

MEDICAL STAFFING ON CRITICAL CARE UNITS

A LITERATURE REVIEW ON BEHALF OF THE FACULTY OF INTENSIVE CARE MEDICINE WORKFORCE ADVISORY GROUP

This is the second part of a two-part literature review on behalf of the Faculty of Intensive Care Medicine Workforce Advisory Group. The first part of the literature review addresses critical care bed provision, and was undertaken by Mike McAlindon (FICM trainee representative).

The aim of this literature review is to assess current evidence and expert opinion regarding various aspects of *medical* staffing on critical care units within, and outside of, the United Kingdom.

There is a large amount of published work on nurse staffing in critical care which I have not included in the literature review as I believe that it is currently outside the scope of the FICM WAG. There is also some evidence published from paediatric critical care units. Although there may be some lessons to be learnt from the paediatric community, I have not included these studies/ commentaries for simplicity.

I have attempted to address the following questions in this document:

1. What is the ideal doctor to patient ratio on an adult critical care unit?
2. When is direct consultant cover necessary in critical care?
3. Are there alternative practices available to help to reduce the burden of physician cover on critical care?

1. What is the ideal doctor-patient ratio in critical care?

There is a relative paucity of data stipulating recommended maximum physician to patient ratios in critical care, despite nurse to patient ratios being discussed widely in the literature.

In a national survey of training program directors in the United States of America, the average daily census of patients was 18.8 +/- 8.9 patients and the average maximum service was 24.1 +/- 9.9 patients.ⁱ The median (interquartile range) patient-to-attending physician ratio was 13 (10-16). When categorized according to this median, respondents from intensive care units with high patient/physician ratios (n = 31) perceived significantly more time constraints, more stress, and difficulties with teaching trainees than respondents with low patient/physician ratios (n = 40). Twenty-eight percent of respondents felt the average census was "too many" and 71% felt the maximum size was "too many."

A recent statement from the Society of Critical Care Medicine Taskforce on ICU Staffing concluded "advocating a specific maximum number of patients cared for is unrealistic".ⁱⁱ They described a number of underlying principles, namely that:

1. Proper staffing impacts patient care

2. Large caseloads should not preclude 'rounding' in a timely fashion
3. Staffing decisions should factor surge capacity and non-direct patient care
4. Institutions should regularly reassess their staffing
5. High staff turnover or decreases in quality of care indicators in a unit may be markers of overload
6. Telemedicine, advanced practice professionals or non-intensivist medical staff may be useful to alleviate overburdening intensivists
7. In teaching institutions feedback from trainees should be sought to understand the implications of potential understaffing on medical education
8. In academic ICUs [*here defined as those with a role in training*] there is evidence that intensivist/patient ratios less favourable than 1:14 negatively impact education

A 2012 prospective, observational, 48-hour cross-sectional study conducted in 57 intensive care units in Europe cited low physician to patient ratios as one of many variables which increase the likelihood of medical error.ⁱⁱⁱ

2. When is direct consultant cover required in critical care?

There are several arguments proposed in the literature regarding the *potential* benefits of 24-hour intensivist cover on critical care. These include:

1. The nature of critical illness as a rapidly progressing condition which itself does not recognize the boundaries of business hours ^{iv}
2. Robust evidence indicating that delay in treatment impacts negatively on trends in mortality and morbidity in critically ill populations
3. The suggestion that out of hours acute admissions have a higher mortality in many specialities (see below)
4. Evidence that treatment of critically ill patients by a full time intensivist has a beneficial impact on patient length of stay on ICU ^{v vi} although this hasn't been shown to impact on mortality (see below)

There is some contradiction in the literature regarding the impact of weekend and overnight admission to critical care on mortality, a factor which lends itself toward the argument for 24-hour intensivist cover in critical care.

Three cohort studies failed to show an increase in mortality in patients admitted out-of-hours to critical care. ^{vii viii ix} A 2010 systematic review evaluated the findings of ten cohort studies of night-time and weekend admissions to critical care.^x The pooled analysis demonstrated that *night-time* admission was not associated with an increased mortality (OR 1.0, 95% CI 0.87-1.17) however patients admitted over the weekend had a significant increase in the adjusted risk of death (OR 1.08, 95% CI 1.04-1.13).

