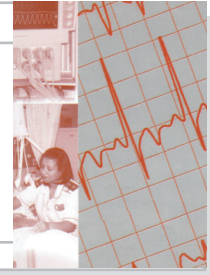


ICU nurse allocation in a cardiothoracic ICU: How many hands do we need?



Department of Anaesthesiology, University of the Witwatersrand, Johannesburg
 Juan Scribante, M Cur
 Sats Bhagwanjee, FCA (SA) (Crit Care)

Aim. To determine the nurse/patient ratios required to render safe, competent ICU nursing.

Method. A patient classification system (CritScore) was used to compile an objective 3-month patient profile. The number (of full-time and agency staff) and the professional profiles of nursing staff allocated to the unit during this period were documented.

Results. The majority of the patients were class 3 patients. While there was concordance between the total number of nurses present in relation to the number predicted by CritScore, the number of ICU-trained nurses was consistently below that ascertained by CritScore. This unit was staffed on average with more than 50% non-permanent staff who were employed on a temporary basis via agencies.

Conclusion. The number of nursing hands allocated is important, but even more so is the quality, or competence, of these hands. Nursing care without an acceptable level of competence in a critical care unit may be considered as a potentially harmful intrusion for the patient.

Critical care is an expensive and scarce resource. In the USA, critical care consumes roughly 0.6% of the American gross domestic product.^{1,2} The cost of critical care in South Africa is not known. It is likely that the demand for critical care will increase in the future, in part as a result of an increasingly aging population.³ In South Africa, the HIV/AIDS epidemic, high incidence of trauma, and increase in degenerative disease will pose an even bigger demand, not only for more health facilities but also for more critical care resources. Since critical care consumes a considerable proportion of health care resources, cost-effective use of this resource is essential.

Staffing represents 40 - 60% of the annual budget of an ICU,⁴ and little scope exists for reducing personnel costs without detracting from the quality of care.^{4,5}

The outcome from critical illness depends on the primary insult and patient characteristics. In addition, the care offered by nurses and doctors significantly affects outcomes. Serious adverse events occur commonly in an ICU and can directly influence mortality. Physician staffing patterns have been associated with outcomes from critical illness.^{5,6} There are data correlating nursing staff ratios and their level of competence with ICU outcomes.⁷⁻¹⁰

In Johannesburg Hospital, the perception of the unit management (both medical and nursing) of one specific

ICU was that the number and the category of nursing staff (ICU trained v. non-ICU) was inappropriate for rendering safe, quality nursing. This perception was supported by observations that surgery was often cancelled because of insufficient nursing staff to attend to the number of patients scheduled for surgery.

CritScore¹¹ is a critical care patient classification system based on TISS (therapeutic intervention scoring system) that was developed and validated for South African use (Fig. 1). The scoring system categorises ICU patients' severity of illness, and then determines appropriate nurse/patient ratios.

We undertook a study in this unit with the aim of determining the nurse/patient ratios required to render safe, quality ICU nursing.

The aim of the study was justified by the following objectives:

- To compile a patient profile of the surgical ICU using CritScore.
- To determine the nurse/patient ratios as recommended by CritScore.
- To record the actual number and category of nurses allocated to direct nursing care in this unit for every day of the study period.
- To compare the actual and recommended nurse/patient ratios.

The instrument is divided into four categories:

- Category A consists of 21 items, each allocated a score of 4 points. Examples in this category are intra-aortic balloon pump assistance and CPR.
- Category B consists of 30 items, each allocated a score of 3 points. Examples include TPN and intermittent mandatory ventilation.
- Category C consists of 8 items, each allocated a score of 2 points. Examples include nasogastric feeding, and intake and output monitoring.
- Category D consists of 14 items, each allocated 1 point. Examples include hourly vital sign monitoring and the administration of 1 IV antibiotic.

Data are collected every 24 hours retrospectively at the same time each day by trained observers. The total weighted score is calculated for each of the 4 different categories, and the patient is placed in 1 of 4 classes on the basis of the numeric value obtained.

- Class 1 patients are not strictly ICU patients. These are either patients ready for discharge or patients inappropriate for ICU admission.
- Class 2 patients are physiologically stable and require intensive monitoring.
- Class 3 patients are physiologically relatively stable but require intensive nursing care, invasive monitoring and predictable medical care.
- Class 4 patients are physiologically unstable, require intensive nursing and medical care, frequent observations and changes in orders, and usually have multi-organ dysfunction with an unpredictable 24-hour prognosis.

One ICU nurse can nurse two class 2 patients. Class 3 patients require a 1:1 ratio. The minimum requirement for a class 4 patient is a competent ICU nurse assisted by another ICU staff member. However, a class 4 patient (e.g. a patient receiving independent lung ventilation) requires to be assigned 2 or more full-time ICU nurses.

Fig. 1. CritScore instrument.

