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The effect of race on post-surgical ambulatory medical follow-up among United States Veterans

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Abstract

Study Objective—To investigate the association between self-identified Black or African-American race and the presence of ambulatory internal medicine follow-up in the year after surgery. Our hypothesis was that among US Veterans who presented for surgery, Black or African-American race would be associated with a decreased likelihood to receive ambulatory internal medicine follow-up in the year after surgery.

Design—Retrospective observational

Setting—All United States Veterans Affairs hospitals

Patients—236,200 Veterans undergoing surgery between 2006–2011 who were discharged within 10 days of surgery and survived the full 1-year exposure period.

Interventions—none

Measurements—Attendance at an internal medicine follow-up appointment within 1 year after surgery.

Main Results—After controlling for year of surgery, age, age ≥ 65 years, gender, Hispanic ethnicity, and number of inpatient days, Black or African-American patients were 11% more likely

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to lack internal medicine follow-up after surgery (adjusted odds ratio 1.11; 95%CI 1.06–1.16). When accounting for geographic region, this difference remained significant at the Bonferroni corrected $p < 0.007$ level only in the Midwest United States where Black or African-American patients were 28% more likely to lack medical follow-up in the year after surgery (OR 1.28; 95%CI 1.16–1.42; $p < 0.0001$).

Conclusions—The disparity in ambulatory medical follow-up following surgery among Black or African-American versus non-Black or African-American veterans in the Midwest region deserves further study and may lead to important quality improvement initiatives aimed specifically at this population.

1.1 Introduction

Public health advocates within the anesthesiology community have suggested that the perioperative period provides an important opportunity for health risk-factor screening and triage,[1] and data supporting this suggestion are increasingly widespread.[2–7] In prior work, we have investigated clinical prediction models among patients presenting for surgery to identify those likely to have poorly controlled hypertension and who thus might benefit from efficient, targeted referral interventions for ambulatory medical follow-up. [8–10]

Because Black or African-Americans have a higher prevalence of cardiovascular risk-factors, including hypertension, as compared to the non-Black or African-American population, they may stand to benefit the most from perioperative care coordination initiatives designed to improve longitudinal cardiovascular risk-factor reduction. Moreover, evidence demonstrates that Black or African-American patients exhibit higher visit rates to Emergency Departments as compared to white persons and lower rates of outpatient office visits where longitudinal risk-factor reduction would typically be the focus of care.[11] The effect of race on location of care remains significant even after controlling for expected source of payment and poverty. For these reasons, the opportunity to harness the perioperative encounter as an additional screening and referral opportunity — particularly for Black or African-American patients — deserves further study.

Racial disparities in the delivery and usage of health care have been described in several contexts within the United States,[12–14] including specifically during the perioperative period. For example, it has been shown that Black or African-American patients are significantly less likely to receive regional as opposed to general anesthesia.[15] However, it is not known whether significant disparities in care ascribable to race continue into the post-surgical follow-up period. Since the subset of Black or African-American patients who come for non-emergency surgery have an already established interaction with a physician specialist, they may not remain as underserved in respect to ambulatory care visits as their larger demographic cohort would suggest.[16] Indeed, there is evidence to suggest that among patients for whom access to insurance is equivalent, racial disparities previously seen in some surgical populations may disappear.[17]

Therefore in the present study we investigated the association between self-identified Black or African-American race and the likelihood of post-surgical outpatient ambulatory internal medicine follow-up within the Veterans Health Administration. Our hypothesis was that i)

among US Veterans who presented for surgery, there would be an association between Black or African-American race and a decreased likelihood to engage in ambulatory internal medicine follow-up in the year after surgery. We further hypothesized that ii) such an effect would persist independent of geographic region, and after controlling for comorbid disease burden, and demographic factors including age, gender and Hispanic ethnicity. Third, we sought to investigate whether a similar association between race and outpatient medical follow-up would be present among the subset of patients who, prior to their surgery, demonstrated blood pressures in the hypertensive range ($\geq 140/90$ mmHg).

