

# Programmatic and Surgeon Specialization Improves Mortality in Isolated Coronary Bypass Grafting

A. Claire Watkins, MD, Merhdad Ghoreishi, MD, Nathan L. Maassel, MD, Brody Wehman, MD, Filiz Demirci, BS, CPHQ, Bartley P. Griffith, MD, James S. Gammie, MD, and Bradley S. Taylor, MD, MPH

Department of Cardiothoracic Surgery, Stanford University School of Medicine, Stanford, California; Division of Cardiac Surgery, University of Maryland School of Medicine, Baltimore, Maryland; and Department of Surgery, Yale University School of Medicine, New Haven, Connecticut

**Background.** Throughout surgery, specialization in a procedure has been shown to improve outcomes. Currently, there is no evidence for or against subspecialization in coronary surgery. Tasked with the goal of improving outcomes after isolated coronary artery bypass grafting (CABG), our institution sought to determine whether the development of a subspecialized coronary surgery program would improve morbidity and mortality.

**Methods.** All isolated CABG operations at a single institution were retrospectively examined in two distinct periods, 2002 to 2013 and 2013 to 2016, before and after the implementation of a subspecialized coronary surgery program. Improved policies included leadership and subspecialization of a program director, standardization of surgical technique and postoperative care, and monthly multidisciplinary quality review. Outcomes were collected and compared.

**Results.** Between 2002 and 2013, 3,256 CABG operations were done by 16 surgeons, the most frequent surgeon doing 33%. Between 2013 and 2016, 1,283 operations were done by 10 surgeons, 70% by the coronary program director. CABGs done in the specialized era had shorter bypass and clamp times and increased use of bilateral internal mammary arteries. Blood transfusion and complication rates, including permanent stroke and prolonged ventilation, were significantly decreased after implementation of the coronary program. Likewise, overall operative mortality (2.67% vs 1.48%,  $p = 0.02$ ) was significantly reduced.

**Conclusions.** Subspecialization in CABG and dedicated coronary surgery programs may lead to faster operations, increased use of bilateral internal mammary arteries, fewer complications, and improved survival after isolated CABG.

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Subspecialization in academic surgery is increasing common. Studies suggest increased hospital and surgeon volume throughout surgery may lead to improved surgical outcomes [1]. The degree of specialization has been shown to reduce operative mortality in a variety of procedures [2]. The relative contribution of hospital volume, surgeon volume, or degree of specialization on operative mortality after isolated CABG is unclear in the current literature [3–5].

As the most common cardiac operation performed [5], coronary artery bypass grafting (CABG) has not seen the degree of specialization seen in mitral valve, aortic, or congenital cardiac surgery. Studies suggest hospital [6] and surgeon volume [3] may both increase the repair rate and operative survival in mitral valve surgery.

Higher-volume cardiac surgery centers have been shown to have improved outcomes after repair of acute aortic dissections [7]. However, results for or against subspecialization in CABG are equivocal [4, 8–11].

The topic of surgical subspecialization coincides with a new era of increased public reporting of surgical outcomes. The outcomes after elective isolated CABG carry an increasing expectation of an operative mortality of less than 1% [12]. In 2013, The University of Maryland Medical Center instituted a programmatic and surgeon subspecialization in coronary bypass surgery with the goal of improving outcomes after isolated CABG. This report presents the retrospectively reviewed outcomes of isolated CABG operations in a single institution before and after the implementation of subspecialization in coronary surgery.

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Address correspondence to Dr Watkins, Department of Cardiothoracic Surgery, Falk Bldg, CVRB, Mail Code 5470, 300 Pasteur Dr, Stanford, CA 94305; email: [aclairewatkins@gmail.com](mailto:aclairewatkins@gmail.com).

## Patients and Methods

### Patient Data Set

The Society of Thoracic Surgeons (STS) cardiac surgery database entries for all patients undergoing isolated

**Abbreviations and Acronyms**

CABG	= coronary artery bypass grafting
CPB	= cardiopulmonary bypass
IMA	= internal mammary artery
IABP	= intraaortic balloon pump
NYHA	= New York Heart Association Functional Classification for heart failure
O/E	= observed-to-expected
PA	= physician assistant
PROM	= Predicted Risk of Mortality
RBC	= red blood cell
STS	= The Society of Thoracic Surgeons

CABG at a single institution between 2002 and 2016 were used for this study. All techniques for CABG were included. Reoperative and initial CABG, all degrees of cardiac function, and elective, urgent, and emergent/salvage cases were included. The STS Predicted Risk of Mortality (PROM) was used to ascertain operative risk for each patient. Approval for this study was waived by the Institutional Review Board.

