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Racial variations in the choice of on-pump versus off-pump coronary artery bypass grafting

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Abstract

Objective—To examine explanations of differences in utilization rates of a newly reintroduced technique – off-pump coronary artery bypass grafting (CABG) – between racial minorities and Whites.

Method—The study was based on 15,313 CABG patients in the New York State Cardiac Surgery Reporting System covering all cardiac surgeons providing off-pump CABG in New York State. We estimated cross sectional, random effect regression models predicting the probability of off-pump versus on-pump surgery.

Results—Thirty one percent of Blacks, 20.7% of other races, and 23% of Whites underwent off-pump CABG ($P < 0.0001$). The higher rates for Blacks arose mostly from being treated by surgeons performing only a few off-pump procedures rather than from surgeons performing many off-pump surgeries. After adjusting for clinical characteristics and coronary anatomy, Blacks

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treated by surgeons with low volume off-pump procedures were 1.9 times ($P < 0.01$) more likely to have off-pump surgery compared with Whites treated by the same surgeons. There were no significant differences between Blacks and Whites treated by high volume surgeons.

Conclusions—These findings suggest that surgeons who are inexperienced with the off-pump techniques are more likely to perform this surgery on Black patients. Further research should examine potential explanations and the agenda addressing racial disparities should be expanded to address issues of treatment decisions.

Introduction

Racial disparities in access to medical care have been documented for decades.¹ Much of the evidence about disparities concerns cardiac care, showing that minorities receive lower quality care from lower quality cardiac surgeons² and have worse outcomes than Whites.^{1,3,4} Controlling for clinical characteristics, Blacks are less likely to be referred for cardiac catheterization,¹ less likely to receive reperfusion therapy,⁵ percutaneous transluminal coronary angioplasty (PTCA),⁶ and coronary artery bypass graft (CABG) than Whites.^{3,6,7} Blacks and other minorities have more limited access to new technologies, with larger disparities in utilization rates compared with Whites when a technology is new, a disparity that diminishes (but does not disappear) as the technology diffuses into regular care.^{8,9}

Consistent with the literature, data from New York State (NYS) shows that minorities classified as ‘other race’ (e.g. Asian, American Natives) had lower rates of a recently reintroduced type of CABG – the off-pump procedure. In contrast, minorities classified as Blacks were more likely than Whites to undergo the off-pump procedure. In 1999, in NYS, while 23% of Whites had off-pump surgery, and 20.7% of other/non-Hispanic minorities did, among non-Hispanic Blacks 31% did. To explain this apparent paradox we examine several potential explanations, including differences in patients’ clinical risks that may indicate that Blacks are better candidates for the procedure, patient preferences, and surgeons’ decisions as they relate to gaining experience with a new procedure.

In 1999, off-pump CABG was still relatively new, performed mostly by a small number of cardiac surgeons. Traditionally, CABG was performed using the cardiopulmonary bypass to circulate blood externally during the operation, thus giving the surgeon a stable and blood-free environment in which to operate. The use of the cardiopulmonary bypass is, however, believed by many cardiac surgeons to be associated with serious complications, including cognitive deficits, stroke, renal failure, and pulmonary dysfunction.¹⁰ Off-pump surgery, which is performed on the beating heart without the use of the cardiopulmonary bypass,¹¹ was reintroduced in the late 1990s because many cardiac surgeons believed it may decrease the incidence of complications.¹⁰

Methods

Data

This study is based on the Cardiac Surgery Reporting System (CSRS) data that are collected by the NYS Department of Health. These data include information on patient demographics,

hospital and clinician-identifiers, preoperative risk factors, and type of surgery – on-pump and off-pump. Preoperative risk factors included the severity of the coronary artery disease (e.g. ejection fraction and coronary anatomy), previous open-heart surgeries, and other comorbidities (Table 1). The data collection tool was developed by the NYS Department of Health and the NYS Cardiac Advisory Committee, which included cardiothoracic surgeons and cardiologists. Hospitals were trained in collecting these data and were audited every other year by the NYS Department of Health to assure data accuracy.¹⁰

We identified off-pump surgeries following the intention-to-treat principle: all CABGs with cardiopulmonary bypass time equal to zero and those that were converted from off-pump to on-pump were considered to be off-pump surgeries in this study.