Method

A contextual, exploratory, descriptive, prospective study was undertaken in the 6-bed cardiothoracic ICU of Johannesburg Hospital. Ethics approval to conduct the study was obtained from the Ethics Committee of the University of the Witwatersrand. The researchers made use of a purposeful sampling method. Records of all patients admitted to this unit during the period March 2002 - May 2002 were included in the study. CritScore¹¹ was used to compile an objective patient profile. The number (of full-time and agency staff) and

the professional profiles of nursing staff allocated to the unit during this period were recorded.

The records of all patients in the unit during the study period were scored and categorised by a researcher experienced in the use of CritScore. The actual number and category of nurses allocated to direct nursing care during the same period were recorded. The corresponding nurse/patient ratios recommended by the CritScore model were computed and recorded. All data were captured in a structured spreadsheet.

Results

The majority of the patients were class 3 patients. The patient profiles appear in Fig. 2. On day 8, for example, there were 6 patients in the unit; 2 were class 4 patients, 3 were class 3 patients, and 1 was a class 2 patient. The latter was a high-care patient and should have been discharged from the unit. Nursing care is largely provided by registered nurses (45%), and only 14.5% of nurses were ICU-trained (Table I).

While there was concordance between the total number of nurses present in relation to the number predicted by CritScore, the number of ICU-trained nurses was consistently below that specified by CritScore (Fig. 3). This unit is staffed on average with more than 50% non-permanent staff employed on a temporary basis via agencies (Fig. 4).

Discussion

In South Africa, nurses undergo a 4-year training course. During the first 2 years, general nursing subjects are presented. At the end of this 2-year period, students can exit the programme and register as enrolled nurses. During the subsequent 2 years, students receive specialty training in community health, midwifery and psychiatric nursing. After completing this basic training, the nurse can embark on a postgraduate (diploma or master's degree) in critical care nursing. An audit of all critical care resources in South Africa revealed that the majority (49%) of nurses working in critical care units in South Africa were registered nurses without critical care training and with less than 5 years' experience.¹² Therefore, novice registered nurses, who have had only 2 years' general nursing experience 2 years previously, have thus entered the domain of highly demanding critical care.

Table I. Profile of nursing staff working in the unit during the study period	
Registered ICU nurses	14.5%
ICU students	4.8%
Registered nurses	44.9%
Semi-professional nurses	2.8%
Agency	33.1%

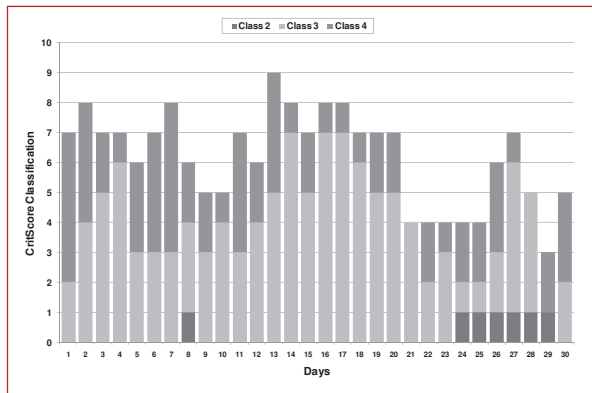


Fig. 2. Patient profile.

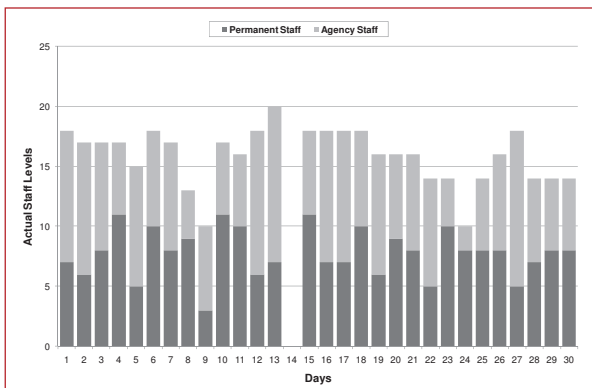


Fig. 3. Profile of permanent and agency staff.

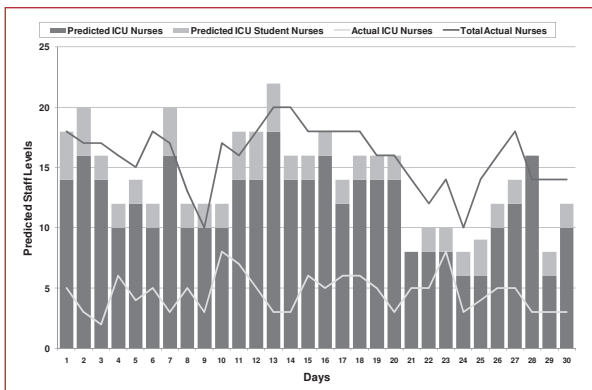


Fig. 4. Actual versus predicted staffing levels.

