The ICD Critical Care Severity Score (ICASS): Working Toward Better Metrics to Quantify Burden of Disease in Pediatric Trauma

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Background & Purpose

• Severity of injury (SOI) metrics essential for trauma system benchmarking, risk adjustment, evaluation of field triage tools

• Initial trauma care often delivered at non-trauma centers – need metrics that don’t require a trauma registry

• Mortality-based metrics (e.g. International Classification of Diseases (ICD) Injury Severity Score (ICISS)) may underestimate burden of trauma in kids

• Purpose: develop and validate a resource-based SOI measure, then compare this measure across age groups of injured patients.
Methods

- ICISS: predicted mortality risk based on survival risk ratios associated with ICD diagnosis codes

- ICD Critical Care Severity Score (ICASS) developed in similar fashion: predicted risk of critical care admission

- Derived from Florida state administrative database, 2012-2016

- Validated with 2017 data from same database

- Logistic regression used to validate each SOI measure

- Distributions of ICISS and ICASS compared across pediatric (0-15 yrs), adult (16-64 yrs), and elderly (65-84 yrs) age groups.
Results

- Derivation cohort: 668,346 emergency pts

- Validation cohort: 24,070 trauma alert pts
  - 1,342 pediatric (0-15 yrs)
  - 17,239 adult (16-64 yrs)
  - 5,489 elderly (65-84 yrs)

- On logistic regression, ICASS was strongly predictive of critical care utilization (p<0.001).
Results

Distribution of ICD Injury Severity Score (ICISS) by Age Group

Distribution of ICD Critical Care Severity Score (ICASS) by Age Group

Mean ICISS 11 for pediatric and 19 for adult patients (ratio 0.56) -> predicted pediatric mortality risk slightly over half that of adults.

Mean ICASS 50 for pediatric and 53 for adult patients (ratio 0.94) -> predicted pediatric vs. adult critical care utilization nearly the same.
Conclusions

• The ICD Critical Care Severity Score (ICASS)
  – Resource-based SOI measure
  – Easily calculated with administrative data
  – Validated in statewide Florida cohort

• By ICISS (mortality-based measure), severity of pediatric injury appears much lower than adult

• By ICASS, pediatric and adult burden of injury appear very similar

• If validated in larger studies, ICASS may be a valuable complement to existing measures in capturing true burden of pediatric injury
Survival Risk Ratio\(_d\) = SRR\(_d\) = \(1 - \frac{\text{Number of pts with diagnosis } d \text{ who died}}{\text{Total number of pts with diagnosis } d}\)

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ICISS = [1 - (SRR_1 \times \cdots \times SRR_d)] \times 100
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Critical Care Risk Ratio\(_d\) = \(\frac{\text{Number of pts with diagnosis } d \text{ receiving critical care services}}{\text{Total number of pts with diagnosis } d}\) \times 100

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ICASS = \text{maximum}[\text{Critical Care Risk Ratio}_1, \ldots, \text{Critical Care Risk Ratio}_d]
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Anesthesia Risk Ratio\(_d\) = \(\frac{\text{Number of pts with diagnosis } d \text{ receiving anesthesia services}}{\text{Total number of pts with diagnosis } d}\) \times 100

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IGASS = \text{maximum}[\text{Anesthesia Risk Ratio}_1, \ldots, \text{Anesthesia Risk Ratio}_d]
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Distribution of ICD General Anesthesia Severity Score (IGASS) by Age Group