We categorized each patient into one of six race/ethnicity groups – White non-Hispanic, White Hispanic, Black non-Hispanic, Black Hispanic, Other non-Hispanic, and Hispanic. Race and ethnicity in this data set are determined by the provider, not the patient. Because the decision to perform off-pump surgery was likely to have been made by the surgeon, race as perceived by the provider is the more appropriate for this analysis.

As a proxy for surgeon experience with off-pump techniques, we measured the number of off-pump procedures the surgeon performed during the year and defined those who performed fewer than 18 as low volume surgeons. It should be emphasized that this designation is based only on their off-pump CABG volume and not total CABG volume. We also note that this designation of low volume is somewhat arbitrary. Ideally we would have liked the designation of low volume to be linked to clinical outcomes. Because there are no studies showing a relationship between off-pump volume and outcomes, we were instead guided by an a priori examination of the distribution of surgeon volume. This revealed that 75% of surgeons performed less than 18 procedures in 1999 (Table 2). Thus we chose to designate the top quartile of the distribution (i.e. 18 or more) as high volume.

Analyses

We estimated random effect logistic models (clustered on surgeons) predicting whether the patient underwent off-pump surgery. The explanatory variables included all relevant individual risk factors that are recorded in the CSRS and that were significantly associated with the probability of having off-pump surgery, based on a stepwise procedure. Because of the high correlations between many of the risk factors, some that may seem to be important clinically (like sex) were excluded by the stepwise procedure, as the information they carry is included by other variables, such as variables indicating the diseased vessels and the extent of the disease. All the risk factors considered in the original analyses are listed in Table 1. These models also included race and ethnicity variables, a variable classifying the surgeons as low volume or not and an interaction between race/ethnicity and surgeon volume. These variables were excluded from the stepwise procedure and thus included in all models.

In one version of the model we also included a variable measuring the proportion of Blacks in the surgeon's CABG practice. Including this variable allowed us to test the hypothesis that

the differences in the likelihood of receiving off-pump surgery can be explained by slower adoption of this technology by surgeons who treat a large proportion of Blacks.

The models were estimated as random effect models because patient observations were nested within surgeons. These multiple patient observations for each surgeon are likely to be correlated, due to unobserved surgeon selection effects. A random intercept model with clustering at the surgeon level takes into account the potential for such correlations.

Results

In NYS, in 1999, of 17,792 CABG procedures, 14,218 or 80% were done on-pump and 3574 or 20% were done off-pump. Eighty percent of cardiac surgeons performed off-pump surgeries. The vast majority, however, performed only a few –75% performed fewer than 18 off-pump surgeries during the year (Table 2).

We excluded 2468 on-pump CABGs done by surgeons who did not perform any off-pump surgery and 11 off-pump surgeries performed by surgeons who did not perform any on-pump surgery. The final sample included 15,313 CABGs.

Table 3 shows the distribution of patients by race/ethnicity and by type of surgery. On average, 23.3% of all surgeries were off-pump. Blacks/non-Hispanics were significantly more likely to have off-pump surgery, at 31%, compared with Whites/non-Hispanics, at 23%, while other/Hispanics were the least likely at 11.6%.

