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Relative impact of surgeon and hospital volume on operative mortality and complications following pancreatic resection in Medicare patients

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ABSTRACT

Background: Surgeon and hospital volume are both known to affect outcomes for patients undergoing pancreatic resection. The objective was to evaluate the relative effects of surgeon and hospital volume on 30-d mortality and 30-d complications after pancreatic resection among older patients.

Materials and methods: The study used Texas Medicare data (2000-2012), identifying high-volume surgeons as those performing ≥ 4 pancreatic resections/year, and high-volume hospitals as those performing ≥ 11 pancreatic resections/year, on Medicare patients. Three-level hierarchical logistic regression models were used to evaluate the relative effects of surgeon and hospital volumes on mortality and complications, after adjusting for case mix differences.

Results: There were 2453 pancreatic resections performed by 490 surgeons operating in 138 hospitals. Of the total, 4.5% of surgeons and 6.5% of hospitals were high volume. The overall 30-d mortality was 9.0%, and the 30-d complication rate was 40.6%. Overall, 8.9% of the variance in 30-d mortality was attributed to surgeon factors and 9.8% to hospital factors. For 30-d complications, 4.7% of the variance was attributed to surgeon factors and 1.2% to hospital factors. After adjusting for patient, surgeon, and hospital characteristics, high surgeon volume (odds ratio [OR] = 0.54, 95% confidence interval [CI], 0.33-0.87) and high hospital volume (OR = 0.52; 95% CI, 0.30-0.92) were associated with lower risk of mortality; high surgeon volume (OR = 0.71, 95% CI, 0.55-0.93) was also associated lower risk of 30-d complications.

Conclusions: Both hospital and surgeon factors contributed significantly to the observed variance in mortality, but only surgeon factors impacted complications.

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Introduction

For complex surgical procedures, the influence of high surgeon and hospital volume on improved perioperative and postoperative outcomes is well established. Since the 1970s, a growing body of evidence has demonstrated an absolute mortality benefit when complex surgical procedures are performed at high-volume centers or by high-volume providers.¹⁻⁴ These benefits have been identified in patients undergoing total hip replacement,⁵ ovarian cancer resection,⁶ and complex oncologic resections,^{7,8} including pancreatic resection.^{9,10}

Although studies have attempted to understand the relative contribution of surgeon and hospital volume on perioperative outcomes in patients undergoing pancreatic resection, the results have been discordant.⁹⁻¹³ Most studies that evaluate surgeon and hospital volume have focused exclusively on in-hospital or 30-d mortality and concluded that both hospital and surgeon volume affect mortality independently; however, some studies have suggested little difference between the impacts of hospital or surgeon volume, or that surgeon volume may be more influential.^{3,9,10} In addition, isolated studies have even demonstrated excellent outcomes at individual low-volume centers or with low-volume surgeons.¹³ Finally, even among high-volume centers, significant variability in outcomes exists, suggesting that other factors are at play.^{14,15} Therefore, it remains unclear that how much of the observed variation in mortality and complications is explained by hospital and surgeon volume, separately or in concert. Current recommendations from the Leapfrog group¹⁶ emphasize increased hospital volume (≥ 11 pancreatic resection per year), but not surgeon volume, as a necessary component to improve operative outcomes for all complex surgical patients. In addition, no previous studies have addressed the relative effect of hospital and surgeon volume on complications after pancreatectomy.

We used Texas Medicare claims data (2000-2012) to determine the relative effects of surgeon and hospital volume factors on 30-d mortality and 30-d complications among patients aged 66 y and older undergoing pancreatic resection. We further partitioned the variance to understand how much of the variation in outcomes between surgeons and hospitals was explained by surgeon and hospital volume.

Methods

This study involved analysis of secondary data and was not considered human subjects research. It was thus exempt from review by the Institutional Review Board at the University of Texas Medical Branch.

Data source and study cohort

We performed a retrospective cohort study of all patients aged ≥ 66 y who underwent pancreatic resection including pancreaticoduodenectomy, distal pancreatectomy, total pancreatectomy, and other pancreatectomies (*International Classification of Diseases, Ninth Edition* codes: 52.6, 52.7,

52.51-52.53, 52.59) in Texas between 2000 and 2012. Data were obtained from the Texas Medicare claims data. Medicare data do not include older adults who underwent pancreatic resections at Veterans Affairs hospitals, and therefore, these patients were not included in the cohort. Medicare files used for this study included the denominator file, the Medicare provider analysis and review file (MedPAR) for inpatient claims, the carrier claims file, and the outpatient Standard Analytical File. We excluded the following from the study cohort: (1) patients < 66 y at the date of surgery; (2) patients not living in Texas; (3) patients with no identifiable surgeon from carrier file; and (4) patients with missing surgeon and hospital information.

Outcome measure

The study outcomes were 30-d mortality and 30-d complications. Both outcomes were defined within 30 d from the date of surgery. We also considered 90-d mortality outcome for sensitivity analysis. *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes used to identify complications are presented in [Appendix 1](#).

Provider volume

Identifying the operating surgeon

MedPAR inpatient stay records do not include physician Unique Provider Identification Numbers (UPIN) or National Provider Identifiers. Therefore, the operating surgeon was identified using the UPIN or National Provider Identifiers and specialty code from carrier files. We linked the inpatient pancreatic resection record from MedPAR to carrier claims by date of surgery and procedure codes. All carrier claims filed by surgeons including general surgeons, surgical oncologists, and other surgical specialty were retained. If multiple surgeons had claims in the carrier file, the surgeon who billed the highest amount was designated as the performing surgeon. To handle new or retired surgeons, we identified the first and last claims for each surgeon by scanning all the claims associated with the surgeon in the carrier file for each year. If we did not find any claims from a surgeon in an entire calendar year, we assumed surgeon stopped practicing or performing pancreatectomies. We only considered the active time period for the surgeon to define surgeon volume. American Medical Association Masterfile was used to find surgeon characteristics through the crosswalk with UPIN.

Surgeon volume

Surgeons with an average Medicare volume of ≥ 4 pancreatic resections per year over the study period were considered high-volume surgeons. Previous studies have classified surgeons as high volume if they performed ≥ 5 pancreatic resections in a given year.¹⁰ However, only 15 surgeons in Texas performed ≥ 5 pancreatic resections on Medicare patients in any given year. The Leapfrog Group evidence-based surgeon high-volume safety standard criterion for pancreatic resection is 2 per year.¹⁶ As our volume estimates were based on Medicare patients and are therefore slightly lower than they would be if patients outside Medicare were included, we chose

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