Commentary: The association of race with coronary artery bypass grafting mortality: A complex issue

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In this issue of the *Journal*, Benedetto and colleagues¹ report their exploration of the association of race with operative mortality after coronary artery bypass grafting (CABG). The study's strengths include a large data set of real-world patient encounters, pairwise comparisons between races, as well as risk-adjusted analyses in studies where the data were provided. Of the 28 studies included in the final analysis, 21 studies compared black patients (n = 222,892) and white patients (n = 3,884,043), 7 studies compared Hispanic patients (n = 91,256) and white patients (n = 1,458,524), and 9 studies compared Asian patients (n = 27,820) and white patients (n = 1,081,642). Benedetto and colleagues¹ show that black patients had worse outcomes after CABG than did white patients. There was a nonsignificant trend toward poorer outcomes in Asian patients and no difference in Hispanic patients. A subgroup analysis of South Asian patients also demonstrated a trend toward poorer outcomes. The findings comparing black and white patients were particularly robust, related to the large sample size, congruent findings in the unadjusted and adjusted analyses, and a significant increase in postoperative complications in black patients, consistent with an increased mortality. By means of metaregression, Benedetto and colleagues¹ found that mortality decreased significantly with time for both black and white patients, yet substantial differences in outcomes between groups persisted.

The study does, however, have some important limitations. The number of studies examining Asian patients, in particular East Asian patients, limits the power for analysis in this group, suggesting that further research is needed on this comparison. Although South Asians and East Asians share the same continent, they have different genetic backgrounds and also have cultural differences.² The included studies were predominantly from the United States, where private health insurance and different hospital referral patterns may produce outcome differences not applicable to

Venn diagram showing the biologic, cultural, and socioeconomic considerations.

Central Message

Meta-analysis of real-world data demonstrates higher in-hospital mortality in black patients than in white patients for coronary artery bypass grafting, equivalent in Hispanics, and unclear in Asians.

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single-payer health care systems. A study separate from the meta-analysis found that black patients in the United States were more likely to go to hospitals that had higher CABG-related mortalities.³ Unfortunately, only 2 out of 21 studies comparing black and white patients adjusted for any hospital effects. Although 13 studies adjusted for baseline differences, only a limited number of covariates were adjusted in most studies. Notably, only 10 studies comparing black and white patients adjusted for diabetes, which is more prevalent in the black population.

Although traditional mortality-adjusted models include mainly disease-related risk factors, the true cause for the variation in outcomes may be more complex as it relates to race. Observed differences may be related to cultural factors, socioeconomic status, and biologic causes. In the meta-analysis, only 7 studies adjusted for socioeconomic status. The median 2017 household incomes across the United States were \$81,331 for Asians, \$68,145 for whites, \$50,486 for Hispanics, and \$40,258 for blacks.⁴ A direct comparison of white versus black patients suggests that there is some correlation of outcomes with income; however, this association does not hold true for other races, suggesting that other factors should be considered. Furthermore, historical context is important. Centuries of discrimination in the United States may have resulted in a mistrust of authority.⁵ In addition, implicit bias towards

black and other minority patients by physicians may play a role in delayed care or lack of care, which potentially portend poorer outcomes.⁵ These factors are external to income yet still affect care.

Biologic differences between races may also play a role in differing CABG mortalities. Genome-wide association studies have identified genes associated with increased left ventricular hypertrophy (*RAI14*, *CD36*, and *NCAM1*), increased stroke (*NINJ2* and *CD36*), and higher blood pressure (*SLC24A4* and *CACNA1H*) in blacks, although none so far have been found for coronary artery disease or calcification.⁶⁻¹⁰ Studies show that the coronary arteries of Asian patients are smaller in diameter than those in white patients, resulting in more challenging surgery^{11,12} and the potential for increased postoperative major adverse cardiac events.¹³ Interestingly, however, Deb and colleagues¹⁴ compared retrospective observational data of South Asian patients against the general population in a propensity-matched study and identified a lower major adverse cardiovascular or cerebrovascular event rate among South Asian patients at a mean follow-up of 9.1 ± 3.9 years. Although the size of the native coronary arteries is important, studies also show that coronary calcification is most prevalent in white populations and lower in black, Hispanic, and Asian populations.¹⁵ In addition, there is some suggestion that atherosclerotic plaques in black patients are less likely to calcify than those in white patients,¹⁵ which may make them less likely to rupture.¹⁶

In summary, this analysis shows that there is a persistent association of poorer outcomes for black patients relative to white patients and suggests that there is much more work to be done to improve outcomes in this group of patients. In addition, future studies examining the long-term outcomes of surgery in Hispanics and Asians, a rapidly growing segment of the global population, would be informative.^{17,18} Nonetheless, this comprehensive meta-analysis is an insightful step forward to addressing outcomes related to racial disparity.

