# Measuring Racial Disparities in the Quality of Ambulatory Diabetes Care

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**Background:** Improving the health of minority patients who have diabetes depends in part on improving quality and reducing disparities in ambulatory care. It has been difficult to measure these components at the level of actionable units.

**Objective:** To measure ambulatory care quality and racial disparities in diabetes care across groups of physicians who care for populations of ambulatory diabetes patients.

**Research Design:** Prospective cohort analysis using administrative data.

**Subjects:** Using fee-for-service Medicare claims data from 2003 to 2005, we link patients to their principal ambulatory care physician. The patients are then linked to the hospital where their physicians work or have their patients admitted, creating physician-hospital networks.

**Measures:** Proportion of recommended diabetes testing received by black and nonblack diabetes patients.

**Results:** Blacks received 70% of recommended care compared with nonblacks who received 76.9% ($P < 0.001$). However, for black and nonblack patients, variation in the quality of care exceeds the racial gap in treatment. The network-specific performance rates for blacks and nonblacks were highly correlated ($r = 0.67$, $P < 0.001$), but 47% of blacks, versus 31% of nonblacks, received care from the third of networks with lowest quality. Physician-hospital networks with higher overall quality, or patients with higher socioeconomic status, were no less likely to exhibit black-white disparities.

**Conclusions:** It is possible to measure, benchmark, and monitor the quality of minority care at the level of networks responsible for ambulatory care. Consequently, it should be easier to provide patients with information on network performance and to design policies that improve the quality of minority-serving providers.

**Key Words:** disparities, quality, diabetes

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Racial disparities in healthcare have been identified in both fee-for-service (FFS) and managed care settings.[1–6] Progress in reducing disparities has been made, particularly in the managed care setting.[3] In the managed care setting, the population of patients served by a group of providers can be clearly identified, which allows for measurement of their performance and provides information to stimulate improvement. For the much larger FFS ambulatory care setting, identifying the providers that are responsible for care and measuring their performance is difficult. FFS providers do not have the information on which to base interventions to improve quality and reduce disparities. This is particularly problematic for providers with relatively small numbers of minority patients where statistical precision to identify disparities is lacking.[2,7–9] Moreover, reporting disparities at the level of individual physicians could worsen access and quality, if providers respond to such reporting by avoiding minority patients.

In this article, we seek to measure and report quality and disparities in ambulatory diabetes care among groups of providers serving the black Medicare FFS population to address some of the measurement challenges that may hamper future improvement efforts. We focus on ambulatory diabetes care because of the promise that quality improvements in this sphere will prevent vision loss, amputations, and renal failure; negative outcomes for which blacks are at particular risk.[10–12] Previous work has defined these disparities at the level of states or geographic regions, but these units may be too large for the purpose of reporting performance or designing interventions.[13,14] We identified populations served by all acute care US hospitals and the physicians who worked within or admitted their patients to these facilities, creating empirically defined physician-hospital networks. These physician-hospital networks have been previously used to model the feasibility of applying incentive structures associated with "accountable care organizations."[8,15,16] In this article, we use this level of reporting to examine racial disparities in quality in the Medicare FFS population. For each population served by a physician-hospital network, we report the percentage of diabetic patients who received recommended diabetes care and the size of racial disparities within that network. We examine the variation in process of care quality between networks and the size of the disparity within networks, and discuss how this information can be used to improve network performance or guide patients to better networks.

# METHODS

## Overview

We constructed physician-hospital networks for Medicare FFS beneficiaries with diabetes by linking them to their most frequently consulted ambulatory physician, who was in turn assigned to the hospital where that physician is most likely to work or have patients admitted as described in previous publications.[15] We report quality and disparities at the level of these networks.

