Racial Disparities in Abdominal Aortic Aneurysm Repair Among Male Medicare Beneficiaries

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Hypothesis: Although investigators have reported that abdominal aortic aneurysm (AAA) repair is performed less frequently in black subjects than in white subjects, these findings may be explained by a lower prevalence of AAA disease among black subjects. We examine this assumption by determining the relative rate (RR) of elective AAA repair in black men vs white men after accounting for differences in disease prevalence.

Design: We used Medicare data from January 2001 to December 2003 to identify men 65 years and older undergoing elective or urgent AAA repair. We calculated the age-adjusted RR of repair in black men vs white men. We then used findings from the Aneurysm Detection and Management Veterans Affairs Cooperative Study to determine the ratio of screen-detected AAA prevalence among black men vs white men. Finally, we calculated prevalence-adjusted RRs of repair.

Setting: Medicare data study.

Participants: Men 65 years and older undergoing elective or urgent AAA repair.

Main Outcome Measure: Prevalence-adjusted RR of AAA repair in black men vs white men.

Results: The annual rate of elective AAA repair in black men was less than one-third that in white men (42.5 vs 147.8 per 100,000; RR, 0.29; 95% confidence interval [CI], 0.27-0.31). The disparity in urgent AAA repair was smaller, with black men undergoing repair at roughly half the rate of white men (26.1 vs 50.5 per 100,000; RR, 0.52; 95% CI, 0.48-0.56). The screen-detected disease prevalence of AAA among black men was less than half that among white men. Adjusting for this difference in prevalence diminished but did not erase the disparity in elective AAA repair (RR, 0.73; 95% CI, 0.68-0.77) and suggested that black men face a higher rate of urgent AAA repair (RR, 1.30; 95% CI, 1.21-1.41).

Conclusions: Black men undergo elective AAA repair at a lower rate than white men even after accounting for their decreased disease burden. However, the prevalence-adjusted rate of urgent repair is higher among black men. Whether the lower frequency of elective procedures is responsible for the higher frequency of urgent procedures warrants further investigation.


Racial variations in health care do not always reflect racial discrimination. They may reflect racial disparities in socioeconomic status and in the ability to pay. They may also reflect disparate practice norms of providers (ie, individuals and groups that offer clinic-based care) and hospitals in geographic locales with differing racial compositions. They may be the result of educational and cultural differences that cause black subjects to make different health care choices than white subjects. Finally, they may reflect differences in biologic function and disease prevalence that call for racially disparate care.

Treatment of abdominal aortic aneurysm (AAA) serves as an example. Although a substantial racial disparity has been documented in the rate of AAA repair, black subjects are also known to have a lower prevalence of AAA disease. Therefore, the disparity in treatment is seen as reflecting the underlying disparity in disease burden. In this study, we examine this assumption. In particular, we determine the ratio of AAA disease prevalence among black men vs white men using data from ultrasound screening and then calculate the relative rate (RR) of AAA repair in black men vs white men after adjusting for the difference in prevalence.
METHODS

RATE OF AAA REPAIR

Using the Medicare Provider Analysis and Review claims data file, we identified all AAA repairs performed in male Medicare beneficiaries 65 years and older from January 2001 to December 2003. The following 2 criteria had to be met for a patient record to be identified as an AAA repair: (1) an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic code for atherosclerotic disease (AAA, ruptured or nonruptured) and (2) an ICD-9-CM procedure code for AAA repair (conventional repair or endovascular repair). Race was dichotomized into black and nonblack, labeling nonblack as white as other investigators have done in the largely white Medicare population. An AAA repair was defined as elective if the patient had an elective code for admission status and a diagnosis code indicating elective AAA repair. A case was defined as urgent if the patient had an urgent or emergent admission code or if the patient had a diagnostic or procedure code indicating a ruptured aneurysm repair.

The rate of AAA repair was calculated using the Medicare beneficiary denominator file population to determine the total number of black and white male beneficiaries during the study period. Rates were annualized (ie, averaged) during the 3 years of the study period and were stratified by race and admission status (elective vs urgent). All rates were age adjusted using the standard population.

AAA PREVALENCE AMONG BLACK MEN VS WHITE MEN

To estimate the underlying disease burden in black subjects vs white subjects, we sought population-based data from AAA ultrasound screening studies. One of the largest, and the only study stratified by race, was the Aneurysm Detection and Management (ADAM) Veterans Affairs Cooperative Study, which included approximately 60,000 white men and 6000 black men. We obtained data on the counts of AAAs from the principal investigator regarding aneurysms greater than 4 cm in diameter stratified by patients’ smoking status and race. We established the prevalence among white men and black men stratified by smoking status (never vs ever smoked) [self-reported smoking of >100 cigarettes in one’s lifetime).

