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EDITORIAL

Nighttime physician staffing improves patient outcomes: yes

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Nighttime physician staffing improves patient outcomes. This is supported by the literature [1–5] and we have all seen it personally. The question is really not whether nighttime intensivists improve outcomes, but rather when, where, how and at what cost. The question hinges on context.

There is abundant evidence that nighttime physician staffing is responsible for improved patient outcomes both directly and indirectly in a variety of settings. Nighttime physician staffing is associated with improved intensive care unit mortality [1, 3, 5], improved quality of death and dying [2], and alignment of care to patient preferences outside the intensive care unit [4]. Nighttime intensivists improve outcomes for patients with unexpected deterioration after hours, albeit in ways that are difficult to capture in clinical research. Nighttime intensivist staffing also indirectly improves patient care by mitigating the negative effects of cognitive fatigue and sleep deprivation in a daytime-only staffing model [6]. Both cognitive fatigue and sleep deprivation are associated with impaired performance, decreased use of decisional support, compromised patient safety, and physician burnout [7–9]. Nighttime intensivist staffing mitigates some of these effects by allowing the daytime attending to rest at night [6], thereby improving the care that is delivered during the day. Therefore, in the right setting, through both direct impacts on patient care overnight and indirectly by facilitating high quality care during the day, nighttime staffing improves patient outcomes.

Context is equally important for reconciling the results of studies that did not find benefits from nighttime physician staffing. A recent randomized trial of nighttime staffing in a large academic medical intensive care unit did not show improved patient survival or length of stay [10]. It is certainly possible (if not likely) that the study's 1-week cycling of daytime-only staffing was not sufficient to unmask the deleterious effects of cognitive and physical fatigue, contributing to a null result. Similarly, 1-week daytime-only staffing cycles would be unlikely to induce physician burnout or emotional exhaustion—domains related to patient safety in critical care that are improved by nighttime staffing [11, 12].

A closer look at the University of Pennsylvania study demonstrates how, taken out of the context of avoiding physician burnout or alleviating cumulative cognitive and physical fatigue, the study biased the effect of nighttime staffing towards the null. Figure 1 shows that when an effect of accumulating fatigue is included, there are now four exposure categories. In the study's main analysis, patients A and D were considered equivalent: both were admitted to and analyzed in the intervention arm. Similarly, patients B and C were included as controls. However, as the figure shows, patients A–D represent different admission scenarios.

Patient A is admitted on a calendar day with nighttime intensivist staffing, yet the daytime attending is still moderately fresh. In this setting, as it relates to the domain of cumulative cognitive and physical fatigue, we would not expect the nighttime intensivist to have a major impact on daytime care. However, patient D is also admitted to a calendar day with nighttime intensivist staffing, yet here the daytime attending is nearing the end of service, and consequently stands the most to benefit from intensivist staffing at night. A similar situation is present for the controls. Patient B is admitted to a calendar day with only daytime coverage and near the end of service, during the highest risk of cumulative fatigue effects. Patient C is admitted to a calendar day with only daytime coverage, but early in the service cycle, with lower attendant risks from fatigue. Again, in the main analysis, patients A and

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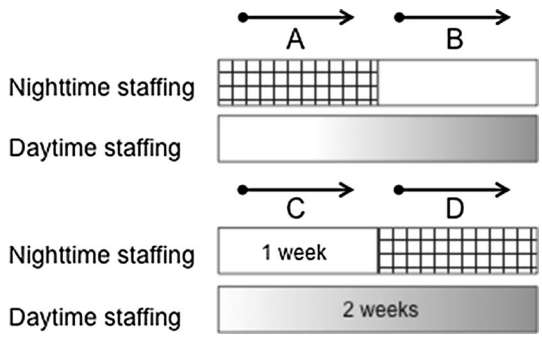

Fig. 1 The outcomes for patients admitted on calendar days with nighttime staffing (*A* and *D*) and control staffing (*B* and *C*) are averaged in the main analysis and time-varying covariate analysis, despite representing different clinical scenarios. *Checkered regions* show weeks with nighttime intensivist staffing. The gradient represents the cumulative cognitive and physical fatigue experienced by the daytime attending. *Black arrows A–D* show episodes of care for patients admitted during varying staffing scenarios

D are equivalent, as are patients B and C—despite the fact that each represents a different context for nighttime staffing benefits. By averaging these effects the null result is not surprising and is analogous to exposure misclassification in epidemiologic research [13].

This is not to say that nighttime staffing will always produce improved patient outcomes, if only viewed through the right lens. Nighttime staffing will clearly not improve quality in all circumstances. Furthermore, hospitals need to weigh the value of adding or maintaining nighttime staffing against competing strategies to improve patient care. Finally, hospitals that are considering de-adoption of nighttime staffing face a special challenge: could a change to daytime-only staffing deliver equivalent care? Unfortunately there are no easy answers to these questions, and certainly no answers that do not consider the local motivations for adopting nighttime coverage, careful process and outcome monitoring, and involvement of key stakeholders. Researchers, administrators, and clinicians alike need to be attentive to context when evaluating the data on nighttime intensivist staffing—particularly when it comes to decisions regarding adoption, de-adoption, or maintenance of this service. Your patient outcomes depend on it.

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Compliance with ethical standards

Conflicts of interest
The author declares no conflicts of interest.

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