2.1 Materials and Methods

After appropriate IRB approval, we created an Electronic Health Record (EHR)-based historical cohort of patients age ≥ 21 years who received surgical care at any Veterans Health Administration (VHA) healthcare facility between September 2006 and August 2011 as has been previously described.[18] The resulting cohort is being used in several studies examining the relationship between perioperative assessments and postoperative outcomes. [10, 18]

For the present study, the outcome of interest was whether the patient had at least one non-surgical medical visit (described below) within the VHA in the 365 days following surgery. To minimize confounding due to perioperative morbidity and mortality, only patients who were discharged within ten days of surgery and who survived for a full 365-day period after surgery were included in the analysis of ambulatory clinic follow-up. After unadjusted analysis, Cox proportional hazard ratios were calculated to determine whether Black or African-American race was independently associated with likelihood of ambulatory care follow up in the VHA system after surgery when controlling for a variety of patient and facility-level factors. In a parallel analysis, we explored the same association using only the subset of patients who presented preoperatively with blood pressures $\geq 140/90$ mmHg, calculated as the mean of two preoperative readings. Specific blood pressure targets to define hypertension remain controversial. [19, 20] In the present study, we chose to define blood pressure status by actual recorded blood pressure rather than a diagnostic code for the disease of hypertension because poorly controlled blood pressure — rather than a patient's being classified as a hypertensive — is the primary mediator of morbidity in this population, and those patients with elevated blood pressures may have the highest likelihood of benefitting from improved post-operative internal medicine follow-up care.

2.2: Data sources

Data sources and variable specifications have been summarized previously.[18] Briefly, patients were identified by their unique Patient Integration Control Number (PatientICN) assigned by the VHA Master Veteran Index. Demographic information, surgical specialty, American Society of Anesthesiologists Physical Status score (ASA Physical Status score), [21] and ICD-9-CM inpatient diagnostic codes dating from January 2000 to the index surgery date were extracted from the VHA Corporate Data Warehouse for inclusion in this analysis. Black or African-American race and Hispanic ethnicity were coded separately based on self-identification to allow for both classifications independently. The mechanism

for obtaining self-identified race typically occurs during intake into the VHA system, but a Veteran's chosen racial affiliation may be modified at any point in the care pathway at the request of the Veteran. Patients with missing self-reported race were excluded. Age was included as a semi-continuous variable and also dichotomized as ≥ 65 years to account for discontinuities in healthcare usage that occur with the assumption of Medicare eligibility. [22–24] Other data included in the analysis were the year of surgery (to account for increasing EHR penetrance during the study period), and the number of inpatient days postoperatively. Preoperative blood pressures were taken as the mean of two measurements from within 30 days prior to surgery and were considered hypertensive if either the systolic blood pressure was ≥ 140 mmHg or the diastolic blood pressure was ≥ 90 mmHg.

Ambulatory visit data for the 365 day postoperative period were collected by querying the VHA National Patient Care Database Medical SAS Outpatient Datasets[25] as has been described in prior reports.[26] Clinic types were identified by the Stop Codes associated with each visit. As has been described previously, a Stop Code for any of the following clinics was considered positive for the exposure of interest: primary care, cardiology, pulmonology, endocrinology, diabetes, hypertension, women's, infectious disease, and geriatric primary care.[18] This outpatient clinic list was based on the NEXUS clinic group as defined by the VHA External Peer Review Program, with the addition of infectious disease clinics. NEXUS clinic visits are used to determine which Veterans are receiving Primary Care across the VHA system. Infectious Disease clinics were included because they are the primary care source for many Veterans with HIV.

