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## Examining variation in Medicare payments and drivers of cost for carotid endarterectomy

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### ABSTRACT

**Background:** There is a growing interest in providing high quality and low-cost care to Americans. A pursuit exists to measure not only how well hospitals are performing but also at what cost. We examined the variation in costs associated with carotid endarterectomy (CEA), to determine which components contribute to the variation and what drives increased payments.

**Materials and methods:** Patients undergoing CEA between 2009 and 2012 were identified in the Medicare provider and analysis review database. Hospital quintiles of cost were generated and variation examined. Multivariable logistic regression was performed to identify independent predictors of high-payment hospitals for both asymptomatic and symptomatic patients undergoing CEA.

**Results:** A total of 264,018 CEAs were performed between 2009 and 2012; 250,317 were performed in asymptomatic patients in 2302 hospitals and 13,701 in symptomatic patients in 1851 hospitals. Higher payment hospitals had a higher percentage of nonwhite patients and comorbidity burden. The largest contributors to variation in overall payments were diagnosis-related groups, postdischarge, and readmission payments. After accounting for clustering at the hospital level, independent predictors of high-payment hospitals for all patients were postoperative stroke, length of stay, and readmission, whereas in the symptomatic group, additional drivers included yearly volume and serious complications. **Conclusions:** CEA Medicare payments vary nationwide with diagnosis-related group, readmission, and postdischarge payments being the largest contributors to overall payment variation. In addition, stroke, length of stay, and readmission were the only independent predictors of high payment for all patients undergoing CEA.

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## Background

Recently, there has been a growing interest in providing high hospital quality care at lower cost to Americans.<sup>1</sup> It has been estimated that with the Affordable Care Act, signed in March 2010, the impact of health care reform would save nearly 600 billion dollars in health care spending.<sup>2</sup> In fact, more recent estimates suggest even more savings than initially expected, given the slowing of new drug development and imaging technology.<sup>3</sup> Ultimately, achieving the goal of the “triple aim,” proposed by Berwick *et al.*,<sup>4</sup> to ensure improvement of patient experience, the overall health of populations, and reducing the price per capita remains a challenge. Nonetheless, policymakers, payers, and health care leaders are charged with optimizing the delivery of health care, as the United States spends more than any other country despite the most recent World Health Organization ranking of 31st for life expectancy.<sup>5</sup> One strategy is to eliminate wasteful spending by incorporating widespread best practices, minimizing overtreatment, and fixing pricing failures.<sup>6</sup> An alternative strategy is to implement payment reform. Among the multiple payment reforms that have been considered, bundled episode-based payment models may represent a more optimal solution and have already been rolled out in cardiac and orthopedic surgery.<sup>7</sup>

Within the bundled episode-payment model, variation in Medicare payments has yet to be examined for carotid endarterectomy (CEA).<sup>8-10</sup> Previous studies have found wide variation in Medicare payments suggesting that there are areas for improvement and cost savings for payers.<sup>9,11,12</sup> However, undue burden may be placed on hospitals that treat more complex patients if bundled payments are put into place.<sup>13</sup> After reviewing some initial examples of bundled payments, Shih *et al.* found that savings were modest at best. For example, bundled payments for percutaneous coronary interventional procedures saved approximately \$71 after accounting for postdischarge care.<sup>14</sup>

Similar to previously studied cardiac procedures, CEA is a straightforward, common operation with most patients being discharged home on postoperative day 1. Given the frequency of CEA performed by vascular surgeons, we sought to (1) investigate variation in Medicare payments associated with CEA, particularly focusing on the different components of total payments including diagnosis-related group (DRG), outlier, readmission, physician, and postdischarge payments and (2) examine the relationship of patient, operative, and postoperative factors with Medicare payments. Ultimately, we aimed to determine which component is the main contributor to the variation seen after CEA and to identify drivers of increased payments.

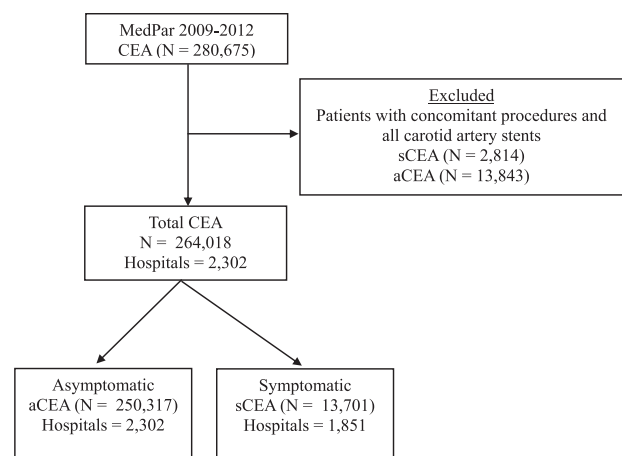
## Materials and methods

### Study design

We performed a retrospective cohort study using the Medicare Provider Analysis and Review (MedPar) database. We identified all patients undergoing carotid endarterectomies from

2009 to 2012 using International classification of diseases 9 codes. Carotid procedures were performed with other concurrent major surgeries (e.g., coronary artery bypass), and all carotid-stenting procedures were excluded from the analysis. Given the vast differences between patient populations, patients were separated by symptomatic status for analysis. Symptomatic status was determined by International classification of diseases 9 codes (Fig. 1).

Next, we examined hospital payment data across the United States for all included cases. Using a similar algorithm to account for regional cost variation previously described, we completed our price standardization for all hospitals.<sup>9,15,16</sup> To accomplish this, patient records are linked to Centers for Medicare and Medicaid Services (CMS) files containing claims for services related to an index procedure. Payments were then measured for all services from the date of admission for the index procedure to 30 d following discharge from the hospital. Since Medicare payments vary depending on region the procedure was performed, teaching status of the hospital, and disproportionate share, payments were adjusted for these known factors as previously described by Gottlieb *et al.*<sup>16</sup> and Birkmeyer *et al.*<sup>15</sup> This method is similar to the algorithms used by CMS. Since CMS adjusts DRG payments based on regional differences in the cost of care, a method must be used to adjust for this purposeful variation. Using methods commonly used in the Dartmouth Atlas, the DRG payments across region are compared, and an adjuster is used to account for this variation. This method essentially accounts for the geographic variation in reimbursement by normalizing payments across regions for specific DRGs. After payment standardization, we calculated a composite total payment for each hospital. Hospitals were then grouped into five separate payment quintiles, but for simplicity will report the differences between the lowest and highest hospital payment quintile. The study was deemed exempt from the institutional



**Fig. 1 – Flow diagram demonstrating the number of asymptomatic and symptomatic carotid endarterectomies with the associated number of hospitals. aCEA, asymptomatic carotid endarterectomy; sCEA, symptomatic carotid endarterectomy.**

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