



ICU Staffing, Models, and Outcomes in Onco-Critical Care Unit

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2.1 Introduction

The ‘Intensive Care Unit’ (ICU) in any hospital houses critically ill patients and is specifically designed, staffed and equipped to monitor and manage the life threatening illnesses and other complications which may be seen in critically sick patients [1]. Thus, an ICU is a area of the hospital which is cost intensive to maintain and operate and requires precise management to be economically viable for any hospital.

Historically, the concept of a designated area for the management of critically ill patients has developed with major historical events of the world. The World War 1 saw the development of the so called ‘shock wards’ for the resuscitation of soldiers in hypovolemic shock with colloids and crystalloids. This progressed to surgical wards with the onset of blood transfusion and surgeries for management of wounds sustained in the battlefield. The concept of a ‘respiratory unit’ with mechanical ventilatory support emerged during the polio epidemic which saw widespread use of ventilators for respiratory support [2]. Organ specific based intensive care was first described in neurosurgery as ‘brain teams’ looking after the perioperative care of neurosurgical patients [3].

With the progress of medicine and development of various medical and surgical branches ICUs in the present-day scenario are super specialized units where medical or surgical patients requiring intensive round the clock monitoring and management are admitted. ICU’s are graded into three levels (level 1, 2 and 3) on the basis of the size and speciality of the hospital housing these units [4]. The basic guidelines on skeletal and structural formation of an ICU according to the level of care the number of beds to be housed, number of beds in a chamber, the spacing and

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V. Kumar et al. (eds.), *Onco-critical Care*,
https://doi.org/10.1007/978-981-16-9929-0_2

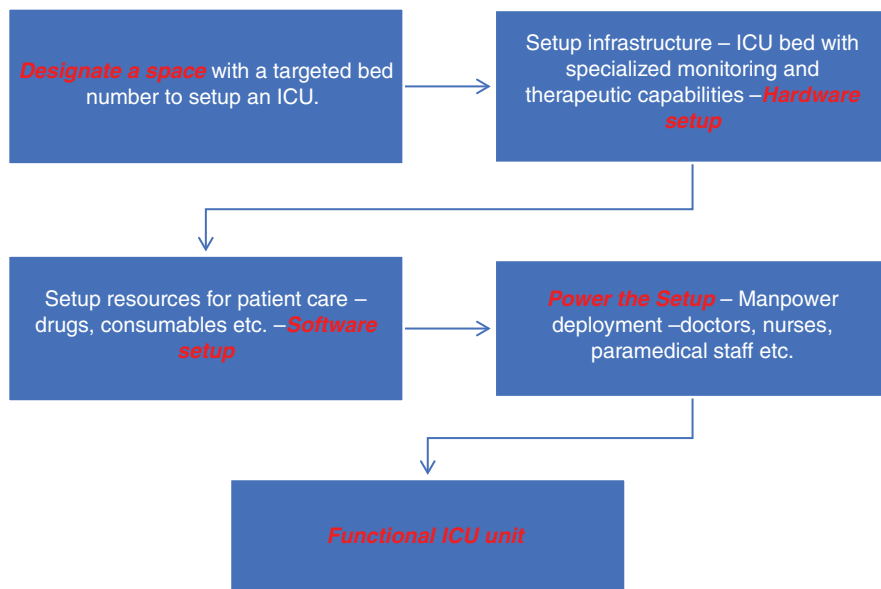


Fig. 2.1 Showing the basic steps of designing and operating an ICU

distance between the beds, the equipment's required for proper functioning of an ICU according to its level of care are well defined in literature [4].

Majority of the ICUs in the developed as well as developing nations are designed and operated in the basic steps as outlined in Fig. 2.1.

2.1.1 Staffing Patterns in ICU—Current Concepts and Practices –

Doctors or intensivists, nursing and other para medical staff like physiotherapists, phlebotomists, cleaning staff, equipment in charge, store in charge etc. are integral to the functioning of any ICU.

