

Who You Are And Where You Live: How Race And Geography Affect The Treatment Of Medicare Beneficiaries

There is no simple story that explains the regional patterns of racial disparities in health care.

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ABSTRACT: The existence of overall racial and ethnic disparities in health care is well documented, but this average effect masks variation across regions and types of care. Medicare claims data are used to document the extent of these variations. Regions with high racial disparities in one procedure are not more likely to be high in other procedures. Unusually large racial disparities in surgery are often the result of high white rates rather than low black rates. Differences in end-of-life care are driven more by residence than by race. Policies should focus on getting the rates right, rather than solely on racial differences.

THERE IS AN EXTENSIVE LITERATURE documenting racial and ethnic disparities in the use of health care in the United States. A recent Institute of Medicine (IOM) report concluded that there are large, significant disparities in the quality and quantity of health care received by minority groups.¹ Most studies have used national samples to study racial disparities in health care, so their results represent an average across U.S. regions. Other studies extrapolate from the experiences of a single area or a single hospital.² One might reasonably infer from these studies' findings that racial and ethnic disparities in health care use are pervasive in every region and for all types of care. However, recent studies have shown that overall national differences mask sizable variation across regions and across procedures in racial and ethnic disparities in utilization rates.³

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We use a rich data source, Medicare claims data, to explore the prevalence and patterns of racial disparities. We show that although there are indeed widespread disparities in black and white patients' care, much heterogeneity exists in the overall quality of care and in the extent of racial disparities, both across different parts of the country (disparities for any given procedure vary widely from region to region) and across different procedures (some procedures have much larger and more consistent disparities than others).⁴ In fact, a region with relatively small racial disparities for one procedure is just as likely to have larger-than-average disparities for another. Thus, studies limited to one procedure or one region are likely to yield misleading results if generalized to others. Furthermore, racial disparities for surgery in some regions are often driven by higher-than-average use by white patients, not lower-than-average use by black patients.

In sum, there is no simple story that explains or captures the regional patterns of racial disparities in health care. In some cases, average disparities are driven by black beneficiaries living disproportionately in regions with low overall rates for whites and blacks; in these cases, equalizing rates within regions would not eradicate disparities at the national level. In other cases, disparities are entirely local, and policies directed at raising overall use of services by the minority elderly population, particularly in "outlier" regions, hold the greatest promise.

The nature of policy reform should also depend on the type of procedures considered. For highly effective care (for example, mammograms for women or eye exams for diabetics), the objective should be to increase rates for all recipients—not just to achieve equality in black and white rates. For other types of care (for example, back surgery or percutaneous coronary interventions), policies should aim to ensure that all patients receive treatments that best meet their individual needs and that resources are devoted to care that produces the greatest health benefits.

Data And Methods

■ **Sample.** Our analysis is based on Medicare claims for 1998–2001, including a 100 percent sample of hospitalizations (the Medicare Provider Analysis and Review, MEDPAR, file) and a 20 percent sample of Part B claims. All data were limited to the population age sixty-five and older in fee-for-service (FFS) Medicare. The *Dartmouth Atlas of Health Care* has divided the United States into 306 hospital referral regions (HRRs), with each region determined at the ZIP code level by the use of an algorithm reflecting commuting patterns and the location of major referral hospitals. HRRs are named for the hospital service area containing the referral hospital or hospitals (of which at least one must provide cardiac surgery) but may also capture large numbers of rural residents who seek care at those metropolitan hospitals. The regions may cross state and county borders because they are determined solely by patients' migration patterns. For example, the Evansville, Indiana, HRR encompasses parts of three states because it draws patients heavily from Illinois and Kentucky.⁵

We calculated the rates at which different procedures were performed in the

population of each region. Utilization rates are determined by where the patient lived rather than where he or she received services. Thus, if a Medicare enrollee living in Richmond, Virginia, were admitted to a hospital in Charlottesville, the utilization would be attributed to Richmond, not Charlottesville. This means that the variations observed at the HRR level are blurred somewhat—since the practice patterns of Charlottesville hospitals are assigned back to the Richmond HRR—but it avoids the potentially more serious shortcoming of unusually high utilization rates in large referral centers such as Rochester, Minnesota, or Boston, Massachusetts. Furthermore, such assignment captures the patterns of primary and secondary care that beneficiaries receive locally.

