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ICU Design – Does it Matter?

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Professor Flaatten explains how design can affect patient outcome, and reports data collected from a temporary ICU set-up during reconstruction of his ICU at Haukeland University.

Does design matter? Intuitively most intensivists would probably answer yes to this question, given the experience we all have from various designs and functions in our daily life. Anyone who has tried to use a nail without a hammer appreciates the effect of using the proper tool for the job! The whole ICU is our “tool” for treating critically ill patients, and is more than the mere sum of various equipment and personnel, but also the size, form and shape of the area in which we work.

Although “evidence based” hospital and ICU design is a hot topic (www.healthcaredesignmagazine.com), the evidence for a possible impact of ICU design on patient outcome is not easy to find in the literature, or to document.

By chance, in our own unit, a 10 bed general ICU in a Norwegian university hospital, we recently experienced the opportunity to study the effects of moving from our unit to another location in the hospital (Flaatten 2005), and our experiences may be of interest in this context.

Some years ago it was decided to rebuild our ICU (the only general ICU in the hospital) to improve its function and design. The most important issues were lack of enough power supply including adequate uninterrupted backup power, pure water for haemodialysis and lack of proper isolation rooms within the ICU. During the reconstruction (which involved a complete stripping of the interior), we had to move out of the area. A temporary ICU was established in one of our postoperative rooms for a period of 9 months, from July 2001 to February 2002. Equipment and personnel remained consistent, but operated in one large room, with difficult access to storage, offices and resting areas, and with no facilities for relatives. After moving back we noticed a slight increase in mortality (yearly report 2001), and decided to have a closer look at the whole 9 month period compared to the prior and following 12 month periods.

Using our traditional analysis with standard mortality ratio, we found an increase, but because of the small numbers of patients, the confidence intervals were rather large. Using another technique, the so-called variable life adjusted display (VLAD; Lovegrove 1997), a very clear picture appeared, illustrating a clear shift in mortality during the whole period of rebuilding (Flaatten 2005). Since this was a retrospective analysis, it was difficult to find specific reasons for the increase in mortality.

The case mix, severity of illness, treatment modalities and personnel had remained the same. We had to conclude that the observed increase in mortality was a poorly explained result of moving to another area, never intended to be used as an ICU. This temporary area had consisted of one large room, compared to several one- and two bed rooms in the ICU, had very little daylight, and nearly half the average area per bed (15m2 compared to 25 m^2).

How is it possible for ICU design to influence outcome? There are no definite answers to this question, but some interesting findings exist. More than 20 years ago, it was shown that postoperative patients who were given a room with a view of natural surroundings suffered fewer complications, used less pain medication and were discharged sooner than those with a view of a brick wall (Ulrich 1984). Although not directly applicable to many ICU patients, this study in fact documents an effect on outcome from how the rooms are constructed. There is also evidence that transmission of bacteria from patient to patient increases with the number of beds in the room (inversely related to the distance between beds) (Kibbler 1998, Borg 2003). There may also be effects of noise and use of colour, but these are more difficult to find evidence for in an ICU population.

The design of the ICU undoubtedly affects how we work as health professionals. Staff satisfaction and turnover may be influenced by the working conditions, and could ultimately influence how patients are treated and quality of care. Knowledge about effects of design and functionality on outcome are essential. This article is the first in an ICU Management series, which will discuss optimal design of the ICU.

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