To apply these prevalence data to our procedure data, we needed to accommodate for the best available estimates of smoking status in the Medicare population. We used the 2001 Behavioral Risk Factor Surveillance Survey to calculate the proportion of men 65 years and older who had ever smoked, stratified by race. We then calculated the race-specific prevalence of AAA disease after adjusting for the small difference in prevalence of having ever smoked among black subjects vs white subjects. Finally, we determined the prevalence ratio, with white subjects as the reference group. This method is shown in Figure 1.

STATISTICAL ANALYSIS

We first calculated the age-adjusted RR of AAA repair in black subjects vs white subjects without any prevalence adjustment. The RRs of AAA repair were calculated separately for elective and urgent procedures. The confidence intervals (CIs) for these rate ratios are based on the counts of procedures and the denominator population. We then calculated prevalence-adjusted RRs by dividing the age-adjusted RR by the prevalence ratio estimated from the ADAM Veterans Affairs Cooperative Study. All statistical analyses were performed using a commercially available software package (STATA 8.2; StataCorp LP, College Station, Texas).

RESULTS

From January 2001 to December 2003, approximately 17,000 elective AAA repairs and 6000 urgent AAA repairs were performed annually among the male Medicare population. The annual age-adjusted rate of elective AAA repair in black men was 42.5 per 100,000; in white men, the annual age-adjusted rate of elective AAA repair was 147.8 per 100,000. Therefore, the RR of elective repair in black subjects vs white subjects was 0.29 (95% CI, 0.27–0.31). For urgent repair, the racial disparity was somewhat smaller, 26.1 per 100,000 in black men vs 50.5 per 100,000 in white men (RR, 0.52; 95% CI, 0.48–0.56).

As shown in Figure 1, the underlying burden of AAA disease detected by ultrasound screening is considerably less in black men than in white men. Although smoking is a powerful risk factor for having an AAA disease, the effect of race is not modified by smoking (the prevalence ratios among black men vs white men were 0.42 among smokers and 0.38 among nonsmokers). Accommodating for the slight difference in smoking history produced our best estimate of a 0.40 AAA prevalence ratio among black subjects vs white subjects.

The Table gives the RR of AAA repair before and after adjusting for this underlying difference in AAA disease prevalence. For elective repair, the prevalence adjustment diminished but did not erase the racial disparity in the rate of repair (RR, 0.29 before adjustment; and RR, 0.73 after adjustment). For urgent repair, the prevalence...
We examined the effect of prevalence adjustment on the observed racial disparity in AAA repair and found that the lower rate of elective AAA repair among black men cannot be entirely explained by their lower prevalence of disease. At the same time, we found that prevalence adjustment suggested that black men require more urgent surgery than white men.

Although racial disparity in the rate of AAA repair has been documented previously in the Medicare population, this analysis is the first report (to our knowledge) of the role that AAA disease prevalence may play in that disparity. Unfortunately, one cannot use Medicare data to determine what difference in AAA disease prevalence may exist between black subjects and white subjects, and only a screening study could provide a reasonable estimate of any racial difference in disease prevalence. We used the ADAM Veterans Affairs Cooperative

![Figure 2. Sensitivity analysis of the relative rate of abdominal aortic aneurysm (AAA) repair (elective vs urgent) in black men compared with white men after adjustment for high, low, and best estimates of the racial prevalence ratio of AAA disease.](image)

Table. Prevalence Ratios of Abdominal Aortic Aneurysm (AAA) Disease and Relative Rates of AAA Repair Before and After Prevalence Adjustment Among Black Men vs White Men

<table>
<thead>
<tr>
<th>Screen-Detected Prevalence of AAA Disease, %</th>
<th>Annual Rate of AAA Repaira</th>
<th>Relative Rate of AAA Repair (95% Confidence Interval)b</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Black Men (a)]</td>
<td>[White Men (b)]</td>
<td>[Not Prevalence Adjusted (y=x/d)]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Prevalence Adjusted (z=y/x)]</td>
</tr>
<tr>
<td>0.56</td>
<td>1.40</td>
<td>0.40</td>
</tr>
<tr>
<td>Elective</td>
<td>42.5</td>
<td>147.8</td>
</tr>
<tr>
<td>Urgent</td>
<td>26.1</td>
<td>50.5</td>
</tr>
<tr>
<td>Adjusted</td>
<td></td>
<td>0.29 (0.27-0.31)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.52 (0.48-0.56)</td>
</tr>
</tbody>
</table>

aPer 100,000 Medicare beneficiaries and age-adjusted using direct standardization with the 2001 Medicare beneficiary denominator file population as the standard population.

bConfidence intervals are based on the number of AAA repairs performed from 2001 to 2003 and the total 2001 Medicare beneficiaries as the denominator for rates. They do not include uncertainty from the prevalence ratio estimate.

