INTRODUCTION

- Demand for intensive care unit (ICU) beds outpaced growth in supply.
- Boarding: patients are assigned beds in other ICUs (e.g. a patient cared for by the medical ICU team can be assigned a bed in the surgical ICU) during ICU bed shortage
  - Introduces geographic barriers between patients and their physicians.
  - Patients no longer matched with nursing expertise as specialized ICUs undergo adaptations to provide optimal care for their target patient population (e.g. trauma versus heart failure)
- Hypothesis: Critically ill patients boarding in non-target ICUs are at higher risk of mortality compared to non-boarders.

METHODS

Study Design: retrospective study using the Medical Information Mart for Intensive Care (MIMIC-III) database from June 2002 – December 2012 looking at admissions to a medical ICU (MICU) at any point during their hospital admission

Statistical Analysis:
- Instrumental variable analysis (IVA): an effective method of overcoming unmeasured treatment selection biases present in observational data [1]
- Exposure: boarding vs. non-boarding
- Outcome: ICU mortality
- Instrument: number of available MICU beds at time of ICU admission, controlling for team census size
- Models controlled for age, gender, length of stay prior to ICU admission, number of boarders being cared for by the MICU team, and calendar year
- Baseline comorbidities and acuity of illness at time of admission adjusted using Elixhauser comorbidity score [2] and Oxford Acute Severity of Illness Score (OASIS) [3] respectively
- A semi-parametric bivariate probit estimation strategy employed, consisting of a bivariate generalized additive probit model for patient boarder status and mortality, linked by a copula
- Splines used to take into account nonlinearity on the effect of observed values on the latent probabilities
Boarding Increases Mortality in Intensive Care Units

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RESULTS

- Study population: 8,442 subjects, with 1,881 (22%) exposed to boarding
- IVA Model demonstrated relative risk of 1.44 (95% posterior interval: 1.18, 1.78) suggesting a causal relationship between boarding and increased risk of ICU mortality
- Sensitivity Analysis: Cox proportional hazards model with covariates identical to the semi-parametric bivariate probit model demonstrated a relative risk of 1.34 (95% CI: 1.06, 1.70)
- Neither model demonstrated a statistically significant effect of team census size on ICU mortality

CONCLUSIONS

- Instrumental variable analysis suggests a causal relationship between boarding of critically ill patients and increased risk of death in the ICU
- Excess mortality risk may relate to both geographic barriers between physicians and patients, as well as differences in the training and specialization of nurses between ICUs.

RECOMMENDATIONS

- The use of high dependency units to admit low acuity ICU patients has been adopted in some large hospitals.
- The construction of ICUs in which the number of co-localized beds reflects the maximum team census size would also decrease the frequency of boarding.
- Clinicians must be mindful that boarding independently increases a patient’s risk of mortality and consider clinical practice modifications to improve their situational awareness of changes in the care of these patients.

REFERENCES