**Intervention**

Beginning in 2013, motivated by suboptimal CABG outcomes, our institution initiated a specialized program in coronary artery bypass surgery. Practices were restructured and clarified in an attempt to streamline the surgical care for CABG patients (Fig 1). A senior surgeon specializing in coronary surgery was recruited, appointed as clinical director, and held accountable for clinical outcomes. The clinical director evaluated all CABG

referrals. Cases were distributed to mentored junior surgeons when appropriate, with recommendations regarding the operative plan. Fitting with the institution's broader model of subspecialization, other cardiac surgeons specialized in noncoronary work. All surgeons performed emergent CABG operations while on-call. Elective or urgent cases were referred to the CABG service as scheduled cases. Surgeons not specializing in coronary surgery performed occasional but far fewer CABGs.

Specific coronary service nurse practitioners and trainees provided increased continuity of care. Clinical protocols for timing of medications, management of atrial fibrillation, drain and pacing wire removal, and discharge were simplified and standardized. The consolidated team recommitted to ensuring unstable myocardial infarction patients were temporized with percutaneous intervention or mechanical support when possible. Medical optimization of symptomatic heart failure was managed by the heart failure cardiology and coronary surgery services.

Surgical approach was standardized, with standard on-cardiopulmonary bypass (CPB), arrested-heart operations being the planned approach for multivessel bypass grafting. Robotic totally endoscopic CABG was abandoned, and robot use was reserved for only isolated left anterior descending artery harvest for single-vessel CABG. Off-CPB CABGs were reserved for single left anterior descending bypass or very rare occasions of porcelain aorta, hepatic dysfunction, severe blood cell dyscrasia, or other medical limitations preventing cardiac arrest.

Operative techniques for conduit harvest, target exposure, and distal and proximal anastomosis were standardized among the director, junior attending surgeons, and surgical trainees. Skeletonized bilateral mammary

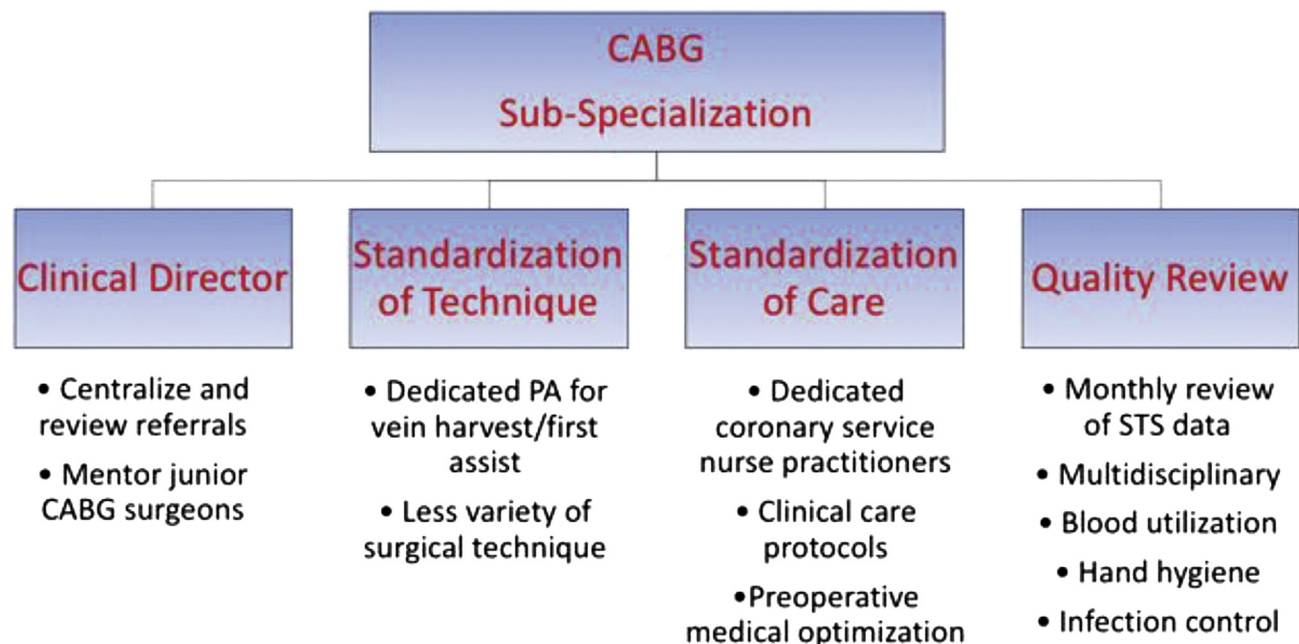


Fig 1. Coronary artery bypass grafting (CABG) subspecialization model. (PA = physician assistant; STS = The Society of Thoracic Surgeons.)

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