Editorial

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The economic cost of racial disparities in patients undergoing cardiac valve repair or replacement

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Historically marginalized populations – including Black and Latino patients, and those of lower socioeconomic status (SES) – are well-known to have poorer cardiovascular outcomes than their majority counterparts [1,2,3,4]. The issue of healthcare equity gained mainstream attention after the release of Unequal Treatment, a seminal Institute of Medicine report that demonstrated these disparities [5]. Healthcare disparities according to race and ethnicity have since been extensively detailed, and have been shown to persist after controlling for SES and comorbidities [5,6]. These differences are attributed in part to the sequelae of structural racism, which refers to 'totality of ways in which societies foster racial discrimination through mutually reinforcing systems of housing, education, employment, earnings, benefits, credit, media, healthcare and criminal justice' [6,7]. Furthermore, these patterns of reinforcement contribute to the higher morbidity and mortality and overall worse clinical outcomes in this population.

Valvular heart disease in the USA, in the past mainly a consequence of complicated rheumatic fever, is now largely a degenerative disease associated with old age, and costs over US$23 billion per year to manage [8]. As the number of people aged 80 and over continues to increase – from 7 million to as many as 25 million from 1990 to 2050 – so too will the human and financial burden of degenerative valve disease [9]. Within valvular heart disease, healthcare costs differ between White and non-white patients. Specifically, non-white patients tend to have worse cardiovascular outcomes, and these outcomes are also associated with greater healthcare costs [1,2].

In this paper, we evaluate the financial cost of racial disparities as they relate to treatment for valvular heart disease in the USA. Using 'back of the envelope' calculations, we estimate the monetary cost of disparities in outcomes of non-white patients undergoing surgical valve replacement and repair. We further estimate the cost of disproportionately low access to emerging therapies such as percutaneous and minimally-invasive valve repairs, which have been shown to eventually produce cost savings relative to traditional surgery.

Length of stay following cardiac valve surgery

Patients of low SES are at increased risk of prolonged hospitalization following cardiac valve surgery. Taylor *et al.* show that compared with White patients, Black patients were more likely to have a postoperative length of stay (LOS) greater than 14 days, as well as longer overall hospital LOS following aortic or mitral valve surgery [10]. Similarly, Vassileva showed that non-white patients undergoing valve replacement surgery had longer median LOS and were more likely to have LOS beyond 12 days [11]. Reasons for this include increased risk of postoperative complications, including prolonged ventilation, bleeding requiring reoperation and postoperative renal failure [10].

According to Taylor, median LOS following aortic valve surgery is 7.4 days for whites and 11.6 days for non-white; for mitral valve surgery, white versus non-white patients' LOS is 13.2 versus 16.7 days, respectively [10]. Elsewhere, average hospital daily costs following cardiac valve surgery are reported to be approximately US$5750, per day [12]. Using these data, we estimate that the average cost of disparities in LOS is US$24,150 (US$5750/day × 4.2 days) per non-white patient for aortic valve replacements and US$20,125 (US$5750/day × 3.5 days) for mitral valve replacements. Given that over 100,000 aortic valve replacements (AVR) and mitral valve replacements (MVR) are performed annually, and that between 4 and 9% of valve surgery patients are non-white, the excess cost associated with increased LOS among non-white patients likely represents a significant health expenditure nationally [9].

Readmissions following cardiac valve surgery

Postoperative hospital readmissions are costly and associated with increased morbidity and mortality [13,14]). non-white patients are at increased risk of postoperative readmission after cardiac valve surgery [3,10,14]. McNeely and colleagues (2018) found that, compared with White patients, Black patients have higher 30-day readmission and 6-month readmission rates following surgical aortic valve replacement (SAVR) (30-day: 25.1% of Black patients compared with 20.1% of White patients; 6-month: 44.1% of Black patients, 34.8% White patients) which persisted after controlling for comorbidities, including congestive heart failure, chronic obstructive pulmonary disease and chronic kidney disease [15]. Moreover, following mitral valve replacement, patients who are covered under Medicaid are significantly more likely to be readmitted than patients with private insurance [13]. It is extensively documented that non-white patients are more commonly covered under Medicaid suggesting that non-white patients may also be more likely to be readmitted following MVR [14,15].

The mean cost of a single readmission following valve surgery was approximately US$15,400, which ultimately accounted for almost 20% of a given patient's care [13]. Given this figure, using data from McNeely (2018) for 30-day readmissions (White readmission rate = 20.1%; Black readmission rate = 25.2%, giving a risk difference of 5.1%), we estimate the cost of disparities in readmission is at least US$770 more per Black patient following cardiac valve surgery (US$15,400/readmission × 0.05 [readmission rate risk difference of 5%]) [15].

