











RESEARCH LETTER

Cardiac Surgeons at the Start of Their Practice Have Similar Volume/Outcome Association Compared With Established Surgeons

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The correlation between surgical volume and patient outcomes has been extensively studied.^{1,2}

Research spanning decades has shown that hospitals and surgeons with higher procedural volumes have lower mortality and complication rates than hospitals and surgeons with lower volumes.³ Recognizing the significance of this relationship, regulatory bodies and professional organizations often incorporate volume thresholds as part of accreditation standards and quality metrics for cardiac surgery.⁴

To date, however, there is limited evidence on the volume/outcome association in different phases of the career of a surgeon. It is unclear if the volume/outcome association is similar for established surgeons (who have higher cumulative procedural volumes) versus surgeons at the start of their careers.

As no individual patients' data were included in this analysis, no ethic approval was requested. We analyzed data from the New York State Cardiac Data Reporting System (New York State Department of Health) including all coronary artery bypass grafting cases performed between 1996 and 2019 in New York State. Surgeons' demographic data, annual volume and risk-adjusted 30-day mortality rate were extracted.

The risk-adjusted 30-day mortality rate is often used as a measure of quality of care provided by hospitals and surgeons.⁵ The data that support the findings of this study are available from the corresponding author upon reasonable request.

Surgeons were categorized in 2 groups: junior surgeons (ie, surgeons in the first 5 years after the completion of their cardiothoracic training) and established surgeons (ie, surgeons in practice for >5 years after the completion of their cardiothoracic training).

A linear mixed-effect regression was used to assess the association between risk-adjusted 30-day mortality rate and the status of the surgeon (ie, junior versus established) adjusted by year, annual cases per surgeon with the use of surgeon and center as random effects. Results were presented as estimates (regression coefficients) with corresponding 95% CIs. Restricted cubic spline analysis was used for annual cases per surgeon. A *P* value ≤0.05 was considered significant. Outlier surgeons with <10 cases per year were excluded from the analysis.

There were 253 surgeons from 42 different centers included in the analysis. Surgeon status (junior versus established) was not associated significantly

Key Words: coronary artery bypass ■ coronary artery disease ■ coronary artery bypass grafting ■ surgeons ■ surgical training

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This manuscript was sent to John S. Ikonomidis, MD, PhD, Guest Editor, for review by expert referees, editorial decision, and final disposition.

For Sources of Funding and Disclosures, see page 2.

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Table. Results From the Linear Mixed-Effect Regression of Risk-Adjusted Mortality Rate for Coronary Artery Bypass Grafting Cases in New York State Adjusted for Year and Annual Cases per Surgeon

| Covariate | Estimates | CI | P value |
|--|-----------|---------------|---------|
| Intercept | 3.25 | 1.87 to 4.63 | <0.01 |
| Annual cases | -0.02 | -0.09 to 0.05 | 0.54 |
| Surgeon status (junior vs established) | 0.04 | -0.63 to 0.71 | 0.90 |

associated with risk-adjusted 30-day mortality rate ($\theta=0.04$ [95% CI, -0.63 to 0.71]; $P=0.90$; see the Table).

Our data show that in New York State cardiac surgeons at the beginning of their clinical practice have a similar coronary artery bypass grafting volume/outcome association compared with established surgeons (point estimate, -0.003 [95% CI, -0.011 to 0.006]; $P=0.53$). Eight and 9 outlier surgeons were detected in the junior and established surgeons' group, respectively.

This work is consistent with previous reports in other surgical fields. An analysis including carotid endarterectomy, lung resection, and esophagectomy and using age as a surrogate of experience found that surgeons aged <40 years had similar mortality rates compared with older surgeons across all procedures.⁶

Different results have been reported in interventional cardiology, where a contemporary analysis shows that early-career operators are managing patients with more acute conditions and higher predicted risks of death and bleeding compared with their more experienced colleagues and have worse outcomes.⁷

It is important to highlight that our observations could potentially vary geographically due to differing training programs. We acknowledge that there is diversity in how cardiac surgery training programs are structured within the state of New York. The extent to which the association between career stage, case volume, and outcomes differ across institutions, and which program-related factors influence these associations, remains to be established. The work aims to describe the situation in the state of New York. Therefore, the findings may not be generalizable to other states or countries.

In addition, the 30-day mortality rate does not fully reflect the outcome of the coronary artery bypass grafting operation, in terms of both safety and effectiveness. Moreover, we acknowledge that highly

complex cases tend to be directed to more experienced surgeons, and this important factor could not be completely accounted for in the present analysis.

ARTICLE INFORMATION

Received September 25, 2024; accepted December 31, 2024.

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Sources of Funding

Dr Caldonazo is supported by the Deutsche Forschungsgemeinschaft (German Research Foundation) Clinician Scientist Program OrganAge funding number 413668513, by the Deutsche Herzstiftung (German Heart Foundation) funding number S/03/23, and by the Interdisciplinary Center of Clinical Research of the Medical Faculty Jena.

Disclosures

Dr Redfors receives grant support from the European Research Council, the Swedish Scientific Council, Swedish Heart and Lung Foundation, and the Swedish Society for Medical Research; and consulting payments from Pfizer and Boehringer Ingelheim. Dr Gaudino receives grant support from the National Institutes of Health, the Canadian Institutes of Health and Research, the Patients Center Outcome Research Institute, and the Starr Foundation. The remaining authors have no disclosures to report.

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