Differences in Specialist Consultations for Cardiovascular Disease by Race, Ethnicity, Gender, Insurance Status, and Site of Primary Care

Nakela L. Cook, MD, MPH; John Z. Ayanian, MD, MPP;
E. John Orav, PhD; LeRoi S. Hicks, MD, MPH

Background—Consultation with cardiologists may improve the quality of ambulatory care and reduce disparities for patients with heart disease. We assessed the use of cardiology consultations and the associated quality by race/ethnicity, gender, insurance status, and site of care.

Methods and Results—In a retrospective cohort, we examined electronic records of 9761 adults with coronary artery disease or congestive heart failure (CHF) receiving primary care at practices affiliated with 2 academic medical centers during 2000 to 2005. During this period, 79.6% of patients with coronary artery disease and 90.3% of patients with CHF had a cardiology consultation. In multivariate analyses, women were less likely to receive a consultation than men for both conditions (coronary artery disease: hazard ratio, 0.89; 95% CI, 0.85 to 0.93; CHF: hazard ratio, 0.93; 95% CI, 0.87 to 0.99). Women also had 15% fewer follow-up consultations than men ($P<0.001$). Similarly, patients at community health centers were less likely to receive a consultation (coronary artery disease: hazard ratio, 0.79; 95% CI, 0.74 to 0.84; CHF: hazard ratio, 0.77; 95% CI: 0.71 to 0.84) and had 20% fewer follow-up consultations ($P<0.001$) relative to those at hospital-based practices. Black and Hispanic patients with CHF had 13% fewer follow-up consultations than white patients ($P=0.01$ and $P=0.04$, respectively). In adjusted analyses, consultation was associated with better processes of care compared with no consultation ($P<0.001$), particularly for women ($P<0.001$ for interaction between consultation and gender).

Conclusions—Among ambulatory patients with coronary artery disease or CHF, women and those at community health centers have less access to cardiologists. Consultation is associated with better quality of care and narrows the gender gap in quality. **(*Circulation*. 2009;119:2463-2470.)**

Key Words: coronary disease ■ healthcare disparities ■ heart failure ■ quality of health care

Cardiovascular disease, including coronary artery disease (CAD) and congestive heart failure (CHF), is the leading cause of death for adults in the United States, accounting for >700 000 deaths per year, and is a costly diagnosis, with healthcare spending and lost productivity exceeding $400 billion in 2008.[1,2] Furthermore, several studies have documented persistent disparities in cardiovascular health care and outcomes, with racial and ethnic minorities, women, and the uninsured experiencing disproportionately higher morbidity and mortality rates.[3–8] The site of primary care is particularly relevant in understanding these disparities because community health centers serve a large proportion of racial/ethnic minorities who either are uninsured or have Medicaid.[9,10]

Clinical Perspective on p 2470

Despite some evidence that the quality of care for these conditions has improved over time,[11–13] several studies have shown that significant gaps in quality persist.[12–15] Given the documented gaps in quality of care and that disparities in cardiovascular disease affect large numbers of individuals, strategies to improve the quality and outcomes of care for these conditions are essential. Prior studies have shown that comanagement between generalists and specialists is 1 possible mechanism for improving both processes and intermediate outcomes of care for patients with CAD and CHF.[16–20] As such, comanagement may be a mechanism for improving overall quality and for reducing disparities in cardiovascular

Received September 30, 2008; accepted March 9, 2009.

From the National Heart, Lung, and Blood Institute, Bethesda, Md (N.L.C.); Department of Health Care Policy, Harvard Medical School, Boston, Mass (J.Z.A., L.S.H.); and Division of General Medicine and Primary Care (J.Z.A., E.J.O., L.S.H.) and Center for Community Health and Health Equity (L.S.H.), Brigham and Women's Hospital, Boston, Mass.

This research was conducted prior to Dr. Cook's current affiliation with the National Heart, Lung, and Blood Institute. As such, the views expressed in this article do not necessarily represent the views of the National Heart, Lung, and Blood Institute, National Institutes of Health, or any other government entity.

The online-only Data Supplement is available with this article at http://circ.ahajournals.org/cgi/content/full/CIRCULATIONAHA.108.825133/DC1.

Guest Editor for this article was Richard F. Gillum, MD, MS.

Correspondence to Nakela L. Cook, MD, MPH, National Heart, Lung, and Blood Institute, Rockledge II, Suite 10018, 6701 Rockledge Dr, Bethesda, MD 20892. E-mail cookn2@nhlbi.nih.gov

Circulation **is available at http://circ.ahajournals.org** **DOI: 10.1161/CIRCULATIONAHA.108.825133**

care. A few studies have suggested that women and patients who are black, Hispanic, or uninsured or receive their care at community health centers are less likely to receive a specialty referral.[9,10,16] Thus, disparities in access to specialists may contribute to lower quality of care and poorer outcomes among certain populations.

To date, little is known about differences in cardiology referrals among ambulatory patients with CAD and CHF based on patient demographic characteristics or the relationship between differences in cardiology consultation and disparities in quality of care. To address these questions, we studied a retrospective cohort of 9761 patients receiving primary care for CAD and CHF to determine whether the likelihood of being comanaged by a cardiologist differed by patients' sociodemographic characteristics or site of primary care. We also assessed whether consultation improved processes and outcomes of care similarly for all demographic groups.

