



Evidence-Based Medicine Journal Club

EBM Journal Club Section Editor: Eric B. Milbrandt, MD, MPH

Journal club critique

eICU program favorably affects clinical and economic outcomes

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Published online: 8 September 2005

This article is online at <http://ccforum.com/content/9/5/E22>

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Critical Care 9: E22 (DOI 10.1186/cc3814)

Expanded Abstract

Citation

Breslow MJ, Rosenfeld BA, Doerfler M, Burke G, Yates G, Stone DJ, Tomaszewicz P, Hochman R, Plocher DW: Effect of a multiple-site intensive care unit telemedicine program on clinical and economic outcomes: an alternative paradigm for intensivist staffing. *Crit Care Med* 2004, 32:31-38 [1].

Background

Telemedicine for the intensive care unit (ICU) has been proposed as potential means of leveraging clinical expertise and bringing that expertise to hospitals with inadequate or complete lack access to intensive care specialists (intensivists).

Objective

To examine whether a supplemental remote intensive care unit care program, implemented by an integrated delivery network using a commercial telemedicine and information technology system, can improve clinical and economic performance across multiple ICUs.

Methods

Design: Before-and-after trial to assess the effect of adding a supplemental remote ICU telemedicine program.

Setting and Patients: Two adult ICUs in a 650 bed tertiary care teaching hospital, with a total of 2,140 patients receiving ICU care between 1999 and 2001 (n=1396 before and n=744 after implementation).

Intervention: The remote care program used intensivists and physician extenders to provide supplemental monitoring and management of ICU patients for 19 hrs/day (noon to 7 am) from a centralized, off-site facility (eICU). Supporting software, including electronic data display, physician note-

and order-writing applications, and a computer-based decision-support tool, were available both in the ICU and at the remote site. Clinical and economic performance during 6 months of the remote intensivist program was compared with performance before the intervention.

Outcomes: Primary clinical outcomes were ICU and hospital mortality and length of stay, while primary economic outcomes were variable cost per case and average per patient hospital revenue.

Results

Hospital mortality for ICU patients was lower during the period of remote ICU care (9.4% vs. 12.9%; relative risk, 0.73; 95% confidence interval [CI], 0.55–0.95), and ICU length of stay was shorter (3.63 days [95% CI, 3.21–4.04] vs. 4.35 days [95% CI, 3.93–4.78]). Lower variable costs per case and higher hospital revenues (from increased case volumes) generated financial benefits in excess of program costs.

Conclusion

The addition of a supplemental, telemedicine-based, remote intensivist program was associated with improved clinical outcomes and hospital financial performance. The magnitude of the improvements was similar to those reported in studies examining the impact of implementing on-site dedicated intensivist staffing models; however, factors other than the introduction of off-site intensivist staffing may have contributed to the observed results, including the introduction of computer-based tools and the increased focus on ICU performance. Although further studies are needed, the apparent success of this on-going multiple-site program, implemented with commercially available equipment, suggests that telemedicine may provide a means for hospitals to achieve quality

improvements associated with intensivist care using fewer intensivists.

Commentary

Each year, there are over 5.7 million adults admitted to ICUs in the United States (U.S.) [2]. Cost are high, not only in financial terms, where hospital costs for critically ill patients top \$67 billion annually [2], but also for clinical outcomes, with mortality rates averaging 10-15% equating to approximately 540,000 deaths each year [3]. Clearly the stakes are high, yet evidence indicates that the quality of ICU care varies widely [4]. For instance, data compellingly show superior clinical outcomes with a dedicated intensivist staffing model [5], yet 85-90% of U.S. hospitals do not use this model, even during daytime hours [6]. Many national patient advocacy groups, including the Leapfrog Group, have identified ICU intensivist staffing as an opportunity to reduce in-hospital mortality. Indeed, data suggest that over 53,000 deaths that occur in the ICU could be avoided if the Leapfrog Group intensivist staffing standard were implemented in all urban hospitals' ICUs nationwide [7].

The current shortage of intensivists presents as a major obstacle to widespread adoption of this care model. Furthermore, demand for ICU care is projected to grow rapidly while intensivist supply is expected to remain nearly constant, leading to even greater intensivist shortages and ever increasing difficulty meeting this newly proposed standard of care [6]. Telemedicine for the ICU has been suggested as a potential means of leveraging existing intensivist clinical expertise and bringing that expertise to hospitals with inadequate or complete lack access to intensive care specialists [8].

The authors of the present study concluded that implementation of a telemedicine program improved clinical as well as economic outcomes. They found that incorporating the eICU into the study hospital resulted in significantly improved patient outcomes, including decreased ICU and hospital mortality as well as ICU LOS. This reduction in length of stay increased the ICU "throughput" by enabling the ICUs to accommodate more patients. In turn, because hospitals are paid based upon patients' diagnoses and not the total number of days in the hospital, the increased throughput resulted in increased hospital revenue. The increased hospital revenue more than offset the cost of the eICU program. In other words, the eICU program was cost-saving.

These results are provocative, particularly since improvements were seen in both the medical and surgical ICUs. However, several major limitations warrant mention. The authors admit that the "actual basis for the observed changes is not known." They note that the introduction of computer systems and decision support tools and the increased institutional focus on ICU care that accompanied the implementation of the eICU program may have affected the results. Although the authors state that no other major changes in care paradigms or protocols occurred during the study period, some unmeasured or unappreciated changes

may have occurred. The use of historical controls, despite the similarity of admission criteria and APACHE III scores between the baseline and intervention periods, raises questions regarding potential differences in case-mix. Although the patient population included medical and surgical ICU patients, the results were based on eICU physicians staffing a total of 18 beds in a single institution that had preexisting daytime on-site intensivist coverage. The clinical impact on hospitals completely lacking intensivist coverage may not be the same. Furthermore, the financial benefits seen herein may not be realized in smaller hospitals with fewer ICU beds due to economies of scale.

Physician resistance and lack of insurance reimbursement for telemedicine-based care pose significant obstacles to widespread acceptance and use of telemedicine in the ICU. In addition to not fully understanding or recognizing the need for increased ICU intensivist staffing, physicians may be unfamiliar and uncomfortable with the technology. Because the hospital or health system pays all of the operating and staffing expenses of the eICU, cash layouts for an eICU system may be deemed an unnecessary and expensive venture, at least in the short-run. Despite these concerns, as many as 100 hospitals nationwide have implemented eICU programs, while others are considering expanding these programs to other high-risk areas of the hospital, such as step-down units.

Recommendation

While ICU telemedicine is not conceived as a replacement for on-site care, it may serve as a means of ensuring continuous proactive care and prompt intervention when on-site care is not possible. Although limited in several ways, the present study serves as a "proof of concept", demonstrating that technology can bridge the gap between the increasing ICU patient population and the ever-growing shortage of specialists trained to manage them.

Competing interests

The authors declare that they have no competing interests.

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