



The Transition from Volume-Based to Value-Based Patient Care

A photograph of a person in a light blue shirt working at a desk. The person is holding a piece of paper in their left hand and using a calculator with their right hand. There is a laptop, a pen holder with several pens, and various papers on the desk. The background is slightly blurred, showing what appears to be a hospital or office setting.

Healthcare Reform Targets CABG Surgery

Authors: Prof. Dr. Claudius Diez and Dr. Jörg Kurz

Cardiovascular disease (CVD) costs constitute a major portion of healthcare expenditures

Direct costs of CVD in Europe total €111 billion a year,¹ and current estimates for the United States place CVD medical costs at \$318 billion annually with an anticipated increase to \$749 billion by 2035.²

Coronary artery bypass grafting (CABG) represents the largest cost expenditure of any single surgical procedure.^{3,4} With more than 200,000 procedures performed annually in the US,⁵ and another 180,000 performed across Europe,⁶ CABG is a prime target for healthcare cost containment efforts.^{3-5,7}

The Transition from Volume-Based to Value-Based Payments

Escalating healthcare costs have been largely attributed to the fee-for-service model that reimburses individual healthcare providers for each service provided during an episode of care, regardless of patient outcomes or costs.⁸⁻¹⁰ As a result, fee-for-service models reward the volume rather than value of services provided. This approach is believed to encourage fragmented care with little incentive for resource stewardship, communication or coordination of care across multiple providers.⁸

In an attempt to control costs and improve quality, payers are transitioning from volume-driven fee-for-service reimbursement to value-based payment systems.⁹⁻¹¹ Value – defined as the quality of health outcomes relative to costs of care – can be increased by improving outcomes, reducing costs, or both. Value-based payment models that link physician and hospital payments to quality and resource utilization measures are being implemented by government and commercial insurers both within the US and internationally.³ In January 2015, the U.S. Department of Health and Human Services announced its intent to tie 85% of all Medicare payments to quality or value by 2016 and 90% of payments by 2018.¹² Passage of the Medicare Access and CHIP Reauthorization Act in April 2015 formalized value-based payment in Medicare.¹² In recent years, a number of other countries have also moved towards value-based healthcare,

including the United Kingdom,¹³⁻¹⁴ Germany,¹⁵ the Netherlands¹⁴ and China.¹⁶

Bundled Payment Initiatives

Episode-based, bundled payments are currently viewed as the most promising approach for stemming rising health care costs.^{7,10,17,18} Several studies have documented large variations in costs for CABG index hospitalizations, physician services, readmissions, and post-acute care.^{8,19} Bundled payments are theorized to incentivize greater coordination of care and efficiency while reducing undesirable variation in expenditures. This would be accomplished by providing a fixed payment (target price) for all services provided during each care “episode” (hospitalization plus a specified period afterward).^{7,8} Participants whose episode costs are less than the target price retain the difference, while those whose costs exceed target pricing must repay the difference.

In 2016, the Centers for Medicare and Medicaid Services (CMS) rolled out the first bundled payment program for hip and knee replacement. Utilizing the same model, a mandatory 90-day, episode-based bundled CABG initiative was slated to take effect in 98 urban health care markets across the US beginning January 2018. Under this initiative, hospitals would be reimbursed by CMS under the standard fee-for-service arrangement based on diagnosis-related group (DRG). At the end of each year, CMS would reconcile payments with target pricing based on cost data for the prior three years. Regional pricing and increasing stop-loss thresholds for hospital reconciliation payments would be phased in. Hospitals that met CABG quality measures and kept spending below a predefined benchmark would be eligible for financial reward, while those exceeding cost benchmarks would be liable for financial overruns. Due to a variety of concerns, CMS cancelled the program in August 2017, announcing that a

modified version would be rolled out in fewer centers on a voluntary basis at a future date.^{10,18}