Methods

Study Sites and Population

Using hospital administrative data, we identified 18 785 adult patients (age, 21 to 85 years) receiving care for CAD (*International Classification of Diseases*, ninth revision [ICD-9] codes 410.xx through 414.xx, V45.81, V45.82) or CHF (ICD-9 codes 428, 402.01, 402.11, 402.91, 429.3, 402.x1, 404.x1, 404.x3) in hospitals and community-based primary care clinics affiliated with 2 large academic medical centers in Massachusetts between January 1, 2000, and December 31, 2005. From these cross-sectional data, we selected 10 625 patients who were seen on 2 occasions in the same primary care clinic within the 12 months before their first primary care visit during the study period (index study visit) to ensure that enrollees were regular ambulatory patients in this system. We eliminated 445 patients of racial/ethnic categories other than non-Hispanic white, non-Hispanic black, and Hispanic because of small numbers and 419 patients with missing race/ethnicity data. Thus, the final sample consisted of 9761 patients for our electronic medical record review. The Human Studies Committee of Partners HealthCare System approved the study protocol.

Medical Record Review

We obtained electronic medical record data from the Research Patient Data Registry, a research and administrative data source designed to identify patients who meet specified criteria through a query tool. Data elements obtained from the Research Patient Data Registry included patients' demographic characteristics (eg, race/ethnicity, gender, age, primary language, and insurance status), laboratory information (including lipids and hemoglobin A_{1c}), comorbid diseases (obtained from outpatient ICD-9 codes), vital signs from each visit (eg, weight), procedure information (eg, echocardiogram), visit record, and site of primary care. Race and ethnicity from the Research Patient Data Registry are collected by registration staff at the time of admission or appointment. Primary care sites included community health centers, off-site satellite practices, and hospital-based practices.

Performance Measures

We chose quality-of-care indicators based on national guidelines or standards, including the American Medical Association's Physician Consortium for Performance Improvement and the American College of Cardiology/American Heart Association physician performance measures to assess quality of care in CHF and stable CAD.[21,22] We used guidelines developed by the Physician Consortium for Performance Improvement to apply these measures using electronic health record systems.[23,24] For this study, we selected 3 measures for CAD and 2 measures for CHF based on the availability of accurate variables in the data set (see the online Data Supplement).

Statistical Analysis

We analyzed patients' demographic and clinical characteristics by condition (CHF or CAD) using descriptive statistics. For each patient, we defined cardiology consultation as any office visit to a cardiologist between the index study visit and the end of the study period. Our first set of analyses used time to first cardiology consult in our study period as the outcome. Some of the patient data were censored because of deaths and withdrawals during the 6 years of follow-up. Accordingly, Kaplan–Meier curves and log-rank tests were used to calculate 5-year cardiology consultation rates and to compare time to consultation across sociodemographic variables (including race/ethnicity, insurance, and gender) and site of care. We then performed multivariate analysis using Cox proportional-hazards regression to examine the simultaneous association of sociodemographic variables and site of care with cardiology consultation, controlling for age, comorbid disease, and disease severity (defined as the number of visits in the primary care clinic in the 12-month interval before the index study visit). Comorbid disease was defined as a categorized Charlson score for each patient based on diagnoses obtained from outpatient visit ICD-9 codes the 12 months before the index study visit (scores of 0, 1 to 2, 3 to 4, and >4). Primary language was not included in any adjusted models because of colinearity with Hispanic ethnicity. The frailty approach was used to adjust for clustering at the level of the physician. We also introduced interactions of race/ethnicity with gender and with site of care. Nonsignificant interaction terms were removed from the final model.

In a second set of analyses, we used the frequency of follow-up consultation as the outcome variable in a Poisson regression analysis, controlling for demographic characteristics (race/ethnicity, sex, age, and insurance status), site of primary care, comorbid disease, disease severity, and clustering at the level of the provider. All of these analyses were performed on the entire cohort and then stratified by condition. As a result of differences in estimates and variances by condition, the final analysis was performed separately for patients with CAD and CHF.

Our third set of analyses focused on performance measures, examining temporal trends and the influence of consultation, sociodemographic variables, and site of care. For overall unadjusted temporal trends, each patient's yearly performance was the unit of analysis. We calculated the performance for each measure as the percentage of eligible patients with at least 1 primary care visit in the study year who achieved the performance goal during each 12-month interval of study participation. A repeated-measures linear regression model was run for each of the 5 performance measures, with study year as the sole linear predictor and the individual patient nested within provider as the source of correlation. To determine the influence of other covariates on performance, while adjusting for changes over time, we ran additional regressions with the patient as the unit of analysis. Similar to other studies using a composite score, we created a yearly performance score for each patient by averaging the total number of applicable performance measures met for the patient for each year of study participation.[25,26] The yearly score was then scaled to have the same mean and variance as the overall proportion of measures met in the sample for that year. We tested the significance of each sociodemographic characteristic using repeated-measures linear regression models with rescaled average scores as the dependent variable and time as a categorical covariate. Finally, repeated-measures hierarchical regression modeling was used to determine the impact of consultation on the performance score, controlling for race/ethnicity, age, gender, insurance, comorbid disease, site of primary care, disease severity, and clustering at the level of patients nested within providers. We examined differential effects of consultation by including interactions of consultation with patients' race/ethnicity, gender, site of care, and insurance status. We used SAS version 9.1 (SAS Institute, Inc, Cary, NC) for the analysis.

