ORIGINAL ARTICLE

Impact of Average Patient Acuity on Staffing of the Phase I PACU

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The authors consider methods for determining staffing requirements for a Phase I PACU. Given that the total number of nursing hours per day is limited by budgetary constraints, PACU staffing can be adjusted to minimize the percentage of days that the PACU is full and cannot accept additional patients from the OR. Except for very small PACUs, the number of staffing options is so large that computer optimization methods must be used. In addition, patient acuity must be incorporated into the staffing plan. Methods are described for adjusting staffing requirements when some patient acuities differ from 1 nurse:2 patients, when patients transition from one acuity to another, and when acuity is not known for all patients.
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DETERMINING the number of nurses that should staff the Phase I postanesthesia care unit (PACU) at various times throughout the day is a well-studied problem. Occasionally, when an additional patient from an operating room (OR) is ready to be admitted to the PACU, the PACU is already full and does not have sufficient staff to care for that patient. Admitting that patient would possibly compromise patient safety. The patient should instead wait in the OR until additional staff are available in the PACU to care for the patient safely. The result is an increase in OR time and creation of additional work for at least an OR nurse and anesthesia provider. Surgeons and other patients may also be inconvenienced if subsequent cases are delayed.

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R.H.E. is President of Medical Data Applications, Ltd., which developed the CalculatOR™ software that was used to perform one of the analyses described in this article. F.D. is Director of the Division of Management Consulting, which is a Division of the Department of Anesthesia at the University of Iowa. He receives no funds personally other than his salary from the State of Iowa, including no travel expenses or honoraria, and has tenure with no incentive program.

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Recently, we systematically reviewed methods for adjusting PACU staffing to reduce the frequency of delays in PACU admission.[1] The intervention that consistently reduced the frequency of delays was to adjust PACU staffing three to four times per year, based on PACU workload.[2,3] However, previous work has not considered the situation in which the Phase I PACU has patients with different acuities. That is the focus of this article.

Background

The number of nurses in the Phase I PACU should be chosen to ensure that the PACU meets staffing guidelines and accommodates all patients from the ORs on the majority of days (95%-99%). The frequency of delays must be balanced against the relative costs of an hour of OR time and an hour of PACU staffing. Prevention of all delays is not cost-effective and is virtually impossible to achieve without a large excess in the number of nurses staffing the PACU.

For smaller PACUs (ie, with less than 4 nurses), staffing requirements can usually be adjusted based on reports from the PACU nurses of the timing of patient arrivals into their PACU. For PACUs with more than four nurses working daily, however, optimal PACU staffing cannot practically be determined without applying operations research optimization methods.[1] Optimization methods minimize the percentage of days with at least one delay in PACU admission, subject to the constraint of the total number of PACU nursing hours available for the day.[1]

To perform the optimization, the following background data must be known: (1) the number of PACU nurses required at each workday hour for all patients to have been admitted into the PACU without delay, (2) the total number of clinical hours of PACU nursing care available each workday, (3) the total number of PACU nurses available each workday, and (4) the start times and durations of shifts that the PACU nurses consider desirable.

The analysis[1] considers every possible combination of the desired shifts. If, during any hour of any workday, a combination of shifts provides too few nurses to meet staffing guidelines and accommodate every admission without delay(s), then the day in question is considered staffed inadequately. A master list is created of all possible staffing combinations that accommodate all patients and provide adequate staff on at least 95% of workdays. If the PACU does not have enough nurses to accommodate all patients on 95% of days, then the optimal staffing solution is the one giving the least number of understaffed days, but not using more nursing hours than are available. If sufficient numbers of PACU nurses are available to satisfy the goal of accommodating all patients on 95% of days, then the optimal staffing solution is the one that achieves that goal with as few PACU nursing hours as possible. For example, optimization methods applied to 1 hospital reduced delays from 56% to 24% of days without increasing staffing (see another example later in this article).[2]

Computer methods are necessary because there are so many staffing options that no person could possibly consider them all manually. For example, consider a PACU with a maximum of 12 nurses working daily in overlapping 8-hour and 10-hour shifts. Between 8 AM and 11 PM, there are eight possible 8-hour shifts: 8 AM to 4 PM, 9 AM to 5 PM, . . . , 3 PM to 11 PM. There are six possible 10-hour shifts: 8 AM to 6 PM, 9 AM to 7 PM, . . . , and 1 PM to 11 PM. In addition, a nurse could have the day off and not be scheduled for any shift at all. Consequently, there are nearly $(8 + 6 + 1)^{12} = 15^{12} = 130$ trillion different scheduling options!

To meet the goal of accommodating all patients on 95% of days, the software must predict the number of days in the future that the PACU will be understaffed for every possible staffing option. This process requires knowledge of the number of PACU nurses needed at each workday hour in the past, and compares the various

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