Effect of Race and Ethnicity on Outcomes With Drug-Eluting and Bare Metal Stents

Results in 423965 Patients in the Linked National Cardiovascular Data Registry and Centers for Medicare & Medicaid Services Payer Databases

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Background—Black, Hispanic, and Asian patients have been underrepresented in percutaneous coronary intervention clinical trials; therefore, there are limited data available on outcomes for these race/ethnicity groups.

Methods and Results—We examined outcomes in 423965 patients in the National Cardiovascular Data Registry CathPCI Registry database linked to Medicare claims for follow-up. Within each race/ethnicity group, we examined trends in drug-eluting stent (DES) use, 30-month outcomes, and relative outcomes of DES versus bare metal stents. Overall, 390,351 white, 20,191 black, 9,342 Hispanic, and 4171 Asian patients >65 years of age underwent stent implantation from 2004 through 2008 at 940 National Cardiovascular Data Registry participating sites. Trends in adoption of DES were similar across all groups. Relative to whites, black and Hispanic patients undergoing percutaneous coronary intervention had higher long-term risks of death and myocardial infarction (blacks: hazard ratio, 1.28; 95% confidence interval, 1.24–1.32; Hispanics: hazard ratio, 1.15; 95% confidence interval, 1.10–1.21). Long-term outcomes were similar in Asians and whites (hazard ratio, 0.99; 95% confidence interval, 0.92–1.08). Use of DES was associated with better 30-month survival and lower myocardial infarction rates compared with the use of bare metal stents among all race/ethnicity groups except Hispanics, who had similar outcomes with DES or bare metal stents.

Conclusions—Black and Hispanic patients undergoing percutaneous coronary intervention had worse long-term outcomes relative to white and Asian patients. Compared with bare metal stent use, DES use was generally associated with superior long-term outcomes in all racial and ethnic groups, although these differences were not statistically significant in Hispanic patients. (Circulation. 2013;127:1395-1403.)

Key Words: continental population groups ■ coronary artery disease ■ drug-eluting stents ■ ethnic groups ■ outcome assessment ■ percutaneous coronary intervention

Limited data exist on the contemporary safety and efficacy of percutaneous coronary intervention (PCI) in racial and ethnic minorities. Previous studies comparing PCI outcomes in black and white patients have had conflicting results,1-6 and these findings may not be applicable to patients undergoing PCI with current stent technology or to other minority populations. Randomized trials have found that drug-eluting stent (DES) use reduces repeat revascularization rates but has similar survival and myocardial infarction (MI) rates compared with bare metal stents (BMS); however, these studies were performed predominantly in white patients.7 Registry analyses have suggested that DES use in community practice may be associated with improved survival and freedom from MI compared with BMS;6 however, to date, such data on comparative PCI outcomes for racial and ethnic minorities are limited.

Clinical Perspective on p 1403

We sought to evaluate long-term PCI outcomes for racial and ethnic minorities in the modern era, as well as DES use, safety, and effectiveness, using a large nationally representative patient sample. We examined data from the National Cardiovascular Data Registry CathPCI Registry linked to Medicare claims data to identify any differences in patterns of DES and BMS use among racial and ethnic groups, to describe and compare outcomes after PCI for each racial and ethnic group, and to assess comparative long-term outcomes after DES versus BMS use within each racial and ethnic group.
Methods

Study Population
The CathPCI Registry is sponsored by the American College of Cardiology and the Society for Cardiovascular Angiography and Interventions. The registry collects information for patients undergoing PCI procedures. We included all CathPCI Registry patients ≥65 years of age undergoing a coronary stent procedure between January 1, 2004, and December 31, 2008, who were identified as being white, black, Asian, or Hispanic. We excluded patients who received >1 stent type (ie, both DES and BMS; Figure 1). The Duke University Medical Center Institutional Review Board granted a waiver of informed consent and authorization for this study.