The authors had full access to and take responsibility for the integrity of the data. All authors have read and agree to the manuscript as written.

Table 1. Cohort Characteristics

Characteristic	CAD Cohort (n=9168), n (%)	CHF Cohort (n=4444), n (%)
Gender		
Male	4783 (52)	2352 (53)
Race/ethnicity		
White	7286 (79)	3399 (76)
Black	907 (10)	571 (13)
Hispanic	975 (11)	474 (11)
Age, y		
21–45	850 (9)	182 (4)
46–65	3359 (37)	1387 (31)
66–85	4959 (54)	2875 (65)
Insurance category		
Private	3496 (38)	1191 (27)
Medicaid	292 (3)	140 (3)
Medicare	5115 (56)	2995 (67)
Uninsured	258 (3)	111 (3)
Missing	7 (<1)	7 (<1)
Site of primary care		
Health center	2129 (23)	1058 (24)
Hospital based	5959 (65)	3029 (68)
Off-site satellite	1080 (12)	357 (8)
Charlson comorbidity score		
0	2914 (32)	746 (17)
1–2	3757 (41)	1859 (42)
3–4	1575 (17)	1090 (24)
>4	922 (10)	749 (17)

Results

Baseline Patient Characteristics

Among the 9761 patients, 9168 (93.9%) had CAD, 4444 (45.5%) had CHF, and 3851 (39.5%) had both conditions (Table 1). Absolute differences between the cohorts were small; however, large patient numbers contributed to statistically significant differences in race/ethnicity, age, insurance, and site of care. About half of patients were men; three quarters were white; nearly 90% spoke English; and two thirds were treated at hospital-based clinics. There were greater proportions of female patients among racial/ethnic minorities (63% of blacks and 55% of Hispanics compared with 44% of whites). Blacks were concentrated in hospital-based clinics, whereas Hispanics were concentrated in community health centers. The proportion of blacks and Hispanics in the study cohort with Medicaid or no insurance was greater than for whites ($P<0.001$ for all comparisons).

Likelihood of Cardiology Consultation

Overall, the unadjusted Kaplan–Meier estimates for receiving cardiology consultation at 5 years were 79.6% for CAD and 90.3% for CHF (Figure 1). Among the CAD cohort, women were less likely than men ($P<0.001$) and patients at community health centers and satellite clinics were less likely than those at hospital-based practices to receive consultations ($P<0.001$). Blacks were more likely than whites and Medicare and Medicaid recipients were more likely than the privately insured to receive consultations during the study period (both $P<0.001$). Among the CHF cohort, women were less likely than men ($P<0.01$) and patients at community health centers were less likely than patients at hospital-based clinics ($P<0.001$) to receive consultations (Figure 1).

After adjustment for age, insurance status, disease severity, comorbid diseases, and clustering by primary physician, disparities in receipt of cardiology consultations for the CAD cohort persisted for women (hazard ratio [HR], 0.89; 95% CI, 0.85 to 0.93) and patients who received their care at community health centers (HR, 0.79; 95% CI, 0.74 to 0.84) relative to men and patients at hospital-based clinics, respectively (Figure 2). Similar disparities persisted in adjusted analyses among CHF patients; women (HR, 0.93; 95% CI, 0.87 to 0.99) and community health center patients (HR, 0.77; 95% CI, 0.71 to 0.84) remained less likely to receive consultations than men and hospital-based clinic patients, respectively (Figure 2).

There were no significant interactions of race/ethnicity with gender across CAD and CHF participants. Among patients with CAD, the greater likelihood of obtaining a consultation was not evident among blacks and Hispanics seen at community health centers ($P=0.02$ for interaction between race/ethnicity and site of care).

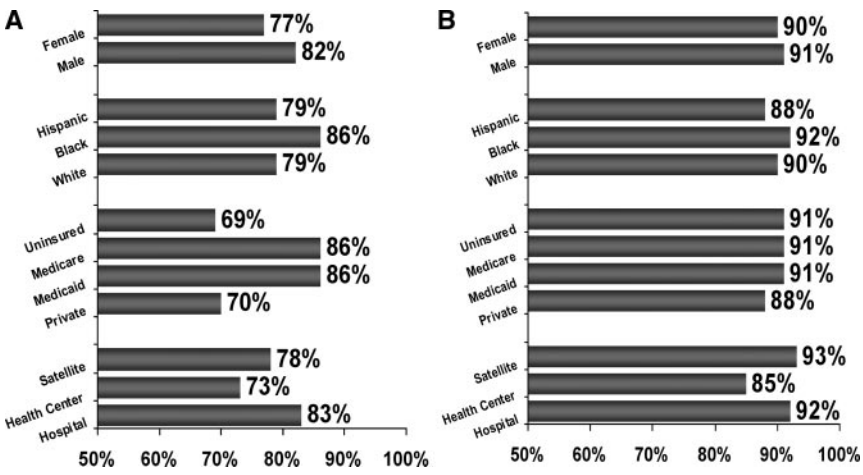

Figure 1. Unadjusted Kaplan–Meier estimates of 5-year consultation rates by sociodemographic characteristics for the CAD cohort (A) and CHF cohort (B). A, B, For gender, the reference group is male; for race/ethnicity, the reference group is white; for insurance, the reference group is private/commercial insurance type; for site of primary care, the reference group is hospital-based practice. A, Probability values across comparison groups from log-rank tests: gender, $P<0.001$; race/ethnicity, $P<0.001$; insurance, $P<0.001$; and site of primary care, $P<0.001$. B, Probability values across comparison groups from log-rank tests: gender, $P=0.004$; race/ethnicity, $P=0.07$; insurance, $P=0.15$; and site of primary care, $P<0.001$.