2.3 Statistical Analysis

After performing descriptive analytics of the included variables, an unadjusted analysis was done to measure the prevalence of at least one non-surgical ambulatory clinic follow up in the year following surgery between Black or African-American and non-Black or African-American patients. We then performed a series of Cox regression models to determine whether the likelihood of ambulatory clinic follow-up during the first surgical year differed for Black or African-American versus non-Black or African-American veterans after controlling for different measures of preoperative comorbidity (ASA Physical Status Score, Charlson Comorbidity Index (CCI), and Veterans Aging Cohort Study comorbidities, respectively). We also controlled for effects of geographic region by modelling location as a random effect to account for the similarity of patients and institutions present within the same area. Location was determined by Veterans Integrated Service Network (VISN) numbers which were then grouped into larger geographic regions as described in table 1 and illustrated in Figure 1. We then sought to pursue the same process as above for the subset of patients presenting with the mean of two preoperative blood pressures $\geq 140/90$ mmHg. While the analytic plan originally focused only on the subset of hypertensive patients, after initial data review we broadened the analysis to incorporate the entire cohort regardless of blood pressure status after the number of failed follow-up events occurring among patients with preoperative hypertension was found to be too small for robust adjustment across models.

3.1 Results

The initial cohort consisted of 385,790 Veterans age ≥ 21 years who underwent surgical care within the time period specified above, among whom 261,159 (67.7%) patients were discharged within 10 days of surgery. From this subset, 90.4%, or 236,200 patients survived the full 1 year follow-up period of whom 223,941 had a self-identified race recorded in the electronic health record and thus were included in the analysis. A flow diagram of patient selection and exclusion is shown in Figure 2, and a full description of the cohort stratified by race and follow-up visit status is illustrated in Table 2.

Overall, 93.6% of included patients were seen in follow-up in the year after surgery, indicating overall excellent continuity of care following surgery in the VHA system. In unadjusted analysis, 8.58% (95%CI 8.30–8.85) of Black or African-American patients were not seen in ambulatory medical clinics within the VHA for the year following surgery versus 6.20% (95%CI 6.09–6.31) of non-Black or African-American patients ($p<0.0001$; absolute difference = 2.38%). Across geographic regions, there was significant variation with the absolute difference in the prevalence of lack of follow-up among Black or African-American patients relative to non-Black or African-American patients ranging from 1.10% to 3.08%, but lack of follow-up measured by internal medicine visits was more prevalent for Black or African-American patients across all geographic areas (Table 3).

3.2 Adjusted Analysis

After controlling for year of surgery, age, age ≥ 65 years, gender, Hispanic ethnicity, and number of inpatient days, the adjusted odds ratio for likelihood of Black or African-American patients not having a visit relative to non-Black or African-American patients was 1.11 (95%CI 1.06–1.16), meaning that Black or African-American patients were approximately 11% more likely not to have a follow up ambulatory medical appointment within the VHA system during the follow-up period in comparison to non-Black or African-American patients. Interestingly, this difference was again not uniform across geographic groups. The difference was seen at the $p<0.05$ level — using a simple Bonferroni correction for 7 comparisons to a significance threshold of $p<0.007$ — only in the Midwest United States where Black or African-Americans were 28% more likely to lack medical follow-up in the year after surgery than non-Black or African-Americans (OR 1.28; 95%CI 1.16–1.42; $p<0.0001$; see table 4).

In models designed to account for baseline comorbidity status including, respectively: ASA Physical Status, Charlson Comorbidity Index, or Veterans Aging Cohort Study comorbidities, a similar pattern was seen. Specifically, Black or African-American patients grouped to the Midwest region were 31%, 29%, and 19% more likely not to have an ambulatory medical clinic visit than their non-Black or African-American peers across these respective models ($p<0.0001$ for all), an effect not shown to be statistically significant at the Bonferroni corrected $p<0.007$ level in any other geographic region in any of the adjusted models, with point estimates for the odds ratios ranging widely from 0.99 to 1.39 across the several geographic regions (See Table 4).