Because we are particularly interested in racial disparities, we limited our analysis to the seventy-nine U.S. regions with the largest black populations. These regions account for 80 percent of the elderly black population in the United States.⁶

■ **Measurement of race and ethnicity.** We used the Medicare Enrollment Denominator File to identify beneficiaries' race/ethnicity. Susan Arday and colleagues have found that the Medicare designations for both black and Hispanic correspond closely to self-reported racial or ethnic identity.⁷ Although analysis of different racial and ethnic groups, such as Hispanics, would certainly be of great interest, we focus on comparing black and nonblack populations for two practical reasons. First, the sensitivity of the Hispanic designation is low; fewer than half of self-identified Hispanic elderly people are coded as such in the Medicare claims data. Second, Hispanic populations are clustered in a small subset of geographic areas, which makes it difficult to include many communities in the analysis. Thus, for utilization measures calculated from the 100 percent Part A sample, we classified beneficiaries as black or nonblack, dropping Hispanic respondents. Because the measures calculated from the Part B claims described below are based on 20 percent samples, cell sizes were too small to separately identify Hispanic rates of usage, and Hispanics were included with nonblacks.⁸ For ease of exposition, we refer to the nonblack population as “white,” even though other racial groups are in this category.

■ **Use of health care.** To explore disparities in use across different types of care, we first chose several examples of low-intensity care with well-established benefits such as those procedures identified by the Medicare Quality Improvement Organizations (QIOs). Examples of these procedures include eye exams and hemoglobin A1c (HbA1c) blood testing for diabetics and mammograms for women.⁹ The “right” rate for these procedures is close to 100 percent in the relevant population.¹⁰

We next examined examples of higher-intensity care for which both benefits and risks may differ greatly across the population of potential candidates and choices should be made by well-informed patients.¹¹ Thus, it is less clear what the target rate should be—or even that the “right” rate is not different for black and white patients. Here we included hip replacement surgery, back surgery, and five coronary procedures: cardiac catheterization, carotid endarterectomy, coronary artery bypass graft (CABG) surgery, percutaneous coronary interventions, and

angiography. Although these procedures are of unquestionable value to many who undergo them, net benefits are much less clear for a subset of patients, either for clinical reasons or because those patients would have opted against surgery had they been fully informed of its potential costs and benefits.¹²

We also examined end-of-life care (including intensive care unit, or ICU, admissions and hospital days), which tends to be associated with the supply of health care resources such as hospital beds or physician capacity rather than with patients' preferences or underlying severity of illness. These measures provide partial risk adjustment for the underlying illness of the population, since everyone in the sample has a life span of only six months. Prior research has shown that end-of-life care is costly but not correlated with the underlying sickness of the population, patient outcomes, or patient satisfaction.¹³

Having chosen examples of different types of interventions, we calculated utilization rates for black and white patients, adjusting for the age and sex composition of each region.¹⁴ For procedures often performed in an outpatient setting (such as diabetic eye exams and HbA1c monitoring and mammograms), we used a 20 percent sample of Part B claims. We calculated the fraction of beneficiaries receiving at least one procedure annually, and we averaged these annual rates for the period 1998–2001. For inpatient procedures (back surgery, hip replacement, coronary procedures, and end-of-life hospital care) we used 100 percent of the Part A claims, with discharge rates calculated per 100 enrollees, averaged over the four-year period. We also examined race- and region-specific rates of overall Medicare spending (as well as spending on enrollees in the last six months of life), again adjusting for the age and sex composition of beneficiaries.

■ **Statistical methods.** Our analysis is based on black and white beneficiaries' use of ten procedures (eye exams and HbA1c monitoring for diabetics, mammograms for women, back surgery, hip replacements, and five coronary interventions), end-of-life care (ICU admissions and hospital days in the last six months of life), and spending (for all beneficiaries and for those in the last six months of life).

We first examined the heterogeneity of disparities in care across different types of treatments. To look for persistent patterns in disparities across different types of treatments, we calculated the correlation coefficients for disparities across different procedures. This tells us whether regions with greater disparities for one type of care are likely to have greater disparities for other types of care.

We next examined the degree to which racial disparities could be explained by disparities within regions (blacks receiving less treatment than whites in the same area) versus disparities between regions (blacks living disproportionately in regions that provide less care). For example, even if blacks and whites receive equal care in every U.S. region, overall disparities could still exist if a larger fraction of blacks live in regions where overall utilization rates were lower. This informs us both about the heterogeneity of disparities and about the relationship between disparities in care and the level of care received by black enrollees.