Figure 2. Sensitivity analysis of the relative rate of abdominal aortic aneurysm (AAA) repair (elective vs urgent) in black men compared with white men after adjustment for high, low, and best estimates of the racial prevalence ratio of AAA disease.

Prevalence adjustment reversed the apparent racial disparity and suggested that black men require more frequent surgery than white men (RR, 0.52 before adjustment; and RR, 1.30 after adjustment).

**COMMENT**

We recognize that there are some differences between the Veterans Affairs population and the Medicare population, including the age of the Veterans Affairs patients but, because the absolute prevalence is unimportant for our purposes, these differences are less important. We are interested only in the prevalence ratio between black men and white men, even if Veterans Affairs patients have more risk factors for AAA disease and a much higher prevalence of AAA disease than Medicare patients, the discrepancy is unimportant as long as the black men and the white men in the Veterans Affairs population are all at increased risk for AAA disease. Therefore, we recognize that there is some uncertainty about our disease prevalence ratio, and that is why we report it as an estimate.

Our analysis is affected by our estimate of the AAA disease prevalence ratio. Because the prevalence of AAA among black subjects is low (especially among nonsmoking black subjects), any estimate of this ratio will necessarily have some imprecision. However, the point estimate of the AAA disease prevalence ratio is virtually the same among smokers and nonsmokers. Furthermore, no matter what the actual AAA disease prevalence ratio is, our data highlight the distinctive RRs of black men vs white men in elective vs urgent repairs.

Given the uncertainty in our AAA disease prevalence ratio estimate, we examined the estimate using a sensitivity analysis to see how varying this ratio affected our findings (Figure 2). We considered the range of values included in the CI around the point estimate for the AAA disease prevalence ratio (CI, 0.28-0.56). If the high estimate for the AAA disease prevalence ratio is correct, then there is little disparity in urgent repair, but the disparity in elective repair is even larger. Conversely, if the low estimate is correct then, while there is little disparity in elective repair, there is almost a 2-fold higher rate of urgent repair among black men. We believe the most biologically plausible scenario is that the AAA disease prevalence ratio is near our best estimate, namely, that the lower rate of elective repair among black men leaves more black men at risk to experience leak or rupture and require an urgent repair.

Another potential threat to the validity of our analysis is confounding by hospital coding practice. Hospi-
tals that disproportionately treat more black subjects could be more likely than hospitals that primarily treat white subjects to code operations as urgent. If the conditions of black men were being upcoded as urgent more often than in white men, one would expect to see lower mortality among urgent repairs in black men because they were not as severely ill as the white men undergoing urgent repairs. In a subanalysis of the data, the 30-day mortality of the urgent repairs among black men was similar to that among white men (approximately 25% mortality for urgent admission regardless of race). This finding argues that substantial confounding by admission status coding is unlikely.

Our analysis is also limited in that it only considers men. Abdominal aortic aneurysm is much less common among women and is probably less common among black women. Because our data on prevalence come from the Department of Veterans Affairs (which cares for a small number of women) and because AAA is so rare in women, there were insufficient data to estimate a female prevalence ratio. However, the Medicare data contained a similar pattern for women; there was a racial disparity for AAA repair, and it was more pronounced for elective procedures.

If disease prevalence does not explain the racial differences in AAA care, why then do black men have a lower elective rate of AAA repair (and a higher rate of urgent repair)? Others have suggested a systematic framework to understand racial variation by considering whether variations are the result of 1 of the following 3 general factors: (1) confounding patient factors such as differences in patient preferences or need (ie, prevalence of disease), (2) system factors such as proximity to high-quality hospitals or access differences that reflect socioeconomic status (ie, insurance status and the ability to pay for care), or (3) racial bias in provider care and decision making.19

In the case of the racial variation in AAA repair, we have shown that prevalence cannot explain the disparity in elective and urgent AAA repairs simultaneously. Patient preferences could explain the variation if black men are less likely to want elective AAA repair when having a diagnosis of AAA. Previous investigators have demonstrated that black subjects were less likely to choose to have major surgery than white subjects for potentially life-threatening problems.9 The caveat to this explanation for variation is that racial differences in patient preferences may have more to do with effectiveness of risk-benefit communication by the health care provider than with underlying racial variation in attitudes about surgery.

