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Racial Disparities in Outcomes After Cardiac Surgery: the Role of Hospital Quality

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Abstract

Patients from racial and ethnic minorities experience higher mortality after cardiac surgery compared to white patients, both during the early postoperative phase as well as long term. A number of factors likely explain poor outcomes in black and minority patients, which include differences in biology, comorbid health conditions, socioeconomic background, and quality of hospital care. Recent evidence suggests that a major factor underlying excess mortality in these groups is due to their over-representation in low-quality hospitals, where all patients regardless of

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Compliance with Ethics Guidelines

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race have worse outcomes. In this review, we examine the factors underlying racial disparities in outcomes after cardiac surgery, with a primary focus on the role of hospital quality.

Keywords

Racial disparity; Health disparities; Coronary artery bypass grafting; CABG; Hospital quality; Hospital outcomes; Quality improvement

Introduction

Over 400,000 cardiac surgeries are performed each year in the USA [1]. Pioneered more than 50 years ago, cardiac surgery, which includes coronary artery bypass graft (CABG) surgery and valve surgery, has been the cornerstone of treatment of ischemic and valvular heart disease [2]. Despite the decline in surgical volumes in recent years [3], cardiac surgery remains one of the most common operating room procedures in the USA [4].

Reducing mortality after cardiac surgery has been a major focus of regional as well as national quality improvement programs over the past two decades [5]. Refinement in operative techniques, greater use of arterial conduits, emphasis on pharmacotherapy at the time of discharge as well as the widespread participation in the Society of Thoracic Surgeons national quality improvement registry have led to more than 50 % reduction in cardiac surgical mortality—from 3.9 % in 1990 to 1.9 % in 2009 [6, 7]. Although significant progress in improving cardiac surgical outcomes has been achieved, racial and ethnic differences in outcomes following cardiac surgery have persisted [8, 9•]. Factors underlying racial differences in cardiac surgical outcomes may include biology and genetics, higher prevalence of comorbidities, socioeconomic and environmental factors, quality of care, and the complex interrelationship of these factors [10, 11]. Recent studies have shown that poor outcomes in blacks are in large part due to over-representation of black and minority patients in lower-quality hospitals. In this article, we review existing evidence regarding factors underlying racial disparities in outcomes of cardiac surgery, with a primary focus on the role of hospital quality. Given the relative paucity of literature on disparities in other ethnic groups (e.g., Hispanics), we will primarily focus this article on disparities between black and white patients.

Overview of Racial Disparities in Outcomes After Cardiac Surgery

A number of studies have showed that mortality and morbidity after cardiac surgery is significantly higher in black patients compared to white patients [12, 13]. In patients undergoing CABG, risk of early mortality is 1.5 times higher in blacks, and this difference in mortality is further magnified over long term [8, 9•] In a recent paper that used Medicare data 2007–2008, Rangrass et al. [14••] found that the risk of 30-day mortality after CABG in black Medicare beneficiaries was 35 % higher compared to whites. In another study of >30,000 patients from the Veterans Administration, Rumsfeld et al. [15] found that black race was associated with higher mortality (OR 1.52, 95 % CI 1.10 to 2.11, p=0.01) in patients with low surgical risk. This was due to a higher incidence of postoperative complications in black patients [15]. Furthermore, racial differences in clinical outcomes

following cardiac surgery also persist long term. Using Medicare data, Konety et al. [9•] found that the risk of 3-month and 1-year mortality in black patients was 11 and 25 % higher compared to white patients. Differences in mortality difference were further magnified at 5 years, when risk-adjusted mortality in black patients was nearly twice that among white patients [16]. Similar differences in outcomes by race have also been reported in valve surgery and cardiac transplantation [17].

Proposed Mechanisms of Racial Differences in Outcomes

Although a number of studies have described racial differences in surgical outcomes, fewer studies have explained the mechanism of survival differences by race. The relationship between race and outcomes is likely to be multifaceted and includes biological and genetic differences, health status and comorbidities, and differences in social and physical environments (Fig. 1). However, a growing body of literature suggests that over-representation of black and minority patients at lower-quality hospitals may be a significant driver of racial differences in outcomes.

Biologic and Genetic Factors

Genetic differences between whites, blacks, and other ethnic minorities may be associated with 1) accelerated atherosclerotic disease progression in the African-American and Mexican-American populations [18–20], 2) differential pharmacological response to preventive therapy [18, 21, 22], and 3) vascular receptor profile differences which may be of particular importance in graft stability in post-bypass surgical patient [23]. However, genetic differences by race explain only a small proportion of the variation in cardiac surgical outcomes [24, 25]. Moreover, overemphasis on genetic differences between blacks and whites may detract from the importance of inequalities in care that account for a substantial proportion of racial differences in surgical outcomes [26, 27].