Results

There is much variation across regions and across types of care in both overall use and racial disparities (Exhibit 1). Whites, for example, get almost three times as many carotid endarterectomies as blacks but only 30 percent more angiograms. Blacks have higher rates of admission to the ICU in their last six months of life.¹⁵ Rates of use for highly effective, lower-intensity procedures such as mammograms and eye exams for diabetics fall well short of the ideal for both black and white enrollees. On average, black enrollees have more money spent on them, particularly near the end of life, but receive less of these highly effective interventions.

Looking at the correlation coefficients for the different procedures and spending across HRRs shows that disparities in the use of the five coronary procedures are, unsurprisingly, highly correlated, with correlation coefficients ranging from .43 to .86, all with *p* values less than .005.¹⁶ These disparities are not, however, correlated with disparities in the use of the highly effective diabetic screening and mammography—with low, variable, and insignificant correlation coefficients.

EXHIBIT 1
Level Of And Disparities In Care For Different Treatments, 1998–2001

	Average for black patients		Disparity measure	
	Mean	Standard deviation	Difference, white minus black	Ratio of black to white
Expenditures				
Total	\$ 8,436	\$2,113	–\$1,675	1.25
Last 6 months of life	\$17,048	\$6,201	–\$3,855	1.29
Diabetic utilization				
Eye exams	54.93%	4.79	4.85	0.92
HbA1c monitoring	57.32%	6.78	7.80	0.88
Mammograms	35.05%	6.27	14.19	0.71
Hip replacement	0.14	0.03	0.11	0.56
Back surgery	0.22	0.06	0.19	0.54
Catheterization	2.36	0.51	0.99	0.70
Angiography	1.81	0.39	0.68	0.73
PCI	0.56	0.17	0.50	0.53
CABG	0.33	0.07	0.36	0.48
Carotid endarterectomy	0.13	0.04	0.25	0.34
End-of-life care				
Percent admitted to ICU	4.06	0.60	–0.37	1.10
Hospital days	1.57	0.34	–0.34	1.28

SOURCE: Data are from seventy-nine hospital referral regions (HRRs) with largest black population (representing 80 percent of the black elderly population) and come from Medicare claims, 1998–2001.

NOTES: Diabetic utilization and mammograms are measured as percentage of enrollees having at least one procedure annually. Other utilization is measured as discharges per 100 enrollees. End-of-life refers to patients in the last six months of life. Expenditures are measured in year 2000 dollars. All measures are age-adjusted, and all but mammograms are sex-adjusted. Correlations are weighted by the size of the black population. PCI is percutaneous coronary intervention. CABG is coronary artery bypass graft. ICU is intensive care unit.

Disparities in hip replacement and back surgery are uncorrelated with most other utilization disparities and are negatively correlated with each other. Thus, the prospects of using a “report card” to identify regions with particularly poor records for disparities are not promising; the results seem more consistent with “surgical signatures” of race- and procedure-specific disparities.¹⁷

We next explored the disparities in use of three interventions (HbA1c monitoring for diabetics, hip replacement, and percutaneous coronary intervention, or PCI) and in overall spending in more detail.¹⁸ Exhibits 2 and 3 show the rates at which black enrollees received a given intervention against the rate at which white enrollees did, for the seventy-nine regions we considered.¹⁹ Points on the diagonal line represent equal treatment, while distance away from that line shows the degree of disparity within each region (points below the line indicate that blacks receive less care). These exhibits demonstrate graphically the degree to which disparities are driven by differences in care between regions versus differences within regions. If all points were on the diagonal line, there would be no disparities within regions, but disparities could still be observed at the national level if blacks were more likely to live in regions with low overall rates in the lower left corner of the graph.²⁰

HbA1c testing for diabetics among both blacks and whites in every region falls well short of a 100 percent rate, and the black rate is lower in nearly every region (Exhibit 2). In some areas, such as Columbia, South Carolina, and the Bronx, New York, rates are nearly equal for both racial groups, while in other regions, such as Durham, North Carolina, and East Long Island, New York, there are wide disparities in rates. This example highlights the fact that disparities are not clustered in particular geographic areas (such as the South) and thus cannot easily be attributed to historical regional patterns of discrimination.

