

5.12 Coronary Artery Bypass Graft Mortality Rate (IQI 12)

Coronary artery bypass graft (CABG) is a relatively common procedure that requires proficiency with the use of complex equipment; and technical errors may lead to clinically significant complications such as myocardial infarction, stroke, and death.

Relationship to Quality	Better processes of care may reduce mortality for CABG, which represents better quality care.
Benchmark	State, regional, or peer group average.
Definition	Number of deaths per 100 discharges with procedure code of CABG.
Numerator	Number of deaths (DISP=20) with a code of CABG in any procedure field.
Denominator	Discharges with ICD-9-CM codes of 3610 through 3619 in any procedure field. Age 40 years and older. Exclude cases: <ul style="list-style-type: none"> • missing discharge disposition (DISP=missing) • transferring to another short-term hospital (DISP=2) • MDC 14 (pregnancy, childbirth, and puerperium) • MDC 15 (newborns and other neonates)
Type of Indicator	Provider Level, Mortality Indicator for Inpatient Procedures
Empirical Performance	Population Rate (2003): 3.39 per 100 discharges at risk
Empirical Rating	5

Summary of Evidence

CABG mortality is one of the most widely used and publicized post-procedural mortality indicators. Demographics, comorbidities, and clinical characteristics of severity of disease are important predictors of outcome that may vary systematically by provider. Chart review may help distinguish comorbidities from complications.

This indicator should be considered with length of stay and transfer rates to account for differing discharge practices among hospitals. The use of smoothed estimates to help avoid the erroneous labeling of outlier hospitals is recommended.

Limitations on Use

Some selection of the patient population may lead to bias; providers may perform more CABG procedures on less clinically complex patients with questionable indications. Risk adjustment for clinical factors, or at a minimum APR-DRGs, is recommended because of the confounding bias of this indicator. Finally, the evidence for the construct validity of this indicator is limited.

Details

Face validity: Does the indicator capture an aspect of quality that is widely regarded as important and subject to provider or public health system control?

Post-CABG mortality rates have recently become the focus of State public reporting initiatives.⁹⁶ Studies suggest that these reports serve as the basis for discussions between physicians and patients about the risks of cardiac surgery.

Precision: Is there a substantial amount of provider or community level variation that is not attributable to random variation?

Without applying hierarchical statistical models to remove random noise, it is likely that hospitals will be identified as outliers as a result of patient variation and other factors beyond the hospital's control. Empirical evidence shows that this indicator is precise, with a raw provider level

⁹⁶Localio AR, Hamory BH, Fisher AC, et al. The public release of hospital and physician mortality data in Pennsylvania. A case study. *Med Care* 199;35(3):272-286.

mean of 5.1% and a standard deviation of 6.2%.⁹⁷

Relative to other indicators, a lower percentage of the variation occurs at the provider level, rather than the discharge level. The signal ratio (i.e., the proportion of the total variation across providers that is truly related to systematic differences in provider performance rather than random variation) is moderate, at 54.5%, indicating that some of the observed differences in provider performance likely do not represent true differences.

Minimal bias: Is there either little effect on the indicator of variations in patient disease severity and comorbidities, or is it possible to apply risk adjustment and statistical methods to remove most or all bias?

Based on studies using large databases, cardiac function, coronary disease severity, and the urgency of surgery appear to be powerful predictors of mortality.⁹⁸ Some of these risk factors are not available from administrative data.

Construct validity: Does the indicator perform well in identifying true (or actual) quality of care problems?

Numerous studies have reported an association between hospital volume and mortality after CABG surgery. However, experienced surgeons and surgical teams should be able to improve post-operative mortality by reducing aortic cross-clamp time, which has been repeatedly associated with post-operative mortality after adjusting for a variety of patient characteristics.⁹⁹ It is unknown how performance of these processes of care would affect hospital-level mortality rates.

Empirical evidence shows that CABG mortality is positively related to bilateral catheterization

and negatively related to laparoscopic cholecystectomy.¹⁰⁰

Fosters true quality improvement: Is the indicator insulated from perverse incentives for providers to improve their reported performance by avoiding difficult or complex cases, or by other responses that do not improve quality of care?

Public reporting of CABG mortality rates may cause providers to avoid high-risk patients. Sixty-three percent of cardiothoracic surgeons surveyed in Pennsylvania reported that they were "less willing" to operate on the most severely ill patients since mortality data were released.¹⁰¹ However, one study using Medicare data shows no evidence that cardiac surgeons in New York, which also reports CABG mortality rates, avoided high-risk patients.¹⁰² All in-hospital mortality measures may encourage earlier post-operative discharge, shifting deaths to skilled nursing facilities or outpatient settings and causing biased comparisons across hospitals with different mean lengths of stay.

Prior use: Has the measure been used effectively in practice? Does it have potential for working well with other indicators?

CABG mortality is publicly reported by California, New Jersey, New York, and Pennsylvania. Recent users of CABG mortality as a quality indicator include the University Hospital Consortium, the Joint Commission on Accreditation of Healthcare Organizations' (JCAHO's) IMSystem, Greater New York Hospital Association, the Maryland Hospital Association (as part of the Maryland QI Project) and HealthGrades.com.

⁹⁷Nationwide Inpatient Sample and State Databases. Healthcare Cost and Utilization Project. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/data/hcup/>

⁹⁸Higgins TL, Estafanous FG, Loop FD, et al. Stratification of morbidity and mortality outcome by preoperative risk factors in coronary artery bypass patients. A clinical severity score. JAMA 1992;267(17):2344-8.

⁹⁹Ottino G, Bergerone S, Di Leo M, et al. Aortocoronary bypass results: a discriminant multivariate analysis of risk factors of operative mortality. J Cardiovasc Surg (Torino) 1990;31(1):20-5.

¹⁰⁰Nationwide Inpatient Sample.

¹⁰¹Hannan EL, Siu AL, Kumar D, et al. Assessment of coronary artery bypass graft surgery performance in New York. Is there a bias against taking high-risk patients? Med Care 1997;35(1):49-56.

¹⁰²Peterson ED, DeLong ER, Jollis JG, et al. Public reporting of surgical mortality: a survey of new York State cardiothoracic surgeons. Ann Thorac Surg 1999;68(4):1195-200; discussion 12-1-2.