Health Status and Comorbidities

In a previous study of patients undergoing cardiac surgery, black patients were found to have a higher prevalence of diabetes (40 vs. 29 %), heart failure (26 vs. 18 %), and chronic renal disease (18 vs. 10 %), compared to white patients suggesting that patient-level differences in comorbidities may explain survival differences between blacks and whites [14••]. Although most studies have adjusted for patient-level differences, confounding by unmeasured disease severity cannot be entirely excluded. However, given that comorbidities account for <5 % of racial differences in survival [14••], it appears unlikely that racial differences in survival are entirely explained by unmeasured disease severity and comorbidities.

Socioeconomic and Cultural Factors

Socioeconomic status is an important determinant of overall health and can impact health outcomes in a number of important ways. It is a measure of financial well-being as well as overall educational status. On a direct level, it influences the ability to afford high-quality healthcare. Indirectly, socioeconomic status also influences behavior towards risk factors (e.g., smoking), seeking medical treatment, as well as periprocedural care [28, 29].

It is well known that African-American and Hispanic patients are more likely to be uninsured or underinsured [30], have less education, and lower income [31, 32]. In a study examining Medicare beneficiaries ≥65 years, Popescu et al. [33] demonstrated lower access to highly ranked hospitals among socially disadvantaged and ethnic minorities. Sociocultural differences and racial sensitization also affects rapport and trust between patients and physicians [34]. Black and white patient populations perceive health issues differently and have differing knowledge, attitude, beliefs, and practices [35]. This may contribute to the lower frequency of accepting medical advice, including recommendations for peri- or post-surgical care, which may contribute to outcome differences [36, 37].

The Role of Hospital and Provider Quality

A number of studies have demonstrated that poor outcomes in racial and ethnic minorities may be largely due to the fact that blacks and other minority patients disproportionately seek care at poor-quality hospitals, which consistently underperform on several key measures of hospital quality. In the Rangrass study [14••], differences in the admitting hospital accounted for 34 % of the outcome differences between black and white patients and 54 % of the differences in outcomes between Hispanic and white patients. Socioeconomic status further explained more than 30 % of the disparities in clinical outcomes. In contrast, patient-level risk factors explained only 3 % of the mortality difference between black and white patients. Nevertheless, a significant proportion of the difference in outcomes remained unexplained, suggesting that other factors may be playing an important role (Fig. 2). In another study of Medicare beneficiaries, black patients undergoing several key cardiac surgical procedures (including CABG, aortic valve replacement, and aortic aneurysm repair) had a 20 % higher mortality compared to white patients, most of which was attributable to lower hospital quality [38]. Notably, the hospitals that disproportionately serve black and minority patients have lower surgical volumes and excess surgical mortality regardless of the patient's race [39, 40]. In the Rangrass study [14••], hospitals with >18 % nonwhite CABG patients had 30 % excess CABG mortality in nonwhite patients and a 19 % higher CABG mortality in white patients, when compared to hospitals with <2 % nonwhite patients. These data suggest that worse outcomes in black and minority patients may be largely due to the fact that they predominantly seek care in poor-quality hospitals.

Konety et al. [9•] studied a cohort 591,139 black and white patients, 65 years and older, who underwent CABG between 1997 and 2000 at 1091 hospitals. After adjustment of patient characteristics, CABG mortality was 8, 11, and 25 % higher in black patients at 30 days, 90 days, and 1 year, respectively, compared to whites. Black patients were more likely to undergo CABG at hospitals with lower CABG volume and higher in-hospital mortality. After adjustment for hospital-level effects, differences in 30-day and 90-day outcomes between black and white patients disappeared. However, 1-year mortality remained significantly higher in black patients.

So why do black patients preferentially seek care at poor-quality hospitals? Although empirical data are limited, a number of factors may influence patients' choice of specific hospitals and physicians.