Table 4 presents the odds ratio for having off-pump surgery for patients of different race/ethnicity (based on multivariate regression models) unadjusted for patient risks. The reference category is non-Hispanic Whites. Odds ratios are shown separately for patients treated by high off-pump volume surgeons and for patients treated by low off-pump volume surgeons. The odds ratios for all patients treated by high volume surgeons were not significantly different from 1, indicating that there were no significant differences between non-Hispanic Whites and patients of other race/ethnicity groups to have off-pump surgery. Similarly, there were no significant differences in the odds ratios for Other, Hispanics and non-Hispanics, among those treated by low volume surgeons. This was not the case among Blacks treated by low volume surgeons. Hispanic and non-Hispanic Blacks were significantly more likely to have off-pump surgery compared with non-Hispanic Whites, with odds ratios of 1.88 ($P < 0.01$) and 2.82 ($P < 0.05$), respectively. White Hispanics were also more likely to have off-pump surgery when treated by low-volume surgeons, although the odds ratio for this group was significantly different only at the 0.1 level.

Table 5 presents odds ratios adjusted for individual risk factors. The results are very similar to the unadjusted results: there were no significant differences by race for patients treated by high volume surgeons. Among those treated by low-volume surgeons, Blacks were significantly more likely to have off-pump surgery, with White Hispanics showing a marginally significant result. Thus, accounting for individual patient risks does not explain the differences we observe in the propensity to perform off-pump surgery.

Table 6 includes odds ratios adjusted also for the percent of Blacks (both Hispanic and non-Hispanic) among all the CABG patients treated by the surgeon. The odds ratios for Blacks are somewhat lower in this model compared with the model controlling only for individual risks, at 1.81 compared with 1.92 for non-Hispanic Blacks and 3.15 compared with 3.29 for Hispanic Blacks. However, the odds ratios in this model are still large and statistically significant, suggesting that the large proportion of Blacks in the practice cannot explain the differences in utilization.

We also tested the joint hypothesis that all minorities treated by high-volume surgeons (i.e. the race variables in the model that did not interact with low volume) as a group had odds ratios different from those of non-Hispanic Whites. This hypothesis was rejected with a *P* value of 0.33.

Discussion

In contrast to much of the evidence about racial disparities, we found that Blacks were more likely to undergo the off-pump procedure compared with Whites. This difference was concentrated among patients treated by surgeons who performed very few off-pump procedures. The first finding is inconsistent with the large body of literature that shows that Blacks have less access to and receive poorer quality cardiovascular care than Whites. The second finding may explain this inconsistency.

There are several potential reasons for the higher use of the procedure for Blacks among surgeons inexperienced with the off-pump procedure. First, the risk factors included in our analyses may not capture all the differences between patients. If there are clinical characteristics that surgeons consider when making the choice of off-pump versus on-pump surgery that are not included in the CSRS database, and if Blacks treated by low-volume surgeons are more likely to have these risk factors compared with Blacks treated by high-volume surgeons, then our finding may be explained by inadequate risk adjustment. However, there is no reason to believe that the distribution of these unmeasured risk factors should be different in Blacks treated by low-volume off-pump surgeons versus Blacks treated by high-volume off-pump surgeons.

Second, the coronary anatomy of Blacks treated by low-volume off-pump surgeons may have been more amenable to an off-pump approach.^{10,12} However, the CSRS database contains detailed information on coronary anatomy and this information was included in our multivariate models.

Third, new technologies are not adopted by all cardiac surgeons at the same rate.¹³ If surgeons who treat a large number of Blacks are more likely to be late adopters of the off-pump technique, our finding that Blacks treated by low off-pump volume surgeons are more likely than Whites to have off-pump surgery may be an artefact. To test this hypothesis we estimated models that controlled for the racial composition of each surgeon's practice. However, we found that differences in patient populations between low and high-volume off-pump surgeons had minimal impact on the propensity of low-volume surgeons to perform off-pump CABG on Black patients.

Fourth, differences in patient preferences may explain why low off-pump volume surgeons were more likely to perform off-pump CABG on Blacks than on Whites. We did not have information about patient preferences and could not test their impact on the choice. It seems unlikely, however, that patient preferences among Blacks will vary by the off-pump experience of the surgeon. In fact, if there was such a systematic difference it is more likely that those Blacks who prefer off-pump surgery would have sought surgeons who are more likely to offer off-pump surgery, the high-volume off-pump surgeons, but they did not.

