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LESS IS MORE IN INTENSIVE CARE

ICU beds: less is more? Not sure

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There exists a huge variation in intensive-care unit (ICU) beds across ICUs, hospitals, and countries. This begs the question of just what the optimal number of ICU beds is, a conundrum which has been thrown into the spotlight with the coronavirus disease 2019 (COVID-19) [1].

The hypothesis that less ICU beds is more is supported by various arguments [2]. There is evidence that healthcare systems with a relative abundance of ICU beds tend to use these beds more liberally, even for patients who may not benefit from intensive care [3]. For example, in a study of ICU patients in the United States in 2008, only about one-quarter required mechanical ventilation [4]. This has several consequences. First, overly enthusiastic use of ICUs is not without risks. The incidence of medical errors and adverse events among ICU patients, sometimes from unnecessary treatments, ranges from 15 to 51% [5]. Second, the line between intensive care and end-of-life care can become excessively grey, with more people spending their last days in the ICUs. This is despite evidence that most people prefer to die at home [6]. Third, ICU beds are an expensive resource which contribute substantially to healthcare costs [7]. When unaffordable and, therefore, inaccessible, they can lead to guilt in families of the critically ill, especially in resource-limited settings.

These arguments are sound, but have to be considered concurrently with opposing views [8]. A lack of ICU beds creates a capacity strain, conceptually defined as a mismatch between demand and supply. It forces clinicians to aggressively ration. The consequences are denial of or delay in admission of ill patients who would have benefited from intensive care, and out-of-hours discharge of existing patients from the ICU, all of which have been associated with increased mortality [9]. These issues have always existed, but were made painfully clear with the surge of COVID-19 in many overwhelmed healthcare systems [10].

We believe that both the statements "less is more" and "less is not more" for ICU beds are too simplistic. The solution to the question of the optimal number of ICU beds is best provided by a Goldilocks answer: "just the right amount" in the context of each ICU, hospital, and country. But how is one to determine this number?

First, a nuanced understanding of what exactly is an ICU is required. The World Federation of Intensive and Critical Care suggested that "an ICU is based in a defined geographic area of a hospital, and an organised system for the provision of care to critically ill patients that provides intensive and specialised medical and nursing care, an enhanced capacity for monitoring, and multiple modalities of physiologic organ support to sustain life during a period of acute organ system insufficiency" [11]. This attempt to standardise definitions notwithstanding, intensive care is provided in different settings across the world today, from ICUs capable of extracorporeal support in resource-rich urban areas to makeshift facilities without mechanical ventilators in resource-limited rural areas [12].

Second, ICUs are not just a static collection of infrastructure and equipment, but a dynamic force driven by physicians, nurses, and allied health professionals. Units with many high-acuity beds but insufficient trained staff risk compromising patient outcomes. Intensivist-to-patient ratios lower than 1:15 adversely affect patient care and staff well-being in academic medical ICUs [13]. One-to-one nursing is clearly safer than one-to-many, but critical care nursing shortages are pervasive even in high-income settings. On the other hand, units with mostly low-acuity patients and too much manpower risk deskilling staff, who then struggle to cope when the sickest of the sick present. Thus, while it has been suggested that bed occupancy rates of 70–75% are optimal [14],

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estimation of bed requirements must take into account the availability and training of staff.

Third, ICUs exist within hospitals as part of a complex healthcare system and cannot be seen in isolation. Tertiary hospitals that provide more complex treatments and perform more high-risk surgeries will require more ICU beds. Hospitals that have invested in providing "critical care without walls" will require less ICU beds. Possibilities include the flexible use of high dependency units, remodelled general wards, post-anaesthesia care units, emergency departments, and deployable field units for high-acuity patients [1]. Many hospitals have also invested in telemedicine, which is postulated to reduce ICU length of stay and, hence, bed requirements [15]. Rapid response systems, often advocated in the same vein, have not been associated with a decrease in ICU admissions [16].

Fourth, ICU bed capacity varies widely across countries. Low- and middle-income countries have significantly fewer ICU beds than high-income ones. For example, while Uganda and Bangladesh, respectively, have 0.1 and 0.8 adult critical care beds per 100,000 population, Taiwan and the United States, respectively, have 28.5 and 27.0 [17]. Clearly, rationing of ICU beds is the norm in resource-limited settings. While it is tempting to call for more ICU beds in these countries, governments, policy makers, and the intensive-care community will have to balance this with investments in more basic healthcare [12]. Cultural and societal views of the role of ICUs in end-of-life care also differ widely across countries, and must be factored into any discussion on ICU bed capacity [18].

Finally, demand for ICU beds is not constant, but surges during pandemics and declines during peacetime [1]. Many have been struck by how new ICUs and ICU beds had to be created literally overnight to deal with COVID-19 in places like Wuhan and Lombardy [19, 20]. After the pandemic eases, much of the infrastructure remodelled and created will likely form the surge capacity for future outbreaks, while many of the ventilators procured and manufactured will likely enter a national or local stockpile. How much to pre-emptively invest in such capacity and stockpiles is a matter of judgment. The cost–benefit at a societal level—while acknowledging the tragedy of each life lost at a family level due to a lack of ICU resources—needs contemplation. The implications at the hospital level—while recognising the need to complement any hardware with skilled human resource through continuing education and clinical training—require consideration.

In conclusion, the adverse impact of extremes of ICU bed capacity is clear. Too few, and patient outcomes are compromised. Too many, and healthcare costs balloon, while possibly also worsening patient outcomes. What is too few or too many is, however, difficult to define. It depends on the very definition of an ICU bed, the acuity and staffing of each ICU, the services and facilities of each hospital, the resources and culture of each country, and the waxing and waning of pandemics.

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Compliance with ethical standards

Conflict of interests
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