Financial Impact of Bundled CABG Payments

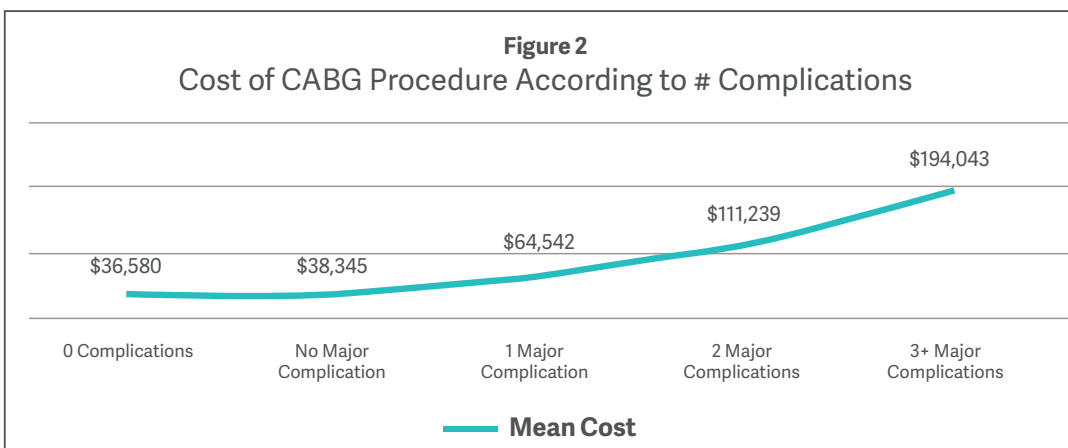
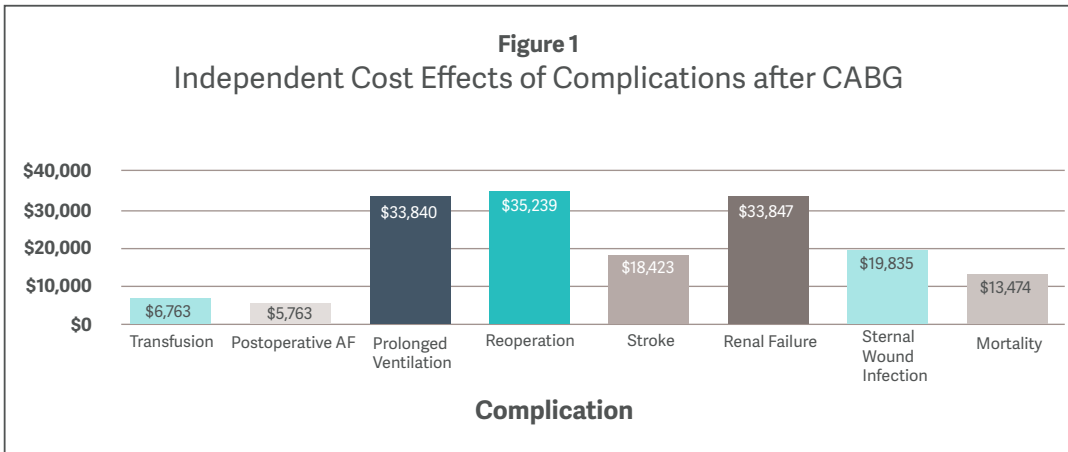
One of the most challenging aspects of bundled payment plans is target pricing. Accurate prediction of CABG costs has proved extremely difficult.^{5,17,20} Further, numerous stakeholders have expressed concern that financial penalties may deter treatment of high-risk patients and disproportionately impact safety-net hospitals that treat poor or uninsured patients, thereby reducing care for vulnerable populations.¹⁸ Risk adjustment of pricing bundles has been advocated as measure to combat these unwanted effects. Unfortunately, current risk models do not predict costs well, accounting for only about 30% of the variance.^{17,20}