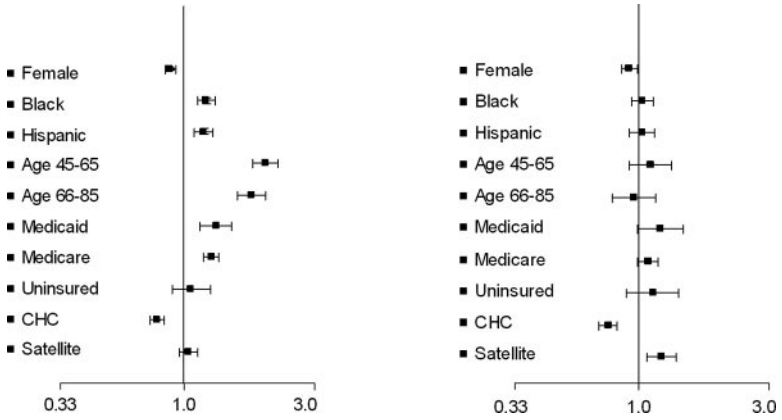

Figure 2. Adjusted HRs for receipt of cardiology consultation for the CAD cohort (A) and CHF cohort (B). Results of the Cox proportional-hazards regression models predicting likelihood of consultation for predictors, including gender, race/ethnicity, age, site of primary care, insurance status, comorbid disease, and disease severity, while controlling for clustering at the level of the physician. For gender, the reference group is male; for race/ethnicity, the reference group is white; for age, the reference group is 21 to 44 years; for site of primary care, the reference group is hospital-based practice; for insurance, the reference group is private/commercial insurance type. CHC denotes community health center.

Patients with CAD had a mean of 6.2 visits with a cardiologist over the study period, and 5861 (64.0%) patients had >1 visit. Patients with CHF had a mean of 9.3 visits with a cardiologist, and 3487 (78.5%) patients had >1 visit. Results for multivariate Poisson models predicting the number of follow-up visits with a cardiologist are presented in Table 2. For both CAD and CHF, women and patients at community health centers had fewer follow-up consultations than men or patients at hospital-based practices, respectively (all $P<0.001$). Among black and Hispanic patients with CHF, despite being more or just as likely to receive an initial cardiac consultation, respectively, they received ≈13% fewer follow-up consultations than their white counterparts. Among patients with CAD, those with Medicare had more follow-up consultations compared with privately insured patients ($P<0.001$).

Table 2. Adjusted Rates of Follow-Up Consultations*

	CAD		CHF	
Predictors	Follow-Up Consults, %	*P*	Follow-Up Consults, %	*P*
Gender				
Male	Reference	Reference	Reference	Reference
Female	14.9 fewer	<0.001	14.8 fewer	<0.001
Race/ethnicity				
White	Reference	Reference	Reference	Reference
Black	4.5 fewer	0.4	13.8 fewer	0.01
Hispanic	6.9 fewer	0.2	13.1 fewer	0.04
Age, y				
21–45	Reference	Reference	Reference	Reference
46–65	63.2 more	<0.001	9.7 fewer	0.3
66–85	60.7 more	<0.001	16.6 fewer	0.07
Insurance category				
Private	Reference	Reference	Reference	Reference
Medicaid	9.5 more	0.24	3.0 fewer	0.7
Medicare	20.7 more	<0.001	9.3 more	0.06
Uninsured	9.4 fewer	0.4	8.3 fewer	0.5
Site of primary care				
Hospital based	Reference	Reference	Reference	Reference
Health center	20.7 fewer	<0.001	19.2 fewer	<0.001
Off-site satellite	4.3 fewer	0.5	12.3 more	0.06

*Poisson regression with the covariates of gender, race/ethnicity, age, site of primary care, insurance status, and comorbid disease and controlling for clustering at the physician level.

Impact of Consultation on Performance

Overall, quality of care for both CAD and CHF was suboptimal, with patients receiving 69.7% and 68.8% of applicable care, respectively, during the study period. In unadjusted analyses for CAD patients, performance decreased overall during the study period for rates of lipid measurement (year 1, 77% [n=8221]; year 3, 72% [n=5985]; year 6, 71% [n=4046]; $P<0.001$ for trend). For attainment of low-density lipoprotein <130 mg/dL, performance remained stable or increased over time (year 1, 63%; year 3, 62%; year 6, 66%; $P<0.001$ for trend). Rates of hemoglobin A_{1c} control for diabetic patients increased over time (year 1, 73% [n=2919 for diabetes subset]; year 3, 75% [n=2293]; year 6, 79% [n=1634]; $P<0.02$ for trend). Unadjusted trends in performance for CHF demonstrated increasing rates of recording weight over time (year 1, 38% [n=4418]; year 3, 52% [n=3556]; year 6, 62% [n=2523]; $P<0.01$). Left ventricular function assessment was the only performance measure evaluated once over the entire study period, with a rate of 86.0%.

