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BRIEF REPORT

A Multisite Assessment of Inpatient Safety Event Rates During the Coronavirus Disease 2019 Pandemic

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Abstract

To date, there has been a notable lack of peer-reviewed or publicly available data documenting rates of hospital quality outcomes and patient safety events during the coronavirus disease 2019 pandemic era. The dearth of evidence is perhaps related to the US health care system triaging resources toward patient care and away from reporting and research and also reflects that data used in publicly reported hospital quality rankings and ratings typically lag 2-5 years. At our institution, a learning health system assessment is underway to evaluate how patient safety was affected by the pandemic. Here we share and discuss early findings, noting the limitations of self-reported safety event reporting, and suggest the need for further widespread investigations at other US hospitals. During the 2-year study period from January 1, 2020, through December 31, 2021 across 3 large US academic medical centers at our institution, we documented an overall rate of 25.8 safety events per 1000 inpatient days. The rate of events meeting "harm" criteria was 12.4 per 1000 inpatient days, the rate of nonharm events was 11.1 per 1000 inpatient days, and the fall rate was 2.3 per 1000 inpatient days. This descriptive exploratory analysis suggests that patient safety event rates at our institution did not increase over the course of the pandemic. However, increasing health care worker absences were nonlinearly and strongly associated with patient safety event rates, which raises questions regarding the mechanisms by which patient safety event rates may be affected by staff absences during pandemic peaks.

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In 2019, the Agency for Healthcare Research and Quality (AHRQ) reported nearly 3 million patient safety events, including falls, hospital-acquired infections, pressure ulcers, and adverse drug-related events occurring annually in US hospitals.[1] The AHRQ proposed a goal to reduce the rate of these events by 20% beginning in 2019. However, the coronavirus disease 2019 (COVID-19) pandemic presented unprecedented risks to patient safety as a result of dramatically increased hospital censuses and staff absences resulting in burnout, particularly for frontline staff, and supply chain shortages impacting personal protective equipment and other critical supplies.

The uncertainty surrounding the potential effects of the pandemic on patient safety events led to modifications to data exclusion periods and cohort inclusion criteria for federal pay-for-performance programs, such as the Hospital-Acquired Conditions Reduction Program and the Hospital Readmissions Reduction Program. For instance, the Hospital-Acquired Conditions Reduction Program will be excluding calendar year 2020 data for all patients for the fiscal year 2022 and 2023 penalties, whereas the Hospital Readmissions Reduction Program will be excluding only patients with COVID-19 diagnoses from condition-specific cohorts, such as pneumonia.[2] Other hospital quality and patient safety stakeholders, such as the Centers for Medicare and Medicaid Services, Leapfrog, and the US News & World Report, are now facing similar questions regarding the most

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appropriate way to exclude data periods as they begin to evaluate patient outcome data from the pandemic era.

To date, there has been a notable lack of peer-reviewed or publicly available data documenting rates of hospital quality outcomes and patient safety events during the pandemic era. The dearth of evidence is perhaps related to the US health care system triaging resources toward patient care and away from reporting and research and also reflects that data used in publicly reported hospital quality rankings and ratings typically lag 2-5 years. The few studies available that address patient safety during the pandemic focused on catheter-associated urinary tract infections, central line—associated blood stream infections, and other hospital-acquired infections, indicating that these may have increased during the pandemic.[3-6] Yet, peer-reviewed data on pandemic-era patient safety events in other domains, such as falls, pressure injuries, management of care, or medication errors, remain scarce.

As the COVID-19 pandemic transitions to the endemic stage, the US health care system must develop a robust, shared evidence base regarding the effects of the pandemic on patient safety to understand how we might mitigate or adapt to these impacts during times of significant health care resource strain. For the good of our patients, it is also critical that we continue to equitably measure and monitor hospital safety no matter what challenges our health care system faces to facilitate learning while remaining mindful of inherent potential flaws or biases in voluntary self-monitoring of patient safety and thus being cautious in our interpretation of temporal trends in self-reported event rates.[7,8] Although controlling for the burden of COVID-19 between hospitals is inherent to such an evaluation, complete data exclusions do not permit an assessment of the robustness and agility of our response in times of stress—important information to help patients make informed decisions about their care. At our institution, a learning health system assessment is underway to evaluate how patient safety was affected by the pandemic. Here, we share and discuss patient safety event rates across our institution during the pandemic while being cognizant of the limitations of self-reported safety event reporting and suggesting the need for further widespread investigations at other US hospitals.

