another. Providers also discussed performing tasks that were typically assigned to another role, due to both the increased influx of patients and the inexperience of the redeployed workforce. Examples included nurses performing the tasks of environmental services staff or phlebotomy, and physicians performing nursing tasks. These new roles added to the workload of the already strained clinicians.

Personal Protective Equipment Rationing

Nurses described attempts made at limiting the number of providers interacting with COVID-19 patients, in an effort to conserve PPE. As described previously, this led to additional tasks being assigned to the nurses who were going into the patient rooms.
Physicians also described a change in the distribution of tasks among attendings, residents, and specialty consultants with the main goal of limiting the use of PPE. In addition to new roles, there were fewer patient-provider interactions and less time that patients had with providers at the bedside. Clinicians identified risks associated with this decrease in patient-provider interaction, such as delays in the administration of routine care and the chance of missed or incorrect diagnoses.

**Volume of Patients Requiring Isolation**

The overwhelming number of patients and their isolation requirements necessitated creative solutions when it came to space and infrastructure. The negative impact of infrastructure changes on patient safety ranged from the size of the room limiting the ability of clinicians to administer necessary care (“They put [patients] in rooms the size of closets. Difficult to run [rapid responses], intubate…” [78]) to the distance between providers and patients (“When patients aren’t physically in the ICU where I spend the majority of my time, I can’t check on them as regularly.” [264]). The physical location of patients in the hospital directly impacted the ability of providers to administer safe patient care. There were also numerous responses relating to suboptimal remote monitoring resulting in lack of ability of providers to be alerted to change in patients’ status and respond promptly to alarms. Some alarms were simply inaudible to the care teams, while other patients who would have normally been connected to a device that had an alarm went unmonitored because of equipment shortages. This resulted in failure to recognize critical device removal in delirious patients and subsequent failure to rescue. Finally, patient visualization led to difficulties monitoring critically ill patients. Standard ICUs have glass doors or large windows so providers can easily see the patient, intravenous pump settings, and continuous vital sign monitors. However, when hospitals were forced to expand to accommodate the increased numbers of critically ill patients requiring isolation, visualization was not always possible. This also led to increased risk of failure of clinicians to identify and rescue deteriorating patients.

**Unifying Themes Across Domains**

The adaptations necessitated by this crisis had effects on patients without COVID-19. Clinicians identified how patients without COVID were negatively affected by the strain placed on the hospital: “We have… seen the COVID staffing increase due to numbers but also have had more and more staff out for infection/exposure, as well as burnout in those that started staffing the [COVID] units early on. This has forced the hospital to scavenge staff from [regular] units to staff COVID units, leading to shortages in staff in other places…. While I do not know of any definitive events, we have seen degradation in our ability to accept patients and less safety margin for those that we are caring for…” (285)

A devastating response from a physician at a pediatric oncology hospital described the impact of the pandemic on patients at the end of life: “The most tragic part of [the pandemic] for our hospital… was [the] limitations on visitation due to lack of PPE. It was HEART BREAKING to watch children die without being able to say goodbye to many of their family members…. What was a tragedy… was that we could not provide the kind of emotional support we usually do for families…. It was soul crushing for us all.” (148)

There were numerous mentions of burnout among clinicians during this time. Two clinicians directly connected this burnout to a worsening patient safety climate: “I… suspect the burnout that we all felt contributed to errors as well. Personally, I know that months of working in a COVID ICU dulled my ability to recognize issues as I went into an “autopilot” mode just to get through each day.” (163)

“I don’t have any specific examples, but the level of fatigue throughout the team surely places our patients at increased risk for human error.” (128)

**DISCUSSION**

Results of this national survey characterized the broad and substantial impact of COVID-19 on patient safety in ICUs across the United States. Higher COVID-19 caseloads were associated with clinicians’ perceptions of a less safe environment, as well as an increase in observed patient safety events. Staffing and equipment shortages had direct impacts on the ability of ICU clinicians to administer safe and high-quality patient care. In free-text responses, the respondents described interconnected patient safety hazards introduced by the pandemic that conferred risks for ventilator-related injury, oversedation, medication and diagnostic errors, oxygen device removal, and falls.

Research has demonstrated that a high percentage of COVID-19 cases within a hospital, insufficient hospital capacity, and lack of resources are associated with higher COVID-19 mortality rates.11-12,15,21,22
To our knowledge, this is one of the first studies to investigate the direct impact of resource limitations on patient safety, which is potentially a component of the increased mortality among strained hospitals. It is notable that oxygen delivery devices were among the most frequently cited equipment shortages in our data; during an outbreak of a respiratory virus, having available oxygen and respiratory equipment is almost certainly linked to a hospital’s ability to provide effective and safe care. In addition, numerous studies have demonstrated trends toward higher mortality among patients admitted on public holidays compared with during the week; a leading hypothesis for this phenomenon is that fewer experienced providers are on site at those times. While the medical community appreciates the assistance that other specialties have provided during the pandemic, our results suggest that careful oversight, adequate onboarding, and cross-training are crucial to the ability of redeployed providers to administer safe care in a high-acuity critical care environment.