3.3 Sensitivity Analysis

Given the stark difference in the point estimates of the adjusted odds ratios across geographic regions, we sought to determine whether this might be due to differences in overall rates of follow-up across geographic regions. In Table 3, we list summary statistics for the sample size of the cohorts and the overall percent follow-up. These data demonstrate a relatively consistent rate of lack of follow-up which was not substantially different in the Midwest (6.1% no follow-up) from other regions (6.6% no follow-up).

Regarding the subset of patients with preoperative high blood pressure $\geq 140/90$ mmHg, the unadjusted analysis closely mirrored the analysis for all subjects, with 436/5543 (7.87%) of hypertensive Black or African-American patients lacking an ambulatory medical appointment versus 1055/16262 (6.49%) of non-Black or African-American patients ($p < 0.0001$). However, the number of events (i.e., no follow-up) across geographic regions in this subset of patients was too small to provide reliable estimates in the regression models. Therefore, we were only able to compute adjusted odds ratios of Black or African-American vs. non-Black or African-American hypertensive patients in the overall model, in which no statistically significant differences were found (Table 4).

4.1: Discussion

In the present study, we saw a persistent effect of Black or African-American race on lower odds of ambulatory medical follow-up in the VHA system across several risk-adjustment models within the Midwestern United States, an effect that did not appear to be present in other regional subsets. Within the subgroup of patients with apparently elevated preoperative blood pressures (who may thus benefit from follow-up for intensified hypertension therapy), a similar effect of Black or African-American race was seen in the unadjusted model, but sample size limitations did not allow for adjusted modeling in this group.

4.2 Limitations

Several limitations of the present study deserve emphasis. First, it is not clear if simply improving rates of follow-up will necessarily lead to better health. Although virtually all patients undergoing anesthesia have already engaged with a surgical provider, the control of cardiovascular risk-factors among inner-city African-Americans remains poor even among those who have recently seen a physician.[27] This may suggest that factors such as socioeconomic status or other unmeasured factors that exhibit collinearity with race may mediate some of the persistent disparities seen in the control of cardiovascular risk-factors amongst Black or African-American populations. A more extensive intervention beyond mere care coordination to assure ambulatory medical follow-up will likely be necessary to improve the control of cardiovascular risk-factors among Black or African-American veterans undergoing surgery. Second, the effects of socio-economic status (SES) are likely an important contributor to likelihood of post-surgical follow-up, and we did not have a reliable indicator of SES in our database. It is possible, and indeed likely, that controlling for SES would change the outcomes of our multivariable modeling.

Additionally, further limitations include the following: 1) The present study describes an association for which the underlying causality remains to be understood. Regarding causation, there are many factors that may co-vary with race that mediate the association between race and follow-up and that were not measured in the present study. 2) US Veterans represent a special population with unique characteristics, and thus finding using data from the Veterans Health Administration may not be generalizable to other populations or care delivery models; [28] and 3) as with all large database studies, the conclusions drawn from them are subject to distortions characteristic of administrative and clinical data sources in which the sensitivity and specificity of information within structured database fields are imperfect. [29] Nevertheless, the VHA informatics platform is by far the largest in the United States to include comprehensive data from both surgical and postoperative outpatient encounters within a single, searchable integrated Electronic Health Record. [30] While necessarily tentative in our interpretation, we believe the present findings suggest — at the very least — a potent area for further study.

In conclusion, in the present study we found a persistent association between Black or African-American race and a higher likelihood of not receiving ambulatory medical follow-up across several risk-adjustment models within the Midwestern United States, an effect not seen in other regional subsets. The disparity in ambulatory medical follow-up following surgery among Black or African-American versus non-Black or African-American veterans in the Midwest region deserves further study and may lead to important quality improvement initiatives aimed specifically at this population. Care coordination interventions targeted specifically to the Midwestern Black or African-American veteran population may be warranted.

