Health Workforce Abstract
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Impact of Hospital Staffing Strategies in Response to COVID-19

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ISSUE: The impact of COVID-19 on the hospital nurse workforce has led to significant attrition caused by moral injury and burnout. The Bureau of Labor Statistics reported that over 100,000 nurses left the workforce in 2021, and most were under 35 years of age. As facilities responded to the intensifying shortage, hospitals employed a combination of strategies: lower levels of overall nurse staffing, fewer Registered Nurses (RNs) within the full nurse skill mix, more RN overtime, and increased use of supplemental nurses, both per diem and travel nurses. There has been an assumption that hospitals with fewer resources experienced the greatest shortages. Despite over twenty years of research on the effects of nurse staffing on patient safety, however, little is known about how hospital financial characteristics are associated with nurse staffing levels and configuration, and no studies have examined how financial resources were associated with different nurse staffing strategies during the pandemic. In this study, we examine whether more "days cash on hand," an industry measure of financial stability, was associated with nurse staffing levels and configurations during four waves of COVID-19, from 2019 to 2022. This period is unique because patient demand fluctuated so radically and because the government provided significant assistance for temporary nurse staffing to hospitals, making it a case study of how different resources hospitals use cash on hand or not to modify their nurse staffing strategies.

METHODS: For our analysis, we used data from a sample of Premier Inc. member hospitals across the country from January 2019 through April 2022. The data combined different databases that contained facility-level information, nurse and other staff worked hours, facility financials, patient count, and outcome measures. The analytical dataset included 52 facilities reporting biweekly. We employed a multivariate random effects model of "days cash on hand" on various staffing measures, including total nurse skill mix hours per patient days, the proportion of registered nurses (RNs) in the skill mix, and the proportion of temporary contract and overtime hours relative to the total nurse hours per patient days. Our specification included controls for state policies related to nursing labor laws, beds, and patient mix.

FINDINGS: Average "days cash on hand" fluctuated by period, likely due to government subsidies, as did nurse staffing levels. We found that compared to the pre-March 2020 period (January 2019 to March 2020), finances increased by 131 percent (from 116.32 to 268.73 days cash on hand). However, over the full period, nurse staffing declined from 18.351 to 11.202 total nurse hours per patient day. We found a similar decline in registered nurses (RNs) from 9.987 to 7. 994 hours per patient day. Our regression results revealed that hospitals experienced a 1.321 ($p<0.01$) decrease in overall nurse hours per patient days in the intensive care unit (ICU) for every one day increase in their days cash on hand. We also found an inverse relationship between total nurse hours per patient day and the proportion of those hours that were RN contracted hours. Lastly, our analysis confirmed that patient excess deaths were higher when nurse staffing levels declined.

DISCUSSION: The findings that hospitals with greater "days cash on hand" report lower nurse staffing levels and higher contract RN levels suggest that facilities with greater resources may stay financially buoyant by decreasing nurse staffing. Further, the inverse relationship between the ratio of contracted nurses to the overall nurse staffing suggests that there may be a substitution effect occurring. Since our model also confirms that patient outcomes worsen as staffing declines, these findings raise several policy questions. In particular, since FEMA hospital relief funds were targeted for contract RNs,

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it is possible that the unintended effect of this restriction was to incentivize both substitution for regular staff and an overall decline in nurse staffing. Since we could not track individual hospital subsidies for confidentiality reasons, we cannot confirm this, but our findings suggest that a better understanding of the use of government subsidies is critical. It is also possible that even without subsidies, hospitals with more financial stability partially achieved this at the expense of nurse staffing and, therefore, patient outcomes. Alternatively, there may be an association without causation: i.e., richer hospitals tend to have lower staffing and more contract nurses for some other reason. Since we controlled for patient acuity and volume, other reasons could be related to management culture and the nurse practice environment. Again, these are questions that require additional research to answer. What is clear is that greater hospital financial resources do not necessarily translate to higher nurse staffing and the related benefit to patients.

Key Words: nurse staffing, COVID-19, health workforce

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