Before the 1960s, segregation of health care by race was legal, and some states had separate hospitals for black and white patients as well as separate systems for training black physicians [41]. Although these practices are no longer sanctioned, old patient referral patterns may prevail, effectively limiting access to high-quality hospitals for blacks. Prior research suggests that residential segregation is an important factor in racial health disparities and may create differential access to high-quality hospitals. In a study using the Medicare database for the years 2000–2005, Vaughan-Sarrazin et al. [42•] examined the impact of racial heterogeneity at a community and hospital level on access to high-quality hospitals. They found that the likelihood of admission to a high-mortality hospital for treatment of acute myocardial infarction (AMI) was 35 % higher for blacks than that for whites in areas with high residential segregation, i.e., neighborhoods with an unevenly distributed large black population, but not significantly different in areas with low segregation, i.e., where the proportion of black and white patients were closer to the average and were distributed evenly across neighborhoods. These data might suggest that poor-quality hospitals are located in areas with high residential segregation and therefore more likely to be accessed by black patients. While that may be partly true, other studies have shown that even when black patients live in close proximity to a high-quality hospital, they are more likely to bypass such a hospital in preference for a higher mortality hospital that may be at a farther distance [43]. Dimick et al. [44••] found similar results for patients undergoing CABG. While black patients were twice as likely to reside within 5 miles of a high-quality hospital (45 vs. 26 %), they were 25 % more likely than whites to receive care at a high-mortality, low-quality hospital, which was located further away from a high-quality hospital. For areas with high residential segregation blacks were 48 % more likely than whites to undergo CABG at low-quality hospitals. This may reflect differences in referral patterns for different racial groups. Culture and patient preferences may also intensify choice of hospitals, especially in segregated areas. It is likely that cultural concordance is an important factor for black patients and may play an important role in determining choice of hospitals [45, 46].

Second, physician referral patterns may also impact hospital and physician selection. Black patients are more likely to be treated by black physicians [47, 48] who, in turn, are more likely to practice in hospitals with a tradition of caring for black patients [49, 50]. Whether this pattern is by choice or due to limited access is unclear. The primary care physician treating black patients also report difficulties in referring patient to high-quality specialist providers and secure non-emergent patient admissions [50]. Black patients also are more likely to undergo cardiac surgery by surgeons with poorer reported outcomes or risk-adjusted operative mortality [51, 52]. Black patients are also likely to receive poorer periprocedural care, with 80 % of black patients receiving their primary care from approximately one fourth of the physicians, who were also more likely to be less qualified and had lower access to necessary technology [50].

Finally, hospitals that predominantly serve black and minority appear to be resource poor and therefore limited in engaging quality improvement efforts. For example, Jha et al. [53] demonstrated that hospitals caring for the majority of black patients had higher AMI mortality and significantly lower nursing to patient ratios compared to other hospitals. Popescu et al. [43] demonstrated that black Medicare enrollees are more likely to be

admitted to safety net hospitals, which typically serve large numbers of uninsured or underinsured patients. Lack of resources may compromise a hospitals' ability to engage in quality improvement efforts.

Reducing Disparities in Outcomes

Three decades of research have consistently demonstrated racial differences in cardiac surgery outcomes, but dedicated investigations into amelioration of these disparities have been lacking [54–57]. Consequently, these disparities have persisted over time [58, 14••]. The task of improving disparities in outcomes is an uphill but important one. Reducing racial disparities will require a multifaceted approach. In order to ensure that clinical outcomes are not dependent on the color of one's skin, we need to ensure that all patients have access to the same high-quality care and that healthcare is consistent and standardized across hospitals.

First, efforts at eliminating poverty, improving literacy, and improving employment opportunities, with goal of broad social upliftment of disadvantaged social minorities, need to be at the heart of this change [54]. Second, it is essential to ensure that interaction of patients with the healthcare system is easy and seamless that removes barriers from accessing high-quality care. Culturally sensitive and locally appropriate community level interventions like the use of care navigators/coordinators are promising [59]. Efforts at improving earlier detection before disease becomes advanced, improvement in perioperative care with focus on managing risk factors and comorbidities, and avoiding complications could also have a significant impact on outcomes in this group [60]. Improvement in patient-provider communication and close provider follow-up could also help improve issues related to provider mistrust [34].

Concentrating quality improvement efforts at hospitals where a majority of racial minorities seek care could have a major impact on reducing racial disparities in healthcare especially given the concentration of black and minority patients at relatively fewer hospitals. This would require a concerted effort at understanding the specific organizational (e.g., surgeons, physicians, nurses), cultural (e.g., problem solving, innovation), and leadership (e.g., senior management) issues that may be related to poor performance at such hospitals. Developing a better understanding of the specific issues faced by such hospitals would be the key to designing targeted quality improvement programs at such hospitals. In the 1990s, the Northern New England Cardiovascular Disease Study Group used a combination of data feedback, continuous quality improvement, and cross-visit by surgeons, anesthesiologists, and nurses within a consortium of hospitals which led to a dramatic 20 % improvement in CABG mortality [61]. Similar exchange between high-mortality hospitals that disproportionately serve racial and ethnic minorities with nearby lower-mortality hospitals could stimulate quality improvement through an observation of their processes. In a recently study, Siegel et al. [62] describe a consortium of 10 high-volume hospitals serving a largely minority populations which underwent a systematic process of quality improvement, consisting of evidence-based order sets for AMI care, training and implementation of interdisciplinary care teams for overseeing patient outcomes, regular reporting and quarterly internal assessment of hospital quality measures, and external regulatory group performing