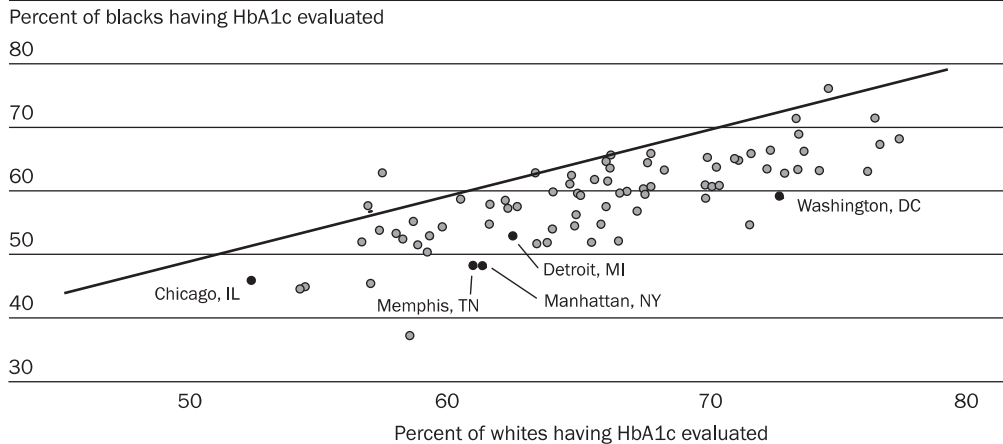
Regions with the smallest racial disparities are not necessarily the ones providing the best-quality care for black patients. For example, the rate of HbA1c testing for black diabetics is lower in the Bronx (53 percent), which had a small racial disparity (4 percent), than it is in Washington, D.C. (59 percent), which had a much greater racial disparity (14 percent). In this case, targeting low utilization rates, rather than disparities per se, would be most effective in identifying areas of need, especially because more black Medicare recipients live in the Washington HRR than in the Bronx.

The average disparity in rates for hip replacement is very large, with rates more than 40 percent lower for blacks (Exhibit 3). The magnitude, however, differs markedly across regions. For example, in Raleigh, North Carolina, the black rate is 22 percent lower than the white rate (1.8 per thousand black enrollees versus 2.3 for whites), while in Manhattan, New York, the black rate is 74 percent lower (0.8 per thousand black enrollees versus 2.1 for whites).

Rates of PCI show a similar pattern.²¹ Nationally, rates for black Medicare enrollees are almost 50 percent lower than for white enrollees during the study pe-

EXHIBIT 2

Black-White Differences In HbA1c Evaluation For Diabetics In 79 Hospital Referral Regions (HRRs), Medicare Population, 1998–2001



SOURCE: Authors' analysis of Medicare claims data, 1998–2001.

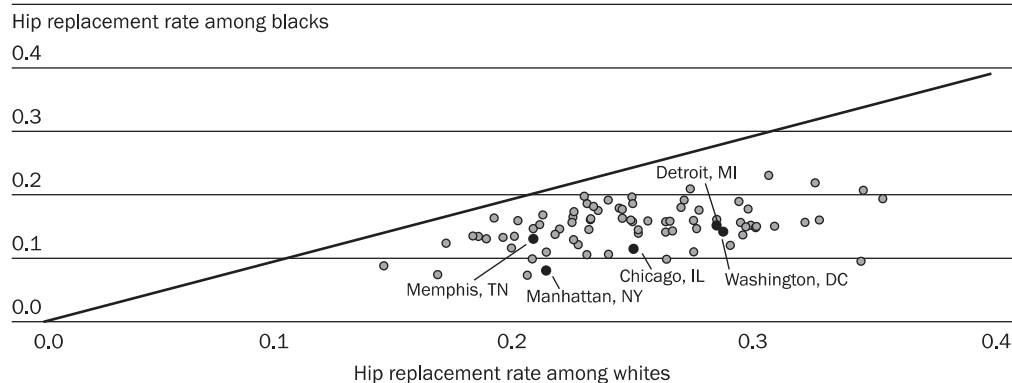
NOTES: Sample is Medicare enrollees in the seventy-nine HRRs with the largest black populations (representing 80 percent of the U.S. elderly black population). Data represent the percentage of diabetics having hemoglobin A1c (HbA1c) evaluated at least once each year, by race, adjusted for age and sex.

riod, but this national average again masks large differences between regions. Here, too, the lowest disparity does not always indicate the highest rates.

We next examine the correlation of racial disparities in surgical rates with the level of black utilization and with the fraction of blacks living in an area. Racial disparities in utilization of some surgical procedures seem to be driven by above-average white rates, rather than by below-average black rates, with positive corre-

EXHIBIT 3

Black-White Differences In Hip Replacement Surgery In 79 Hospital Referral Regions (HRRs), Medicare Population, 1998–2001



SOURCE: Authors' analysis of Medicare claims data, 1998–2001.

