Show me the money (cost)

Frank A. Baciewicz, Jr, MD

From the Division of Cardiothoracic Surgery, Michael and Marian Ilitch Department of Surgery, Harper Hospital, Wayne State University School of Medicine, Detroit, Mich.

Disclosures: Author has nothing to disclose with regard to commercial support.

Received for publication Sept 9, 2017; accepted for publication Sept 17, 2017; available ahead of print Oct 25, 2017.

Address for reprints: Frank A. Baciewicz, Jr, MD, Harper Hospital, 3990 John R, Detroit, MI 48201 (E-mail: fbaciewi@dmc.org).

J Thorac Cardiovasc Surg 2018;155:883-4

0022-5223/\$36.00

Copyright © 2017 by The American Association for Thoracic Surgery

<https://doi.org/10.1016/j.jtcvs.2017.09.082>

In the film *Jerry Maguire*,¹ Arizona Cardinals wide receiver, Rod Tidwell (Cuba Gooding, Jr), emphatically requested Jerry Maguire (Tom Cruise) to “show me the money.” The recent article by McHaffey and colleagues² shows us the cost of individual complications after coronary artery bypass grafting (CABG). With the constant societal and institutional emphasis on quality and cost in CABG/cardiac surgery, the article is well timed.

The authors have reviewed the Commonwealth of Virginia’s 10-year experience with CABG, demonstrating an impressive overall 30-day mortality of 0.6% and an average cost of \$36,580 ± \$14,633 per case. The average cost of \$36,580 increased from previous cost data presented in 2008³ and 2015.⁴ The authors attributed the increased cost to sicker patients, although the average ejection fraction for the series was 55%. Greater than 50% of the patients undergoing CABG in the groups with and without major postoperative complications received urgent operation. The urgent nature of these CABG procedures may have accounted for a portion of the increased overall cost for the entire cohort.

A major complication was present in 13% of patients undergoing CABG, and the cost of care for each additional complication increased the cost exponentially. This complication rate mirrored that reported by Brown and colleagues³ in 2008. Overall, the greatest costs from complications were secondary to prolonged ventilation and atrial fibrillation (minor complication). These complications accounted for \$59 million and \$27 million, respectively. Prolonged ventilation was responsible for \$59 million of the \$78.2 million or 75% of the money spent treating major complications. Funds allocated for renal failure, reoperation, stroke, and deep sternal wound infection (the other major morbidities) were \$8 million, \$8 million, \$3 million, and \$250 thousand, respectively.

The cost of all complications was directly correlated with the intensive care unit length of stay and the total hospital length of stay. Reoperation, which has a staggering impact on morbidity and mortality,⁵ had the highest cost of the major morbidity.

Frank A. Baciewicz, Jr, MD

Central Message

The Virginia Consortium “shows us the money” (cost) of major morbidities following CABG over a ten year experience. The prediction and prevention of these major morbidity costs is the future goal.

See Article page 875.

Fortunately, the major complications of reoperation, renal failure, stroke, and deep sternal wound infection had an incidence of only 3.3% to 0.1% in the Virginia experience. Because the cost of these 4 major complications is a relatively small part of overall complication costs, cardiac programs could target atrial fibrillation (18.9%) and prolonged ventilation (9.0%) to decrease CABG cost.

It would seem a straightforward endeavor to target those patients with the highest preoperative Society of Thoracic Surgeons Predicted Risk of Mortality and Morbidity (PROMM) score. The patients with major morbidity in this study had a PROMM score of 17.5% as opposed to a PROMM score of 10.2% for those without major morbidity. The Virginia Consortium should be complimented for achieving morbidity and mortality rates less than predicted. However, the authors’ previous publications have suggested that the Society of Thoracic Surgeons PROMM score does not accurately predict these cost over-runs. Preoperative risk stratification was able to explain only 28% of cost variation in the article by Younk and colleagues.⁶ Lapar and colleagues⁷ showed that payer mix was the best predictor of CABG costs.

The issue is predicting patients who will experience a particular complication. If a particular complication was predictable, the cardiac surgery team might remedy it by altering preoperative strategy or being extremely attentive to intraoperative or postoperative causative factors. For example, respiratory complications might be decreased by

insisting that patients stop smoking preoperatively, before operation, providing preoperative pulmonary rehabilitation, or having patients with presumptive sleep apnea evaluated preoperatively. Intraoperative strict fluid management, decreasing blood and blood product use, and not using drugs that cause intensive care unit respiratory depression might reduce the cost of respiratory complications. These strategies are currently used at our institution in an effort to decrease length of postoperative ventilation.

New formulas for predicting postoperative complications could increase our ability to avoid these costly complications. If postoperative respiratory or renal issues could be predicted by markers such as hemoglobin A1c⁸ or inflammatory biomarkers,⁹ as suggested in recent articles, cost could be lessened. A patient's operation could be delayed until he/she was at less risk for a particular complication or treatments could be instituted to decrease their incidence. As Jerry Maguire helped Rod Tidwell secure a more lucrative contract in the movie, new models or tests may "show us the money" in terms of predicting CABG complication cost overruns.

The other avenue is alternative preoperative, intraoperative, and postoperative strategies that could "show us the money" in terms of avoiding costly major postoperative complications.

References

1. Crowe C. *Jerry Maguire [film]*. Culver City, CA: Columbia TriStar Home Entertainment; 1997.
2. Mehaffey JH, Hawkins RB, Byler M, Charles EJ, Fonner C, Kron I, et al. Cost of individual complications following coronary artery bypass grafting. *J Thorac Cardiovasc Surg*. 2018;155:875-82.e1.
3. Brown PP, Kugelmass AD, Cohen DJ, Reynolds MR, Culler SD, Dee AD, et al. The frequency and cost of complications associated with coronary artery bypass grafting surgery: results from the United States Medicare Program. *Ann Thorac Surg*. 2008;85:1980-6.
4. Giacomino BD, Cram P, Faughan-Sarrazin M, Zhou Y, Girotra S. Association of hospital prices for coronary artery bypass grafting with hospital quality and reimbursement. *Am J Cardiol*. 2016;117:1101-6.
5. Ruel M, Chan V, Boodhwani M, McDonald B, Ni X, Gill G, et al. How detrimental is reexploration for bleeding after cardiac surgery? *J Thorac Cardiovasc Surg*. 2017;154:927-35.
6. Younk KW, Isbell JM, Lichtendahl C, Dietch Z, Ailawadi G, Kron IL, et al. Bundled payments in cardiac surgery: is risk adjustment sufficient to make it feasible? *Ann Thorac Surg*. 2015;100:1646-52.
7. LaPar DJ, Stukenborg GJ, Guyer RA, Stone ML, Bhamidipati CM, Lau CL, et al. Primary payer status is associated with mortality and resource utilization for coronary artery bypass grafting. *Circulation*. 2012;126:S132-9.
8. Narayan P, Kshirsager SN, Kumar Mandal C, Ghorai PA, Rao YM, Das D, et al. Preoperative glycosylated hemoglobin: a risk factor for patients undergoing coronary artery bypass. *Ann Thorac Surg*. 2017;104:606-12.
9. Moledina DG, Isguven S, McArthur E, Thiessen-Philbrook H, Garg AX, Shlipak M, et al. Plasma monocyte chemoattractant protein-1 is associated with acute kidney injury and death after cardiac operations. *Ann Thorac Surg*. 2017;104:613-20.