Finally, surgeons may be more likely to try (intentionally or unintentionally) a new procedure on Blacks, patients who may be less knowledgeable about treatment options, who are less likely to play an active role in choosing between alternative treatments and who are less likely to take action if they experience a poor surgical outcome.^{14,15} This explanation for the observed higher utilization of off-pump surgery among Blacks is consistent with the literature about barriers that minorities experience in accessing care in general and high-quality providers in particular.

We had no information about patient socioeconomic status. As race and ethnicity tend to be highly correlated with education and income we cannot rule out the possibility that the tendency of surgeons less experienced with the new procedure to perform it on Blacks is indeed related to race and not socioeconomic status. In either case, the evidence presented here suggests that it is a vulnerable patient population that is at risk.

Another potential limitation of this study, which should be addressed in future research, is that it was cross sectional. Future research should examine this question in a longitudinal data set that would allow examination of procedure choice along the trajectory of volume growth for each surgeon. Further research is also needed to gain a better understanding of the reasons for the higher use of the reintroduced off-pump technology among Blacks and White Hispanics. It may also be informative to explore the reasons that other minority groups did not have a similar experience. Research into practices involving introduction of other new technologies may also offer insights.

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References

1. Institute of Medicine. Unequal Treatment: Controlling for Racial and Ethnic Disparities in Health. 1st edn.. National Academies Press; Washington, DC: 2003.
2. Mukamel DB, Murthy AS, Weimer DL. Racial differences in access to high quality cardiac surgeons. *Am J Pub Health*. 2000; 90:1774–7. [PubMed: 11076249]
3. Peterson ED, Shaw LK, DeLong ER, Pryor DB, Califf RM, Mark DB. Racial variation in the use of coronary-revascularization procedures. Are the differences real? Do they matter? *N Engl J Med*. 1997; 336:480–6. [PubMed: 9017942]
4. Groeneveld PW, Heidenreich PA, Garber AM. Racial disparity in cardiac procedures and mortality among long-term survivors of cardiac arrest. *Circulation*. 2003; 108:286–91. [PubMed: 12835222]

5. Canto JG, Allison JJ, Kiefe CI, et al. Relation of race and sex to the use of reperfusion therapy in Medicare beneficiaries with acute myocardial infarction. *N Engl J Med.* 2000; 342:1094–100. [PubMed: 10760310]
6. Weitzman S, Cooper L, Chambless L, et al. Gender, racial, and geographic differences in the performance of cardiac diagnostic and therapeutic procedures for hospitalized acute myocardial infarction in four states. *Am J Cardiol.* 1997; 79:722–6. [PubMed: 9070548]
7. Hannan EL, van Ryn M, Burke J, et al. Access to coronary artery bypass surgery by race/ethnicity and gender among patients who are appropriate for surgery. *Med Care.* 1999; 37:68–77. [PubMed: 10413394]
8. Groeneveld PW, Laufer SB, Garber AM. Technology diffusion, hospital variation, and racial disparities among elderly Medicare beneficiaries: 1989–2000. *Med Care* 2005. 43:320–9.
9. Groeneveld PW, Heidenreich PA, Garber AM. Trends in implantable cardioverter-defibrillator racial disparity: the importance of geography. *J Am Coll Cardiol.* 2005; 45:72–8. [PubMed: 15629377]
10. Racz MJ, Hannan EL, Isom OW, et al. A comparison of short- and long-term outcomes after off-pump and on-pump coronary artery bypass graft surgery with sternotomy. *J Am Coll Cardiol.* 2004; 43:557–64. [PubMed: 14975463]
11. Peterson ED, Mark DB. Off-pump bypass surgery – ready for the big dance? *J Am Med Assoc.* 2004; 291:1897–9.
12. Mathison M, Edgerton JR, Horswell JL, Akin JJ, Mack MJ. Analysis of hemodynamic changes during beating heart surgical procedures. *Ann Thorac Surg.* 2000; 70:1355–60. [PubMed: 11081898]
13. Committee for Evaluating Medical Technologies in Clinical Use DoHSPDoHPaDPIoM. Assessing Medical Technology. 1st edn.. National Academy Press; Washington, DC: 1985.
14. Saha S, Arbelaez JJ, Cooper LA. Patient-physician relationships and racial disparities in the quality of health care. *Am J Pub Health.* 2003; 93:1713–9. [PubMed: 14534227]
15. Schulman KA, Berlin JA, Harless W, et al. The effect of race and sex on physicians' recommendations for cardiac catheterization. *N Engl J Med.* 1999; 340:618–26. [PubMed: 10029647]