METHODS

All reported inpatient safety events captured in the patient safety reporting software (MIDAS, https://www.midasplus.com/Midas_Care%20Mgmnt.pdf) from January 1, 2020, through December 31, 2021 were compiled across 3 destination medical centers (Rochester, Minnesota; Phoenix, Arizona; and Jacksonville, Florida) in a multisite health system. Critical data points recorded in the patient safety reporting system included the level of harm and event type for each patient safety event. Levels of harm were graded ranging from "A" through "I," with A-C grades being categorized as "nonharm," D-E grades being categorized as "moderate harm," and F-I grades being categorized as "serious harm." In this report, we grouped moderate and serious harm into a single "harm" category. Patient safety event types included management of care events, medication and intravenous events, laboratory, falls, controlled substance discrepancy, equipment and medical or surgical device and supply related, surgical and other invasive procedure events, safety and security events, blood product transfusion events, environment-related events, and infections (Supplement, available online at http://www.mcpiqojournal.org). We tabulated daily hospital-specific patient safety events, both overall and by levels of harm and event type. We combined these data with our hospitals' daily inpatient censuses (both the total hospital census and the COVID-19 census) to summarize patient safety event rates per 1000 inpatients and plot using 30-day moving averages. Finally, we collected hospital-specific daily aggregate health care worker absence reports, defined as absence among any patient-facing or non—patient-facing staff, from the single-source institutional occupational health database. These data were used to model the association of health care worker absences with patient safety event rates using a log-linear Poisson model with an offset for daily census and interaction term for site.

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RESULTS

During the 2-year study period, we documented an overall rate of 25.8 safety events per 1000 inpatient days. The rate of events meeting "harm" criteria was 12.4 per 1000 inpatient days, the rate of nonharm events was 11.1 per 1000 inpatient days, and the fall rate was 2.3 per 1000 inpatient days. The most common event type was management of care events, with a rate of 8.1 per 1000 inpatient days. The Table shows daily patient safety events, census, and health care worker absences by site. Figure 1A shows site-specific daily event rates overlayed with COVID-19 census. Figures 1B and 1C show daily event rates by level of harm and event type, respectively, at each of the 3 sites. In the Poisson model, patient health care worker absences were significantly and nonlinearly associated with patient safety event rate ($P<.0001$; Figure 2), as was the interaction term between staff absences and site ($P_{interaction}<.001$).

DISCUSSION

The initial findings from this institutional learning assessment to evaluate patient safety event rates during the COVID-19 pandemic produced important insights while generating additional questions. This descriptive exploratory analysis suggests that self-reported patient safety event rates at our institution did not increase over the course of the pandemic. However, increasing health care worker absences were nonlinearly and strongly associated with patient safety event rates but not in an identical pattern across sites, which raises questions regarding the mechanisms and factors by which patient safety event rates may be related to staff absences during pandemic peaks. Finally, we observed slightly different visual time trends across patient safety event types. More rigorous statistical methodologies could be applied to investigate the pandemic's potential effects on individual patient safety measures in the future along with efforts to better understand potential biases in self-reporting that may mask underlying trends in event rates during health care crises.

Further investigation is already underway at our institution, with teams exploring whether rates of AHRQ Patient Safety Indicators (PSIs), such as PSI-3 (stage III or IV pressure ulcers) or PSI-12 (perioperative deep vein thrombosis), were higher among patients with COVID-19.[9] Likewise, we have added a filter identifying patients with COVID-19 to our "real-time" patient safety and quality dashboards so that we are able to monitor outcomes comparing patients with COVID-19 and patients without COVID-19 at our hospitals, although during periods of low COVID-19 census, it may be supply chain issues and staff absences that are of more relevance. Our findings regarding the association between health care worker absences and patient safety event rates, although not surprising, were varied across sites and have led us to consider initiatives for improving the recruitment and retention of staff, which will be an ongoing priority into the foreseeable future even as the pandemic wanes. In fact, our institution has gradually

TABLE. Patient Safety Events, Hospital Census, and Staff Absences at 3 Mayo Clinic Destination Medical Centers During the COVID-19 Pandemic from January 1, 2020, to December 31, 2021