## Study Populations

We used 100% MedPAR, Inpatient and Outpatient files and a 20% random sample of Medicare beneficiaries from the Carrier File to create physician-hospital networks. Beneficiaries were eligible if they were at least 65 years old and had a clinic, nursing home, or home visit in the index year and excluded if in a health maintenance organization or not Parts A and B eligible. Eligible physicians had a valid UPIN and identifiable specialty. Acute care hospitals were located in the United States and did not close during the study period. Diabetes and chronic health conditions were identified by 1 Part A or 2 Part B claims in the index year.[17] We restricted our analysis to diabetes patients between 65 and 75 years old because they are eligible for Healthcare Effectiveness Data and Information Set (HEDIS) quality measures.

Race was obtained from the Medicare denominator file, which has good accuracy for whites and blacks.[18] Hispanics and other groups constitute less than 5% of the sample and these racial designations are much less accurate.[18] The number of Hispanic patients and those of other ethnicities is very small at the level of physician-hospital networks, precluding separate analysis for these groups. Consequently, we decided to combine beneficiaries of White, Asian, Native American, Hispanic, and Other designations as "nonblacks." Our decision to combine these groups is unlikely to affect our overall results, but to the extent that it does, it will have the effect of understating disparities in care.

## Constructing Physician-Hospital Networks

We used Medicare claims to link beneficiaries to physicians who provide their care, and then linked physicians to hospitals based on where they work or have their patients admitted. The details of this method are described elsewhere, and differ only to the extent that the extended hospital medical staff is now described as "physician-hospital networks."[15] In brief, the primary care or medical specialist physician who provided the most ambulatory visits in 2 years was identified for each beneficiary (>97% patients). Patients with no physicians of these types were allowed linkage to other specialties. Each physician was linked to a specific hospital either by where the physician billed for the most inpatient work (approximately 60% of physicians) or, if there were no claims for inpatient work, by where the plurality of patients for whom they submitted bills were admitted. Beneficiaries were then linked with their physician's hospital, regardless of whether they required hospitalization. In summary, 96% of eligible Medicare FFS beneficiaries were linked to a unique hospital and its affiliated physicians.[8,15]

Using this algorithm, we performed the linkage process for 2003 to 2005 (n = 15,825,994 beneficiary-year observations) and constructed 5134 networks, each referenced by the acute care hospital. In all, 1616 networks (31%) had at least 1 black diabetic beneficiary and 638 (12.3%) had greater than 100 black diabetes patients assigned. In total, there were 205,665 black and 1,399,273 nonblack diabetic person-years identified for analysis. Compared with nonblacks, blacks were younger (69.2 vs. 69.5 years), and more likely to be female (63.8% vs. 51.1%) and to be covered through Medicaid (37.0% vs. 18.3%; all $P < 0.001$). Diabetic patients concentrated their physician visits within their assigned physician-hospital network (an average of 75% of their visits were within their network) with no difference between blacks and nonblacks. Beneficiaries were excluded from the study if they had no clinic, nursing home, or home visits. A higher proportion of blacks versus nonblacks were excluded (11.5% vs. 7.4%, respectively).

## Diabetes Process-Quality Measures

We calculated process-quality measures from HEDIS indicators for diabetes care among diabetes patients between 65 and 75 years old: receipt of an eye examination, glycosylated hemoglobin test, or lipid test.[19] Each diabetes process quality measure was calculated annually for every physician-hospital network. We calculated a composite measure (called "diabetes quality") as the average of the 3 testing rates, pooled across all 3 years to simplify reporting. The composite measure represents the percent of recommended testing received by diabetes patients. It was highly correlated with each component test ($r = 0.8$, $P < 0.001$) and with a more sophisticated measure derived using factor analysis ($r = 0.99$, $P < 0.001$). In other work (which is not reported), we found that risk adjustment for age, gender, and comorbidity gave nearly identical results, a finding consistent with the view that such measures are not sensitive to risk-adjustment and that more chronically ill patients are just as likely to receive these measures.[20]