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Highlights

- Post-surgical medical follow-up has been associated with long-term survival.
- Black of African-American race is associated with lower odds of post-surgical medical follow-up.
- The above association was robustly present within Midwestern VA Hospitals.
- Further studies of Midwestern Veterans and post-surgical follow-up are warranted.

Figure 1.
VISN map of the United States

Figure 2.
Flow Diagram of Patient Selection and Exclusion.

Table 1

Veterans Integrated Service Networks (VISNs) by Geographic Region

VISN	Region
1, 2, 3, 4	Northeast
5, 6	MidAtlantic
7, 8, 9, 16, 17	Southeast
10, 11, 12, 15, 23	Midwest
18	Southwest
19	Mountain West
20, 21, 22	West

Table 2

The descriptive statistics of demographics and other clinical characteristics by race and postoperative visiting status

	BLACK race		Other race	
Variables	No Visit (n = 3490)	Visit (n = 37205)	No Visit (n = 11353)	Visit (n = 171893)
AgeDOS	55.2 (14.6)	59.3 (11.4)	57.5 (16.4)	63.1 (11.6)
CCI	1.1 (1.9)	1.4 (1.9)	1 (1.8)	1.2 (1.8)
YEAR of Surgery				
2006	247 (10.24%)	2164 (89.76%)	848 (7.31%)	10758 (92.69%)
2007	751 (9.83%)	6887 (90.17%)	2406 (6.80%)	33001 (93.20%)
2008	661 (8.62%)	7004 (91.38%)	2174 (6.24%)	32654 (93.76%)
2009	653 (7.84%)	7678 (92.16%)	2097 (5.75%)	34371 (94.25%)
2010	682 (7.97%)	7875 (92.03%)	2254 (5.93%)	35788 (94.07%)
2011	496 (8.14%)	5597 (91.86%)	1574 (5.85%)	25321 (94.15%)
Surgery type				
Cardiac/Thoracic Surgery	80 (2.38%)	3283 (97.62%)	298 (1.41%)	20890 (98.59%)
ENT	148 (7.40%)	1852 (92.60%)	546 (7.10%)	7142 (92.90%)
General Surgery	938 (9.83%)	8601 (90.17%)	3352 (7.95%)	38805 (92.05%)
Gynecology	341 (24.84%)	1032 (75.16%)	399 (20.14%)	1582 (79.86%)
Neurosurgery	230 (6.52%)	3300 (93.48%)	811 (5.63%)	13592 (94.37%)
Ophthalmology	38 (11.14%)	303 (88.86%)	103 (10.62%)	867 (89.38%)
Oral Surgery	52 (14.77%)	300 (85.23%)	104 (13.37%)	674 (86.63%)
Orthopedics	616 (8.05%)	7036 (91.95%)	2592 (6.60%)	36654 (93.40%)
Other	64 (9.60%)	603 (90.40%)	204 (7.17%)	2640 (92.83%)
Plastic Surgery	114 (16.69%)	569 (83.31%)	256 (10.38%)	2211 (89.62%)
Podiatry	60 (8.29%)	664 (91.71%)	187 (6.67%)	2617 (93.33%)
Urology	497 (7.78%)	5894 (92.22%)	1625 (6.80%)	22258 (93.20%)
Vascular Surgery	312 (7.65%)	3768 (92.35%)	876 (3.84%)	21961 (96.16%)
AGEDOSGE65				
no	2721 (9.13%)	27082 (90.87%)	7853 (7.19%)	101310 (92.81%)
yes	769 (7.06%)	10123 (92.94%)	3500 (4.72%)	70583 (95.28%)
GENDER				
Female	814 (19.85%)	3286 (80.15%)	1748 (16.29%)	8984 (83.71%)
Male	2676 (7.31%)	33919 (92.69%)	9605 (5.57%)	162909 (94.43%)
HISPANIC				
NO	3440 (8.66%)	36266 (91.34%)	10956 (6.21%)	165389 (93.79%)
YES	50 (5.06%)	939 (94.94%)	397 (5.75%)	6504 (94.25%)
INPTDAYSPSTGROUP				
Postoperative Stay 0–1	1045 (9.69%)	9736 (90.31%)	3804 (7.55%)	46605 (92.45%)
Postoperative Stay 2–4	1461 (8.98%)	14800 (91.02%)	4351 (6.00%)	68182 (94.00%)