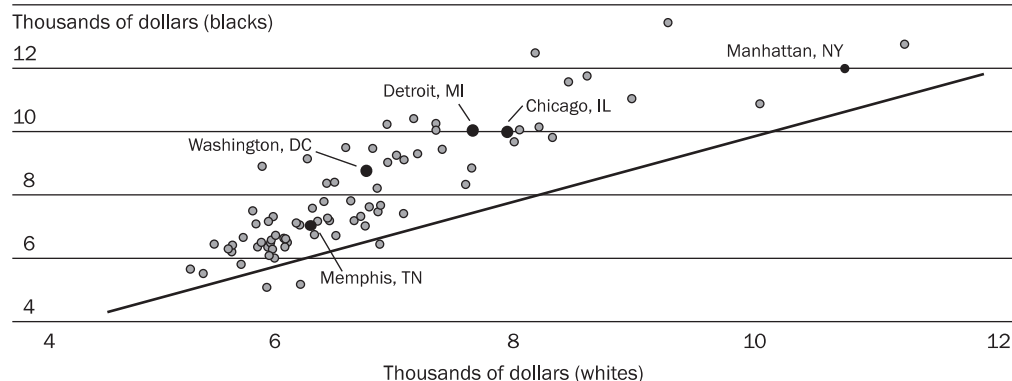
NOTES: Sample is Medicare enrollees in the seventy-nine HRRs with the largest black populations (representing 80 percent of the U.S. elderly black population). Data represent the number of hip replacement discharges per 100 Medicare beneficiaries, by race, adjusted for age and sex. "Whites" include all nonblack enrollees.

lation coefficients between disparities and black rates for CABG ($\rho = 0.20, p = .07$) and carotid endarterectomy ($\rho = 0.43, p < .01$). This seemingly paradoxical result is driven by the fact that black rates for these procedures tend to be somewhat higher in regions where white rates are very high. Furthermore, these disparities are amplified by the fact that blacks tend to live disproportionately in areas with larger racial disparities for these surgical procedures.²²

We also examined an overall measure of health care by graphing total per capita Medicare spending by race and by region (Exhibit 4). Total medical expenditures measure the dollar value of all interventions performed on a patient and are therefore a useful summary measure of how much care a beneficiary receives. Black Medicare recipients have much higher health care spending than their white peers. Again, however, this is not because black enrollees are getting more of everything—they are less likely to get many treatments and procedures, particularly high-quality, effective care. Within a given HRR (such as Chicago or Memphis), disparities in overall spending will not be affected by differences in Medicare's geographic price adjustment. The illustration in Exhibit 4 is limited by the fact that we did not risk-adjust the data (ideally, we would use racial differences in total spending after an index event such as a heart attack). Therefore, the results also capture the extent to which the reduced provision of effective care may result in more interventions later in life. Indeed, the primary source of spending variation is spending on a beneficiary in the last six months of life. (A regression of total spending on end-of-life spending by area produces an R^2 of .754.) For this group of beneficiaries (who will all die in six months and are therefore similarly sick), we see exactly the same pattern of disparities as in Exhibit 4.²³

EXHIBIT 4

Black-White Differences In Total Medicare Spending In 79 Hospital Referral Regions (HRRs), 1998–2001



SOURCE: Authors' analysis of Medicare claims data, 1998–2001.

NOTES: Sample is Medicare enrollees in the seventy-nine HRRs with the largest black populations (representing 80 percent of the U.S. elderly black population). Data represent spending in dollars per Medicare beneficiary, by race, adjusted for age and sex. "Whites" include all nonblack enrollees.

Discussion

We have documented the wide variability of racial disparities in the care received by the Medicare population, both across regions and for different procedures. There are, however, limitations to this analysis.

■ **Study limitations.** The first limitation is our focus on just the Medicare population. An advantage of this approach is that it eliminates a great deal of the heterogeneity in health coverage of a younger group, and greatly reduces the resulting heterogeneity in financial barriers to care.²⁴ On the other hand, this limits the generalizability of the study to younger populations for whom lack of insurance is likely to be more pervasive. Our sample is also limited to the Medicare FFS population—beneficiaries enrolled in health maintenance organizations (HMOs) may face different levels of and disparities in care.²⁵