## Analysis

To illustrate our ability to measure network performance on both the level of care provided to beneficiaries, and the racial disparity in care, we report the performance of specific networks by characteristics of the anchoring hospital: (1) whether it is a member of the Council of Teaching Hospitals, and (2) whether the zip code falls in an urban versus nonurban area according to the 4-level rural urban commuting area designation.[21] For this portion of the analysis, we focused on 500 networks with the largest number of black diabetic patients (accounting for 49% of all black diabetes patients and 34% of all nonblack diabetes patients) to minimize sampling variation when computing rates for smaller networks. We identify each network by its census region and a randomly generated numeric identifier.

We used multiple regression analysis to determine whether racial disparities were larger (or smaller) in higher quality networks, were concentrated in certain regions (measured by the 9 census regions), varied according to network characteristics (academic hospital, rurality of setting), or

varied by patient population characteristics such as percent black, percent eligible for Medicaid, average patient income (measured by income at the patients' zip code), and average patient education (measured by average percent at patients' zip code with less than high-school degree). We hypothesize that these population characteristic measures are correlated with patient behaviors such as adherence and compliance, and we interpret their role in predicting disparities as evidence of patient factors (rather than the quality of the network in affecting care). These network-level regressions were weighted by the number of minority patients in the network; results were not sensitive to choice of weights (total number of beneficiaries vs. number of nonminority patients).

All analyses were performed using SAS version 9.1 and STATA version 10.

## RESULTS

### National and Local Disparities in Care

Among FFS Medicare beneficiaries with diabetes, blacks received less care for each of the 3 components of our diabetes quality measure (Table 1). For our composite measure, blacks received 70.0% of recommended care and non-blacks received 76.9%.

This national disparity of 7% masks considerable variation in size of racial disparities between networks, which ranged from −29.9 points to +25.0 points. The quality of care received by beneficiaries also varied significantly: for blacks who were treated in networks with at least 25 black diabetic patients, it ranged from receiving 26% of recommended testing in the lowest performing network to 86% in the best performing network. This variation is illustrated in Figure 1 where we graph rates at which nonblacks and blacks received recommended care for diabetes among the 500 largest minority-serving networks. The Figure highlights 3 findings. First, the majority of networks (430 out of 500) exhibit disparities against blacks—statistically significant in 158 (32%) physician-hospital networks. Second, there are networks where nonblacks receive lower quality care than blacks. Finally, the quality of care received by black and nonblack diabetic patients is highly correlated within networks ($r = 0.67$, $P < 0.001$).

We explore the relationship between race and the quality of care in Figure 2, where we assigned each network into 3 equally sized groups of composite quality (that we label
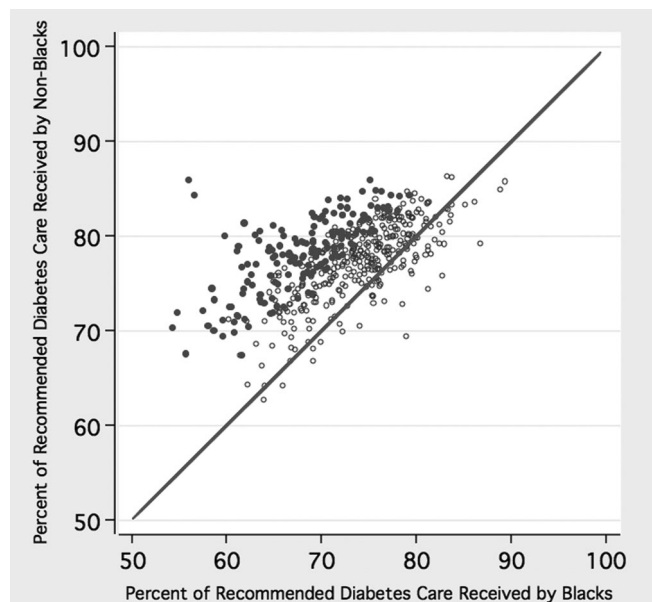