CABG providers are exposed to significant financial risk as a result of the inability to predict costs accurately.⁴ Hawkins et al. modeled the potential financial impact of the 5-year CABG bundled payment program by comparing actual costs to target prices for 13,276 Medicare patients undergoing isolated CABG at 18 hospitals.⁴ Hospitals that owed money to CMS following payment reconciliation were categorized as “penalized,” whereas hospitals paid by CMS for being below target price were categorized as “rewarded.” Penalized hospitals treated patients with significantly higher preoperative risk and experienced significantly higher rates of major morbidity but lower risk-adjust mortality than rewarded

hospitals. During the period modeled, CABG costs increased 4% per year and varied substantially across hospitals. Financial liability increased steadily as caps on reconciliation payments rose. By the final year, 72% of hospitals (13 of 18) owed CMS reconciliation payments averaging more than \$614,000 (range: \$67,404 to \$2,102,292). Investigators concluded that significant variation in costs represents a potentially large source of savings for CMS but could pose financial risk that hospitals may not be able to absorb.

Impact of CABG Complications and Readmissions on Costs

Postoperative complications are major drivers of CABG costs.^{20,21} Benchmarks for the cost of an uncomplicated CABG procedure and incremental costs accruing from postoperative complications are provided by Virginia Cardiac Services Quality Initiative (VCSQI) data from 18 hospitals and cardiac surgery practices providing 99% of adult cardiac surgery cases in the state.²¹ The average cost of CABG without complications was \$36,580 ± \$14,633. Independent increases to CABG cost resulting from individual complications ranged from \$6,763 to \$35,239 (see Figure 1); reoperation, renal failure and prolonged ventilation exerted the greatest impact, nearly doubling procedure costs (93%-96% increase). Additional complications increased costs exponentially rather than additively (see Figure 2), with costs increased three-fold by two complications and five-fold by three or more complications.



Readmissions due to postoperative complications have a significant impact on CABG costs.⁷ Using Medicare claims to calculate 90-day CABG episode payments for 5,910 patients undergoing non-emergent procedures at 33 Michigan hospitals, Guduguntla et al.⁷ documented that hospitals in the highest quartile of payments had 35% greater readmissions payments than those in the lowest quartile. While rates of single readmissions were nearly equal, the rate of multiple readmissions was 77% higher in the highest-quartile hospitals, with multiple readmissions occurring for 41% of patients readmitted for infection and 27% of patients readmitted for heart failure. Lack of post-acute care was identified as potential factor in multiple readmissions; 5% of patients with multiple readmissions received post-acute care between the first and second readmission compared with 49% of patients without subsequent readmissions. Improving post-discharge care and reducing readmissions will be critical to success under bundled CABG payment models.

Lessening the financial burden associated with postoperative complications and readmissions will be increasingly important as the prevalence of diabetes, older age, obesity, pre-existing lung disease and other risk factors known to correlate with poor outcomes continues to rise.²³

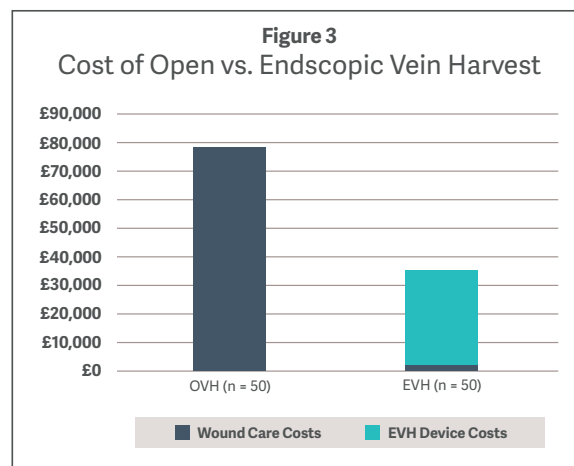
Quality Improvement Efforts to Reduce Costs of Complications

Following identification of prolonged ventilation and acute renal failure as predominant contributors of excess costs, VSQI implemented a regional quality improvement effort to reduce their occurrence.²⁴ Efforts to decrease prolonged ventilation included preoperative smoking cessation, pulmonary rehabilitation, presumptive sleep apnea evaluation, strict fluid management, decreased blood product use, and avoidance of drugs that cause respiratory depression. Renal failure reduction efforts focused on preoperative optimization of renal function, optimization of intraoperative and postoperative hemodynamics, and optimization of intraoperative and postoperative fluids and intravascular volumes. Despite increasing patient risk, significant reductions were realized in both complications following protocol implementation, translating into estimated savings of \$10,212,637 and \$8,519,630 for prolonged ventilation and acute renal failure, respectively.