Table 1

Odds ratios for having off-pump surgery for individual patient risk factors in the model including race/ethnicity^{*}

Individual patient risk factors	Odds ratio	P value
IV nitroglycerin within 24 h before operation	0.81	0.003
Congestive heart failure, this admission	1.40	0.000
Cardiopulmonary resuscitation one hour prior to surgery	0.11	0.049
Extensively calcified ascending aorta	2.22	0.000
Stroke	1.27	0.020
ECG evidence of left ventricular hypertrophy	1.19	0.034
Renal failure, creatinine > 2.5 mg/dL	1.93	0.000
Age	0.90	0.000
Age squared	1.001	0.000
Left main trunk coronary artery 50–69% (relative to LMT < 50%)	0.60	0.000
Left main trunk coronary artery 70–89% (relative to LMT < 50%)	0.55	0.000
Left main trunk coronary artery 90–100% (relative to LMT < 50%)	0.44	0.000
PTCA before this admission	1.22	0.008
Left anterior descending or major diagonal artery 70–100% (relative to < 70%)	0.90	0.107
Emergency transfer to OR after diagnostic cath	0.35	0.000
Middle third/distal third left artery descending or major diagonal coronary artery 70–100% (relative to < 70%)	0.78	0.000
Right coronary artery or posterior descending artery 50–69% (relative to < 50%)	0.64	0.000
Right coronary artery or posterior descending artery 70–100% (relative to < 50%)	0.43	0.000
Left circumflex artery or large marginal artery 50–69% (relative to < 50%)	0.44	0.000
Left circumflex artery or large marginal artery 70–100% (relative to < 50%)	0.31	0.000
One previous open heart operation (relative to no previous heart operations)	1.78	0.000
Two or more previous open heart operations (relative to no previous heart operations)	3.70	0.000
Hepatic failure	9.49	0.000

* The initial analysis included in addition the following risk factors: sex, height, weight, ejection fraction, stress test results (positive, negative, not done, unknown), CCS Functional class, previous MI (less than 6 h, 6–23, and more than 23 h), carotid/cerebrovascular, femoral/popliteal, aortoiliac, hemodynamic instability, hemodynamic shock, hypertension history, congestive heart failure before this admission, malignant ventricular arrhythmia, COPD, myocardial rupture, extensively calcified ascending aorta, diabetes requiring medication, renal dialysis, immune system deficiency, intra-aortic balloon pump pre-op, emergency transfer to OR after PTCA, previous PTCA this admission, thrombolytic therapy within seven days of surgery, stent thrombosis

Table 2

Number and proportion of surgeons by the volume of off-pump procedures performed in 1999

Surgeon volume of off-pump surgeries	Number (%) of surgeons at this volume level	Cumulative number (%) of surgeons at this volume level
0	33 (20.4)	33 (20.4)
1–5	47 (29.0)	80 (49.4)
6–17	42 (25.9)	122 (75.3)
18–100	33 (20.4)	155 (95.7)
More than 100	7 (4.3)	162 (100.0)

