Integrating Research on Racial and Ethnic Disparities in Health Care Over Place and Time

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Black Americans have substantially higher rates of cardiovascular mortality than other racial and ethnic groups in the United States, and they have experienced much less improvement in this important outcome than white Americans over the past 15 years.1,2 Racial disparities in cardiovascular treatment contributing to this mortality gap have been extensively documented.3–5

Numerous deficiencies, however, limit the usefulness of prior studies of racial and ethnic disparities in health care to guide policy and improve clinical practice and outcomes. Even studies with national scope have rarely assessed the extent to which variations among regions, local health markets, or hospitals might mediate observed racial disparities in care. Cross-sectional studies provide little information on changes over time. Furthermore, many studies have focused solely on black and white patients, providing little understanding of treatments and outcomes for other major racial and ethnic groups, including Latinos, Asian Americans, Pacific Islanders, and American Indians.

Three new studies in this issue of Medical Care consider racial and ethnic differences in cardiovascular care across providers,6 over time,7 and across multiple groups.8 Each study contributes to our understanding of specific aspects of disparities in care.

Using data from the Cooperative Cardiovascular Project (CCP) for nearly 140,000 elderly Medicare beneficiaries treated in the mid-1990s at approximately 4700 hospitals, Barnato and colleagues analyzed the relative contributions of within-hospital and between-hospital effects to disparities between black and white patients in medical therapies, coronary procedures, and risk-adjusted mortality after myocardial infarction.6 They concluded that black patients more often were treated in hospitals where effective medical therapies were less often prescribed, coronary procedures were more often used, and 30-day mortality rates were worse; thus, hospital assignment was an important mediator of disparities. These findings complement another recent study by Rathore et al from the CCP that attributed similar racial differences to regional variations in care,9,10 with black patients disproportionately treated in the Southeast where beta blockers are less often prescribed, coronary angioplasty is more common, and risk-adjusted mortality rates are higher than in the Northeast.11,12 These 2 studies both may be correct in attributing a part of racial disparities to variations in quality across hospitals or regions, respectively, but because each study assessed only 1 of these factors, the relative importance of hospital and regional effects cannot be determined. Furthermore, only very limited data were available...
on structural characteristics of hospitals that might explain differences in quality of care and outcomes.

Groeneveld and colleagues analyzed temporal trends in cardiovascular care from 1989 through 2000. Using Medicare claims data, they assessed patterns of treatment of 2 million elderly patients eligible for 1 of 5 “emerging” procedures, including 4 related to cardiovascular disease. In contrast to another recent finding of narrowing racial disparities in use of implantable cardiac defibrillators, this study found no clear reduction in disparities for the most effective form (internal mammary artery grafting) of coronary artery bypass surgery or the most advanced (dual chamber) cardiac pacemakers. Hospitals with higher proportions of black patients were less likely to perform these procedures on patients regardless of race, and racial disparities were also larger within these hospitals. This attention to the racial composition of hospitals is a noteworthy contribution to the literature on health care disparities, but the study did not evaluate whether hospital-level variations reflected uneven regional uptake of the new technologies or the impact of these disparities on clinical outcomes.

Cromwell and colleagues analyzed the use of coronary procedures and subsequent mortality over 2.5 years among all major racial and ethnic groups, using Medicare claims data for over 700,000 elderly patients hospitalized in 1997 for ischemic heart disease. Black and American Indian patients were much less likely to undergo revascularization procedures, and these groups, as well as Hispanic and Asian patients, derived substantially lower survival benefits on average than white patients, raising provocative questions about why these differences arise despite Medicare insurance coverage and comparable access to hospitals performing these procedures. Similarly, a recent study we conducted found that insurance coverage was associated with substantial reductions in mortality for near-elderly white adults but not for a comparable cohort of black adults. Nonetheless, unmeasured variations by race in supplemental insurance coverage may undermine Cromwell’s assumption of uniform health insurance coverage. Furthermore, in an observational study, interpreting a difference in outcomes as causally related to use of particular therapies is challenging and often speculative, especially with only administrative claims data. The racial differences in estimated treatment effects noted in this study could reflect unmeasured differences in clinical characteristics, treatment selection by providers or patients, or treatment effectiveness.