Infection is primary cause of readmission following CABG and imposes particular financial burden because it is a non-reimbursable event. While deep sternal wound infections and mediastinitis can result in serious morbidity and mortality, their occurrence is infrequent compared with graft harvest site infection.²⁵ Leg wound infections following saphenous vein graft (SVG) harvest represent a significant cause of prolonged length of stay and increased costs.^{25,26} In a large multicenter analysis of 2,174 patients, 34% of patients who developed SVG harvest site infections were readmitted with a median re-hospitalization stay of 7 days.²⁶ Endoscopic vessel harvest (EVH) was performed significantly

less frequently among patients who experienced harvest site infections than those who did not (60% vs. 76%, $p < 0.01$). While the majority of infections were diagnosed within 30 days of discharge, 18% were diagnosed between 30 and 65 days post-discharge, placing them inside the new 90-day window for bundled reimbursement.

Endoscopic vessel harvest (EVH) reduces leg wound complication incidence by approximately 70% compared with traditional methods utilizing lengthy incisions.²⁷ While predominant in the US,²⁶ EVH is utilized less frequently in other geographies. The value of EVH in improving patient outcomes while reducing healthcare expenditures is illustrated by a recent United Kingdom hospital evaluation of EVH in 50 patients at high risk for harvest site infections.²⁸ Patients who underwent EVH had 92% fewer wound complications (4% vs. 48%, $p < 0.01$), had 1 day shorter postoperative lengths of stay (4 vs. 5, $p = 0.01$), made 97% fewer total wound clinic visits (10 vs. 290, $p < 0.01$), and required 99% fewer total home nursing visits (5 vs. 462, $p < 0.01$) than OVH patients with comparable risk factors. As a result of reduced treatment requirements, wound care costs were 96% lower for EVH group. After accounting for the additional cost of the EVH device (£650/kit), there was a cost savings of £856 per patient when EVH was utilized. (see Figure 3)



Impact of Standardized Clinical Pathways on CABG Costs

Inter-hospital variability in care processes contributes heavily to disparities in coronary revascularization costs.^{8,19} In a study using Nationwide Inpatient Sample data for 183,973 patients treated in 633 US hospitals, CABG costs varied by 30% across institutions, independent of multiple patient characteristics and clinical outcomes.¹⁹ These results suggest that wide divergence in clinical pathways may underlie cost differences and highlight the potential for reducing variation with standardized care pathways.

Geisinger Health System has coupled episode-based payment bundling with care delivery reengineering for more than 10 years.²⁹ The *ProvenCare* program centers around three components: establishing best practices for elective

CABG patients, assembling a multidisciplinary team to “hardwire” these best practices into everyday workflow, and implementing the program with real-time data collection, feedback and focused redesign. To evaluate *ProvenCare* impact, compliance with 40 performance measures and subsequent clinical outcomes were tracked. Post-intervention outcomes showed statistically nonsignificant trends toward improvement with decreases in average length of stay and 5% reduction in mean hospital charges.³⁰

The University of Utah Value-Driven Outcomes program demonstrated that adherence to care metrics demonstrably correlated with costs of care can result in significant savings.¹¹ After development and introduction of clinical protocols designed to achieve key metrics, compliance was tracked at both physician and nursing levels. After adjusting for preoperative risk, overall costs were 37% lower for patients who received “perfect care” (adherence to all metrics) versus those who did not. Additional analyses identified that standardized protocols for iterative assessment for readiness to wean from inotrope discontinuation, ventilator weaning and use of albumin resulted in the largest cost decreases.