Follow-up Information
Because CathPCI Registry data are limited to a single episode of care, we used the research-identifiable Medicare 100% inpatient fee-for-service claims file for longitudinal patient follow-up. PCI procedure codes (International Classification of Diseases, ninth revision, clinical modification [ICD-9-CM]) procedure codes 00.66, 36.0x, 37.22, 37.23, and 88.5x, except 88.59) were used to identify potential index procedure matches in the Medicare files, which were then linked to the CathPCI Registry using indirect identifiers (ie, nonunique fields that, when used in combination, may identify unique hospitalizations) to create unidentified longitudinal profiles and to obtain up to 3 years of follow-up.9,10 Linking rules used a hierarchy-of-evidence approach so that rules with the most information were applied before those with less information. Once a unique match was achieved for a patient, no further rules were applied. Our linking rules contained combinations of information denoting the index PCI procedure site, patient date of birth (or components thereof) or age, admission date, discharge date, and sex. In the rare event that a single CathPCI Registry record could be matched with multiple Medicare records using the same rule, no linking occurred. CathPCI Registry sites that did not match to Medicare records were excluded, as were patients whose index PCI procedure did not occur during a period of fee-for-service enrollment.

Statistical Analysis
Baseline and propensity-matching characteristics were categorized by race and ethnicity (white, black, Asian, and Hispanic) and summarized as counts and percentages for categorical variables and means with standard deviations for continuous variables. Differences between groups were compared by use of χ² tests for categorical variables and the Kruskal-Wallis test for continuous variables. The P values for the temporal trends of DES use were obtained by modeling time as an ordinal independent variable using the logistic generalized estimating equations method with an exchangeable working correlation matrix to account for within-hospital clustering, because patients at the same hospital are more likely to have similar responses relative to patients at other hospitals (ie, within-center correlation for responses). Statistical significance was defined as P<0.05. SAS statistical software (version 9.2, SAS Institute, Cary, NC) was used for all calculations.

Clinical End Points
We evaluated 4 clinical end points: death, MI, repeat revascularization (PCI or coronary artery bypass grafting), and the combined end point of death or MI. Death was the only event defined both during the index PCI procedure (with CathPCI Registry information) and after discharge (with the Medicare denominator file). Clinical end points were defined with the Medicare claims file as the primary diagnosis for a hospital admission. The ICD-9-CM diagnosis codes used to identify MI were 410.X1. Revascularizations were identified with ICD-9-CM procedure codes (PCI: 36.00, 36.06, 36.07, and 36.09; coronary artery bypass grafting: 36.10-19). Only revascularizations occurring after discharge from the index hospital stay were included in the revascularization analysis. Estimates of the event rates for clinical end points at 1 month, 1 year, and 30 months after intervention and the P values to test the difference among race/ethnicity groups were based on inverse probability-weighted estimators to account for incomplete data resulting from staggered entry into the cohort. The cumulative incidence rates for time-to-event clinical outcomes were estimated by use of the Gray method11 to account for competing risks. One-month, 1-year, and 30-month outcomes for each race/ethnicity group were analyzed and displayed with Kaplan-Meier methods; survival P estimates were calculated for each outcome and used for comparisons among groups, with whites as the reference group for each comparison. For 30-month clinical end points, Cox proportional hazard analyses were performed to adjust for differences in baseline clinical characteristics.

Propensity Score Models
For adjusted analyses, a separate propensity score model was created within each racial and ethnic group to compare DES and BMS.
Propensity scores represent the estimated probabilities of patients receiving 1 device type versus another (DES versus BMS). In this case, conditioned on observed covariates (Table I in the online-only Data Supplement). The propensity score logistic regression models had c indexes of 0.741 for the white group, 0.743 for the black group, 0.746 for the Hispanic group, and 0.775 for the Asian group. The greedy matching algorithm was used to match each pair of device types on the basis of the propensity scores. After matching, the distribution of estimated propensity scores for patients with DES closely matched that for patients with BMS as evidenced by the 5-number summaries (minimum, 25th, 50th, 75th, maximum) describing the curves for patients receiving each type of device (white group: DES: 8.9%, 55.1%, 66.1%, 78.1%, and 99.2%; BMS: 9.2%, 55.1%, 66.1%, 78.1%, and 99.2%; black group: DES: 14.4%, 53.2%, 63.0%, 74.9%, and 98.7%; BMS: 14.4%, 52.6%, 63.0%, 74.9%, and 98.7%; Hispanic group: DES: 21.5%, 57.5%, 67.6%, 78.2%, and 97.4%; BMS: 15.0%, 57.6%, 67.7%, 78.2%, and 97.4%; and Asian group: DES: 10.1%, 56.8%, 69.1%, 81.5%, and 98.7%; BMS: 13.1%, 57.1%, 69.3%, 81.5%, and 98.7%). Adjusted event rates and hazard ratios (HRs) comparing DES and BMS were calculated among the propensity score–matched race/ethnicity cohorts. This served as our primary analysis. Secondary analyses included traditional Cox modeling using backward selection of the propensity score variables with a selection threshold of \( P = 0.05 \). In addition, forward variable selection was used as a sensitivity analysis for internal validation of the final model, which contained 60 covariates.