Trends in quality scores differed by consultation status and sociodemographic characteristics over the study period. Patients with consultation performed better than patients without consultation over time ($P<0.001$ from repeated-measures regression). For example, year 1 mean performance score was 69.7% for those with consultation compared with 60.4% for those without consultation (year 3, 69.7% versus 55.8%; year 6, 71.8% versus 58.8%). Additionally, there were significant demographic differences in quality of care, with women, blacks, Hispanics, and Medicaid recipients receiving poorer overall care than men, whites, and privately insured patients over time (all $P<0.01$). After adjustment for patients' clinical and demographic characteristics, consultation remained a significant predictor of better performance (Table 3). The effect of consultation on quality of care significantly differed by gender, with consultation narrowing the gap in performance between men and women ($P<0.001$) (Figure 3).

Discussion

Among ambulatory patients with CAD and CHF, we found differences in receipt of consultation based on sociodemo-

Table 3. Adjusted Predictors of Overall Quality on 5 Clinical Performance Measures*

Predictors	Least-Square Means, %	*P*
Consultation		
No	55.0	Reference
Yes	65.2	<0.001
Gender		
Male	62.9	Reference
Female	57.4	<0.001
Race/ethnicity		
White	61.4	Reference
Black	60.3	0.16
Hispanic	58.7	<0.01
Age, y		
21–45	52.4	Reference
46–65	63.0	<0.001
66–85	65.1	<0.001
Insurance category		
Private	60.3	Reference
Medicaid	57.4	0.03
Medicare	60.4	0.97
Uninsured	62.4	0.22
Site of primary care		
Hospital based	58.6	Reference
Health center	60.6	<0.001
Off-site satellite	61.2	0.01

*Results from repeated measures longitudinal regression analysis with outcome of mean performance score and independent predictors as shown. Model was adjusted for condition type, comorbid diseases, disease severity, and clustering at the provider level in addition to the predictors shown in the table.

graphic characteristics and site of care. Women and patients from community health centers were less likely to obtain initial and follow-up consultations than men and patients in hospital-based clinics in both cohorts. Black patients were more likely to obtain an initial consultation, but blacks with CHF had fewer follow-up consultations than whites, which may reflect weaker relationships with their specialists. Many studies have documented disparities in access to cardiovascular procedures[3]; however, access to cardiology specialists in ambulatory care, often a prerequisite for obtaining cardiovascular procedures, is less well studied. We determined that consultation with a cardiologist was associated with improved performance on process measures endorsed by national guidelines. Additionally, consultation narrowed the gap in clinical performance measures between women and men, suggesting a role of consultation in improving outcomes and mitigating performance disparities.

Prior studies of cardiologist involvement in the care of patients with cardiovascular disease have focused primarily on the hospital or proximal postdischarge setting.[20,27] We found higher rates of consult in our cohorts than previously reported. For example, among active CAD patients in the Veteran's Affairs system, Ho et al[19] found that 27% of patients had a cardiology clinic visit. In the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments Trial, among patients admitted on a generalist service for CHF, 40% received cardiology consultation.[27] Higher levels of consultation in our cohort may be attributable to the affiliation of primary care practices with academic hospitals, where prior studies report higher use of available services and specialty consultation.[9] Thus, variations in the likelihood of consultation in our study may represent a conservative estimate of differences that may be larger in nonacademic settings.

Our major findings that women and patients receiving care at community health centers were less likely than their counterparts to obtain consultation are consistent with the literature on decision making about specialty referrals. In a survey of physicians and their practices, Forrest et al[28] found that for all conditions men were more likely to obtain a specialty referral compared with women. Specific to cardiovascular disease, women have been shown to have higher rates of angina and CAD but lower rates of cardiac investi-

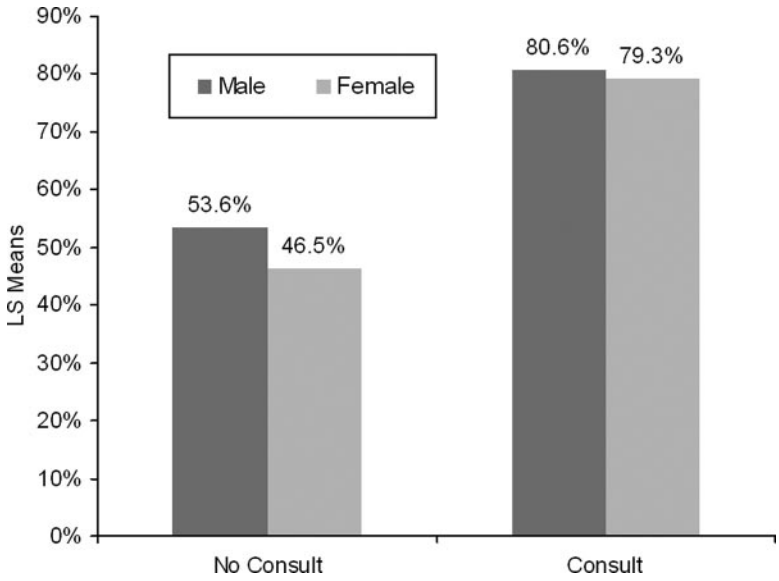

Figure 3. Differential effect of consultation on performance score by gender. Results from the consult and gender interaction term in the repeated-measures model that evaluates the effect of consultation on overall performance score. $P<0.001$ for difference in differences.