A second limitation is the lack of controls for how income and health status differ across regions—in particular, the underlying incidence of cardiac disease or hip osteoarthritis.²⁶ Differences across regions in the use of highly effective (and rarely contraindicated) care such as diabetic monitoring and mammography, however, cannot reasonably be attributed to health status, since nearly everyone in the relevant group should be receiving the treatment. Although analysis of decedents does not eliminate all potential health disparities, the role that health differences play in disparities in end-of-life care is limited by the fact that everyone in that sample is in the last six months of life. Previous research has also suggested that controlling for income differences does not eliminate racial disparities in use, and, again, our focus on the Medicare population eliminates a great deal of the income-driven heterogeneity in health insurance coverage.²⁷

■ **Policy implications.** Policymakers have many choices available to them, including the choice of whether to focus on reducing disparities or on increasing the quality of care for minority patients (or for patients overall). The primary policy implication from this analysis is that these choices should depend critically on what kind of care is being considered. For highly effective, high-value care, the objective should not be to ensure that black rates are simply set equal to white rates, since doing so could leave in place geographic disparities (such as those noted earlier in the comparison of the Bronx with Washington, D.C.). Reforms could improve the infrastructure that ensures that patients in need of effective care are identified and that appropriate care is provided. For diabetic care, this should presumably occur in the context of programs to improve the management of chronic illness; for mammograms, the need is a population-based, public health approach to preventive care. Because this care tends to be lower in regions with a higher fraction of black residents, improving the quality of care in the lowest-use regions would tend to provide differential benefits to the black population and thereby shrink overall racial disparities in health outcomes.²⁸

For more intensive procedures for which patients' preferences and providers' practice styles may play a larger role in care decisions, it is less clear what the tar-

get rate should be—or even that the “right” rate is the same for black and white patients. Previous studies have suggested that racial differences in overall joint replacement rates are strongly affected by beliefs in the value of alternative treatments (including prayer) and by beliefs about the effectiveness of surgery.²⁹ However, these may also be procedures that require the greatest degree of navigation through primary care to referral services and are the ones most likely to be discouraged by cultural or language barriers.³⁰ As Jeffrey Katz has pointed out, it is important to distinguish between choices “guided by informed decisions” and choices “limited by truncated opportunities or historical circumstances.”³¹ Thus, the policy goal here is not necessarily to remove all differences in rates of this type of care but rather to ensure that individual choices for such care are made by well-informed patients who make decisions that are not unduly influenced by past adverse experiences. The remedy for this variation is to create a health care system that allows patients to choose treatment according to their own preferences when fully informed about the options.³² Furthermore, for some types of care (such as intensive end-of-life treatment, which may be driven primarily by the supply of providers and for which more money is spent on black recipients than on whites), it seems likely that resources devoted to blacks’ and whites’ care alike could be better spent on care that produced greater health benefits.³³

IMPROVING MINORITIES’ ACCESS to high-quality health care that meets patients’ needs can improve health care overall, allocate health resources more efficiently, and reduce health care disparities. Understanding the factors that drive disparities in care in different regions and for different types of care will ensure that differences in patient care are driven by differences in needs and preferences, not by a legacy of discrimination or by where patients happen to live.

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NOTES

1. Institute of Medicine, *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* (Washington: National Academies Press, 2002); and K. Baicker, A. Chandra, and J. Skinner, “Geographic Variation and the Problem of Measuring Racial Disparities in Health Care,” *Perspectives in Biology and Medicine* (forthcoming).
2. E.D. Peterson et al., “Racial Variation in the Use of Coronary Revascularization Procedures: Are the Differences Real? Do They Matter?” *New England Journal of Medicine* 336, no. 7 (1997): 480–486. The trade-off is that clinical data are often more detailed at the hospital level.
3. A. Chandra and J. Skinner, “Geography and Racial Disparities in Health and Health Care,” NBER Working Paper no. 9513 (Cambridge, Mass.: National Bureau of Economic Research, 2003); A. Zaslavsky, E. Schneider, and A. Epstein, “Racial Disparities in the HEDIS Measures of Health Care Quality,” *Proceedings of the Joint Statistical Meetings, American Statistical Association* (2002): 3933–3938; and J. Skinner et al., “Ra-