Enhanced Recovery after Surgery (ERAS) programs standardize perioperative care through implementation of evidence-based, best-practice recommendations to improve quality of care and reduces costs. ERAS pathways have demonstrated improvement in a wide variety of patient outcomes, including decreased length of stay, decreased surgical site infections, decreased readmissions, across variety of surgical disciplines.⁹ The Enhanced Recovery after Cardiac Surgery (ERAS Cardiac) Collaborative was founded in 2017 to standardize best practices in cardiac surgery. The first ERAS Cardiac Surgery Consensus Statement was presented in April 2018.³¹

Table 2 . Examples of Cardiac Surgery ERAS (Kolarczyk, ERAS Cardiac)

Preoperative	<ul style="list-style-type: none"> • Physical exercise programs • Smoking cessation • Optimization of nutritional status • Identification of patients at risk for acute kidney injury
Intraoperative	<ul style="list-style-type: none"> • Perioperative glycemic control • Multimodal anesthesia • Minimization of long-acting opioids • Lung-protective ventilation • Avoidance of excessive crystalloid administration • Rigid sternal fixation
Postoperative	<ul style="list-style-type: none"> • Active chest tube clearance • Formal ventilator weaning protocol • Early extubation pulmonary toileting • Early ambulation programs • Pain management

In 2018, the UK National Health Service published a series of ERAS clinical management strategies in the *Getting It Right the First Time (GIRFT) Programme Review of Cardiothoracic Surgery*.³² The GIRFT program seeks to identify variation in practices, processes and outcomes for the purpose of improving efficiencies in NHS hospitals. The report is based on an evaluation of 31 cardiothoracic units and summarizes practices that have been associated with positive patient outcomes and greater cost efficiencies. Units that have achieved substantial reductions in morbidity and associated costs are highlighted in “Best Practice Case Studies.” One example is the Plymouth Hospitals Trust, which has the lowest postoperative blood transfusion rate in England. This trust attributes the low rate of blood product utilization to a set of key practices: stressing the importance of blood transfusion practices to surgical trainees, stopping pre-operative dual antiplatelet therapy, observing a strict transfusion trigger (Hb of 8g/100ml), using IV iron in anemic patients pre-operatively, and careful evaluation of incoming patients and in-hospital transfers by surgical care practitioners.

Conclusions


CABG payment reform is inevitable. As healthcare reimbursement continues to transition toward bundled-payment models, minimizing costs of care over longer postoperative periods will be increasingly important. Because of their enormous impact on costs, reducing complications and readmissions will be critical to both cost containment and healthcare provider financial viability. Further, accumulating evidence indicates that standardized care pathways developed using best evidence to identify processes most strongly tied to costs and building alignment across care settings to minimize lapses in post-acute care may significantly augment the impact of ongoing quality improvement initiatives.