gation and procedure use.[29,30] Our findings show differences in referral to the specialists who often recommend and facilitate further cardiac studies and procedures. The prior literature on access to specialty care for community health center patients reported difficulty in access to specialists but suggested that an affiliation with a hospital or academic medical center eases this difficulty.[10] However, our study highlights that even in academic healthcare systems with referral networks in place, patients at community health centers may have reduced access. Moreover, among our study patients with CAD, the greater likelihood of obtaining a consultation disappeared among blacks seen at community health centers.

Two less expected referral patterns emerged. Medicare and Medicaid recipients were more likely to obtain a consultation than privately insured patients, and racial and ethnic minorities were either more likely or just as likely to obtain a consult relative to whites. With regard to Medicaid recipients, Forrest et al[28] also found higher referral rates for the Medicaid population, and further evaluation of the clinical characteristics and unique reimbursement patterns may be necessary to explain the higher rates of consultation in this group. However, Medicare recipients in our cohorts were more likely to have cardiology consultation, in contrast to the Forrest et al study, in which primary care visits by Medicare beneficiaries predicted lower odds of specialty referral.[28] One difference among our patients is the known diagnosis of cardiovascular disease that affects an older cohort, differentiating these patients from an unspecified mix of primary care patients.

Contrary to prior studies, we did not find a lower likelihood of cardiovascular specialty use among racial and ethnic minority patients for initial consultation. However, black and Hispanic patients with CHF had fewer follow-up consultations than their white counterparts. Similarly, women and patients at community health centers had fewer follow-up consultations. These findings, related to the number of consultations obtained after an initial consult, may reflect the cohesiveness of the comanagement relationship and are important because they indicate the level of input that specialists provide that may subsequently affect performance.

Finally, our evaluation of performance in this cohort reveals suboptimal quality overall, although similar to national rates for low-density lipoprotein screening and control and hemoglobin A_{1c} control in the Healthcare Effectiveness Data and Information Set benchmarking data sets.[11] Our study reflects ambulatory care management, and rates of performance in this setting are traditionally lower than in hospital or at hospital discharge.[11] Factors related to patients, patient/doctor interactions, and clinical and social environments may influence performance in evaluations of longer-term adherence to measures compared with in-hospital or early postdischarge measures. For example, issues that may contribute to lower adherence rates include the development of adverse symptoms that may not formally meet criteria for contraindication to treatment, the overemphasis of relative contraindications by physicians, and the tendency of ambulatory medicine to focus on higher-acuity conditions rather than preventive concerns.[31,32] Consultation might improve performance and adherence to guideline treatment by endorsing or refining recommendations from primary care physicians, balancing relative contraindications with potential benefits. Furthermore, by partnering with primary care physicians, consultants can provide additional monitoring of patients' concerns and adherence, can function as added prescribers for cardiac therapies, and can provide specialized knowledge regarding appropriate use of key advances in the management of cardiac patients.[16,33,34]

When looking at performance by sociodemographic characteristics, we found overlap between fewer consultations and lower performance scores among women, blacks, and Hispanics relative to men and whites. Moreover, when we examined the role of performance and consultation in disparities, we found that consultation mitigated the gender gap in performance. The literature supports that comanagement enhances clinical performance for patients with improved blood pressure and low-density lipoprotein cholesterol control among patients with CAD and improved left ventricular function assessment, increased angiotensin-converting enzyme inhibitor use, and reduced hospitalization and 90-day mortality rates for CHF.[17–19] However, the finding of a differential effect of consultation on performance by gender is particularly important because CAD is the leading cause of death for both men and women, yet the rate of decline in CAD mortality for women is less than that for men.[2] Prior studies have suggested that markets with higher use of services and procedures do not always provide higher quality.[35] Nevertheless, there may be a role for increased use of cardiology consultations, with the goal of improving performance overall and specifically among women. Further evaluation is needed to determine whether the differential patterns and frequencies of consultation that we report represent underuse or overuse before an increase in use of specialty services is recommended because there are potential disadvantages of increased consultation, including cost, difficult care coordination, and increased testing and procedure use.