Results

Between January 2004 and December 2008, 665,848 National Cardiovascular Data Registry patients ≥65 years of age underwent stent implantation, and 63.8% were linked to longitudinal Medicare records. After exclusions, the study population included 423,965 patients from 940 sites (Figure 1). Comparison of CathPCI Registry patients who did and did not match to Medicare records revealed that nonmatched patients were more likely to be slightly younger (age, 74 versus 75 years) and male (62% versus 58%) and on average to have had a more recent PCI (PCI in 2008: 38% versus 26%). The linked population included 390,351 white patients (92.1%), 20,101 black patients (4.7%), 9342 Hispanic patients (2.2%), and 4171 Asian patients (1.0%).

Unadjusted baseline characteristics for racial and ethnic groups are listed in Table 1. Significant differences in baseline characteristics among groups were apparent. Black patients had a higher proportion of women compared with other groups. Black, Hispanic, and Asian patients all had higher rates of diabetes mellitus, renal failure, and dialysis use than white patients but lower rates of prior coronary artery bypass grafting. Ages and rates of congestive heart failure, prior MI, and prior PCI were similar among all groups.

DES and BMS Use

Overall, 107,185 patients (25.3%) received 1 or more BMS and 316,780 patients (74.7%) received 1 or more DES (51% paclitaxel-eluting, 42% sirolimus-eluting, 6% everolimus-eluting, and 3% zotarolimus-eluting stents). Blacks patients were slightly less likely than white patients to receive DES (71.9% versus 74.8%) and had the lowest rate of DES use of all racial and ethnic subgroups. Hispanic and Asian patients had slightly higher rates of DES use than white patients (76.3% and 79.0%, respectively). In all racial and ethnic groups, patients who received DES (compared with those who received BMS) were slightly younger, more likely to have diabetes, and more likely to have had prior revascularization (PCI or coronary artery bypass grafting). Temporal trends in relative DES versus BMS use for racial and ethnic subgroups are shown in Figure 2. All racial and ethnic groups showed a decline in relative DES use over the duration of the study period (all \( P < 0.001 \)), which was similar across all groups (trend comparisons: white versus black, \( P = 0.288 \); white versus Hispanic, \( P = 0.617 \); white versus Asian, \( P = 0.877 \)).

Unadjusted Outcomes

Unadjusted rates of death, MI, and repeat revascularization and the composite end point of death or MI at 1 month, 1 year, and 30 months are shown in Figure 3. Compared with white patients, black patients had higher 30-month rates of death (19.8% versus 15.9%; \( P < 0.001 \)), higher rates of MI (10.7% versus 7.5%; \( P < 0.001 \)), and slightly lower rates of repeat revascularization (19.7% versus 21.4%; \( P = 0.001 \)). Hispanic patients had higher 30-month rates of death compared with white patients (17.0% versus 15.9%; \( P = 0.01 \)), higher rates of MI (9.1% versus 7.5%; \( P = 0.028 \)), and similar rates of repeat revascularization (21.8% versus 21.4%; \( P = 0.40 \)). Asian and white patients had similar 30-month rates of death (16.7% versus 15.9%; \( P = 0.076 \)), MI (6.6% versus 7.5%; \( P = 0.726 \)), and repeat revascularization (21.9% versus 21.4%; \( P = 0.515 \)). The composite end point of death or MI tracked similarly to its individual components in each racial and ethnic group and, compared with white patients, occurred more frequently in the black group (HR, 1.28; 95% confidence interval [CI], 1.24–1.32) and the Hispanic group (HR, 1.15; 95% CI, 1.10–1.21), with similar occurrence rates among Asian and white patients (HR, 0.99; 95% CI, 0.92–1.08).