References

1. Benedetto U, Kamel MK, Khan FM, Angelini GD, Caputo M, Girardi LN, et al. Are racial differences in hospital mortality after coronary artery bypass graft surgery real? A risk adjusted meta-analysis. *J Thorac Cardiovasc Surg.* 2019;157:2216-25.e4.
2. Leow MK. Characterization of the Asian phenotype—an emerging paradigm with clinicopathological and human research implications. *Int J Med Sci.* 2017;14:639-47.
3. Khara R, Vaughan-Sarrazin M, Rosenthal GE, Girotra S. Racial disparities in outcomes after cardiac surgery: the role of hospital quality. *Curr Cardiol Rep.* 2015;17:29.
4. Fontenot K, Semega J, Kollar M. Income and poverty in the United States: 2017. Available at: <https://www.census.gov/content/dam/Census/library/publications/2018/demo/p60-263.pdf>.
5. Armstrong K, Ravenell KL, McMurphy S, Putt M. Racial/ethnic differences in physician distrust in the United States. *Am J Public Health.* 2007;97:1283-9.
6. Peprah E, Xu H, Tekola-Ayele F, Royal CD. Genome-wide association studies in Africans and African Americans: expanding the framework of the genomics of human traits and disease. *Public Health Genomics.* 2015;18:40-51.
7. Franceschini N, Hu Y, Reiner AP, Buyske S, Nalls M, Yanek LR, et al. Prospective associations of coronary heart disease loci in African Americans using the MetaboChip: the PAGE study. *PLoS One.* 2014;9:e113203.
8. Lettre G, Palmer CD, Young T, Ejebe KG, Allayee H, Benjamin EJ, et al. Genome-wide association study of coronary heart disease and its risk factors in 8,090 African Americans: the NHLBI CARE Project. *PLoS Genet.* 2011;7:e1001300.
9. Arnett DK, Meyers KJ, Devereux RB, Tiwari HK, Gu CC, Vaughan LK, et al. Genetic variation in NCAM1 contributes to left ventricular wall thickness in hypertensive families. *Circ Res.* 2011;108:279-83.
10. Wojczynski MK, Li M, Bielak LF, Kerr KF, Reiner AP, Wong ND, et al. Genetics of coronary artery calcification among African Americans, a meta-analysis. *BMC Med Genet.* 2013;14:75.
11. Dhawan J, Bray CL. Are Asian coronary arteries smaller than Caucasian? A study on angiographic coronary artery size estimation during life. *Int J Cardiol.* 1995;49:267-9.
12. Makaryus AN, Jauhar R, Torte LM, Pekmezaris R. Comparison of the diameters of the major epicardial coronary arteries by angiogram in Asian-Indians versus European Americans <40 years of age undergoing percutaneous coronary artery intervention. *Am J Cardiol.* 2017;120:924-6.
13. Ngaage DL, Hashmi I, Griffin S, Cowen ME, Cale AR, Guvendik L. To graft or not to graft? Do coronary artery characteristics influence early outcomes of coronary artery bypass surgery? Analysis of coronary anastomoses of 5171 patients. *J Thorac Cardiovasc Surg.* 2010;140:66-72. 72.e61.
14. Deb S, Tu JV, Austin PC, Ko DT, Rocha R, Mazer CD, et al. Impact of South Asian ethnicity on long-term outcomes after coronary artery bypass grafting surgery: a large population-based propensity matched study. *J Am Heart Assoc.* 2016;5(7).
15. Bild DE, Detrano R, Peterson D, Guerci A, Liu K, Shahar E, et al. Ethnic differences in coronary calcification: the Multi-Ethnic Study of Atherosclerosis (MESA). *Circulation.* 2005;111:1313-20.
16. Motoyama S, Kondo T, Sarai M, Sugiura A, Harigaya H, Sato T, et al. Multislice computed tomographic characteristics of coronary lesions in acute coronary syndromes. *J Am Coll Cardiol.* 2007;50:319-26.
17. Trends Child. Fertility and birth rates. Available at: <https://www.childtrends.org/indicators/fertility-and-birth-rates>.
18. United States Census Bureau. 2017 National Population Projections Tables. Available at: <https://www.census.gov/data/tables/2017/demo/popproj/2017-summary-tables.html>.