Should Risk Adjustment for Surgical Outcomes Reporting Include Sociodemographic Status? A Study of Coronary Artery Bypass Grafting in California

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BACKGROUND: Public reporting of surgical outcomes must adjust for patient risk. However, whether patient sociodemographic status (SDS) should be included is debatable. Our objective was to empirically compare risk-adjustment models and hospital ratings with or without SDS factors for patients undergoing coronary artery bypass grafting.

STUDY DESIGN: This is a retrospective analysis of the California Coronary Artery Bypass Grafting Outcomes Reporting Program, 2011–2012. Outcomes included 30-day or in-hospital mortality, perioperative stroke, and 30-day readmission. Sociodemographic status factors included race, language, insurance, ZIP code-based median income, and percent that were a college graduate. The c-statistic and goodness-of-fit were compared between models with and without SDS factors. Differences in hospital performance rating when adjusting for SDS were also compared.

RESULTS: None of the SDS factors predicted mortality. Income, education, and language had no impact on any outcomes. Insurance predicted stroke (MediCal vs private insurance, odds ratio [OR] = 1.91; 95% CI, 1.11–3.31; $p = 0.020$) and readmissions (Medicare vs private insurance, OR = 1.36; 95% CI, 1.16–1.61; $p < 0.001$; MediCal vs private insurance, OR = 1.56; 95% CI, 1.26–1.94; $p < 0.001$). Race also predicted stroke (Asian vs white, OR = 2.26; $p < 0.001$). Adding SDS factors improved the c-statistic in readmission only (0.652 vs 0.645; $p = 0.008$). Goodness-of-fit worsened when adding SDS factors to mortality models, but was no different in stroke or readmissions. Hospital performance rating only changed in readmissions; of 124 hospitals, only 1 hospital moved from "better" to "average" when adjusting for SDS.

CONCLUSIONS: Adjusting for insurance improves statistical models when analyzing readmissions after coronary artery bypass grafting, but does not impact hospital performance ratings substantially. Deciding whether SDS should be included in a patient's risk profile depends on valid measurements of SDS and requires a nuanced approach to assessing how these variables improve risk-adjusted models. (J Am Coll Surg 2016;223:221–230. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

It is widely agreed that reporting of surgical outcomes must adjust for patient risk. Through risk-adjusted analyses controlling for the risk of the patient populations they serve, performance of health care organizations can be compared more fairly. Most risk adjustment typically focuses on patient comorbidities or disease severity. However, including sociodemographic status (SDS) is debatable.

Socioeconomic status is broadly conceptualized as one's relative position within society. It has traditionally been measured based on income, education, and occupation.[1] These factors are often identified as contributing to health disparities.[2] Other individual sociodemographic factors related to socioeconomic status can include race and ethnicity, language, homelessness, insurance status, and literacy.

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Abbreviations and Acronyms

AOR	= adjusted odds ratio
CABG	= coronary artery bypass grafting
CCORP	= California Coronary Artery Bypass Grafting Outcomes Reporting Program
SDS	= sociodemographic status

Previously, the National Quality Forum prohibited inclusion of sociodemographic factors in risk adjustment, instead preferring to stratify for these factors. This was due to concern that, although quality of medical care has improved, disparities have not, and adjusting for SDS variables can mask health disparities. Adjusting for these factors assumes that these patients have an inherent increased risk of poor outcomes based on their SDS. Critics contend that adjusting for SDS factors will lead to codified acceptance of lesser standards for disadvantaged patients. Alternatively, proponents of including SDS in risk-adjustment analyses argue that adjusting for these factors is necessary to provide a clear assessment of comparative performance of hospitals, and that hospitals should not be responsible for community factors that affect patient outcomes.[1] This is particularly important for safety net hospitals.

This study aims to empirically compare risk-adjustment models and hospital ratings with and without SDS factors to determine whether including these factors improves statistical robustness of risk-adjusted models when examining outcomes after coronary artery bypass grafting (CABG) in California. We compare models that include SDS factors to models that do not for the following outcomes: 30-day mortality, postoperative stroke, and 30-day readmissions. We performed 3 separate analyses to evaluate the impact of risk adjusting for SDS factors: impact on the model's c-statistic, adequacy score of each variable, and difference in hospital ranking.

As we continue to debate how to best measure quality of surgical care—which has important implications for reimbursement—the question of how to risk adjust for fair hospital comparison becomes increasingly important. Deciding whether markers of SDS should be considered an inherent part of a patient's risk profile is an important decision that will have practical ramifications for how we judge and reimburse surgeons and hospitals.

METHODS

Data source

Data were obtained from the California Coronary Artery Bypass Grafting Outcomes Reporting Program (CCORP), which is managed by the California Office of Statewide Health Planning and Development. The CCORP mandates California hospitals to submit detailed clinical information on preoperative demographic characteristics, clinical conditions, and outcomes relevant to CABG surgery. The data-collection system, based on specifications from the Society of Thoracic Surgeons, includes a multi-step data cleaning process and annual onsite audit to ensure data accuracy. The CCORP data are used for annual public reporting of risk-adjusted outcomes, including 30-day mortality, postoperative stroke, and 30-day readmission by hospital and surgeon. The CCORP data-collection procedures and analysis methodology are described in detail elsewhere.[3]

Data analysis

During 2011 and 2012, one hundred and twenty-four hospitals submitted data including patient demographic characteristics, clinical characteristics, postoperative complications, and both inpatient and 30-day mortality. We selected all isolated CABG performed in 2011 and 2012 as the study population. Isolated CABG surgery was defined as CABG surgery performed without other major surgical procedures, such as valve repair or carotid endarterectomy, during the same operation. The following 5 variables were used as surrogate indicators for SDS: race, language spoken at home, insurance type, median household income, and percent college graduate. These were obtained through linking the CCORP database with additional databases.

To identify patients who died within 30 days of the operation, we linked to the California Death Registry. To identify readmissions and insurance type, we linked to the California Patient Discharge Data. We also linked the data to the US Census Bureau American Community Survey to obtain ZIP code-based median household income and percent college graduate.

Overall linkage to the Patient Discharge Data success rate was 99.5%. When linked to US Census Bureau American Community Survey by ZIP code, 7.8% of patients were missing household income and 8.7% of patients were missing educational information. All missing records were imputed with median values of household income and percent that were a college graduate when applying the risk model to assess hospital expected outcomes.

We developed 3 risk models using all patients without missing data for each of the following outcomes measures: mortality, postoperative stroke, and 30-day readmission. Mortality includes all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days; and deaths occurring after discharge from the hospital, but within 30 days of the procedure.