Worldwide critical care society guidelines insist on a fixed nursing ratio for ICU patients [1, 4, 5], a nurse patient ratio of 1:1 for ventilated and other critically ill patients and a ratio of 1:2 or 1:3 for less sick patients. However, literature does not exactly specify the staffing pattern and numbers for doctors or intensivists for proportion of patients in any ICU. A statement released in 2013 from the Society of Critical Care Medicine states that intensivist patient ratio less favourable than 1:14 negatively impacted patient care, teaching training and staff wellbeing [6]. However, this statement has not been implemented as a standard guideline by the various critical care societies around the world. The reason behind this is that an ICU trained doctor or an 'Intensivist' is a scarce manpower resource all over the world in all types of medical systems be it a government sponsored institute or a private medical centre or hospital.

To understand the dynamic concept of staffing an intensivist in ICU and its related outcomes one first needs to understand the working modes of ICU and patient care delivery, as these models call for different types of staffing for smooth running of the ICU.

2.2 Working Modes of an ICU

ICU is an interwoven and complex organisation which deals with patients from various specialities. There are multiple stakeholders for each patient right from the primary physician, the intensivist in the ICU to the various doctors which may be called for their speciality reference. The primary stakeholder may be the intensivist or the primary care physician depending on the working model of the ICU. The staffing patterns, duty hours of the ICU and the role of a trained intensivist varies according to the working model adopted by the ICU.

The various working models described for ICU's are summarized in Table 2.1.

Table 2.1 Summarizing working models for an ICU [7]

Working Model	Closed ICU	Open ICU	Semi closed ICU	Semi open ICU.
Salient features	Admission and discharge rights only with the intensivist All decisions on patient care and management are taken by the critical care team The initial physician becomes only an observer with no active role in patient management Practised predominantly in ICU'S in Europe and Australia Can easily be applied and practised in 'academic institutes	Admission and discharge—any physician with hospital admission rights can admit the patient directly to the ICU Primary care provider—management and decision making remains in the hands of the primary care provider ICU just provides a place of intensive monitoring (eg. vasopressor infusion and invasive monitoring), better nursing care etc	Hybrid model between closed and open model Admission rights—anyone can admit the patient in ICU Management—critical team is automatically consulted and comanages all patients with the primary physician	Hybrid model between closed and open model Anyone with admitting rights can admit a patient Critical team is consulted for all patients <i>but</i> all patients are not comanaged

(continued)

Table 2.1 (continued)

Working Model	Closed ICU	Open ICU	Semi closed ICU	Semi open ICU.
Advantages	Unidirectional flow of command and a single decision-making team for the patient, thus no confusion in medical decision making	Primary physician is the decision maker—thus continuity of care is maintained Less labour intensive and not dependent on critical care specialist	Aims at best of both open and closed system—i.e., continuity of care with primary physician and specialist care by the intensivist	Opinion of critical care is sought initially and then whenever require leaving the entire decision making on the primary physician
Drawbacks	Most labour intensive of all the systems	The specialized care of an intensivist trained in managing critically ill patients is missing Primary physician may not be expert in certain ICU procedures and techniques (ventilatory management, bedside procedures)	Two managing teams (primary physician and the intensivist) may lead to conflict of ideas and thoughts and may delay or negatively impact clinical decisions	Daily involvement of a critical care specialist is missing

2.3 Staffing of an ICU

After a basic understanding of the working models of ICU it is quite clear that the closed model of ICU will be the most labour intensive with respect to employing trained intensivists, the open system will be the least labour intensive with no involvement of the intensivist and the semi closed and semi open will be somewhat in between of the two, with the semi closed system requiring more staff than the semi open as intensivists comanage all cases in semi closed whereas are consulted only on need basis in semi open system.

