

From the Society for Vascular Surgery

## Patient selection and perioperative outcomes are similar between targeted and nontargeted hospitals (in the National Surgical Quality Improvement Program) for abdominal aortic aneurysm repair

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### ABSTRACT

**Objective:** The targeted vascular module in the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) consists of self-selected hospitals that choose to collect extra clinical details for better risk adjustment and improved procedure-specific outcomes. The purpose of this study was to compare patient selection and outcomes between targeted and nontargeted hospitals in the NSQIP regarding the operative management of abdominal aortic aneurysm (AAA).

**Methods:** We identified all patients who underwent endovascular aneurysm repair (EVAR) or open AAA repair from 2011 to 2013 and compared cases by whether the operation took place in a targeted or nontargeted hospital. EVAR and open repair as well as intact and ruptured aneurysms were evaluated separately. Only variables contained in both modules were used to evaluate rupture status and operation type. All thoracoabdominal aneurysms were excluded. Univariate analysis was performed for intact and ruptured EVAR and open repair grouped by complexity, defined as visceral involvement in open repair and a compilation of concomitant procedures for EVAR. Multivariable models were developed to identify effect of hospital type on mortality.

**Results:** There were 17,651 AAA repairs identified. After exclusion of aneurysms involving the thoracic aorta ( $n = 352$ ), there were 1600 open AAA repairs at targeted hospitals (21% ruptured) and 2725 at nontargeted hospitals (19% ruptured) and 4986 EVARs performed at targeted hospitals (6.7% ruptured) and 7988 at nontargeted hospitals (5.2% ruptured). There was no significant difference in 30-day mortality rates between targeted and nontargeted hospitals for intact aneurysms (EVAR noncomplex, 1.8% vs 1.4% [ $P = .07$ ]; open repair noncomplex, 4.2% vs 4.5% [ $P = .7$ ]; EVAR complex, 5.0% vs 3.2% [ $P = .3$ ]; open repair complex, 8.0% vs 6.0% [ $P = .2$ ]). For ruptured aneurysms, again there was no difference in mortality between the targeted and nontargeted hospitals (EVAR noncomplex, 23% vs 25% [ $P = .4$ ]; open repair noncomplex, 38% vs 34% [ $P = .2$ ]; EVAR complex, 29% vs 33% [ $P = 1.0$ ]; open repair complex, 27% vs 41% [ $P = .09$ ]). Multivariable analysis further demonstrated that having an operation at a targeted vs nontargeted hospital had no impact on mortality for both intact and ruptured aneurysms (odds ratio, 1.1 [0.9-1.4] and 1.0 [0.8-1.3], respectively).

**Conclusions:** This analysis highlights the similarities between targeted and nontargeted hospitals within the NSQIP for AAA operative management and suggests that data from the targeted NSQIP, in terms of AAA management, are generalizable to all NSQIP hospitals. (J Vasc Surg 2016;■:1-10.)

There is a growing focus on tracking and improving outcome measures after surgery.<sup>1-3</sup> The Centers for Medicare and Medicaid Services have issued quality benchmarks that will be used to identify and reward hospitals who consistently meet these process measures.<sup>4,5</sup> In addition, multiple professional societies have created their own data registries to track and improve

outcomes through in-depth analysis of clinically relevant data.<sup>1,2</sup> The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) is a national clinical data set with a robust network of participating hospitals that share the goal of improving patient care through collective data sharing. In 2011, the NSQIP expanded its registry by creating targeted modules,

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which include additional clinical variables, to better answer controversies in selected clinical subspecialties with improved risk adjustment and focused analyses on more procedure-specific end points. Within the targeted vascular module, examples of novel variables include proximal aneurysm extent, symptom status (including ruptured aneurysm with or without hypotension), operative approach, and aneurysm diameter. As with the original (nontargeted) NSQIP, participating hospitals in these groups are self-selected. Participation in the targeted module adds additional cost to the hospital and requires a minimum of 1680 cases per year. Clinical reviewers sample eligible operations in the same way, but there is a possibility that targeted hospitals have more of their vascular surgery cases represented in the sample reported.