Adjusted Outcomes

Cox proportional hazard analyses were performed to adjust for differences in baseline clinical characteristics (Table 2). After adjustment, black patients continued to have a slightly higher 30-month mortality risk compared with white patients (HR, 1.08; 95% CI, 1.04–1.12), a higher risk of MI (HR, 1.26; 95% CI, 1.19–1.33), and a slightly lower risk of repeat revascularization (HR, 0.92; 95% CI, 0.89–0.96). Hispanic patients had a similar adjusted risk of death compared with white patients (HR, 1.04; 95% CI, 0.99–1.11), a higher risk of MI (HR, 1.23; 95% CI, 1.13–1.34), and a slightly higher risk of repeat revascularization (HR, 1.07; 95% CI, 1.01–1.13). Asian patients had a slightly lower adjusted risk of death than white patients (HR, 0.90; 95% CI, 0.82–0.98) and similar risks of MI (HR, 0.89; 95% CI, 0.77–1.04) and repeat revascularization (HR, 0.93; 95% CI, 0.85–1.01). Compared with white patients, the adjusted risk for the composite end point of death or MI remained higher in the black group (HR, 1.12; 95% CI, 1.08–1.16) and the Hispanic group (HR, 1.08; 95%
Asian patients demonstrated a lower adjusted risk for the composite end point compared with white patients (HR, 0.89; 95% CI, 0.82–0.96).

Propensity-Matched Analyses
To compare the safety and effectiveness of DES versus BMS in each racial and ethnic group, propensity score–matched analyses were performed using 92,330 pairs of white patients who received each stent type (92,330 received DES and 92,330 received BMS), 5183 pairs of black patients who received each stent type, 2071 pairs of Hispanic patients who received each stent type, and 798 pairs of Asian patients who received each stent type. Baseline characteristics were similar between DES and BMS subgroups within each racial and ethnic group (Table I in the online-only Data Supplement).

The clinical outcomes of DES versus BMS for each end point in each group are shown in Figure 4, with results for the propensity score-matched cohorts presented alongside unadjusted results. White patients who received DES (instead of BMS) were less likely to experience death (HR, 0.77; 95% CI, 0.75–0.79), MI (HR, 0.79; 95% CI, 0.76–0.83), death or MI (HR, 0.77; 95% CI, 0.76–0.79), or repeat revascularization (HR, 0.91; 95% CI, 0.89–0.94; P<0.001). Black patients who received DES were less likely to experience death (HR, 0.80;
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95% CI, 0.70–0.90) or death or MI (HR, 0.81; 95% CI, 0.74–0.88) or to undergo repeat revascularization (HR, 0.88; 95% CI, 0.79–0.99) than those who received BMS while showing a trend toward a lower MI rate (HR, 0.59; 95% CI, 0.33–1.03).

Discussion

This large cohort of elderly patients allowed us to address the knowledge gaps in clinical outcomes and stent use in racial and ethnic groups. We found that black and Hispanic patients undergoing PCI had worse long-term outcomes relative to white and Asian patients. Although overall use of DES versus BMS and temporal trends were similar by race/ethnicity group, those receiving DES generally had superior long-term outcomes regardless of racial and ethnic group.

The concern for differential use in revascularization procedures for coronary artery disease in racial and ethnic minorities was raised as early as 1989, with several early studies demonstrating a lower rate of cardiac catheterization, angioplasty, and coronary artery bypass grafting in black patients compared with white patients and, to a lesser degree, Hispanic and Asian patients. Relative to white patients, these disparities in the use of revascularization procedures persisted in black patients when controlling for the degree of coronary artery disease and after adjusting for the severity of underlying disease.

After the introduction of DES into the United States in April 2003, they were rapidly adopted. During this time period, black patients were found to be less likely to receive DES than white patients. Although this difference was greater in 2003 than in 2004, the difference was still present in 2004.