**FIGURE 1.** Ambulatory diabetes care for non-Black and Black patients across physician-hospital networks. Forty-five degree line represents equal rates for Blacks and non-Blacks. Solid circles indicate networks with statistically significant racial disparities ($P < 0.05$).

lowest, middle, and highest quality), and report black and nonblack rates within each group. Disparities were not larger or more likely to be prevalent in lower quality networks. However, blacks are disproportionately more likely to be served by lower quality networks: 47% of blacks are treated in the lowest quality networks, while only 31% of nonblacks receive ambulatory care in these networks. These results suggest that even if disparities were completely erased within each network, disparities would still exist at the national level because of the larger share of black patients in lower quality networks.

Multiple regression analysis revealed that the presence of disparities is a highly idiosyncratic process: neither level of quality, geographic region, network characteristics (academic hospital, rurality of setting), nor patient characteristics (such as percent black, percent eligible for Medicaid, average patient income, and average patient education) explain the

**TABLE 1.** National Rates and Racial Disparity in Ambulatory Diabetes Quality for Fee-for-Service Medicare Beneficiaries With Diabetes

| Diabetes Quality Measure | Black Diabetic Patients N = 205,665 Beneficiary-yr Percent Receiving Recommended Care (25th Percentile, 75th Percentile) | Non-Black Diabetic Patients N = 1,399,273 Beneficiary-yr Percent Receiving Recommended Care (25th Percentile, 75th Percentile) | Absolute Disparity* |
|---|---|---|---|
| Eye examination | 60.9 (55.4, 66.7) | 67.5 (63.4, 72.2) | −6.6 |
| Hemoglobin A1C | 73.1 (68.0, 79.1) | 78.5 (75.0, 83.0) | −5.4 |
| Cholesterol testing | 76.5 (71.6, 82.3) | 84.7 (82.1, 88.4) | −8.2 |
| Composite quality measure | 70.0 (65.7, 75.2) | 76.9 (74.2, 80.3) | −6.9 |

*All Black-White differences are statistically significant different ($P < 0.0001$).
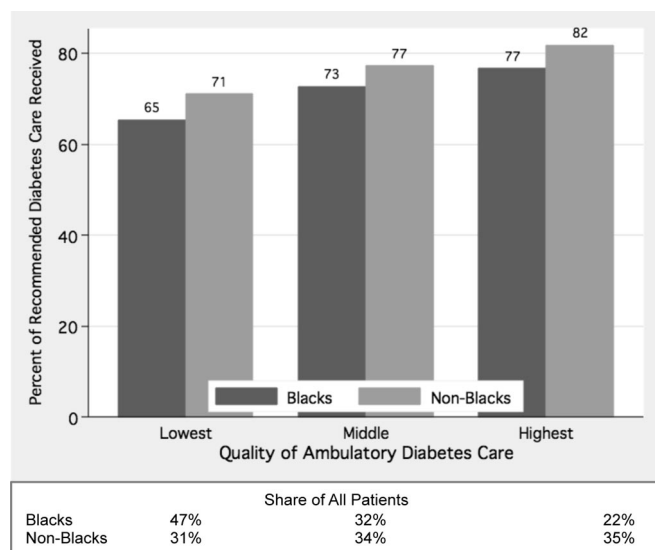
FIGURE 2. Racial disparities in ambulatory diabetes care across terciles of ambulatory care quality.

variation in disparities. These factors collectively explained only 4% of the variation in disparities (data not shown).

## Measuring Quality and Disparities in Specific Physician-Hospital Networks

To demonstrate our ability to measure disparities and quality by types of providers, we report the magnitude of racial disparities and quality of care for blacks and nonblacks in physician-hospital networks with the greatest number of black diabetic patients stratified by teaching status (Fig. 3A, B). The 40 teaching and nonteaching networks in Figures 3A, B represent 12.6% of the national sample of black diabetes patients. Plots stratified by urban/rural status showed similar within strata variation (data not shown). Regardless of the type of network, Figure 3 graphically illustrates the lack of association between quality and disparities that we noted in regression analysis; there are high-quality providers that demonstrate disparities and low-quality ones that do not.