Daily hospital characteristics	Mayo Clinic Rochester, Minnesota (n=731 d)	Mayo Clinic Phoenix, Arizona (n=731 d)	Mayo Clinic Jacksonville, Florida (n=731 d)
Total events, median (IQR)	24 (20-29)	5 (4-7)	9 (7-12)
Harm events, median (IQR)	11 (8-14)	3 (2-5)	5 (2-7)
Nonharm events, median (IQR)	11 (8-13)	2 (1-3)	4 (3-6)
Falls, median (IQR)	2 (1-4)	0 (0-1)	0 (0-1)
Event type, median (IQR)			
MGT	8 (5-10)	1 (1-2)	3 (1-4)
MED	6 (4-8)	1 (0-2)	1 (0-3)
LAB	1 (0-4)	1 (0-2)	0 (0-2)
EQUIP	2 (1-3)	0 (0-0)	0 (0-0)
All other types	4 (2-6)	1 (0-2)	3 (1-5)
Daily total inpatient census, median (IQR)	1012 (932-1092)	285 (254-308)	284 (256-305)
Daily COVID-19 inpatient census, median (IQR)	17 (10-45)	14 (7-37)	10 (4-18)
Daily percentage of health care workers absent, median (IQR)	1.8 (1.6-2.0)	1.9 (1.6-2.3)	1.4 (0.2-3.6)

COVID-19, coronavirus disease 2019; EQUIP, equipment and medical or surgical device and supply related; IQR, interquartile range; LAB, laboratory; MED, medication and intravenous; MGT, management of care.

