Published in final edited form as:

Crit Care Med. 2014 February ; 42(2): 463–464. doi:10.1097/CCM.0b013e3182a523fa.

The Effect of Organizational Structure and Processes of Care on ICU Mortality as Revealed by the USCITG-Critical Illness Outcomes Study

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Keywords

health service research; intensive care units; delivery of health care; organizational structure; processes of care; protocols; critical care

Checkley and the investigators of the United States Critical Illness and Injury Trials Group Clinical Illness Outcomes Study (USCITG-CIOS) analyze the effect of organizational structure, staffing, patient volume, and processes of care delivery of 69 participating intensive care units (ICUs) on annual ICU mortality.(1) Organizational structure and processes of care are integral to the delivery of critical care services and central to patient outcomes following critical illness, but are notoriously difficult to study due to the qualitative and heterogeneous nature of care processes and the interplay that each of these structure and process elements have upon each other in affecting patient outcomes.(2, 3) Organizational structure includes the availability and composition of all of the specialized personnel that participate in the care of the ICU patient, the intensity of provider staffing, the rules governing provider involvement, the equipment and technology available, patient volume and case mix. Processes of care activities encompass the daily work flow, the composition of multidisciplinary rounds, the integration of evidence based protocols and order sets, electronic health information systems, processes for transfers of care, communications among providers, “ICU culture,” quality improvement programs, and infection control processes. Thus, the investigators are to be commended for this Herculean undertaking of identifying, defining and quantitating the individual key structure and process elements that collectively represent “organizational structure and processes of care,” and collecting each of these elements for 69 separate ICUs.

Even before analyzing the effect of structure and process on outcome, the initial survey evaluating current practice across these 69 ICUs is informative. All of these ICUs have medical directors and nurse managers, an intensivist in the ICU during the day and an average of 19 protocol bundles including the near universal incorporation of protocols for ventilator management, infection control, nutrition, and prevention of thromboembolism. There is a high level of evidence to support these interventions, and a systematic approach to

Disclosures:

Dr. Moss. received support for article research from the National Institutes of Health. Dr. Moss’ institution received grant support from NIH-NHLBI.

Dr. Frankel is employed by National Jewish Health.

assuring their delivery would be expected in a high performing ICU. On the other hand, there was considerably variability in staffing models, the composition of the multi-disciplinary team, case mix, other organizational elements, (i.e. closed versus open ICU) and the other care processes that each ICU chose to protocolize. How and why these differences occur among expert providers is an interesting question in its own right-- Why is therapeutic hypothermia protocolized in 80% of these ICUs, and a restrictive transfusion strategy in 39%? Still, it was these very differences that permitted the current line of investigation to be pursued and the effect of specific, non-universal measures to be determined.

To summarize, the study identified one key process, and one structural element that were potentially modifiable and associated with a lower mortality. First, ICUs that had a daily plan of care review had a 5.8% lower mortality than those ICUs having no daily review. Second, ICUs with a lower bed to nurse ratio (i.e. more intensive nurse staffing) were associated with a 1.8% lower mortality when the ratio was decreased from 2:1 to 1.5:1.(1)

In 2003, Pronovost *et al* reported that implementing a daily goals form clearly outlining the goals of care for the day increased resident and nurse understanding of the daily goals and decreased ICU length of stay by 50%.(4) In 2013, assuring effective regular communications among providers, and clearly reviewing the goals of care for the day remains critical to optimizing patient outcomes. It is easy to assume one does this in the course of routine care, but this communication does not magically happen. Rather, it requires a daily concerted effort and institution of a formal process to assure it is reliably delivered each and every day on every patient 100% of the time. Similarly, simply having a checklist does not assure it is used effectively. In a controlled cohort study by Weiss and colleagues, care teams in a tertiary medical ICU were trained to use and complete an ICU quality checklist on rounds, but the experimental cohort had the addition of a non-care providing resident who would prompt the team if any of the parameters addressed on the ICU checklist were overlooked.(5) Compared with control, the patients on the prompted team not only had improved compliance with care processes, but a lower risk adjusted ICU mortality. Ultimately, the delivery of highly reliable and effective care requires a robust and formalized implementation and adherence program, and cannot be achieved when quality improvement is treated as a *pro forma* requirement.

Second, lower bed to nurse ratios were associated with lower mortality. While seemingly intuitive, the objective demonstration of the benefit is critically important given the resources required to achieve this more favorable bed to nurse ratio. As any ICU provider knows, the nurse is the primary provider of care to the individual patient. The more time the nurse has available to dedicate to the care of that patient, the more likely the patient will have a better ICU outcome.(6) As the results of this study underscore, the ability to provide both comprehensive care and expeditious care depends upon the availability of the bedside nurse.

There are two key limitations to the CIOS that bear highlighting. First, almost all of the ICUs participating in this study are academic, high-performing, high-acuity ICUs in major medical centers. As such, one must be exquisitely cautious about extrapolating these findings to community hospitals and non-academic centers. Indeed, the most controversial findings in this study, that neither 24-hour intensivist coverage nor a closed ICU model demonstrated any benefit on patient mortality, likely relates to the surplus of resources and robust care processes available in these ICUs.(7, 8) Whether or not community hospitals and smaller centers can realize similar benefits via the adoption of organization elements and care processes without being similarly resourced very much remains an open question, albeit one which needs to be studied expeditiously given the critical care workforce shortage and the costs associated with 24 hour intensivist staffing.(9–11)

Second, the choice of mortality as the endpoint should be recognized as a limitation as well as a strength of the study. Mortality is an objective, appropriate and incontrovertible metric. However, mortality is not the only “medical good” that we wish to achieve, and it would be important to determine the effect of organizational elements and processes of care on other clinically important endpoints such as (i) patient and family satisfaction, (ii) costs of care, (iii) long term functionality and quality of life following critical illness, and (iv) provider turn-over and satisfaction, before deciding that a care process is or is not “beneficial.”

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