## DISCUSSION

This study has measured performance across all US FFS Medicare physician-hospital networks for both racial disparities and process quality of ambulatory diabetes care. We measure performance at the level of groups of physicians whose work patterns suggest they form a virtual network around a local hospital. These networks have been proposed as a nexus for quality improvement and reporting. We note large variation in the magnitude of disparities across networks that are not associated with the level of network quality. This finding challenges the view that racial disparities in care are principally caused by whites receiving high-quality care, while blacks receive low-quality care in the same network. Rather, in the context of ambulatory care for diabetes whites and blacks receive a similar level of quality within networks. When racial disparities within network are present, they are just as likely to be evident in high-quality

networks as in those with lower quality. We also found that the network-level patient characteristics explained only 2% of the variation in network level disparities, suggesting that role of patient level behaviors such as adherence, while important, is unlikely to be the leading explanation for variation in network performance.

Many studies have focused on disparities in expensive procedures and hospital care for chronic disease care, but few focus on the upstream practices in primary care outside the Veteran's Administration system health system and managed care.[10,22,23] It is important to look outside managed care and the VA because patterns may be different in the absence of an identifiable system with the capacity to implement quality improvement. The most comprehensive study in the FFS setting was conducted by RAND and included 12 communities in the United States on 439 measures in its Quality Assessment Tools to determine which individual characteristics predicted receiving low quality care.[24] In contrast to our finding of a 7% absolute lower receipt of recommended care, the RAND study did not find significant differences in recommended care by race. The difference between our overall results and those from the RAND study may be explained by our focus on a more limited set of measures. Some evidence for this hypothesis comes from a secondary finding in the RAND study of greater disparities arising in a limited set of 33 quality measures. As well, the RAND study included just 12 communities, and so may not have reflected the true degree of disparities across the US, yet both studies demonstrate that the gap from disparities is small relative to the gap in quality.