References

1. Wilkins E, Wilson L, Wickramasinghe K, Bhatnagar P, Leal J, Luengo-Fernandez R, Burns R, Rayner M, Townsend N (2017). European Cardiovascular Disease Statistics 2017. European Heart Network, Brussels.
2. American Heart Association. (2017) Cardiovascular Disease: A Costly Burden for America – Projections through 2035. Washington, DC: American Heart Association.
3. Osnabrugge RL, Speir AM, Head SJ, Jones PG, Ailawadi G, Fonner CE, Fonner E Jr, Kappetein AP, Rich JB. Prediction of costs and length of stay in coronary artery bypass grafting. *Ann Thorac Surg*. 2014 Oct;98(4):1286-93.
4. Hawkins RB, Mehaffey JH, Yount KW, Yarboro LT, Fonner C, Kron IL, Quader M, Speir A, Rich J, Ailawadi G; Investigators for the Virginia Cardiac Services Quality Initiative. Coronary artery bypass grafting bundled payment proposal will have significant financial impact on hospitals. *J Thorac Cardiovasc Surg*. 2018 Jan;155(1):182-188.
5. Osnabrugge RL, Speir AM, Head SJ, Jones PG, Ailawadi G, Fonner CE, Fonner E Jr, Kappetein AP, Rich JB. Cost, quality, and value in coronary artery bypass grafting. *J Thorac Cardiovasc Surg*. 2014 Dec;148(6):2729-35.
6. Eurostat. Cardiovascular diseases statistics, 2017. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Cardiovascular_diseases_statistics#Cardiovascular_healthcare (accessed September 11, 2018)
7. Guduguntla V, Syrjamaki JD, Ellimoottil C, Miller DC, Prager RL, Norton EC, Theurer P, Likosky DS, Dupree JM. Drivers of Payment Variation in 90-Day Coronary Artery Bypass Grafting Episodes. *JAMA Surg*. 2018 Jan 1;153(1):14-19.
8. Shih T, Chen LM, Nallamothu BK. Will Bundled Payments Change Health Care? Examining the Evidence Thus Far in Cardiovascular Care. *Circulation*. 2015 Jun 16;131(24):2151-8.
9. Kolarczyk LM, Arora H, Manning MW, Zvara DA, Isaak RS. Defining Value-Based Care in Cardiac and Vascular Anesthesiology: The Past, Present, and Future of Perioperative Cardiovascular Care. *J Cardiothorac Vasc Anesth*. 2018 Feb;32(1):512-521.
10. Wadhwa RK, Yeh RW, Joynt Maddox KE. The Rise and Fall of Mandatory Cardiac Bundled Payments. *JAMA*. 2018 Jan 23;319(4):335-336.
11. Glotzbach JP, Sharma V, Tonna JE, Pettit JC, McKellar SH, Eckhauser AW, Varghese TK Jr, Selzman CH. Value-driven cardiac surgery: Achieving “perfect care” after coronary artery bypass grafting. *J Thorac Cardiovasc Surg*. 2018 Jun 4. pii: S0022-5223(18)31470-3. doi: 10.1016/j.jtcvs.2018.03.177. [Epub ahead of print]
12. Chee TT, Ryan AM, Wasfy JH, Borden WB. Current State of Value-Based Purchasing Programs. *Circulation*. 2016 May 31;133(22):2197-205.
13. The Economist Intelligence Unit. The UK: Value-based strategy in a changing NHS. <http://vbhcgloblassessment.eiu.com/the-uk-value-based-strategy-in-a-changing-nhs/> (accessed October 1, 2018)
14. Finnegan G. How to make value-based healthcare work in Europe. Science Business. June 20, 2017. <https://science-business.net/healthy-measures/news/how-make-value-based-healthcare-work-europe> (accessed October 1, 2018)
15. The Commonwealth Fund. The German health care system. International Health Care System Profiles. https://international.commonwealthfund.org/features/cost_containment/ (accessed October 1, 2018)
16. The Cleveland Clinic. Luye Medical collaborates with Cleveland Clinic to pioneer value-based healthcare in China. Newsroom. <https://newsroom.clevelandclinic.org/2018/07/11/luye-medical-collaborates-with-cleveland-clinic-to-pioneer-value-based-healthcare-in-china/> (accessed October 1, 2018)
17. Yount KW, Isbell JM, Lichtendahl C, Dietch Z, Ailawadi G, Kron IL, Kern JA, Lau CL. Bundled Payments in Cardiac Surgery: Is Risk Adjustment Sufficient to Make It Feasible? *Ann Thorac Surg*. 2015 Nov;100(5):1646-52; discussion 1652.
18. Bergethon KE, Wasfy JH. Introduction, Cancellation, and Future Promise of Medicare Cardiac Episode Payment Models. *Circ Cardiovasc Qual Outcomes*. 2018 Jan;11(1).
19. Kilic A, Shah AS, Conte JV, Mandal K, Baumgartner WA, Cameron DE, Whitman GJ. Understanding variability in hospital-specific costs of coronary artery bypass grafting represents an opportunity for standardizing care and improving resource use. *J Thorac Cardiovasc Surg*. 2014 Jan;147(1):109-15.
20. Baciewicz FA Jr. Show me the money (cost). *J Thorac Cardiovasc Surg*. 2018 Mar;155(3):883-884.
21. Mehaffey JH, Hawkins RB, Byler M, Charles EJ, Fonner C, Kron I, Quader M, Speir A, Rich J, Ailawadi G; Virginia Cardiac Services Quality Initiative. Cost of individual complications following coronary artery bypass grafting. *J Thorac Cardiovasc Surg*. 2018 Mar;155(3):875-882.
22. Liao JM, Navathe AS, Chu D. Reframing the Value Proposition of Coronary Artery Bypass Graft Bundles. *JAMA Surg*. 2018 Mar 1;153(3):199-200.