	BLACK race		Other race	
Variables	No Visit (n = 3490)	Visit (n = 37205)	No Visit (n = 11353)	Visit (n = 171893)
Postoperative Stay 5–7	677 (7.07%)	8894 (92.93%)	2186 (5.04%)	41145 (94.96%)
Postoperative Stay 8–10	307 (7.52%)	3775 (92.48%)	1012 (5.96%)	15961 (94.04%)
ASA				
1–2	1201 (12.62%)	8318 (87.38%)	3779 (10.05%)	33823 (89.95%)
3–5	1856 (6.6%)	26244 (93.40%)	6045 (4.60%)	125432 (95.40%)
CORONARY ARTERY DISEASE				
no	2985 (9.62%)	28058 (90.38%)	9392 (7.83%)	110558 (92.17%)
yes	505 (5.23%)	9147 (94.77%)	1961 (3.10%)	61335 (96.90%)
CONGESTIVE HEART FAILURE				
no	3231 (8.81%)	33460 (91.19%)	10582 (6.40%)	154738 (93.60%)
yes	259 (6.47%)	3745 (93.53%)	771 (4.30%)	17155 (95.70%)
DIABETES MELLITUS				
no	2716 (10.09%)	24206 (89.91%)	9277 (7.43%)	115585 (92.57%)
yes	774 (5.62%)	12999 (94.38%)	2076 (3.56%)	56308 (96.44%)
HYPERTENSION				
no	1483 (15.77%)	7923 (84.23%)	5775 (12.01%)	42295 (87.99%)
yes	2007 (6.41%)	29282 (93.59%)	5578 (4.13%)	129598 (95.87%)
VASCULAR DISEASE				
no	3082 (8.98%)	31236 (91.02%)	9820 (6.68%)	137194 (93.32%)
yes	408 (6.40%)	5969 (93.60%)	1533 (4.23%)	34699 (95.77%)
PULMONARY DISEASE				
no	2733 (9.19%)	26993 (90.81%)	8554 (6.90%)	115433 (93.10%)
yes	757 (6.90%)	10212 (93.10%)	2799 (4.72%)	56460 (95.28%)
Cerebral/Cerebrovascular Disease, Any				
no	3168 (8.38%)	34615 (91.62%)	10458 (6.16%)	159208 (93.84%)
yes	322 (11.06%)	2590 (88.94%)	895 (6.59%)	12685 (93.41%)
Alcohol Abuse, ANY				
no	2698 (9.08%)	27013 (90.92%)	9326 (6.15%)	142259 (93.85%)
yes	792 (7.21%)	10192 (92.79%)	2027 (6.40%)	29634 (93.60%)
Drug Abuse, ANY				
no	2771 (8.78%)	28789 (91.22%)	10336 (6.11%)	158858 (93.89%)
yes	719 (7.87%)	8416 (92.13%)	1017 (7.24%)	13035 (92.76%)
THOUGHT DISORDER, ANY				
no	2847 (8.03%)	32602 (91.97%)	9505 (5.77%)	155110 (94.23%)
yes	643 (12.26%)	4603 (87.74%)	1848 (9.92%)	16783 (90.08%)
DEPRESSION, ANY				
no	2449 (9.09%)	24483 (90.91%)	7937 (6.57%)	112936 (93.43%)
yes	1041 (7.56%)	12722 (92.44%)	3416 (5.48%)	58957 (94.52%)