- cial, Ethnic, and Geographic Disparities in Knee Arthroplasty Rates among the Medicare Population,” *New England Journal of Medicine* 349, no. 14 (2003): 1350–1359. Skinner and colleagues show, for example, that knee replacement rates for black female Medicare enrollees were equal to rates for white female enrollees in some regions but far below rates for white female enrollees in other regions. Unlike rates for women, rates for black men were consistently below those for white men.
4. As we discuss below, the data preclude a more detailed breakdown of racial and ethnic groups.
 5. HRRs are not necessarily the appropriate geographical level for primary care services but are best viewed as the level where tertiary services such as cardiac surgery are received. For more details, see J.E. Wennberg and M.M. Cooper, eds., *The Quality of Medical Care in the United States: A Report on the Medicare Program, The Dartmouth Atlas of Health Care 1999* (Chicago: AHA Press, 1999).
 6. We choose HRRs with larger black populations both to protect confidentiality and to minimize sampling error, which would make treatment patterns appear more variable. For example, see P. Diehr et al., “Can Small Area Analysis Detect Variation in Surgery Rates? The Power of Small Area Variations Analysis,” *Medical Care* 30, no. 6 (1992): 484–502. In practice, sampling errors are extremely small because of the use of multiple years and 100 percent or 20 percent data sources.
 7. S. Arday et al., “HCFA’s Racial and Ethnic Data: Current Accuracy and Recent Improvements,” *Health Care Financing Review* 21, no. 4 (2000): 107–116.
 8. Note that the Medicare claims data do not allow overlap across racial and ethnic groups, as the 2000 census did, so each Medicare enrollee is placed in just one racial or ethnic category.
 9. S.F. Jencks et al., “Quality of Medical Care Delivered to Medicare Beneficiaries,” *Journal of the American Medical Association* 284, no. 13 (2000): 1670–1676. This approach follows J.E. Wennberg, E.S. Fisher, and J.S. Skinner, “Geography and the Debate over Medicare Reform,” *Health Affairs*, 13 February 2002, content.healthaffairs.org/cgi/content/abstract/hlthaff.w2.96 (2 August 2004).
 10. Note that some of the QIO-identified interventions are preventive care measures that should be performed (at least) annually (such as HbA1c monitoring for diabetics) or biennially (such as mammograms for women), while others are interventions that should be performed at the time of an acute incident (such as the use of beta-blockers or aspirin after acute myocardial infarction). The “right” rate for the use of these procedures is thus 100 percent for the relevant population within the recommended time frame. Thus, perfect compliance with the QIO recommendations would imply that an average of 50 percent of female beneficiaries receive mammograms each year but that 100 percent of diabetics receive HbA1c monitoring each year.
 11. These are sometimes referred to as “preference-sensitive” conditions because, in theory, the choice of these procedures should depend on individual preferences. In practice, rates of procedure use may depend more on providers’ practice styles, whether across regions or by race. See J.Z. Ayanian et al., “The Effect of Patients’ Preferences on Racial Differences in Access to Renal Transplantation,” *New England Journal of Medicine* 341, no. 22 (1999): 1359–1368.
 12. Wennberg et al., “Geography and the Debate over Medicare Reform.”
 13. Ibid.; E.S. Fisher et al., “The Implications of Regional Variations in Medicare Spending, Part 1: The Content, Quality, and Accessibility of Care,” *Annals of Internal Medicine* 138, no. 4 (2003): 283–287, and “The Implications of Regional Variations in Medicare Spending, Part 2: Health Outcomes and Satisfaction with Care,” *Annals of Internal Medicine* 138, no. 4 (2003): 288–299; J. Skinner, E. Fisher, and J. Wennberg, “The Efficiency of Medicare,” NBER Working Paper no. 8395 (Cambridge, Mass.: NBER, 2001); and K. Baicker and A. Chandra, “Medicare Spending, the Physician Workforce, and Beneficiaries’ Quality of Care,” *Health Affairs*, 7 April 2004, content.healthaffairs.org/cgi/content/abstract/hlthaff.w4.184 (2 August 2004).
 14. To control for differences in age and sex among regions, utilization rates presented below are adjusted for differences across regions in age (in five-year increments), sex, and race using the indirect method. See the Appendix to Wennberg and Cooper, eds., *The Quality of Medical Care*, for further discussion of indirect adjustment.
 15. This was shown at the national level by L.R. Shugarman et al., “Differences in Medicare Expenditures during the Last Three Years of Life,” *Journal of General Internal Medicine* 19, no. 2 (2004): 127–135.
 16. These results are available as Exhibit A1 in an online appendix, content.healthaffairs.org/cgi/content/full/hlthaff.var.33/DC2.
 17. Surgical signatures refer to the persistent and dramatic differences in the rates at which certain surgical procedures are performed in adjacent regions with similar patient populations. They are the consequence of individual physicians’ practice patterns and the local medical culture regarding a particular treatment. They have not been found to be correlated with patient characteristics or differences in physician supply.