Our findings show that this difference has been further reduced with time, with all groups having a similarly high amount of relative DES use in 2005 followed by similar trends in DES use through 2008, as evidenced by the declines in relative DES use in more recent years (Figure 2). We suspect that the trend of declining use of DES in all ethnicities represents an initial response to registry data published in 2006 that raised concerns for DES safety, with a reversal in the trend for DES use as subsequent data confirmed the overall safety of DES. This suggests similar access to stent technology, no evidence of a persistent lag in adoption of DES, and similar responses to clinical evidence on the safety and efficacy of DES across racial and ethnic groups. As a result, access to stent technology appears to be similar across racial and ethnic groups, and observed outcome differences are unlikely to be related to differential use of DES among these groups.

In the pre-DES era, reports of long-term post-PCI outcomes between black and white patients were conflicting, with higher mortality observed in black patients in some studies but not in others. Since the introduction of DES, 1 study including 1221 black patients receiving DES found an elevated 1-year mortality risk after PCI compared with whites, although risks for major adverse cardiac events were similar after risk adjustment (HR, 1.1; 95% CI, 1.0–1.4; \( P=0.14 \)). In terms of the risk of MI, black patients were previously found to have a higher 5-year risk of MI than whites after PCI in a study of 730 mostly black patients with 89% stent use (all BMS). We found elevated rates of both death and MI in black patients that persisted after risk adjustment. This expands substantially...
on previous findings by examining these outcomes in a much larger modern cohort, which is reflective of current use patterns of both DES and BMS. Furthermore, we were able to examine outcomes in Hispanic and Asian patients with relatively large sample sizes. Prior data on PCI outcomes in these populations are more limited. A few smaller studies have reported similar PCI outcomes in Hispanic and Asian patients relative to whites. In a recent study, Hispanic patients with 29% DES use and 1 year of follow-up were found to have no difference in the risk of MI or repeat revascularization compared with white patients. In contrast to these findings, we observed an elevated risk of death or MI in Hispanic patients, driven primarily by an increased risk of MI. Although differences in length of follow-up, procedural characteristics, and study populations may help explain the differences between our study and some previous authors’ findings, it is also possible that the lack of an elevated event rate in Hispanic patients in prior studies was due in part to smaller sample sizes with wide CIs rather than equivocal risk. Our large contemporary patient population may more accurately reflect small differences not appreciated previously. In contrast to black and Hispanic patients, we found Asian patients to have the lowest event rate of any racial or ethnic group, which is consistent with previous findings.1

Although the magnitude of outcome differences among racial and ethnic groups was relatively small, these differences deserve some further consideration because the observational nature of our study limits our ability to determine causative factors. Consistent with other studies, we found that black and Hispanic patients carried a greater burden of cardiovascular risk factors than whites, and incomplete adjustment for baseline risk factors may be partially responsible for the observed outcome differences. PCI outcomes of individual hospitals may also contribute to racial and ethnic outcome differences in that hospitals that treat predominantly black patients have demonstrated to have worse outcomes for treatment of MI than hospitals that treat predominantly white patients, with the racial disparities significantly attenuated.

<table>
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<th>Outcome</th>
<th>White HR</th>
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<th>Upper CL</th>
<th>PValue</th>
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<td>0.013</td>
</tr>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Black</td>
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<td>1.038</td>
<td>1.118</td>
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<tr>
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<td>0.986</td>
<td>1.106</td>
<td>0.139</td>
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<tr>
<td>Any MI</td>
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<td>0.765</td>
<td>1.042</td>
<td>0.150</td>
</tr>
<tr>
<td>Asian</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Black</td>
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<td>0.963</td>
<td>0.004</td>
</tr>
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<td></td>
</tr>
<tr>
<td>Black</td>
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CABG indicates coronary artery bypass grafting; CL, confidence limit; HR, hazard ratio; MI, myocardial infarction; and PCI, percutaneous coronary intervention.
after within-hospital outcomes comparisons. To determine the effect of hospital quality, we compared adjusted outcomes for each race and ethnicity group after adding in-hospital mortality as a covariate in our risk-adjusted model. This resulted in no significant change in the relative outcomes of any of the primary end points for each race and ethnicity group, suggesting that the observed outcome differences in our study may be independent of hospital quality.

