Increased ICU workload is *not* associated with increased inpatient mortality

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Abstract

Rationale: Although ICUs with higher overall patient volume may achieve better outcomes, there are few data on the effects of increasing patient loads on patients within the ICU.

Methods: We examined 198,877 patients in 108 ICUs in 2002 - 2005 using conditional logistic regression with an ICU-specific fixed effect

Main Results: Patients admitted on high census days had the same odds of inpatient mortality or transfer to another hospital as patients admitted on average or on low census days.

Conclusions: The ICUs in this data set are able to function as high-reliability organizations.

Background

- There is increasing demand for the concentration of critical care services in a smaller number of hospitals due to (1) hospital closures; (2) payer-initiative to achieve economies of scale; and (3) policy decisions to implement regionalized care.
- Higher volume hospitals may be associated with improved patient outcomes for many critical care services.
- The impact of *increasing* patient volumes on ICU performance is unknown.
- In many other acute services, particularly emergency care, higher than typical workload is associated with worse patient outcomes.

Objective

Examine the effects of day-of-admission ICU occupancy on the mortality rate of patients admitted to that ICU, compared to other patients admitted to the same ICU.

Methods

Data sources and patients

- Hospitals participating in APACHE clinical information system from 1/1/2002 - 6/30/2005
- Exclusions:
  - CABG patients
  - ICUs with fewer than 100 patients
  - Initial 100 patients for each ICU in the dataset

Variables

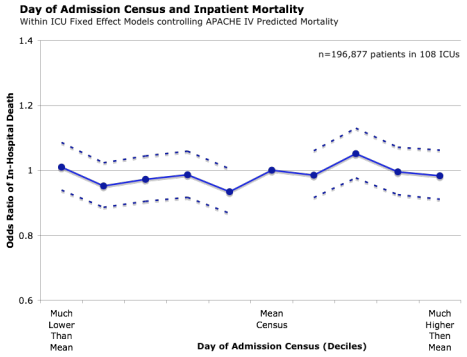
- *Exposure:* Census of the ICU on day of admission, divided into deciles relative to the mean census of the ICU.
- *Primary Outcome:* Inpatient Mortality
- *Secondary Outcomes:* ICU and hospital length of stay, rates of transfer to other hospitals

Statistical Analyses

- Patient-level analysis of the effect of census on outcome using conditional logistic regression with an ICU-specific fixed effect
- Risk adjustment using APACHE IV
  - Clinical variables, age, diagnostic category, and physiologic variables from the first 24 hours of the ICU admission

Results

- 196,877 patients were admitted to 108 ICUs in 46 hospitals
- Patients were admitted across a wide-range of ICU relative census, from <65% of mean census to >147% for that specific ICU.
- There was no significant relationship between day-of-admission census and inpatient mortality or discharge destination. *(See Figure.)*



Sensitivity Tests. Our results were robust in a range of analyses, including:

- Alternative parameterizations of daily census, including 14-prior-day moving average
- In surgical and non-surgical patients
- In patients with >50% predicted inpatient mortality
- In ICUs of non-teaching, small teaching, and major teaching hospitals
- In patients admitted on weekends and weekdays

Conclusions

- ICUs appear to function as high-reliability organizations, in the sense that they are able to maintain patient outcomes across a wide-range of operational conditions.
- Research is needed into the organizational characteristics of ICUs that allow them to function robustly -- the lack of high reliability organizations in health care is often noted and lamented.

Policy Implications

- Effective organizational structures appear able to buffer individuals from the effects of high workload, even in the medical setting
- Increasing workload in large ICUs as a result of regionalization or concentration of care may be safe for patients.