For the purpose of measuring and reporting disparities in ambulatory care, our analysis focuses on groups of physicians caring for a population of patients rather than individual physicians. Prior investigators have made 2 key observations regarding efforts to report individual physician performance: (1) for reliable reporting, minimum sample sizes must be 50 to 100 patients[25]; and (2) it is possible to game the system by avoiding small numbers (1–3) of patients.[26] Regarding racial disparities, other investigators have also pointed out that a small group of physicians provide most minority primary care, often in less supportive environments.[7,27] Yet individuals receive care simultaneously from many physicians and specialties.[28] Consequently, reporting performance at the individual primary care physician level may not only have a disproportionally negative impact on providers who care for minorities but also create greater incentives to avoid caring for these patients. Reporting quality and disparities at the network level, as we have done, therefore offers several advantages. Only 1% of physicians are in networks with fewer than 100 patients in contrast to the 66% of individual physicians who would have fewer than 100 Medicare patients.[8] A network-based approach to measure performance reduces the incentive to avoid high-risk patients because the outcomes for patients who receive care across the network are included whether individual providers attempt to limit access or not. The administrative burden and cost of public reporting would be markedly reduced (eg, from 400,000 physicians to 5000 physician-hospital networks). Finally, reporting at the
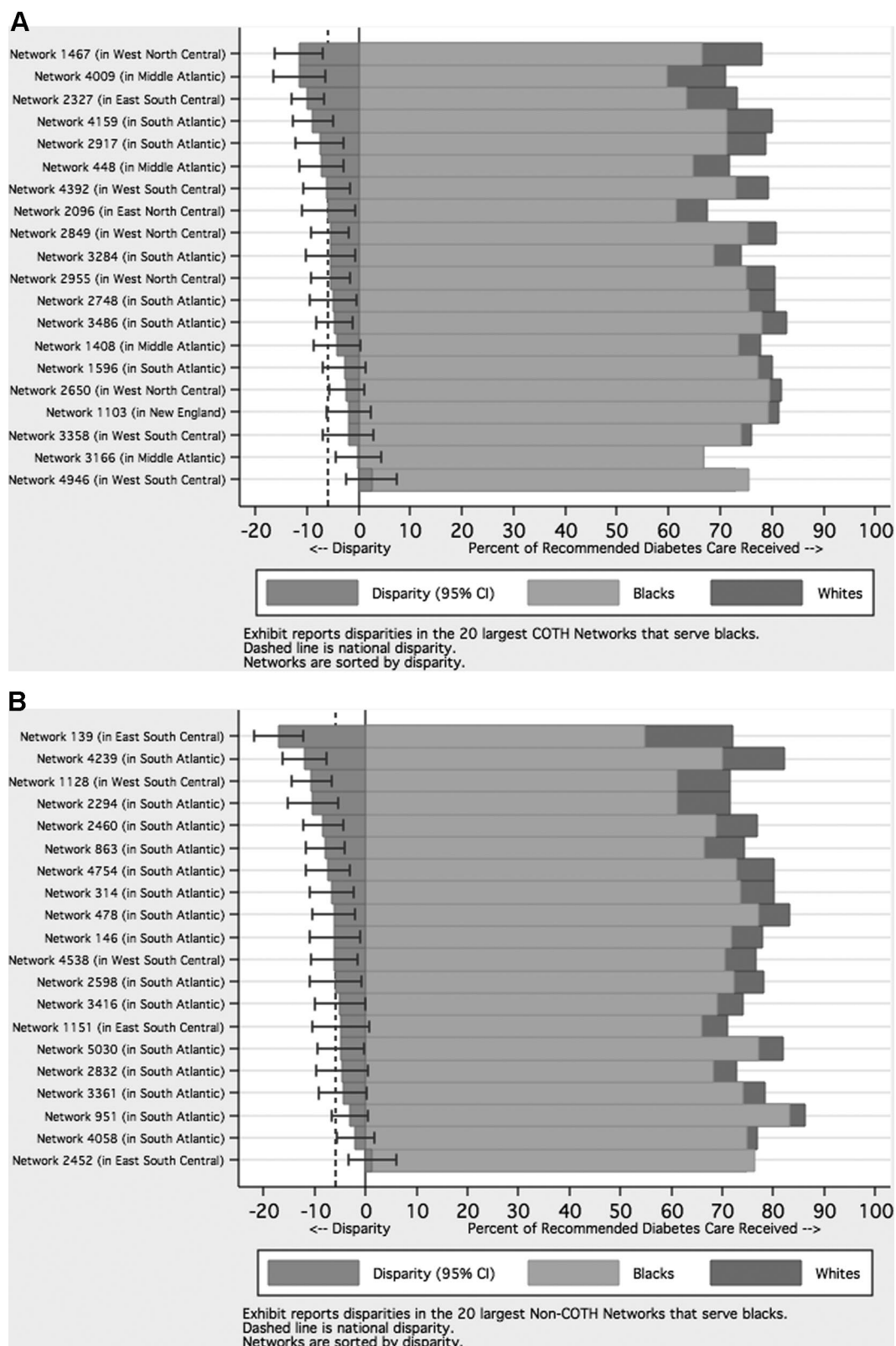
**FIGURE 3.** Delivery of ambulatory diabetes care for non-Black and Black patients at physician-hospital networks grouped by (A) teaching and (B) nonteaching networks.