There are several limitations to our findings. We examined patients receiving care in practices affiliated with 2 large tertiary hospitals. Our findings may not be generalizable outside of similar academic settings. However, the variations in practice sites in these hospital systems provide information on the impact of different sites of care, and differences in receipt of consultation may be magnified in settings with fewer cardiologists. Additionally, these sites had small numbers of black and Hispanic patients relative to whites, raising the concern that the study may be underpowered to observe interaction effects between race and gender or to make strong conclusions about minority/white comparisons. However, the black/white comparisons discussed are statistically significant and raise areas for future investigation surrounding contributors to described disparities in cardiovascular care. Second, because of incomplete pharmaceutical data, we were unable to assess differences in quality of care for performance measures of CAD and CHF related to medication use. Nevertheless, the measures used were selected from consensus-derived, evidence-based measures used in prior work.[21,22,36,37] Another limitation relates to consultation as our primary predictor of quality. There may be other unmea-

sured variables that account in part for the effects witnessed such as length of time spent with a patient during a specialty visit versus a primary care office visit or increased attention to testing results. Because there are likely factors in the generalist-specialist interaction that are not represented in our models, we use this concept of comanagement, operationalized as the number of follow-up consultations, as a proxy for the intensity of relationship between patients and specialists. However, frequency of follow-up may be related to unmeasured factors at the level of patients (eg, transportation barriers or patient refusal), insurers (eg, number of visits covered annually), providers (eg, availability of appointments), or study design (eg, misclassification of diagnosis). Finally, performance measures are inherently limited in their ability to predict quality and outcomes, and measures of specialty care have not yet been validated through large-scale implementation.

Conclusion

Among patients with CAD and CHF, rates of consultation with a cardiologist were higher than previously reported. However, women and patients seen at community health centers were less likely to receive a consultation for both conditions. In our cohort, consultation improved performance scores, and women, in particular, had greater improvement than men when they received a cardiology consultation. Collaborative efforts by policy makers, health system administrators, and physicians are needed to improve equity in access to cardiovascular specialists, especially for women and patients at community health centers, because consultation may improve performance and reduce gender disparities in quality of care.

Acknowledgment

We would like to thank Deborah Williams for her programming contributions.

Source of Funding

Dr Cook was supported by an institutional National Research Service Award from the Agency for Healthcare Research and Quality (5 T32 HS000020–21) during the conduct of this research.

Disclosures

Dr Hicks consults for WellPoint. The other authors report no conflicts.

References

1. Centers for Disease Control and Prevention. National Center for Health Statistics: health data interactive. Available at: www.cdc.gov/nchs/hdi.htm. Accessed January 30, 2009.
2. *Heart Disease and Stroke Statistics: 2008 Update*. Dallas, Tex: American Heart Association; 2008.
3. Institute of Medicine. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC: National Academy Press; 2002.
4. Gillum RF. Coronary heart disease in black populations, I: mortality and morbidity. *Am Heart J*. 1982;104:839–851.
5. Agency for Healthcare Research and Quality. *2007 National Healthcare Disparities Report*. Rockville, Md: US Department of Health and Human Services, Agency for Healthcare Research and Quality; 2008. AHRQ publication No. 08–0041.
6. Wong MD, Shapiro MF, Boscardin WJ, Ettner SL. Contribution of major diseases to disparities in mortality. *N Engl J Med*. 2002;347:1585–1592.
7. Ayanian JZ, Udvarhelyi IS, Gatsonis CA, Pashos CL, Epstein AM. Racial differences in the use of revascularization procedures after coronary angiography. *JAMA*. 1993;269:2642–2646.
8. Hadley J. *Sicker and Poorer: The Consequences of Being Uninsured*. Washington, DC: Kaiser Commission on Medicaid and the Uninsured; 2002.
9. Forrest CB, Whelan EM. Primary care safety-net delivery sites in the United States: a comparison of community health centers, hospital outpatient departments, and physicians' offices. *JAMA*. 2000;284:2077–2083.
10. Cook NL, Hicks LS, Keegan T, O'Malley AJ, Guadagnoli E, Landon BE. Access to specialty care and medical services in community health centers. *Health Aff (Millwood)*. 2007;26:1459–1468.
11. National Committee for Quality Assurance. *The State of Health Care Quality 2008*. Washington, DC: National Committee for Quality Assurance; 2008.
12. Trivedi AN, Zaslavsky AM, Schneider EC, Ayanian JZ. Trends in quality of care and racial disparities in Medicare managed care. *N Engl J Med*. 2005;353:692–700.
13. Ma J, Stafford RS. Quality of outpatient care: temporal changes and racial/ethnic disparities. *Arch Intern Med*. 2005;165:1354–1361.
14. Rathore SS, Foody JM, Wang Y, Smith GL, Herrin J, Masoudi FA. Race, quality of care, and outcomes of elderly patients hospitalized with heart failure. *JAMA*. 2003;289:2517–2524.
15. Rathore SS, Foody JM, Wang Y, Smith GL, Herrin J, Masoudi FA. Sex, quality of care, and outcomes of elderly patients hospitalized with heart failure: findings from the National Heart Failure Project. *Am Heart J*. 2005;149:121–128.
16. Ayanian JZ, Landrun MB, Guadagnoli E, Gaccione P. Specialty of ambulatory care physicians and mortality among elderly patients after myocardial infarction. *N Engl J Med*. 2002;347:1678–1686.
17. Ahmed A, Allman RM, Kiefe CI, Person SD, Shaneyfelt TM, Sims RV, Howard G, DeLong JF. Association of consultation between generalists and cardiologists with quality and outcomes of heart failure care. *Am Heart J*. 2003;145:1086–1093.
18. Ansari M, Alexander M, Tutar A, Bello D, Massie BM. Cardiology participation improves outcomes in patients with new-onset heart failure in the outpatient setting. *J Am Coll Cardiol*. 2003;41:62–68.
19. Ho PM, Masoudi FA, Peterson ED, Grunwald GK, Sales AE, Hammermeister KE, Rumsfed JS. Cardiology management improves secondary prevention measures among patients with coronary artery disease. *J Am Coll Cardiol*. 2004;43:1517–1523.
20. Chen J, Radford MJ, Yun W, Krumholz HM. Care and outcomes of elderly patients with acute myocardial infarction by physician specialty: the effects of comorbidity and functional limitations. *Am J Med*. 2000;108:460–469.
21. American College of Cardiology, American Heart Association, Physician Consortium for Performance Improvement. *Clinical Performance Measures: Chronic Stable Coronary Artery Disease*. Chicago, Ill: American Medical Association; 2005.
22. American College of Cardiology, American Heart Association, Physician Consortium for Performance Improvement. *Clinical Performance Measures: Heart Failure*. Chicago, Ill: American Medical Association; 2005.
23. Coronary artery disease (CAD): algorithm for measures calculation: EHRS. Version 3.0. Chicago, Ill: American Medical Association. 2007.
24. Heart failure (HF): algorithm for measures calculation: EHRS, version 3.0. Chicago, Ill: American Medical Association. 2007.
25. Landon BE, Hicks LS, O'Malley AJ, Lieu TA, Keegan T, McNeil BJ, Guadagnoli E. Improving the management of chronic disease at community health centers. *N Engl J Med*. 2007;356:921–934.
26. Hicks LS, O'Malley AJ, Lieu TA, Keegan T, Cook NL, McNeil BJ, Landon BE, Guadagnoli E. The quality of chronic disease care in U.S. community health centers. *Health Aff (Millwood)*. 2006;25:1712–1723.
27. Auerbach AD, Hamel MB, Davis RB, Connors AF Jr, Regueiro C, Desbiens N, Goldman L, Califf RM, Dawson NV, Wenger N, Vidaillet H, Phillips RS. Resource use and survival of patients hospitalized with congestive heart failure: differences in care by specialty of the attending physician. *Ann Intern Med*. 2000;132:191–200.
28. Forrest CB, Nutting PA, von Schrader S, Rohde C, Starfield B. Primary care physician specialty referral decision making: patient, physician, and health care system determinants. *Med Decis Making*. 2006;26:76–85.
29. Ford ES, Giles WH, Croft JB. Prevalence of nonfatal coronary heart disease among American adults. *Am Heart J*. 2000;139:371–377.
30. Vaccarino V, Rathore SS, Wenger NK, Frederick PD, Abramson JL, Barron HV, Manhapra A, Mallik S, Krumholz HM. Sex and racial