Another possible explanation for the disparity in AAA repair rate is socioeconomic status. Although all of the patients in this study are Medicare beneficiaries, there may be substantial racial differences in comprehensiveness of Medicare benefits, supplemental insurance status, and the ability to pay for health care expenses not covered by Medicare. Previous work among populations that included non-Medicare beneficiaries has demonstrated that insurance status predicted the relative likelihood of a patient having a ruptured aneurysm vs a nonruptured aneurysm at the time of AAA repair, with the underinsured more likely to have experienced rupture than those with comprehensive insurance.15 Another possible explanation is that black subjects are more likely to go to hospitals (or are enrolled in provider networks) that do fewer AAA repairs.

Finally, it is possible that providers treat black subjects and white subjects differently. Perhaps black subjects are not offered surgery for aneurysms of similar size and morphologic structure as those of white subjects. Or, perhaps black subjects are less likely to be screened for AAA disease because of the known lower prevalence of disease among black subjects. Or black subjects may undergo less abdominal imaging in general (as is the case with other diagnostic tests)16,17 and have a lower rate of incidental AAA diagnosis.

The racial disparity in AAA repair likely involves a combination of these explanations. What seems clear is that the racial disparity in AAA repair rate is not simply because of differences in disease prevalence. The fact that black men seem to need more urgent AAA repairs than white men given their disease prevalence suggests that the racial disparity in the use of elective repair merits further investigation.

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Author Contributions: Dr Wilson had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Wilson, Fisher, and Welch. Acquisition of data: Wilson. Analysis and interpretation of data: Wilson and Welch. Drafting of the manuscript: Wilson. Critical revision of the manuscript for important intellectual content: Fisher and Welch. Study supervision: Fisher and Welch.

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REFERENCES

I n 1998, the Department of Health and Human Ser-
sices adopted a goal of eliminating racial/ethnic dis-
parities in health care by 2010 in 6 clinical areas,
including the treatment of cardiovascular disease.1 As
such, the article by Wilson et al is a report card for health
care providers. These authors seek to define the magni-
tude of disparity in AAA repairs among black men vs white
men within the Medicare population from 2001 to 2003.
Because screening data within this population are yet to
mature, Wilson and colleagues derive the AAA preva-
ience ratio among black men and white men from the
ADAM Veterans Affairs Cooperative Study.2,3 Because
there are obvious differences in the comorbidities of the
Medicare population vs the VA population, the preva-
icence ratio must be considered an estimate. Neverthe-
less, because the risk factor profile within the ADAM trial
between white men and black men is similar, it is un-
likely that the derived AAA prevalence ratio is errone-
os. So, if we accept that leap, and I believe we should,
what does this article say about the current state of af-
fairs 8 to 10 years into the federal mandate to alleviate
racial/ethnic disparity in health care delivery?

The answer is simple; there is still a large disparity in
how we treat black patients in the United States in the
cardiovascular field. The differences in AAA treatment
as examined and substantiated by Wilson et al should
bother us, as surgeons and as citizens, for several rea-
sons. First, it may reflect the possibility of racial bias in
how we diagnose and treat AAA. As a vascular and en-
dovascular surgeon, I am more worried by a second, more
distinct, possibility that such bias results in a larger pro-
portion of black patients needing emergent repairs; this
would signal that we may actually be inflicting harm in
such biases. What should be obvious to all is that racial/
ethnic disparities abound in medicine and that change
is a difficult and complicated task. There are issues of ac-
cess to health care, insurance inequity, racial/ethnic bias
to select major procedures, underserved and unrecog-
nized chronic illnesses, and lack of easy metrics for evalu-
ating improvement. Yet all change, just like the politics
we want to blame, is local. Next time you are called to
see an African American patient with abdominal pain who
is a former smoker and is hypertensive, just remember
to palpate the abdomen for a pulsatile mass.

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1. US Department of Health and Human Services. Healthy People 2010: Under-
standing and Improving Health. Washington, DC: US Dept of Health and Hu-
2. Lederle FA, Johnson GR, Wilson SE, et al; Aneurysm Detection and Manage-
ment (ADAM) Veterans Affairs Cooperative Study Group. Prevalence and asso-
ciations of abdominal aortic aneurysm detected through screening. Ann Intern
3. Lederle FA, Johnson GR, Wilson SE, et al; Aneurysm Detection and Manage-
ment (ADAM) Veterans Affairs Cooperative Study Group. Prevalence and asso-
ciations of abdominal aortic aneurysm detected through screening. Ann Intern