Furthermore, unmeasured variables such as socioeconomic status, individual provider practice patterns, and differential use of evidence-based therapies for coronary artery disease after PCI have previously been suggested to influence PCI outcomes and should be considered. For example, a study of Veterans Affairs patients with coronary artery disease found that fewer black patients met low-density lipoprotein cholesterol goals for lipid-lowering therapy for secondary prevention compared with white patients (41% versus 57%; P=0.001). The presence and possible effect of such differences are unknown in our study population, as is whether such factors may have differentially affected selection for DES versus BMS use in race/ethnicity groups. In addition to these variables, physiological differences among racial and ethnic groups must also be considered as potential factors. Recently, Collins et al identified black race as a significant independent risk factor for stent thrombosis with DES on multivariable analysis, despite a higher adherence to clopidogrel therapy in black patients than whites and after adjustment for socioeconomic status (HR, 2.60; 95% CI, 1.40–4.68; P=0.0023).

Although PCI outcomes in racial and ethnic groups have previously been described to some degree, we found a relative lack of comparative effectiveness data evaluating the relative performance of DES and BMS across racial and ethnic groups. We chose to examine the relative performance of DES and BMS within groups using a propensity score–matched cohort approach. It is important to note that our study found a survival advantage associated with DES for most groups that has not been demonstrated in randomized trials. This variation in outcomes for DES and BMS between randomized trials and observational studies has previously been well described. In a meta-analyses by Kirtane et al, randomized trials showed similar rates of mortality and MI and lower rates of revascularization with DES compared with BMS; in contrast, observational studies have shown lower rates of mortality, MI, and revascularization with DES. Although the causative factors for these differences have not been identified with certainty (several factors, including selection bias, differences in study populations between registries and clinical trials, and residual confounding, have been hypothesized), these specific patterns in observational and randomized trials have been demonstrated repeatedly. In our study, the advantages usually associated with DES in observational studies were seen only in white patients for all end points. For black and Asian patients, DES use was associated with better survival and less revascularization. Hispanic patients in our study derived the least benefit with DES and showed no benefit with DES over BMS for any end point. To the best of our knowledge, this is the only study that specifically compares the performance of DES and BMS in a Hispanic population. As mentioned, Hispanic patients also had the highest rate of repeat revascularization. These findings combined are hypothesis generating in regard to DES performance in Hispanic patients, but because of the retrospective nature of our analysis, we cannot further explain the observed similar performance of DES and BMS in this population. Hispanic patients had the highest rates of diabetes mellitus and ST-segment–elevation MI presentation of any group, and further study is needed to identify to what extent these or other factors may be responsible for our findings. In no group was DES associated with a higher risk of adverse outcomes compared with BMS, confirming the general safety of these devices.