differences in the management of acute myocardial infarction, 1994 through 2002. *N Engl J Med*. 2005;353:671–682.
31. Cabana MD, Rand CS, Powe NP, Wu AW, Wilson MH, Abboud PC, Rubin HR. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA*. 1999;282:1458–1465.
32. Stafford RS, and Radley DC. The underutilization of cardiac medications of proven benefit, 1990–2002. *J Am Coll Cardiol*. 2003;41:56–61.
33. Ayanian JZ, Hauptman PJ, Guadagnoli E, Antman EM, Pashos CL, McNeil BJ. Knowledge and practices of generalist and specialist physicians regarding drug therapy for acute myocardial infarction. *N Engl J Med*. 1994;331:1136–1142.
34. Ayanian JZ. Generalists and specialists caring for patients with heart disease: united we stand, divided we fall. *Am J Med*. 2000;108:259–261.
35. Baicker K, Chandra A. Medicare spending, the physician workforce, and beneficiaries' quality of care. *Health Aff (Millwood)*. 2004;W4:184–197.
36. Baker DW, Persell SD, Thompson JA, Soman NS, Burgner KM, Liss D, Kmetik KS. Automated review of electronic health records to assess quality of care for outpatients with heart failure. *Ann Intern Med*. 2007;146:270–277.
37. Persell SD, Wright JM, Thompson JA, Kmetik KS, Baker DW. Assessing the validity of national quality measures for coronary artery disease using an electronic health record. *Arch Intern Med*. 2006;166:2272–2277.

CLINICAL PERSPECTIVE

We assessed differences in the use of cardiology consultations and the relationship of these differences to quality by race/ethnicity, gender, insurance status, and site of care among a cohort of 9761 primary care patients with coronary artery disease or congestive heart failure at practices affiliated with 2 academic medical centers during 2000 to 2005. Despite finding high cardiology consultation rates in these practices, we noted that women were less likely than men and patients at community health centers were less likely than those at hospital-based practices to have a consultation and had fewer follow-up consultations throughout the study period. We also found that black and Hispanic patients with congestive heart failure had fewer follow-up consultations than whites. Furthermore, consultation was associated with better processes of care, particularly for women, suggesting that cardiology consultation with ongoing primary care may improve processes of care and quality for ambulatory patients with coronary artery disease and congestive heart failure and reduce gender disparities. Our results suggest that developing strategies to achieve access to appropriate cardiologist consultation, regardless of site of primary care, may not only improve overall quality of care but also narrow the gender gap in quality. Thus, developing pragmatic, real-world initiatives to improve equity in the access to cardiovascular specialists when appropriate may improve performance and reduce gender disparities in quality of care.