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The effect of physician staffing model on patient outcomes in a medical progressive care unit☆

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ABSTRACT

Purpose: Although evidence supports the impact of intensivist physician staffing in improving intensive care unit (ICU) outcomes, the optimal coverage for progressive care units (PCU) is unknown. We sought to determine how physician staffing models influence outcomes for intermediate care patients.
Materials and Methods: We conducted a retrospective observational comparison of patients admitted to the medical PCU of an academic hospital during 12-month periods of high-intensity and low-intensity staffing.
Results: A total of 318 PCU patients were eligible for inclusion (143 high-intensity and 175 low-intensity). We found that low-intensity patients were more often stepped up from the emergency department and floor, whereas high-intensity patients were ICU transfers (61% vs 42%, $P = .001$). However, Mortality Probability Model scoring was similar between the 2 groups. In adjusted analysis, there was no association between intensity of staffing and hospital mortality (odds ratio, 0.84; 95% confidence interval, 0.36-1.99; $P = .69$) or PCU mortality (odds ratio, 0.96; 95% confidence interval, 0.38-2.45; $P = .69$). There was also no difference in subsequent ICU admission rates or in PCU length of stay.
Conclusions: We found no evidence that high-intensity intensivist physician staffing improves outcomes for intermediate care patients. In a strained critical care system, our study raises questions about the role of the intensivist in the graded care options between intensive and conventional ward care.

1. Introduction

Although considerable attention has been given to the potential benefits of intensivist staffing models for critically ill patients [1–3], little is known about the optimal physician staffing for low-risk monitor patients [4,5] admitted to progressive care units (PCUs; also known as step-down units, transitional care units, intermediate care units, or high-dependency units) [6]. Much of the previously published literature has focused on defining nursing requirements for these patients [7–9], but there is a paucity of data addressing optimal physician coverage for this population. One study in 2012 reported an association between hospitalist management of intermediate care unit patients and favorable unit observed-to-expected mortality ratios [10], suggesting that hospitalist co-management could have a positive impact on patient survival.

At our institution, PCU patients were formerly managed by critical care physicians (intensivists) under a high-intensity staffing model (mandatory intensivist consultation or a closed unit) in a 10-bed unit adjacent to, but physically distinct from, the medical intensive care unit (MICU) [1]. In November 2008, the PCU was moved to a separate hospital floor. In this transition, the PCU assumed a more conventional, low-intensity structural model in which primary management was undertaken by internal medicine hospitalists with optional intensivist consultation [11]. This organizational change enabled a natural experiment in which the impact of intensivist management on patient outcomes could be compared between the 2 groups. We hypothesized that nonintensivist management of these intermediate-risk patients would not significantly impact their outcomes.

2. Materials and methods

2.1. Study design and setting

Using a before-and-after study design, we performed a retrospective observational study comparing 2 patient cohorts: those admitted to the PCU of an urban academic hospital during the 12-month period of high-intensity management (November 1, 2007–October 31, 2008) preceding the relocation of the PCU, and those admitted during a 12-month period of low-intensity management (December 1, 2008–November 30, 2009) thereafter. Given that the date of PCU relocation was identified as November 6, 2008,

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we allowed for several weeks of transition prior to collection of postrelocation patient data in order to avoid overlapping populations.

We queried the electronic health records of Hahnemann University Hospital (Philadelphia, Penn), for consecutive admissions to PCU beds during the defined study periods. The high-intensity PCU was a 10-bed closed unit adjacent to, but independent from, the MICU. Patients here were triaged and managed by the same critical care team comprised of a medically trained intensivist and medicine residents that rounded in the neighboring critical care unit. In contrast, the low-intensity PCU was a geographically distinct unit with an approximately 15-patient maximum census in which a hospitalist-led medical housestaff team directed care with optional intensivist consultation. Admissions to this unit were no longer screened or approved by the intensivist. In both the high-intensity and low-intensity PCUs, beds were equipped with continuous telemetry, pulse oximetry, and noninvasive blood pressure monitoring, and were staffed by respiratory therapists and specialty nurses with a nurse-to-patient ratio of 1:3 to 1:4. Twenty-four-hour resident coverage with similar resident-to-patient ratios was maintained for both units. Any preexisting care protocols in the high-intensity PCU were continued in the low-intensity unit as well. Patients needing invasive central venous pressure, arterial blood pressure, intracranial pressure, or pulmonary artery catheter measurements, or requiring monitoring more frequently than every 2 hours were not permitted PCU admission.

2.2. Patients and variables

We used the patient-level variables in the Mortality Probability Model (MPM_0-III) to risk-adjust mortality rates [12]. Risk-adjustment variables include 3 physiologic variables within 1 hour of admission, 3 acute and 5 chronic diagnoses, age, cardiopulmonary resuscitation within 24 hours of admission, mechanical ventilation within 1 hour of admission, medical or unscheduled surgical admission, and variables adjusting for “zero factor” (ie, no risk factors other than age) and full code status. Patient exclusions were those defined by the MPM_0-III and included cardiac surgery, acute myocardial infarction, burns, patients younger than 18 years, and PCU readmissions during the same hospitalization. We further excluded patients who were admitted for scheduled plasmapheresis sessions in the treatment of neurologic disorders as we anticipated that as elective admissions, they would not be representative of the true PCU population. Patients who were transferred from the high-intensity to low-intensity PCU during the transition period and therefore could not be assigned exclusively to one model of care were also excluded from analysis.