Staffing a closed or semi closed ICU with intensivists would be economically more costly on any hospital system. From an administrative point of view the costs incurred to staff a closed or semi closed ICU should be supported by positive patient outcomes. The earliest concrete evidence in this regard was given by Pronovost and

co-workers in their systematic review published in 2002 addressing the question of relation between ICU physician staffing and patient outcomes [8]. In this paper ICU physician staffing and patient related outcomes like length of stay (LOS), mortality etc. were studied from 1965 to 2001. They grouped the generated data into a '*low intensity staffing model*' where intensivist or the ICU physician is not directly involved in patient care or is only electively consulted (an open or semi open model of ICU care). The second group was '*high intensity staffing model*' where an intensivist was the primary care provider or was mandatorily involved and comanaged all patient (closed or semi closed model of ICU care). They concluded that the high intensity staffing was associated with a lower hospital mortality, lower ICU mortality and lower LOS in the ICU and thus translated into better patient outcomes.

The '*Leapfrog Group*' a consortium of purchasers and providers of health care [9], this group aims to improve healthcare system outcomes, minimize preventable errors, rate the various healthcare systems of America and aims to bring about a system of transparency in the functioning of healthcare in America. This group issues guidelines and sets standards for health care systems housing ICU for staffing and functioning of the ICU.

The Leapfrog group in their 2021 document on ICU physician staffing (IPS) [10] state that—the quality of care in an ICU is broadly determined by (a) whether “intensivists” are providing care and (b) model of care delivery in the ICU (open vs. closed ICU). The Leapfrog group defines ‘Intensivist’ as a board-certified physician additionally certified in the speciality of critical care medicine. A physician eligible for a subspecialty certification in critical care may be a specialist in medicine, emergency medicine, anaesthesia or paediatrics.

The Leapfrog group IPS safety standard guidelines with an aim to minimize preventable errors and enhance positive outcomes in patient care can be summarized as [10]—

1. Certified intensivists to be present on site to exclusively manage (closed model) or comanage (semi-closed model) all the patients in medical or surgical ICU for optimum outcomes.
2. The onsite intensivist to be present for a period of 8 h per day in the day time for 7 days a week for exclusive clinical care in the ICU.
3. When intensivist is not present onsite or working via telemedicine—more than 95% of calls/texts/messages from the ICU are to be returned and answered to within 5 min.
4. An onsite ‘Effector’ i.e., a trained medical person to carry out order given by the intensivist (when not present on site or working via telemedicine) to be present on site and physically reach any patient within 5 min to carry out orders given by the intensivist.

The recommendations have been made in line and based on the evidence generated in the sentinel paper on ICU staffing by Pronovost et al. [8].

2.4 Physician Staffing Models of an ICU

Basic 3 models are described for ICU staffing [7], these are mainly—

- (a) Academic model
- (b) Modified academic model
- (c) Open model.

The salient features of each with its advantages, drawbacks, cost benefit analysis for the hospital are summarized in Table 2.2.

2.4.1 Outcomes with Different Staffing Models

While relatively clear that the academic model will have the maximum benefit and positive impact on patient outcomes, 24-h intensivist on floor versus day time intensivist followed by on call/ telemedicine was a matter of debate. Literature on patient outcome in the recent years has shed light on this question.

Table 2.2 Table describing various physician staffing models for ICU setup

Staffing model	Academic model	Modified academic model	Open model
Salient features.	A team of attending consultant and resident trainees 24 h on floor of the ICU Default model for closed ICU and large teaching institutes	24-h coverage by a certified intensivist not necessarily on ICU floor during this period Physician assistants (PA) and advanced practice providers (APP) on floor of the ICU 24 h a day in shifts to carry out orders of the intensivist within 5 min as per Leapfrog guidelines	Consulting intensivist only when required and do not take over or comanage patients In line with Open or semi open ICU setup May be used mainly by small Level I ICU units
Advantages	Maximum coverage and theoretically minimal chances of lapses in patient care	Better utilization of the scarcest manpower i.e., certified intensivist The concept of ‘Telemedicine’ can be implemented with this model	Minimal costs to the institution
Draw backs	Resource heavy and maximum costs for the system Difficult to find faculties for night shifts and resident trainees for 24-h shift duties Poor work life balance for doctors	The PA’s and APP’s have to be trained in common ICU procedures like lumbar puncture, ventilator management, central line placement etc. for optimal care High risk procedures like intubations, intercostal drain placement etc. may still need on site specialist backup	Not in line with the Leapfrog guidelines Poor patient outcomes and inconsistent care