24. Rich JB, Fonner CE, Quader MA, Ailawadi G, Speir AM. Impact of Regional Collaboration on Quality Improvement and Associated Cost Savings in Coronary Artery Bypass Grafting. *Ann Thorac Surg.* 2018 Aug;106(2):454-459.
25. Olsen MA, Sundt TM, Lawton JS, Damiano RJ Jr, Hopkins-Broyles D, Lock-Buckley P, Fraser VJ. Risk factors for leg harvest surgical site infections after coronary artery bypass graft surgery. *J Thorac Cardiovasc Surg.* 2003 Oct;126(4):992-9.
26. Gulack BC, Kirkwood KA, Shi W, Smith PK, Alexander JH, Burks SG, Gelijns AC, Thourani VH, Bell D, Greenberg A, Goldfarb SD, Mayer ML, Bowdish ME; Cardiothoracic Surgical Trials Network (CTSN). Secondary surgical-site infection after coronary artery bypass grafting: A multi-institutional prospective cohort study. *J Thorac Cardiovasc Surg.* 2018 Apr;155(4):1555-1562.
27. Ferdinand FD, MacDonald JK, Balkhy HH, Bisleri G, Hwang HY, Northrup P, Trimlett RHJ, Wei L, Kiaii BB. Endoscopic Conduit Harvest in Coronary Artery Bypass Grafting Surgery: An ISMICS Systematic Review and Consensus Conference Statements. *Innovations (Phila).* 2017 Sep/Oct;12(5):301-319.
28. Luckraz H, Kaur P, Bhabra M, Mishra PK, Nagarajan K, Kumari N, Saleem K, Nevill AM. Endoscopic vein harvest in patients at high risk for leg wound complications: A cost-benefit analysis of an initial experience. *Am J Infect Control.* 2016 Dec 1;44(12):1606-1610.
29. Slotkin JR, Ross OA, Newman ED, Comrey JL, Watson V, Lee RV, Brosious MM, Gerrity G, Davis SM, Paul J, Miller EL, Feinberg DT, Toms SA. Episode-Based Payment and Direct Employer Purchasing of Healthcare Services: Recent Bundled Payment Innovations and the Geisinger Health System Experience. *Neurosurgery.* 2017 Apr 1;80(4S):S50-S58.
30. Berry SA, Doll MC, McKinley KE, Casale AS, Bothe A Jr. ProvenCare: quality improvement model for designing highly reliable care in cardiac surgery. *Qual Saf Health Care.* 2009 Oct;18(5):360-8.
31. Engelman DT, Boyle EM, Williams JB, Perrault LP, Reddy VS, Arora RC, Roselli EE, Khojenezhad A, Gerdisch M, Levy J, Lobdell K, Fletcher N, Kirsch M, Nelson G, Ali WB. Enhanced Recovery After Surgery (ERAS): An Expert Consensus Statement in Cardiac Surgery. Presented at the Enhanced Recovery After Surgery (ERAS®) session held on Saturday, April 28, 2018, during the American Association for Thoracic Surgery (AATS), San Diego, CA.
32. Richens D. *Cardiothoracic Surgery: GIRFT Programme National Specialty Report.* March 2018.



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