	BLACK race		Other race	
Variables	No Visit (n = 3490)	Visit (n = 37205)	No Visit (n = 11353)	Visit (n = 171893)
BIPOLAR DISORDER				
no	3264 (8.57%)	34834 (91.43%)	10535 (6.16%)	160518 (93.84%)
yes	226 (8.70%)	2371 (91.30%)	818 (6.71%)	11375 (93.29%)
PTSD				
no	3040 (9.05%)	30549 (90.95%)	10078 (6.50%)	145019 (93.50%)
yes	450 (6.33%)	6656 (93.67%)	1275 (4.53%)	26874 (95.47%)
ANEMIA OR HEMAGLOBINOPATHY				
no	2374 (8.33%)	26117 (91.67%)	9029 (6.26%)	135187 (93.74%)
yes	1116 (9.14%)	11088 (90.86%)	2324 (5.95%)	36706 (94.05%)
HYPERLIPIDEMIA				
no	2257 (12.29%)	16114 (87.71%)	6692 (11.42%)	51888 (88.58%)
yes	1233 (5.52%)	21091 (94.48%)	4661 (3.74%)	120005 (96.26%)
Renal DISEASE, ANY				
no	2808 (8.58%)	29903 (91.42%)	9503 (6.20%)	143648 (93.80%)
yes	682 (8.54%)	7302 (91.46%)	1850 (6.15%)	28245 (93.85%)
LIVER DISEASE, ANY				
no	3102 (8.92%)	31688 (91.08%)	10601 (6.22%)	159758 (93.78%)
yes	388 (6.57%)	5517 (93.43%)	752 (5.84%)	12135 (94.16%)
ANXIETY				
no	3189 (8.79%)	33073 (91.21%)	9981 (6.40%)	145942 (93.60%)
yes	301 (6.79%)	4132 (93.21%)	1372 (5.02%)	25951 (94.98%)
ATRIAL FIBRILLATION OR FLUTTER				
no	3366 (8.72%)	35256 (91.28%)	10633 (6.49%)	153095 (93.51%)
yes	124 (5.98%)	1949 (94.02%)	720 (3.69%)	18798 (96.31%)
HIV				
no	3463 (8.70%)	36322 (91.30%)	11340 (6.21%)	171123 (93.79%)
yes	27 (2.97%)	883 (97.03%)	13 (1.66%)	770 (98.34%)
REGION				
Northeast	421 (8.81%)	4356 (91.19%)	1325 (5.73%)	21806 (94.27%)
MidAtlantic	470 (7.77%)	5578 (92.23%)	676 (5.89%)	10807 (94.11%)
Southeast	1537 (8.83%)	15874 (91.17%)	3791 (6.31%)	56322 (93.69%)
Midwest	624 (8.55%)	6677 (91.45%)	2249 (5.60%)	37942 (94.40%)
Southwest	46 (7.82%)	542 (92.18%)	513 (5.35%)	9071 (94.65%)
Mountain West	34 (8.90%)	348 (91.10%)	503 (6.35%)	7413 (93.65%)
West	358 (8.55%)	3830 (91.45%)	2296 (7.45%)	28532 (92.55%)

Note: mean (SD) or n (%) was presented;

Table 3
Summary statistics of missing postoperative visit by race across different regions unadjusted for other covariates.