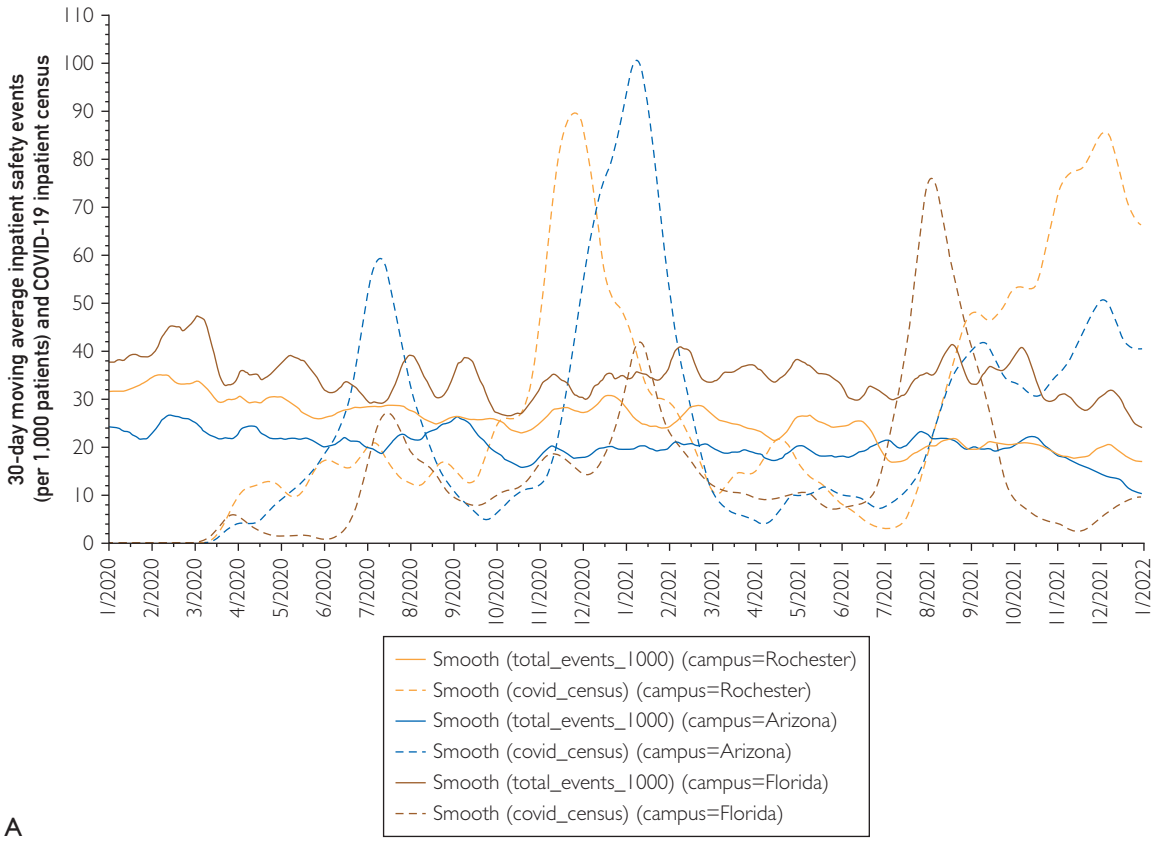

FIGURE 1. Smoothed inpatient safety event rate (per 1000 inpatient days and coronavirus disease 2019 [COVID-19] inpatient census) during the COVID-19 pandemic at 3 destination medical centers. A, Dotted lines indicate COVID-19 inpatient census, and solid lines indicate inpatient safety event rates (per 1000 inpatients). B, Event rates stratified by harm (left panel) and nonharm (right panel). C, Event rates stratified by management of care events (MGT, bottom left panel), medication and intravenous events (MED, bottom right panel), laboratory (LAB, center left panel), falls (FALLS, top right panel), and equipment and medical or surgical device and supply related (EQUIP, top left panel). These categories were the most common event types. In this exploratory analysis, we sought to use these graphs to visually assess trends in reported event rates for further, more rigorous statistical evaluations if any clear visual signals emerged.

pivoted to a focus on staff absence prediction as being more important operationally than prediction of COVID-19 census. Further research into specific staff absences by role (eg, limiting to absences among staff with patient contact only or nursing staff only) might uncover additional associations. Although burnout is a plausible front-of-mind mechanism here, it may simply be one of many factors in addition to hospitals' COVID-19 burdens, staff working outside their normal clinical areas, and other changes in staff responsibilities or priorities brought about by the pandemic. Although the relationship between staff absences and event rates was nonlinear in this analysis, a better framework might be one of a "threshold of staffing adequacy" below which patient safety rates worsen.

An important limitation of this study is the potential underreporting of patient safety events during the COVID-19 pandemic. It is plausible that in times of high staff absences or pandemic peaks, staff are less likely to report patient safety events because of workload or time constraints. Anecdotally, this bias would manifest more noticeably in underreporting of nonharm events because it is less likely that serious harm events would go unreported or unrecognized. A useful next step

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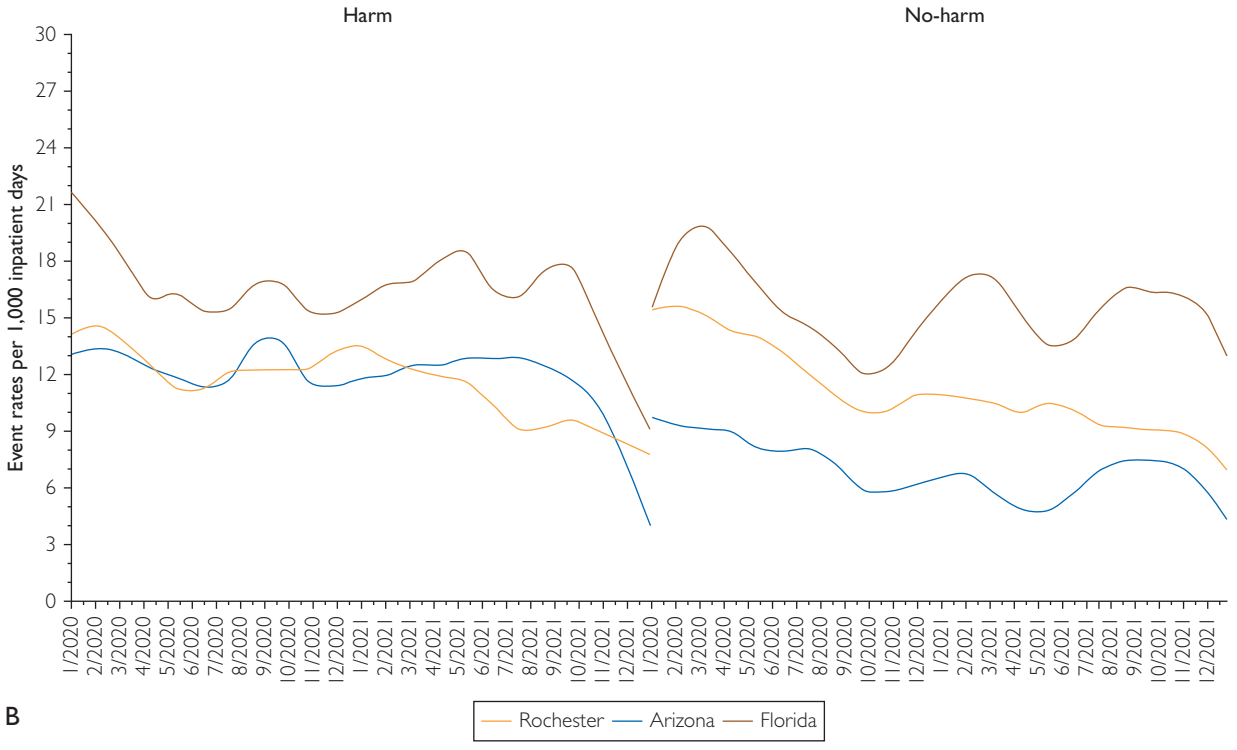

FIGURE 1. (continued).