In addition, hospitals’ equipment and infrastructure have direct impacts on the provision of safe patient care. It is crucial that hospitals are able to safely adapt to rapid changes in available equipment and medications. A recent study by Vranas et al interviewed a national cohort of intensive care physicians surrounding the 4S framework of hospital emergency response planning: space, staff, stuff, and system. Many of the themes identified in these interviews were similar to responses seen in our data: as an example, physicians reported running out of “good ventilators” and how “no one knew how to manage” the backup machines. Respondents in our study clearly and repeatedly identified how running out of medications impacted patient safety; however, in the study by Vranas et al, these same shortages “were not felt to impact patient care substantially.” Discrepancies in experiences between these 2 cohorts likely speak to the variation in hospital responses to the pandemic across geography and time; however, our study independently reproduced several of these themes related to “stuff” and directly

### TABLE 3. Representative Quotations From Free-Text Responses

| Patient Safety Domain | Quotation |
|-----------------------|----------|
| Equipment and medication shortages | “[W]e had... new ARDS patients on travel vents for a couple of days which did not have waveforms available and made understanding whether measured pressures (plateau, driving P [pressure], intrinsic PEEP [positive end-expiratory pressure]) were correctly calculated.” (65) “... due to high census and low supplies—many different types of ventilators were brought in because they were needed but then staff did not know how to work them appropriately...” (173) “[W]e used a lot of ketamine and [hydromorphone] instead of our standard propofol and fentanyl due to shortages—this led to more over sedation [I think as we were less familiar and also [because] ketamine did not suppress resp [respiratory] drive which was an issue with vent synchrony...” (65) |
| Staffing shortages | “Usually[,] our nurses have 1–2 patients. They now have 3–4 and it’s very difficult to get them to mobilize patients, turn patients regularly, or even know medical details of their patients.” (113) “We had to incorporate multiple nurses that do not usually do ICU and there were some gaps in care... where key issues were either not noticed by a more experienced nurse/or they didn’t feel comfortable raising their concern (i.e., such as if they were asked to lower sedation [for] a patient with severe COVID-related ARDS [who was still on] neuro-muscular blockers.” (181) “... proning of patients was observed with minimal repositioning... while on regular hospital beds. Patients would [be maintained in the prone] position for more than 5 consecutive days [and] experience severe skin breakdown to the face, chest, abdomen, and perineal regions. RNs and RTs assigned to patients who were part of relief efforts had minimal or no ICU experience and were not safe to receive these patients...” (246) “Due to the lack of nursing staff there was a night where the nurses had more severely ill patients [than] was safe. This led to delays in care and delays in review of important labs and obtaining order changes. There was no time for nurses to stop and think critically about patient care, so patients only received the bare minimum of care.” (99) “There was one day in which I was running resuscitations on two different floors (one in person, the other by phone).” (201) “‘Nursing staff [were] forced to clean patient rooms due to lack of ancillary help. All shortages of staffing caused nursing staff to bear the burden, taking away from patient care.” (240) |
| PPE rationing | “At least initially, residents/house staff were not allowed to examine COVID+ patients/PUIs [patients under investigation]. That made it more difficult, as the attendings were responsible for a larger patient load without the assistance of residents.” (262) “The donning and doffing led to a lot fewer patients being physically seen by other physician teams. There’s a lot of information gathered by being face to face with a patient and truly examining him or her that was lost... I also felt that PMH [past medical histories] and medication lists were often inaccurate which might have partly been since no one was taking in pen and paper and writing things down.” (152) |
| Volume of patients requiring isolation | “We had all of our patients on portable vital sign machine monitoring and none of the alarms could be heard away from the bedside. Many patients were discovered altered and hypoxic because they had removed their oxygen delivery device but no one could hear an alarm, or they didn’t have a device that could alarm.” (162) “We had all of our patients on portable vital sign machine monitoring and none of the alarms could be heard away from the bedside. Many patients were discovered altered and hypoxic because they had removed their oxygen delivery device but no one could hear an alarm, or they didn’t have a device that could alarm.” (162) “You were told to limit patient contact and [we] were watching from the doors... if there were windows, this was great. Sometimes the engineering department cut new windows but those were small. Later we got iPads and this helped but the patient received less care due to concerns of staff exposure.” (100) |
related the concerns to patient safety. These consistent experiences of frontline providers can serve as informative for hospitals and systems in preparing for the next pandemic.

Our results also build on a national survey conducted by Kleinpell et al conducted early in the pandemic, which asked critical care providers their perceived most critical need to care for the influx of COVID-19 patients. Personal protective equipment (specifically masks) and staffing were the top concerns (38% and 21% of respondents, respectively). In addition, a global survey of ICU clinicians conducted by Wahlster et al noted similar concerns related to equipment and staffing shortages. Our results suggest that not only did these shortages persist throughout the first year of the pandemic but also resulted in serious safety hazards and impaired care delivery.

Our study has several limitations. We had a relatively low response rate, estimated to be approximately 2.4%. Survey dissemination coincided with the peak of the Delta wave in the United States, which likely impacted survey participation. This low response rate, coupled with the convenience sampling method, may limit generalizability of our results, and further research that includes more practitioners’ experiences would be beneficial. However, we were able to capture provider experiences from a wide range of geographic regions over 11 months of pandemic practice. In addition, our responses were limited to mostly teaching hospitals; this was likely a result of the demographics of the listserv through which the survey was distributed but may also reflect bias in participation. Further research is warranted on the patient safety impacts on smaller community hospitals, as those challenges and adaptations may have differed.

In conclusion, a national survey of critical care clinicians elucidated patient safety hazards related to the COVID-19 pandemic, including medication errors, missed diagnoses, and oversedation. Many of these hazards were direct consequences of adaptations made by providers and healthcare systems aimed at addressing pandemic-associated challenges. Higher COVID-19 caseloads were associated with a significant increase in experienced and perceived patient safety hazards.

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