VISN	Region	All Race			Black Race			Other Race			P-value
		Missing Visit	Total	% Missing Visit 6.26	Missing Visit	Total	% Missing Visit 8.81	Missing Visit	Total	% Missing Visit 5.73	Difference % 3.08
1,2,3,4	Northeast	1746	27908	(5.97–6.54)	421	4777	(8.01–9.62)	1325	23131	(5.43–6.03)	(2.23–3.94)
5,6	MidAtlantic	1146	17531	(6.54–6.17–6.90)	470	6048	(7.10–8.45)	676	11483	(5.46–6.32)	1.88 (1.08–2.68)
7,8,9,16,17	Southeast	5328	77524	(6.87–6.69–7.05)	1537	17411	(8.83–8.41–9.26)	3791	60113	(6.11–6.50)	2.52 (2.06–2.99)
10,11,12,15,23	Midwest	2873	47492	(6.05–5.84–6.26)	624	7301	(8.55–7.91–9.19)	2249	40191	(5.37–5.82)	2.95 (2.27–3.63)
18	Southwest	559	10172	(5.50–5.05–5.94)	46	588	(7.82–5.65–9.99)	513	9584	(4.90–5.80)	2.47 (0.25–4.69)
19	Mountain West	537	8298	(6.47–5.94–7.00)	34	382	(8.90–6.05–11.76)	503	7916	(5.82–6.89)	1.48 (0.36–5.45)
20,21,22	West	2654	35016	(7.58–7.30–7.86)	358	4188	(8.55–7.70–9.40)	2296	30828	(7.15–7.74)	1.10 (0.20–2.00)
	Overall	14843	223941	(6.63–6.53–6.73)	3490	40695	(8.58–8.30–8.85)	11353	183246	(6.09–6.31)	2.38 (2.09–2.67)
											<0.0001

Table 4

The adjusted odds ratio and 95% CI of black race vs. other race on the outcome of missing postoperative visit

VSN	Region	Demographics			Demographics + ASAPS			Demographics + CCI			Demographics + VACS		
		OR (95% CI)	P-value		OR (95% CI)	P-value		OR (95% CI)	P-value		OR (95% CI)	P-value	
1,2,3,4,1,2,3,4	Northeast	1.186 (1.043–1.348)	0.0093		1.187 (1.033–1.364)	0.0156		1.180 (1.037–1.342)	0.0117		1.059 (1.011–1.110)	0.0159	
5,6	MidAtlantic	1.038 (0.909–1.186)	0.5798		1.079 (0.939–1.240)	0.2838		1.040 (0.911–1.188)	0.5612		1.085 (0.946–1.244)	0.2437	
7,8,9,16,17	Southeast	1.071 (1.000–1.147)	0.0499		1.042 (0.969–1.121)	0.2689		1.074 (1.003–1.150)	0.041		1.014 (0.944–1.090)	0.6974	
10,11,12,15,23	Midwest	1.284 (1.157–1.423)	<0.0001		1.309 (1.172–1.462)	<0.0001		1.285 (1.159–1.426)	<0.0001		1.190 (1.066–1.330)	0.0021	
18	Southwest	1.221 (0.884–1.687)	0.2263		1.211 (0.845–1.736)	0.297		1.225 (0.887–1.693)	0.2181		1.223 (0.876–1.707)	0.2364	
19	MountainWest	1.343 (0.920–1.961)	0.1269		1.386 (0.920–2.088)	0.1184		1.342 (0.919–1.961)	0.1276		1.386 (0.931–2.063)	0.1075	
20,21,22	West	0.996 (0.882–1.125)	0.9512		0.991 (0.870–1.128)	0.8872		1.007 (0.892–1.137)	0.9082		1.000 (0.882–1.135)	0.9939	
Overall *		1.110 (1.062–1.160)	<0.0001		1.105 (1.054–1.159)	<0.0001		1.114 (1.066–1.164)	<0.0001		1.059 (1.011–1.110)	0.0159	
Overall Among Hypertensives **		1.090 (0.958–1.239)	0.1899		1.091 (0.950–1.253)	0.2195		1.106 (0.972–1.258)	0.1264		1.058 (0.922–1.214)	0.4216	

Demographics: Year of surgery, age, age $\geq$ 65, gender, Hispanic ethnicity, inpatient days, Surgery type

OR > 1: Indicates black or African American race associated with being more likely not to have medical follow-up.

Note: VA station was modeled as a random effect to account for the correlation or similarity of patients being seen within the same station.

* In the overall model, region was adjusted as an additional independent covariate

** The results using subcohort patients whose SBP $\geq$ 140 mmHg or DBP $\geq$ 90 mg Hg