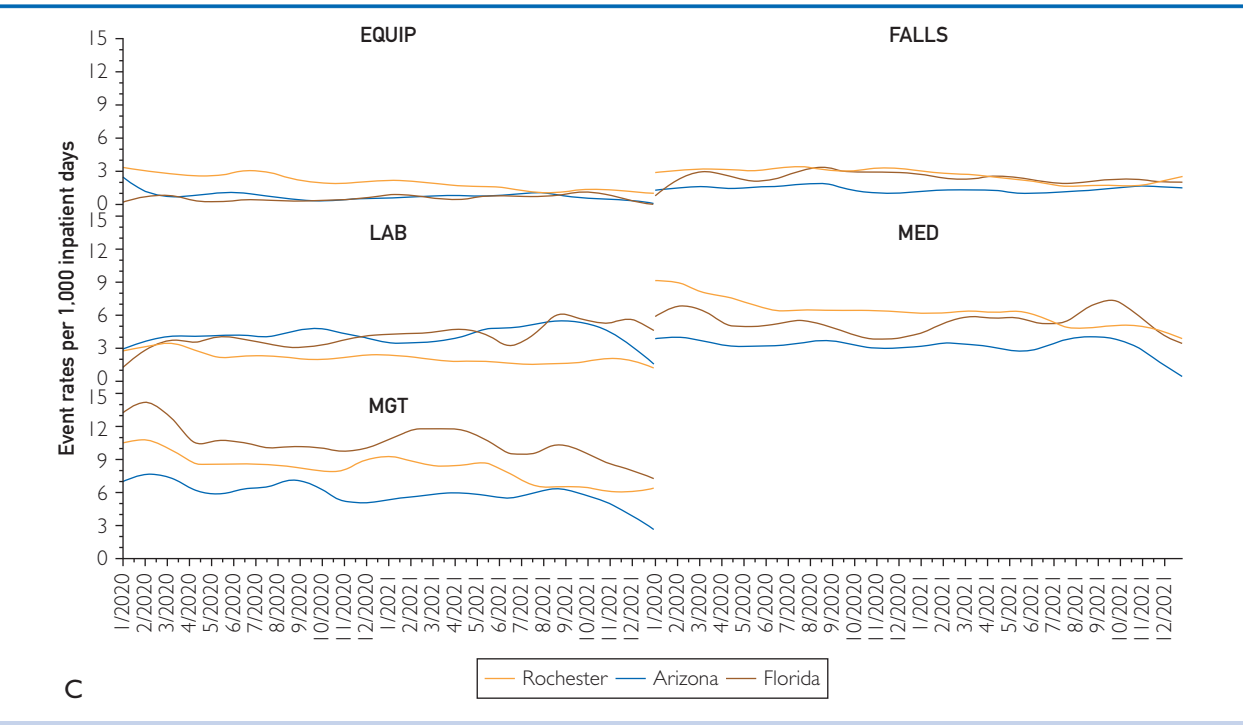

FIGURE 1. (continued).