To date, the data on effectiveness of registries at improving care are conflicting.<sup>6-9</sup> Furthermore, the generalizability of the analyses performed on self-selected "opt-in" clinical registries is often unknown. The additional variables in the targeted vascular module of the NSQIP are expected to provide better risk adjustment and a new wave of research on best practice and prediction tools, but the concern of generalizability remains. Targeted hospitals are thought to be higher volume referral centers that are more resource rich and with potentially better systems and process measures in place, leading some to believe that models based on targeted hospital data may not be generalizable. In addition, these hospitals are also thought to treat sicker patients with more difficult anatomy, potentially leading to worse outcomes, again calling into question how reliable results from this select group of hospitals may be. It is also possible that hospitals choosing to participate in the targeted module have quality of care gaps that they are attempting to correct with participation in this module.

This study aimed to evaluate whether hospitals that choose to participate in the vascular targeted module operate on similar patients and whether they have similar mortality and morbidity compared with nontargeted hospitals.

## METHODS

**Data set.** Using the NSQIP and targeted vascular NSQIP modules from 2011 to 2013, we identified all patients undergoing endovascular aneurysm repair (EVAR) or open abdominal aortic aneurysm (AAA) repair. The NSQIP, as of January 2015, had >390 nontargeted and >65 targeted hospitals contributing clinical data on patients after vascular surgery. Both targeted and nontargeted hospital modules contain all of the original NSQIP variables, which are referred to as nontargeted variables in this paper, compared with the additional targeted variables present only for those hospitals participating in the targeted vascular modules. Trained clinical reviewers identify potential procedures by reviewing operative case

logs, then collect data and categorize procedures using Current Procedural Terminology (CPT) codes at both the targeted and nontargeted NSQIP hospitals. The targeted vascular module was added in 2011 and consists of self-selected hospitals within the NSQIP that agreed to provide additional clinical data, chosen by participating vascular surgeons, to further improve the analytic power of the NSQIP and, subsequently, the quality of patient care. Additional information on the NSQIP is available at [www.facs.org/quality-programs/acs-nsqip](http://www.facs.org/quality-programs/acs-nsqip).

**Cohorts.** Procedures were identified by primary CPT codes (EVAR: 34800, 34802, 34803, 34804, 34805, 34825; open repair: 34830, 34831, 34832, 35081, 35082, 35091, 35092, 35102, 35103). Patients with a postoperative diagnosis of thoracic aorta involvement, as identified by International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes (441.01, 441.03, 441.1, 441.2, 441.6, 441.7), were excluded. Procedure volumes for targeted hospitals were verified with total reported targeted operations as listed in the NSQIP Participant Use Data Files. Only variables present in the nontargeted data set were used for creation of stratified groups as described later. The NSQIP provides a key variable to clearly identify which operations took place at targeted hospitals.

**Type of operation.** Open repair was divided into three treatment types: complex open repair, defined as visceral or renal vessel involvement (CPT: 35091 or 35092); noncomplex open repair (CPT: 35081, 35102, 35082, or 35103); and prior failed EVAR (CPT: 34830, 34831, or 34832). These three treatment types were further categorized as ruptured or intact, defined by ICD-9 postoperative diagnosis codes (rupture: 441.3 or 441.5; intact: absence of ICD-9 rupture codes). For our outcome analysis, patients with prior failed EVAR were excluded (n = 172) as they could not be consistently identified as complex vs noncomplex.

Given the decreased specificity of EVAR coding, a novel definition of complex EVAR was created, which used CPT coding for concomitant procedures captured in the NSQIP as "other procedures." An EVAR was considered complex if CPT coding was present for any of the following; fenestrated EVAR (CPT: 34841, 34842, 34843, 34844, 34845, 34846, 34847, 34848, or 0078T), brachial access (36120 or 34834), visceral or renal angioplasty or stent (35450, 35471, 37205, 37207, or 37236), use of iliac conduit (34833, 35565, or 35665), or iliac cutdown (34820). If none of these CPT codes were present, the EVAR was considered noncomplex. Similar to open repair, EVAR postoperative ICD-9 codes were used to identify rupture.

To appropriately compare operative times, the most straightforward repairs were identified. Straightforward open repair was defined as an intact aneurysm with a CPT code of 35081, which is used for a direct repair of an aneurysm or pseudoaneurysm or excision and graft

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