In 2012 Wallace et al undertook a retrospective, cohort study assessed the impact of night-time intensivist staffing on mortality in 65,752 patients across 49

intensive care units.^{xi} They found that in critical care units with 'low-intensity' daytime staffing, there was a reduction in risk-adjusted in-hospital mortality when night-time intensivists were present. However, among ICUs with high-intensity daytime staffing, nighttime intensivist staffing conferred no benefit with respect to risk-adjusted in-hospital mortality (odds ratio, 1.08; P=0.78). In a retrospective review of 26 months worth of admissions to a surgical ICU in the USA 13 months before, and after, addition of a dedicated night-time intensivist it was found that implementation of 24/7 staffing did not improve morbidity or mortality.^{xii}

3. Are there alternatives available to reduce the burden of physician cover on critical care?

Much of the evidence regarding different models of physician staffing in critical care is from North America and focuses on closed vs open ICUs. As such, much of the literature is not currently relevant to practice in the UK.

Despite this, there is an awareness that the implications of increased demand for critical care beds on a background of a relative shortage of intensivists demands scrutiny and utilization of alternative strategies to enhance service delivery.

Discussions in the literature focus on the future use of:

1. Non-physician providers (both nurse practitioners and physicians assistants)^{xiii xiv}
2. Innovative staffing models
3. Telemedicine and other technologies^{ii xiii}

ⁱ Nicholas S Ward et al., "Perceived Effects of Attending Physician Workload in Academic Medical Intensive Care Units," *Critical Care Medicine* 40, no. 2 (February 2012): 400–405, doi:10.1097/CCM.0b013e318232d997.

ⁱⁱ Nicholas S Ward et al., "Intensivist/Patient Ratios in Closed ICUs: a Statement From the Society of Critical Care Medicine Taskforce on ICU Staffing,," vol. 41, 2013, 638–645, doi:10.1097/CCM.0b013e3182741478.

ⁱⁱⁱ J Steyrer, M Schiffinger, and C Huber, "Attitude Is Everything?: the Impact of Workload, Safety Climate, and Safety Tools on Medical Errors: a Study of Intensive Care Units," *Health Care ...* (2012).

^{iv} Yaseen Arabi, "Pro/Con Debate: Should 24/7 in-House Intensivist Coverage Be Implemented?," *Critical Care* 12, no. 3 (2008): 216, doi:10.1056/NEJMe068310.

^v Thomas L Higgins et al., "Early Indicators of Prolonged Intensive Care Unit Stay: Impact of Illness Severity, Physician Staffing, and Pre-Intensive Care Unit Length

of Stay.," *Critical Care Medicine* 31, no. 1 (January 2003): 45–51,
doi:10.1097/01.CCM.0000038743.29876.3C.

^{vi} Peter J Pronovost et al., "Physician Staffing Patterns and Clinical Outcomes in Critically Ill Patients: a Systematic Review.," *JAMA : the Journal of the American Medical Association* 288, no. 17 (November 6, 2002): 2151–2162.

^{vii} Charles-Edouard Luyt et al., "Mortality Among Patients Admitted to Intensive Care Units During Weekday Day Shifts Compared with 'Off' Hours.," *Critical Care Medicine* 35, no. 1 (January 2007): 3–11,
doi:10.1097/01.CCM.0000249832.36518.11.

^{viii} S A Ensminger, I J Morales, and S G Peters, "The Hospital Mortality of Patients Admitted to the ICU on Weekends," *Chest ...* (2004).

^{ix} Iwan A Meynaar et al., "Off Hour Admission to an Intensivist-Led ICU Is Not Associated with Increased Mortality," *Critical Care* 13, no. 3 (2009): R84,
doi:10.1186/cc7904.

^x R Cavallazzi, P E Marik, and A Hirani, "Association Between Time of Admission to the ICU and MortalityA Systematic Review and Metaanalysis," *Chest ...* (2010).

^{xi} David J Wallace et al., "Nighttime Intensivist Staffing and Mortality Among Critically Ill Patients," *N Engl J Med* 366, no. 22 (May 31, 2012): 2093–2101,
doi:10.1056/NEJMsa1201918.

^{xii} Gwendolyn M van der Wilden et al., "Implementation of 24/7 Intensivist Presence in the SICU: Effect on Processes of Care.," *The Journal of Trauma and Acute Care Surgery* 74, no. 2 (February 2013): 563–567,
doi:10.1097/TA.0b013e31827880a8.

^{xiii} A Garland and H B Gershengorn, "Staffing in ICUsICU Physician StaffingPhysicians and Alternative Staffing Models," *CHEST Journal* (2013).

^{xiv} H B Gershengorn and H Wunsch, "Impact of Nonphysician Staffing on Outcomes in a Medical ICU," *Chest ...* (2011).