In an official systematic review and metaanalysis on night time intensivist staffing done by the American Thoracic Society concluded that Night time intensivist staffing did not have any superior outcome in mortality and length of hospital stay as compared to day time dedicated intensivist coverage [11]. Similar conclusions were echoed in a retrospective study in over 65,000 patients, night time intensivist ICU staffing had a positive impact on outcomes when applied to low intensity ICU care and had no impact on outcomes when applied on day time intensivist covered ICU setups [12].

To conclude, a high intensity (closed or semi closed) staffing model definitely improves overall outcomes as compared to low intensity staffing but the same cannot be said for night time intensivist in all types of ICU's. with advanced in medical care and communication techniques especially with the advent of telemedicine the evidence in favour of night time intensivist has declined in recent literature.

The future of telemedicine in ICU looks promising, a systematic review and metaanalysis on impact of telemedicine on patient outcomes collected data from 13 eligible studies from 35 ICU's and included 41,000 patients. This study concluded that tele ICU coverage was associated with lower ICU mortality and LOS but did not translate into lower in hospital mortality or shortened LOS [13]. In the same year a prospective stepped clinical practice study by Craig M Lily and co-workers on 6290 patients in 7 ICU's showed that implementation of a tele ICU was associated with reduced in hospital mortality and reduced hospital LOS [14]. The key feature in this study which led to its success was that the tele ICU consult providers had full independence in patient care and could order any necessary interventions just as an in-house intensivist.

Thus, the ideal staffing system of an ICU would be a closed type of ICU with high intensity 24-h in-house intensivist. However, keeping in mind the limited available certified intensivists in any medical system and literature clearly showing day time high intensity staffing to be equally effective the most practical system in any ICU setup be it a teaching hospital or a private setup would be a closed or semi-closed type of ICU with high intensity day time staffing with a physician patient ratio of not more than 1:14 and well-trained PA's or APP's for night time cover. Telemedicine can be practised in a robust manner with all decisions and responsibilities resting on the shoulders of intensivist in charge and a well trained on ground medical staff.

2.5 Burnout Among Intensivists

An ICU is a highly stressful workplace with a high-pressure environment. Such work conditions put the workforce both physicians and paramedical staff under extreme stress and make them prone for burnout [15].

Various factors which put the ICU physicians under extreme stress and at risk of burnout are [15–17]—

- Long working hours and shift timings.
- Regular night shifts with no time for family.

- Sick patients with poor outcomes thus poor work satisfaction.
- Poor overall staffing, high physician patient ratios thus poor quality of work.
- Minimal time for research and teaching owing to busy ICU schedules.
- Females are especially at greater risk of experiencing severe burnout symptoms as the juggle for work life balance and raising children etc. is more on the shoulders of females.
- Paediatric/neonatal ICU physicians reported more burnout symptoms.

The list of contributing Factors is exhaustive and does not end here. However, the important point is that organisations, physicians and other staff working in the ICU should accept this problem and take a head on approach to tackle it. The organisational rules and the administration should be sympathetic to the special concerns of the ICU team and should be aware of how stressful the ICU environment can be and should be flexible in duty hours and leave schedules to facilitate proper break from the work routines for ICU staff. The hospitals should have a psychological support program or counsellors specifically working with the ICU team. Working teams should be made aware the signs and symptoms of burnout so that they can identify and notify if a colleague if feeling under the weather or is in undue work pressure. Such steps, even if taken on microscopic level will bear fruit for every organisation and lead to a healthy and productive workforce.

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