

Earned Outcomes Correlate with Reliability-Adjusted Surgical Mortality after Abdominal Aortic Aneurysm Repair and Predict Future Performance

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Objectives

- Cumulative, probability-based metrics are regularly used to measure quality in professional sports, but these methods have not been applied to health care delivery
- Validate a novel measure of surgical quality based on earned outcomes methods (deaths above average, DAA) against the current gold standard (reliability-adjusted mortality rates), using abdominal aortic aneurysm (AAA) repair outcomes.

Methods

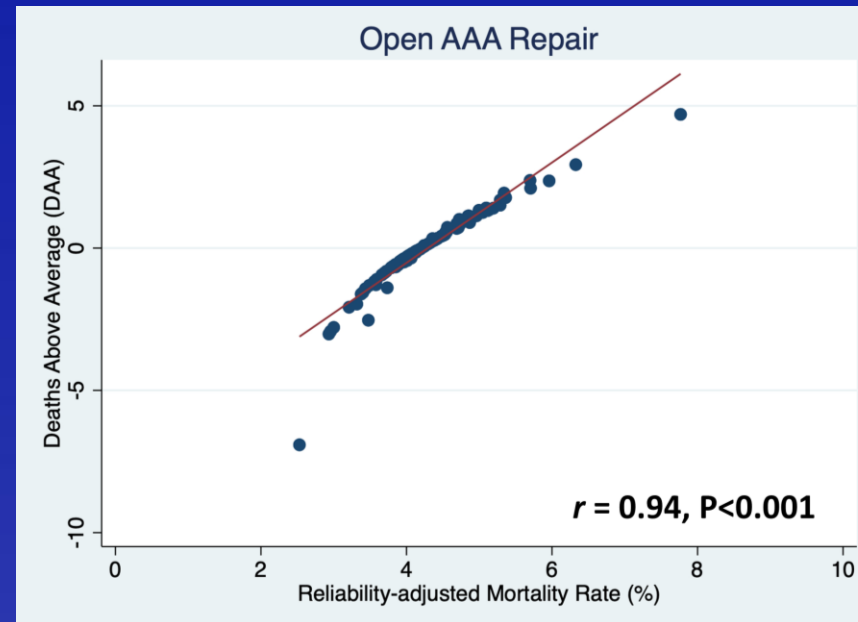
- Elective open AAA repair and EVAR in the VQI (2016-2019)
- Multivariable logistic regression models used to calculate probability of perioperative death for each patient (P_{mort})

$$\begin{aligned} \text{DAA} &= \text{observed} - \text{predicted outcome} \\ &= [0,1] - P_{mort} \\ \text{Hospital DAA} &= \sum \text{patient DAA} \end{aligned}$$

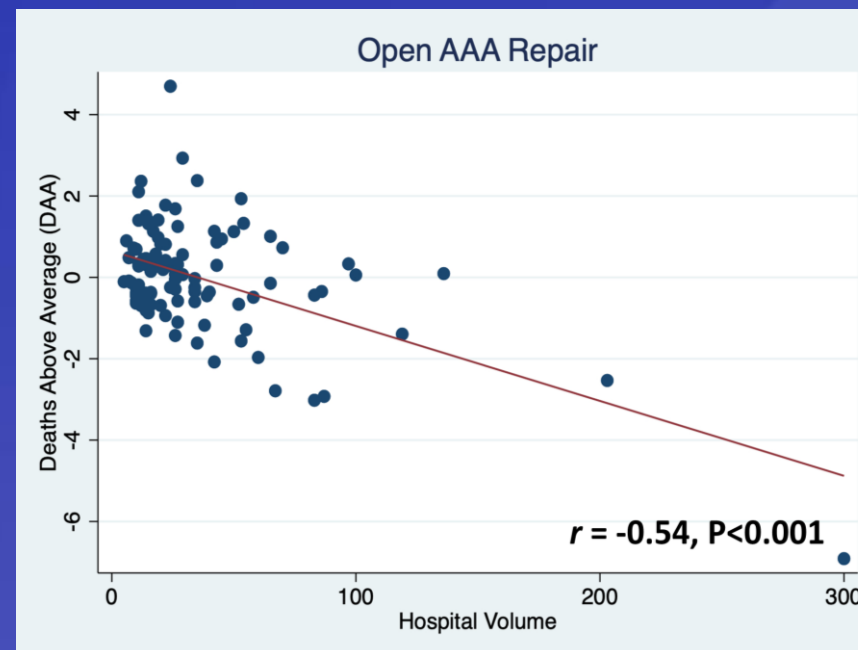
- DAA was correlated with: reliability-adjusted mortality rates and procedure volume
- The ability of 2016-2017 outcomes to predict 2018-2019 risk-adjusted outcomes was determined

Results

- 3,734 open repair patients (106 hospitals); 20,680 EVAR patients (183 hospitals)



DAA correlates with reliability-adjusted mortality rates for open repair ($r=0.94$, $P<0.001$) and EVAR ($r=0.99$, $P<0.001$).



DAA correlates with hospital volume for open repair ($r=-.54$, $P<0.001$), but not EVAR ($r=0.07$, $P=0.3$)

Results

- In 2016-2017, most hospitals had 0% risk-adjusted mortality (55% open repair, 57% EVAR), making it impossible to evaluate hospital quality using traditional risk-adjusted mortality rates alone
- 0% mortality hospitals in 2016-2017 did not demonstrate better outcomes in 2018-2019 for open repair (3.8% vs 4.6%, $P=0.5$) or EVAR (0.8% vs 1.0%, $P=0.2$)
- 2016-2017 DAA evenly divided centers into quality quartiles which predicted future mortality for open repair
- Overall, highest quality quartile hospitals had lower DAA (-1.18 DAA vs +1.32 DAA, $P<0.001$) and reliability-adjusted mortality rates (3.6% vs 5.1%, $P<0.001$) compared to lowest quartile hospitals.

Conclusions

- Earned outcomes:**
 - Cumulative**
 - Risk-adjusted**
 - Volume-sensitive**
 - Can be utilized when event rates are low
 - Correlate with reliability adjusted metrics but are easier to calculate and interpret**
- For 2016-2019, highest quality open AAA repair hospitals each prevented >1 perioperative death compared to the average hospital, and >2 perioperative deaths compared to lowest quality hospitals
- Even after adjustment, mortality-based outcomes are not appropriate quality metrics for EVAR. Incorporation of long-term outcomes is necessary to distinguish hospital quality