Limitations

Although this analysis has several important strengths, including its large sample size and relatively large number of patients representing racial and ethnic minorities, it also has inherent weaknesses that should be recognized. First, our results are limited to patients who were ≥65 years of age and may not be applicable to younger patients. Second, it is unknown to what extent population differences in socioeconomic status, postprocedural medication use, and other variables not measured in this study were present. As discussed, incomplete adjustment for baseline risk factors and unmeasured variables is a limitation inherent to observational studies and has been recently examined in PCI registry analysis by Venkitachalam et al, who compared patients who received DES and BMS in a large registry and found that the use of different adjustment methods demonstrated different relative outcomes with DES and BMS. The difference in outcomes was potentially due to the presence of unmeasured confounders. Although propensity matching was used to balance a treatment assignment of DES versus BMS across groups, this method may not have controlled for specific socioeconomic factors, postprocedural medication use, physiological differences, treatment of coronary artery disease risk factors after PCI, and other factors associated with specific racial and ethnic groups that may have affected treatment choice and outcomes. To address this issue, we performed a different sensitivity analysis to estimate the magnitude of association between an unmeasured confounder and our exposure variable needed to alter our conclusions. This sensitivity analysis estimated the magnitude of odds ratios between an unmeasured confounder and exposure that would invalidate our results. We varied the prevalence of a potential confounder between 0.2 and 0.4 and assumed a strong association of the confounder to the outcome (risk ratio ≥12), so the reported magnitudes are conservative. Sensitivity analysis on residual confounding indicated that an unmeasured confounder would need to be associated with a 3.2- to 6.8-fold increase in the odds of selecting a DES, with a near-perfect predictor of death to eliminate the significant associations of our findings. This analysis strengthens the validity of our findings, but further study is still needed to understand causative factors for the significant mortality benefit with DES seen in our study, as well as other observational studies comparing DES and BMS. The classification of patients into racial and ethnic groups was based on hospital report and may differ significantly from
self-report. Furthermore, broad racial and ethnic categories represent several subpopulations with potentially widely different cardiovascular risk profiles. For example, patients identified as Asian include those with ancestry in the Far East, Indian subcontinent, and Southeast Asia. Each of these populations may carry different cardiovascular risk, and further study is needed to define these risk differences. Finally, all patients within the CathPCI Registry database have been referred for coronary intervention; therefore, we are unable to assess the extent to which differences in referral rates for PCI may persist across these populations. Further study is warranted to identify factors responsible for the outcome differences found in our study.

Conclusions

In this large contemporary cohort of patients undergoing PCI, black and Hispanic patients have a significantly greater risk of adverse cardiac events after PCI relative to white patients. Asian and white patients have similar long-term outcomes. DES use is similar across groups and has decreased over time in all race/ethnicity groups. Longitudinal outcomes are generally superior with DES in each racial and ethnic group, although DES use was not associated with superior outcomes in Hispanic patients.

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Disclosures

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**CLINICAL PERSPECTIVE**

Randomized trials have found that drug-eluting stent use for the treatment of obstructive coronary artery disease reduces repeat revascularization rates with similar survival and myocardial infarction rates compared with bare metal stents. However, these studies were predominantly performed in white patients, so limited data exist on outcomes for black, Hispanic, and Asian patients. We used the National Cardiovascular Data Registry CathPCI Registry linked to Medicare claims to examine outcomes for these understudied racial/ethnic groups. We included all CathPCI Registry patients ≥65 years of age undergoing a coronary stent procedure between January 1, 2004, and December 31, 2008. Relative to white patients, we found that black and Hispanic patients have a significantly greater risk of adverse cardiac events after percutaneous coronary intervention, although long-term outcomes between Asians and whites are similar. We also found better performance of drug-eluting stents compared with bare metal stents in all groups except Hispanics, in whom drug-eluting stent and bare metal stent performance was similar. To the best of our knowledge, this is one of the first studies to examine percutaneous coronary intervention outcomes for a large cohort of minority patients, to compare these outcomes relative to outcomes in white patients, and specifically to evaluate the performance of drug-eluting and bare metal stents within each group. Our findings are significant to clinical practice by providing clinicians with new information on long-term percutaneous coronary intervention outcomes for specific racial/ethnic groups, including data evaluating drug-eluting and bare metal stent performance, which may help in risk stratification and treatment selection to optimize clinical outcomes and to improve resource use for black, Hispanic, and Asian patients undergoing percutaneous coronary intervention for the treatment of coronary artery disease.
Effect of Race and Ethnicity on Outcomes With Drug-Eluting and Bare Metal Stents: Results in 423,965 Patients in the Linked National Cardiovascular Data Registry and Centers for Medicare & Medicaid Services Payer Databases


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## Supplemental Table 1. Baseline Characteristics of Propensity-matched Cohorts

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<th>Asian DES N=798</th>
<th>Caucasian BMS N=92,330</th>
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*p-values for DES vs. BMS

BMS indicates bare metal stent; DES, drug-eluting stent; CABG, coronary artery bypass grafting; CHF, congestive heart failure;
HTN, hypertension; MI, myocardial infarction; NSTEMI, non-ST-segment elevation myocardial infarction; PCI, percutaneous coronary intervention; PVD, peripheral vascular disease; STEMI, ST-segment elevation myocardial infarction; UA, unstable angina