Table 3Procedure type by patient race and ethnicity^{*}

Patient race/ethnicity	All CABG procedures	On-pump procedures	Off-pump procedures	Percent off-pump
White/non-Hispanic	12,814	9862	2952	23.0
White/Hispanic	629	470	159	25.3
Black/non-Hispanic	863	595	268	31.0 ^{**}
Black/Hispanic	49	36	13	26.5
Other/non-Hispanic	656	520	136	20.7
Other/Hispanic	302	267	35	11.6 ^{**}
Total	15,313	11,750	3563	23.3

^{*} Among surgeons performing at least one off-pump procedure

^{**} Significantly different from Whites/non-Hispanic based on a χ^2 test comparing Whites/non-Hispanic to every other race/ethnicity group separately: $P < 0.0001$

Table 4

Odds ratios for having off-pump surgery based on logistic regression model ($n = 15,313$)^{*} unadjusted for patient risks

	Patients treated by <i>high</i> volume off-pump surgeons (95% CI in parentheses)	Patients treated by <i>low</i> volume off-pump surgeons (95% CI in parentheses)
White/non-Hispanic	1.00	1.00
White/Hispanic	0.86 (0.64–1.16)	1.45 [*] (0.94–2.24)
Black/non-Hispanic	1.15 (0.89–1.45)	1.88 ^{***} (1.33–2.66)
Black/Hispanic	3.40 (0.76–15.1)	2.82 ^{**} (1.13–7.05)
Other non-Hispanic	0.79 (0.59–1.07)	0.73 (0.42–1.24)
Other – Hispanic	0.76 (0.40–1.42)	1.06 (0.93–1.92)

^{*} Comparison group is non-Hispanic Whites. Comparisons of racial groups are presented separately for high and low volume surgeons

^{***} $P < 0.01$

^{**} $0.01 < P < 0.05$

^{*} $0.05 < P < 0.1$

Table 5

Odds ratios for having off-pump surgery based on logistic regression model ($N = 15,313$)^{*} adjusted for patient risks[†]

	Patients treated by <i>high</i> volume off-pump surgeons (95% CI in parentheses)	Patients treated by <i>low</i> volume off-pump surgeons (95% CI in parentheses)
White/non-Hispanic	1.00	1.00
White/Hispanic	0.81 (0.58–1.12)	1.48 [*] (0.94–2.34)
Black/non-Hispanic	1.16 ^a (0.89–1.51)	1.92 ^{***} (1.34–2.77)
Black/Hispanic	2.17 (0.43–11.02)	3.29 ^{**} (1.25–8.63)
Other/non-Hispanic	0.96 (0.70–1.32)	0.80 (0.46–1.38)
Other/Hispanic	0.64 (0.32–1.28)	1.17 (0.64–2.14)

^{*} Comparison group is non-Hispanic Whites. Comparisons of racial groups are presented separately for high and low volume surgeons

[†] Patient risks are listed in Table 1

 $P < 0.01$

**
 $0.01 < P < 0.05$

*
 $0.05 < P < 0.1$

Table 6

Odds ratios for having off-pump surgery based on logistic regression model ($n = 15,313$)^{*} adjusted for patient risks and percent Blacks in the surgeon's practice

	Patients treated by <i>high</i> volume off-pump surgeons (95% CI in parentheses)	Patients treated by <i>low</i> volume off-pump surgeons (95% CI in parentheses)
White/non-Hispanic	1.00	1.00
White/Hispanic	0.83 (0.59–1.15)	1.45 (0.92–2.27)
Black/non-Hispanic	1.21 (0.91–1.61)	1.81 ^{***} (1.26–2.61)
Black/Hispanic	2.40 (0.45–12.57)	3.15 ^{**} (1.19–8.33)
Other/non-Hispanic	1.01 (0.61–1.67)	0.78 (0.45–1.35)
Other/Hispanic	0.65 (0.33–1.31)	1.13 (0.62–2.06)

* $0.05 < P < 0.1$

* Comparison group is non-Hispanic Whites. Comparisons of racial groups are presented separately for high and low volume surgeons

 $P < 0.01$

**
 $0.01 < P < 0.05$