physician-network level acknowledges that most patients receive care from multiple providers, including primary care and specialist physicians, and it is the joint performance of these multiple providers, which affects care not the performance of a given physician. Therefore, with information on network performance, patients could switch to better networks. Such reporting is aligned with recent Institute of Medicine reports calling for performance measures that promote such shared accountability.[29]

Our aim is not merely to document the disparities, but to provide a mechanism by which information needed to motivate improvement can be generated. Reporting network-specific performance can facilitate collaborative medical and public health interventions for disparity reduction, a method employed successfully in Centers for Disease Control demonstration projects, and new initiatives such as the Robert Wood Johnson Aligning Forces for Quality Program.[30–33] Furthermore, reporting performance at the network level will almost certainly become widespread, now that health care reform legislation will require Medicare to implement Accountable Care Organizations as a national voluntary program by 2012. Our data also inform how policies to improve network performance for minorities should be structured. One approach is to target within network disparities directly. Another approach is to intervene among lower quality providers since blacks are more likely to be treated in these settings.[6,7,9,13,34] Because we also find that blacks are more likely to receive care from low-quality networks, we were able to ask which of these approaches would be most effective at reducing the national disparity between blacks and whites.

To explore the benefits of each approach, we performed a simulation to compare the gains from eliminating within network disparities completely in all 1616 networks that serve blacks, to one that improved quality to a benchmark of 85% of recommended testing in the 500 largest minority-serving networks (without regard to addressing disparities). The absolute national disparity would be reduced from 7% to 2% by eliminating disparities within every network, and would improve the quality of care received by blacks from 70% to 75% of recommended care. In contrast, the targeted intervention in 500 networks would raise the quality of care for blacks nationally to 81% of recommended care. There are no data with which to compare the costs of the 2 strategies but targeting low-quality minority provider groups as we simulated would involve over a 1000 fewer intervention sites and achieve greater testing rates.

Our study is not without its limitations. First, our analysis is restricted to beneficiaries who have had contact with the health care system by having at least 1 ambulatory care visit and blacks were more likely not to have any visits in a 2-year period. It is unlikely that these individuals are receiving recommended testing, so our estimates may underestimate racial disparities. Second, the use of Medicare claims data forces us to restrict the analysis to whether recommended testing occurred, not whether treatment goals were attained. These measures are important processes of care as reflected by their inclusion in the HEDIS measure set. Our choice of process measures might still be questioned. Although some studies have shown that measures used to assess hospital process quality have little relationship to mortality (in pneumonia and congestive heart failure), other studies have shown a positive relationship.[35–37] Harman et al have shown that improvement on process measures in a health plan has a positive relationship to health in diabetes.[38] Third, it is possible that the claims data do not capture all of the care patients received through incomplete billing, but there is little reason that this problem would differentially affect blacks as compared with nonblacks. Fourth, we were limited to single race categories that do not capture multiethnicity (Hispanic) classifications.[18] There may be different patterns for each subgroup that we could not assess. This limitation underscores the importance of collecting better data on race and ethnicity. Finally, we used a 20% Medicare sample which resulted in many networks having a small sample size, a problem that would be ameliorated by using 100% Medicare data but highlights that even when reporting at the group level there will likely be limitations in reporting data for uncommon diseases or smaller subgroups of the population.

In summary, it is now possible to report racial disparities and the quality of care received by minority patients at the level of physician-hospital networks that provide ambulatory care to a population of diabetes patients. While these networks are "virtual" in the same way that states and regions are not directly responsible for care delivery, the measurement of disparities at a more disaggregated level provides patients with more relevant information on the performance of their care network, and it provides policy-makers with more specific guidance on where to focus efforts to improve minority health. Efforts to improve the quality of minority healthcare will have to focus on both eliminating within-network disparities as well as improving the performance of lower performing networks, which are more likely to care for black patients. Regardless of the specific policies that are chosen to improve networks, we have demonstrated that 1 key ingredient to these policies—the ability to measure and monitor performance for FFS ambulatory diabetes care—is now possible.

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