intermittent site visits. In 2 years, between 2005 and 2007, these measures were associated with significant improvement in compliance with evidence-based AMI care among racial minorities in 7 out of 10 hospitals and the complete elimination of racial differences in three.

It is important to note that the provision of hospital care to ethnic minorities in the USA is highly concentrated, meaning that large gains in racial disparities may be made by targeting improvements to a relatively small number of hospitals. Jha et al. [53] demonstrated that more than 40 % of elderly black Medicare beneficiaries hospitalized during 2004 were concentrated in just 5 % of the nearly 4500 hospitals in the USA. The Centers for Medicare and Medicaid services (CMS) recently initiated hospital incentives for good outcomes under the pay-for-performance (P4P) program [63, 64]. Although some improvement has been noted in outpatient care for Blacks and Hispanics [65], it is unclear if the implementation of P4P has led to improvement in overall measures of hospital quality and a reduction in racial disparities, for which further research is warranted [66].

Another avenue for quality improvement in surgical care for minorities would include selective regionalization of high-risk procedures, like cardiac surgery, which could improve patient outcomes by ensuring that patients undergo cardiac surgery by high-volume surgeons at high-volume centers [67, 68]. However, such an approach could have unintended consequences by worsening geographic access and choice [69], and therefore more empirical data are needed.

Health Policy

Key health policy reforms have been undertaken by several states to improve the quality of health services available to the socially disadvantaged classes [70]. First, several states, like Alabama, Texas, and New York, have implemented loan repayment schemes for medical professionals providing services in medically underserved areas in order to improve the doctor-to-patient ratios in these communities. Second, scholarship programs have been established to bolster the training of physicians from socially disadvantaged backgrounds in order to generate a workforce adept at dealing with challenges unique to these communities. Third, several programs have been initiated for the sensitization of the medical community regarding racial differences in healthcare practices and cultural competency. These initiatives are promising but the actual impact of these measures on reducing healthcare disparities remains to be studied.

Conclusion

Although significant improvement in cardiac surgical outcomes has occurred in recent years, racial disparities in outcomes have largely remained unchanged. A major determinant of higher mortality in blacks and ethnic minorities undergoing cardiac surgery is their over-representation at low-quality hospitals. Concentrating quality improvement efforts at hospitals that disproportionately serve racial and ethnic minorities could go a long way in reducing racial disparities in cardiac surgical outcomes.

Abbreviations

CABG	Coronary artery bypass graft
AMI	Acute myocardial infarction
CMS	Centers for Medicare & Medicaid Services
P4P	Pay-for-performance

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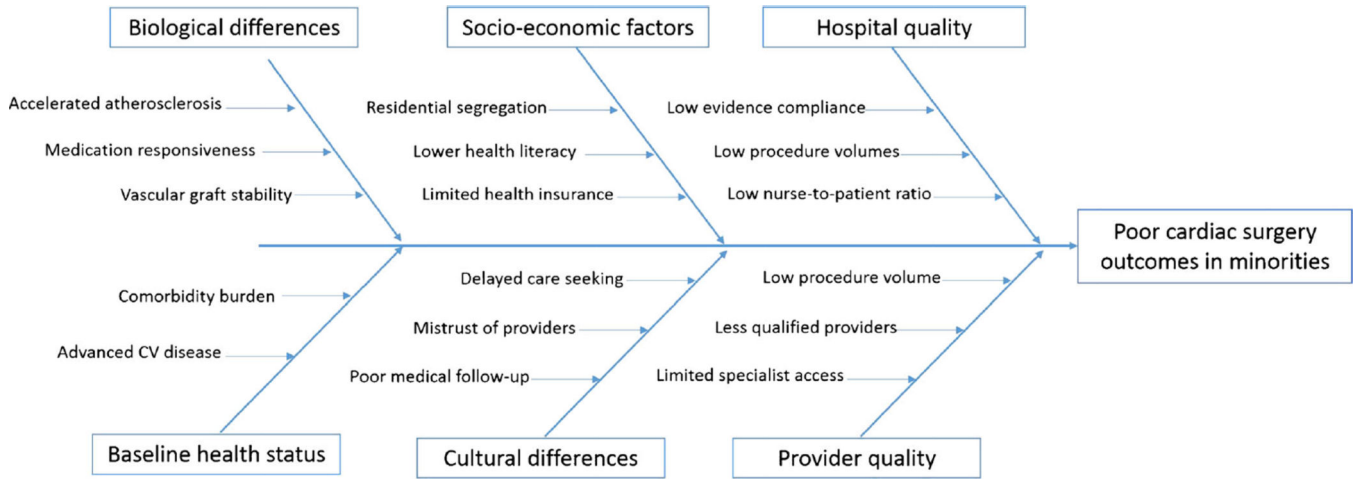