Nurses are accountable for all actions they undertake.¹³ In order to be accountable, they should comply with several preconditions: ability, responsibility and authority.¹⁴ Ability is the basic precondition, comprising knowledge, skills and values.

Generally, nurses practising in critical care are given high levels of responsibility with concomitant expectations of accountability – but in the absence of a suitable ability base and/or the necessary formal authority.¹⁴ A critical care nurse should have in-depth knowledge of the pathophysiology of critically ill patients, and the ability to use high-tech equipment to support them.¹⁵ Nurses should be given, and should accept, responsibility for all actions undertaken.¹⁴ The question arises whether all nurses practising in critical care are ready, willing and able to undertake

the responsibility of working in a critical care unit where heavy demands will be made on their intellectual and emotional resources.¹⁵ It is important that the professional and ethical responsibilities of the individual critical care nurse should influence staffing of the critical care unit, and that these responsibilities be taken into account when staffing needs are determined.

A growing body of evidence suggests that appropriate critical care nurse staffing has a significant impact on patient outcomes.

A large retrospective review of the hospital discharge data of 2 606 patients who underwent abdominal aortic surgery was performed to examine the association between critical care nurse staffing and the likelihood of postoperative complications in these patients.¹⁶ The authors concluded that reduced critical care nurse staffing was significantly associated with increased risk of complications. It was also found that decreasing critical care nurse below a certain threshold level might lead to increased costs of care and length of stay for patients.¹⁷

Tarnow-Mordi *et al.*¹⁸ measured ICU nursing workload by determining bed occupancy, total ICU nursing requirement as defined by the UK Intensive Care Society, and the ratio of occupied to appropriately staffed beds. The authors concluded that variations in mortality could partly be explained by excess ICU workload.

An analysis of the first 3 600 incident reports submitted to the Australian Incident Monitoring Study (AIMS-ICU)¹⁹ identified incidents associated with nurse shortages and assessed their estimated effect on patient outcome. The study suggested that inadequate staffing levels resulted in excessive incidents and compromised patient safety.

A significant increase in morbidity and resource utilisation was noted for patients receiving postoperative care in units where a single nurse was caring for more than 3 ICU patients at night. A night-time nurse to patient ratio of less than 1:2 was associated with a 39% increase in length of stay (LOS) of 4 days and a 32% increase in direct hospital costs.⁸

Critical care units cannot be regarded as a homogeneous group. Although the unit may admit a similar cohort of patients (e.g. postoperative cardiothoracic patients), the number of nursing staff required to render safe nursing care can vary. Nursing workload in critical care is significantly influenced by individual doctor preference of treatment regimens, and the use and availability of high-tech equipment.²⁰ It is therefore of the utmost importance that individual units be given the ability to determine their own staffing needs in an objective manner based on situational specifics.

The number of nursing hands allocated is important, but even more so is their quality, or competency. Nursing care without an acceptable level of competence in the critical care unit may be considered as a potentially harmful intrusion for the patient.²¹ Morrison *et al.*²¹ concluded that nursing staff inexperience has a negative impact on the quality of nursing care experienced by patients while in critical care. Errors are more likely to occur when inexperience combines with staff shortage, inadequate supervision and a busy unit. In South Africa, studies have been carried out to establish critical care nurses' knowledge of various aspects of critical care nursing. The nurses (including critical care trained nurses) on average achieved scores below the set minimum competencies indicators.²²⁻²⁶

Critical care nursing competency is based on a continuum that includes the novice, advanced beginner, competent, proficient, and expert critical care nurse; if competency is not maintained, a decline is inevitable which will result in the critical care nurse descending down the competency curve.^{27,28}

An unacceptably high percentage of non-permanent nursing staff work in critical care units. Agency staff are unfamiliar with – or may not adhere to – unit practices and policies, of which non-adherence to infection control policy is the most significant. Agency staff are also likely to bring with them resistant organisms from other units, putting already compromised patients at further risk. The impact of this particular practice needs careful evaluation.

Conclusion

Critical care is a vital and significant part of the health care system; it is an expensive service but not necessarily delivered in an optimal or optimised manner. Changes in how we deliver – or don't deliver – critical care can have public health ramifications for an entire nation.¹ Patients may suffer if the misplaced fear of 'expensive' critical care affects the focus of policy discussions and adversely influences critical care unit staffing. We concur that 'The goal should be that we get the most for our ICU dollar'.²⁹

In 1930, Dr Kirschner, of the University of Tubingen's surgical hospital in Germany, identified a need for a special department where critically ill and

postoperative patients could be cared for. Dr Kirschner believed that care would be improved if the most experienced nurses worked in such special departments, and experienced physicians were responsible for co-ordination of patient care.³⁰ Seventy-seven years on, we are still trying to convince management and decision makers of the obvious.

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