The primary outcome of interest was in-hospital mortality. Patients discharged to hospice were counted as deaths during the hospitalization due to their high postdischarge mortality rates and consequent potential to bias the results [13]. Secondary outcomes included PCU and hospital lengths of stay (LOS) and subsequent intensive care unit (ICU) admission. We also assessed for differences in admission source and post-PCU disposition. We quantified the nursing workload generated by these low-risk monitor patients at the time of PCU admission using the Simplified Therapeutic Intervention Scoring System (TISS-28) [14,15] as a measure of resource use. Using this system, 1 TISS-28 point equals 10.6 minutes of each nurse's shift, and thus, the higher the number of TISS points, the greater the skill time and effort required in patient care.

2.3. Statistical analysis

We performed standard descriptive statistics to summarize patient characteristics using Fisher exact test or χ^2 test, and *t* test or Wilcoxon rank sum, as appropriate. For the primary outcome of mortality, we used multivariate logistic regression adjusting for the risk factors outlined in the MPM_0-III. To compare LOS outcomes, we used the Wilcoxon rank sum test. Frequencies of subsequent ICU admission were compared using χ^2 analysis, and TISS-28 sample mean values were analyzed using the 2-sample *t* test.

An $\alpha < .05$ was considered statistically significant. All analyses were performed with Stata 11.1 (StataCorp, College Station, Tex). This project was approved by the institutional review board of Drexel University College of Medicine (No. 1303001948).

3. Results

Of 350 patients admitted to the PCU in the defined study periods, 318 were eligible for inclusion (Fig. 1; 143 in the high-intensity PCU and 175 in the low-intensity PCU). Demographic and admission data are presented in Table 1. Patients in the low-intensity PCU were younger and more likely to be admitted from the emergency department (ED) and floor, whereas patients in the high-intensity PCU were more likely to be ICU transfers. Medical admissions were also more prevalent in the low-intensity PCU than were postoperative admissions. Because of the increased number of beds after relocation of the unit, the number of patients admitted to the low-intensity PCU was greater. However, the severity of illness by mean MPM_0-III did not differ between the 2 groups (Table 1).

Progressive care unit discharge characteristics are summarized in Table 2. Irrespective of physician staffing, PCU patients were more often discharged directly home or to a postacute care facility rather than transitioned to a lower level of care on the hospital floors. Of 18 patients subsequently transferred to a critical care unit for a higher level of care after their PCU stay, 13 (72.2%) had been originally stepped down from an ICU (8 in the high-intensity group and 5 in the low-intensity group). All patients who survived their PCU stay but were moved directly to hospice had their life support limited to comfort care at the time of transfer. Of the 15 patients who died during their PCU stay, only 1 patient (in the low-intensity unit) was full code at the time of death and therefore underwent cardiopulmonary resuscitation.

The overall hospital mortality rate for all patients was 10.4%. There was no difference in observed hospital or PCU mortality rates when comparing the 2 periods of PCU physician management (Table 3). In adjusted analysis, there was no association between intensity of physician staffing and hospital mortality (odds ratio, 0.84; 95% confidence interval [CI], 0.36-1.99; $P = .69$) or PCU mortality (odds ratio, 0.96; 95% CI, 0.38-2.45; $P = .69$). Secondary outcome data are summarized in Table 3. There was no increased likelihood of subsequent ICU admission when comparing the 2 periods of physician management. High-intensity intensivist PCU staffing was associated with a significantly longer hospital stay, but this difference was largely attributable to the pre-PCU LOS. High-intensity PCU patients were also more likely to be ICU transfers (61% vs 42%, $P = .001$), but the mean ICU (pre-PCU) LOS for those patients stepped down from critical care did not differ between the 2 groups (12.6 ± 12.8 [95% CI, 9.9-15.4] in the high-intensity PCU and 13.2 ± 14.7 [95% CI, 9.8-16.6] in the low-intensity PCU; $P = .97$). Patients in the low-intensity PCU required significantly less nursing care as measured by admission TISS-28 scores (Table 3). Thirty-nine (22.3%) low-intensity PCU patients were seen in optional consultation by an intensivist at some point during their stay, which accounted for 12.6% of all PCU patient-days in the low-intensity unit. There were no statistically significant differences in outcomes between the low-intensity PCU patients who were seen by an intensivist versus those who were not (online Table E1).

4. Discussion

To our knowledge, this is the first description of the role of intensivists in intermediate care. One previous study examining physician coverage for intermediate care units focused on the role of hospitalists. Based on their results, Lucena and colleagues [10] offered hospitalist staffing as a safe alternative to the intensivists and anesthesiologists who typically managed their units in Spain. Although we are