Fig. 1.

Root cause analysis of higher mortality in black and other minority patients after cardiac surgery

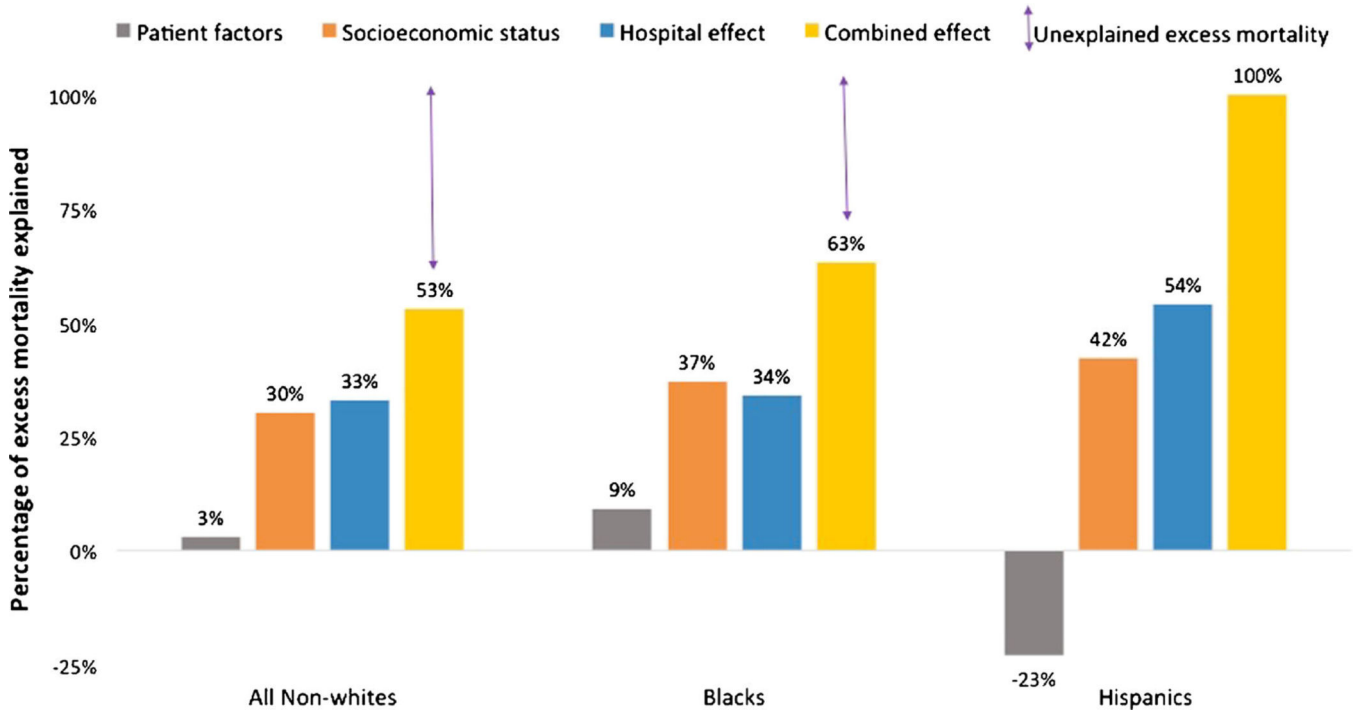

Fig. 2.

Relative contribution of patient factors, socioeconomic status, and hospital effect in excess 30-day mortality after coronary artery bypass grafting in Black and Hispanic Medicare beneficiaries. *Bars* represent the proportion of excess mortality that was explained after adjustment for the specified covariate (Representation of numerical data derived from study by Rangrass et al. [14••])