Decreased access to minimally-invasive therapies

Non-white patients and patients of low SES remain an under-represented population in newer, minimally-invasive cardiac procedures such as transcatheter aortic valve intervention (TAVI) or transcatheter mitral valve replacement, despite similar outcomes after these procedures [16,17,18]. Alkhouli *et al.* (2019) found that Black and Latino patients had similar 30-day and 1-year outcomes following TAVI [19]. Furthermore, data from Baron (2019) suggest that TAVI is a more cost-effective alternative to surgical aortic valve replacement in intermediate-risk surgical patients with severe aortic stenosis [12]. This is despite the significantly higher cost of the TAVI prosthesis compared with the SAVR prosthesis (US$32,000 vs US$5,000). The benefit lies largely in nonprocedural costs associated with patient care, primarily shorter postprocedural hospital LOS [12,20].

Non-white patients less likely to undergo TAVI than are white patients, and there is some evidence that they are less likely to be referred to a cardiologist for both surgical and minimally-invasive valve repair or replacement [17–19]. Black and Latino patients, even after referral to cardiac surgery and interventional cardiology are less likely to undergo valve replacement – both surgical and transcatheter – at all [19,21,22]. However, white and non-white patients overall have similar outcomes after TAVI in early and late mortality [19,22]. Indeed, non-white patients have excellent short-term outcomes following TAVI, comparable with white patients, especially with respect to inpatient morbidity and mortality, a finding which persists at 1-year [19]. By contrast, among patients undergoing SAVR, poorer outcomes persist for non-white patients [10].

Both Black and Latino patients represent approximately 9% of the US population greater than 65 years old, but account for less than 4% of patients undergoing TAVI, based on 2010 US census data. This disparity persists despite a consistent increase in number of TAVR centers in the US, from 141 centers in 2012 to 445 in 2016 [9]. Baron (2019) found that TAVI versus SAVR saved on average US$23,000 per patient – using this data, estimate the cost of disparities in non-white patients undergoing TAVI to be approximately US$120,000 per 100 patients.

Limitations & future directions

This study has several limitations. For instance, our analyses do not account for readmissions that occur to nonindex hospitals. The readmission rate in cardiac surgery patients is known to be as high as 20%, and is associated with excessive mortality [23,24]. Over 25% of the cardiac surgery readmissions in a retrospective study by Goel (2019)

were to nonindex hospitals. The majority of patients who present to nonindex hospitals tend to have Medicaid, be of low SES and are overwhelmingly non-white [25]. Admissions to nonindex hospitals and thus fragmentation of care is costlier and associated with significantly higher morbidity and mortality, even more so than readmission itself [25,26,27,28]. However, this has not been directly studied as it relates to racial disparities in valve surgery. We estimate that this represents a substantial healthcare expenditure in need of further study.

In addition, non-white patients are under-represented in both open and percutaneous cardiac interventions and research. This may partially be a result of historically worse cardiovascular outcomes in non-white patient populations [22]. For instance, Black patients are less likely to participate in clinical trials and emerging treatments are; therefore, relatively untested in this population. Notably, the PARTNER 3 trial enrolled extremely low numbers of Black patients [29,30]. Ensuring a more comprehensive representation of different racial groups in the in clinical trials on novel therapies will be likely essential in identifying and resolving healthcare disparities and reducing the associated financial costs.

Conclusion

This paper quantifies the economic cost of disparities in outcomes following surgical valve repair and replacement, as well as the cost of disproportionately decreased access to newer, less-invasive interventions. Based on the results of this review, the financial burden of racial disparities in cardiac valve surgery remains high, with LOS after traditional surgery accounting for the greatest area of potential cost savings, followed by access to emerging therapies such as TAVI. Given that TAVI now represent the majority of aortic valve replacements done in the US, we expect that the cost of these disparities will only rise as TAVI, and other heart valve interventions (such as transcatheter mitral valve replacement), become more prevalent. With an aging population, the incidence of valvular disorders such as severe aortic stenosis requiring surgical intervention will continue to increase. Safe and cost-efficient strategies for management of these patients will thus be ever more critical.

Author contributions

N Govea wrote and edited the manuscript and performed the cost calculations. R Jotwani edited the manuscript and performed the cost calculations. C Bonaparte reviewed the manuscript. A-G Komlan reviewed the manuscript. RS White reviewed and edited the manuscript. M Hoyler reviewed and edited the manuscript.

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