- N.P. Roos and L.L. Roos, "High and Low Surgical Rates: Risk Factors for Area Residents," *American Journal of Public Health* 71, no. 6 (1981): 591–600; and J. Wennberg and A. Gittelsohn, "Health Care Delivery in Maine I: Patterns of Use of Common Surgical Procedures," *Journal of the Maine Medical Association* 66, no. 5 (1975): 123–130, 149.
18. One study found relatively small differences in monitoring and treatment by race or ethnicity among diabetics in the general population. M.I. Harris, "Racial and Ethnic Differences in Health Care Access and Health Outcomes for Adults with Type 2 Diabetes," *Diabetes Care* 24, no. 3 (2001): 454–459. For related research, see D.E. Bonds et al., "Ethnic and Racial Differences in Diabetes Care: The Insulin Resistance Atherosclerosis Study," *Diabetes Care* 26, no. 4 (2003): 1040–1046.
 19. Other results are shown graphically in Exhibits A3–A8, available online at content.healthaffairs.org/cgi/content/full/hlthaff.var.33/DC2.
 20. This graphical approach is very similar to that of Zaslavsky et al., "Racial Disparities in the HEDIS Measures of Health Care Quality." Also available online are graphs showing the white rate and the white-black disparity for the twenty-five regions with the largest numbers of elderly black residents, ordered according to the size of the racial disparity. The vertical line indicates the average black rate. See Exhibits A3–A4 and A6–A7 at content.healthaffairs.org/cgi/content/full/hlthaff.var.33/DC2.
 21. See Note 19.
 22. There is a strong negative association between disparities and black rates for low-intensity effective care, hip replacement, end-of-life care, and total expenditures, however, and a weak or negative relationship between these disparities and the percentage of the population that is black. The full tables are available as Exhibits A1 and A2 at content.healthaffairs.org/cgi/content/full/hlthaff.var.33/DC2.
 23. Results for end-of-life care are shown in *ibid.*, Exhibit A8.
 24. D. Card, C. Dobkin, and N. Maestas, "The Impact of Nearly Universal Insurance Coverage on Health Care Utilization and Health: Evidence from Medicare," NBER Working Paper no. 10364 (Cambridge, Mass.: NBER, 2004), find that insurance coverage jumps (although copayments may increase) and disparities in use based on race and education drop when patients become eligible for Medicare.
 25. Black and white beneficiaries are enrolled in HMOs at roughly the same rate: 20.4 percent of black beneficiaries versus 19.3 percent of nonblack beneficiaries. Thus, differential enrollment in HMOs is not likely to drive the observed racial disparities in treatment of those enrolled in FFS Medicare. See also Zaslavsky et al., "Racial Disparities in the HEDIS Measures of Health Care Quality."
 26. G.A. Hawker et al., "Differences between Men and Women in the Rate of Use of Hip and Knee Arthroplasty," *New England Journal of Medicine* 342, no. 14 (2000): 1016–1022; and R. Hirsch et al., "Radiographic Knee Osteoarthritis Prevalence in Older Adults in the United States," *Arthritis and Rheumatism* 44 Suppl. (2001): S225.
 27. Skinner et al., "Racial, Ethnic, and Geographic Disparities"; and Card et al., "The Impact of Nearly Universal Insurance Coverage."
 28. Chandra and Skinner, "Geography and Racial Disparities."
 29. For the case of joint replacement, see S. Ibrahim et al., "Understanding Ethnic Differences in the Utilization of Joint Replacement for Osteoarthritis," *Medical Care* 40, no. 1, Suppl. (2002): 144–151; and S. Ibrahim et al., "Variations in Perceptions of Treatment and Self-Care Practices in Elderly with Osteoarthritis: A Comparison between African American and White Patients," *Arthritis and Rheumatism* 45, no. 4 (2001): 340–345.
 30. *Ibid.*
 31. J.N. Katz, "Patient Preferences and Health Disparities," *Journal of the American Medical Association* 286, no. 12 (2001): 1506–1509.
 32. A.M. O'Connor, H.A. Llewellyn-Thomas, and A.B. Flood, "Modifying Unwarranted Variations in Health Care: Shared Decision Making using Patient Decision Aids," *Health Affairs*, 7 October 2004, content.healthaffairs.org/cgi/content/abstract/hlthaff.var.33/DC2.
 33. Growing evidence suggests that greater intensity of care in managing chronic illness or at the end of life does not result in better outcomes (or improved quality of care or satisfaction). See Fisher et al., "The Implications of Regional Variations in Medicare Spending, Parts 1 and 2"; and Baicker and Chandra, "Medicare Spending."