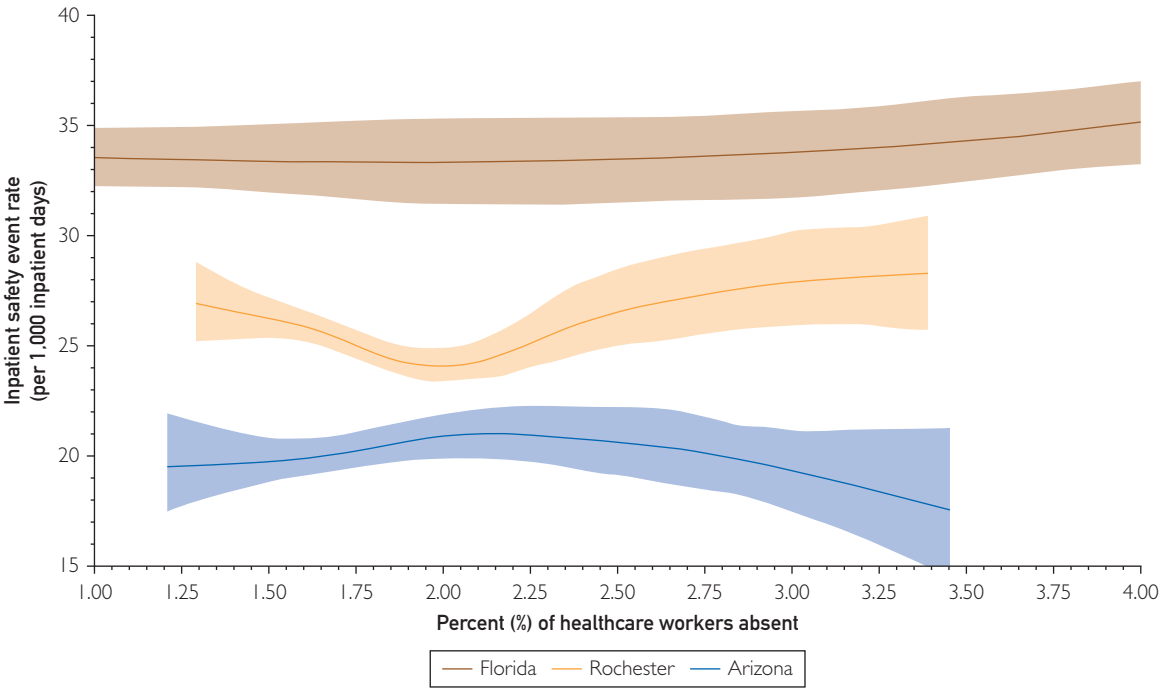

FIGURE 2. Unadjusted relationship between 7-day rolling new health care staff absences and inpatient safety event rates including harm and no-harm events of all types (per 1,000 inpatient days) during the coronavirus disease 2019 pandemic at 3 destination medical centers. Shaded region indicates 95% CIs, $P<.0001$ for the relationship between percentage of health care workers absent and inpatient safety event rates (per 1000 inpatients), and $P_{interaction}<.0001$ indicating differences in this relationship by site.

might be garnering survey data from frontline staff tasked with patient safety reporting to assess these assumptions. Nevertheless, the impetus for this analysis was to document and investigate at a descriptive level any signals of increasing patient safety event rates that might spur further investigation or immediate action. Although known issues with voluntary event reporting persist, it remains important to collect and analyze safety data where they exist because it presents an opportunity to detect early signals and improve underreporting. Therefore, another limitation is that the variety of patient safety events and event types analyzed herein may mask more granular signals in specific patient subpopulations. In investigating the association between staff absences and event rates, our definition of "health care worker" absences may have biased our results toward the null because there is likely some amount of misclassification here given significant expected variation in the extent of patient contact across this group.

Localized outbreaks of COVID-19 paired with a persisting environment of staff absences and burnout may continue to stress US hospitals for years to come. Although staffing mitigation efforts, such as overtime for employed healthcare workers, rapidly training new or contracted staff, shifting staffing between hospitals within a health care system (as was done between the 3 hospitals included here), or reducing admissions, may temporarily blunt the impact of staff absences on patient safety, these efforts are not sustainable in the current health care setting in which hospitals nationwide and worldwide are facing similar challenges. In this setting, resources for maintaining high-quality hospital outcomes and preventing patient safety events may face periodic deprioritization. Important declinations in hospital quality and safety may go undetected or may even be exacerbated as stakeholders, such as Centers for Medicare and Medicaid Services, selectively exclude data from certain hospital performance

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periods. Although enacted with the best of intentions, such exclusions are misguided in that they are not supported by data and will not hold hospitals accountable for delivering high-quality care delivery during exigent circumstances, such as the COVID-19 pandemic. In reality, this selective exclusion of publicly reported outcome data from time periods during the pandemic sends the conflicting message that measurement of patient safety outcomes is not a priority during times of health care system change and may be a missed opportunity to learn about the safety and agility of health systems during times of resource constraint.

It is critical that hospitals explore and reflect upon their patient safety experiences during the pandemic, including understanding the influence of staff absences on patient safety event rates. By analyzing patient safety data from 2020 to 2022, hospitals can understand the bounds of limited resources needed to maintain patient safety while promoting evidence-based usage of pandemic-era data in hospital ratings and pay-for-performance programs.

POTENTIAL COMPETING INTERESTS

The authors report no competing interests.

Abbreviations and Acronyms: **AHRQ,** Agency for Healthcare Research and Quality; **COVID-19,** coronavirus disease 2019; **PSI,** Patient Safety Indicator

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