In the context of other published studies in this field, these 3 new studies on racial and ethnic disparities highlight the need for a more integrated and comprehensive approach to studying disparities in health care. Ideally, such a framework would integrate the following types of data:

- Accurate racial/ethnic identification of patients, with adequate samples to assess health care services and outcomes for all major racial and ethnic groups.
- Sufficiently detailed clinical data for effective risk adjustment and assessments of clinical appropriateness.
- Socioeconomic measures such as income and education for individuals and geographic areas.
- Adequate measures of insurance coverage and access to care.
- Information on potential mediators related to language, acculturation, and health beliefs and preferences.
- Organizational and area characteristics that also might mediate observed differences in care.

Furthermore, data sets with consistent content and measurement methods over time are required to track trends in disparities. Any 1 dataset is unlikely to have all of this desired content, but by integrating existing sources and new data-collection endeavors, researchers can better approach this optimal set of information.

Integrating these elements will also require statistical modeling strategies that can simultaneously incorporate the contributions of individual characteristics, hospital and provider characteristics, and local market or regional factors, with the capacity to describe differences within and among providers and regions and over time. This statistical challenge merits closer attention from researchers studying disparities to assess how factors influencing processes and outcomes of medical care operate at each level of this hierarchy. Differences in health care quality among broad geographic regions are likely to have implications for disparities because racial groups are regionally concentrated. Residential segregation of racial/ethnic groups at a more local level also might interact with local variations in access and quality. Much research has demonstrated variation at each of these levels, beyond what is explained by patients’ clinical or socioeconomic characteristics or by measured characteristics of the areas and their health care systems. Other relevant units that contribute to variations in care include health plans, hospitals and physicians. Researchers must now advance the field of disparities research with more sophisticated analytic methods that address these multiple coexisting levels of variation.

A useful statistical tool for simultaneously describing effects operating at several different levels of aggregation is multilevel (hierarchical) modeling. Each level of a multilevel model represents the effects of 1 type of unit, such as states, local health care markets, hospitals, or individual physicians. At each level, the systematic effects of measured covariates are represented analytically by regression coefficients and the magnitude of the “random” effects (effects of unmeasured characteristics of the units that cause unexplained residual variation at that level) by variance components. The random effects are actually of considerable scien-
tific interest: unexplained variation signals opportunities for further explanation of important mediators at a given level and for quality improvement in local regions or health care organizations.\textsuperscript{24-26} Unlike other methods (such as generalized estimating equations\textsuperscript{27,28}) for inference in the presence of clustering, hierarchical models provide explicit estimates of the amount of unexplained variation due to the units at each level of the analysis. Such models have been used effectively to model variations in use of cardiovascular procedures\textsuperscript{29} and to profile providers.\textsuperscript{30} They can similarly be used to model predictors of and unexplained variations in racial disparities, and to profile areas, hospitals, or health plans on the magnitude of disparities. Finally, these models can also incorporate the dimension of time.\textsuperscript{26,31} Unlike typical applications of multilevel modeling to describe individual subjects’ clinical or developmental progression in longitudinal studies,\textsuperscript{32} the unit of analysis for variation over time in health services research, particularly on disparities, is a geographical or institutional unit that includes many individuals. Thus, growing methodological sophistication is required to accommodate the needs of disparities research.

Related characteristics can have systematic effects at more than 1 level. Quality of care, for example, might be related both to the race of individual patients and the racial composition of hospitals’ clientele; with suitable data the patient-level and compositional effects could be separately identified in a hierarchical model. Although either or both of these relationships could contribute to a quality disparity,\textsuperscript{33,34} the interpretation of a racial disparity in treatment of patients within the same hospital would differ substantially from that of a disparity due to a concentration of patients of 1 race in hospitals of lower quality, and each would call for different remedies. Similar issues arise when interpreting changes in disparities over time, which can occur due to shifting patterns of residential distribution or of referral to providers, trends in the quality of institutions serving a disadvantaged group, or changing quality gaps within institutions. For studies of socioeconomic effects, ideally both measures of individual characteristics (such as household income) and the corresponding measures at aggregated levels (median income by block group or zip code) would be available, the latter representing effects of social context. Aggregated socioeconomic data are often more readily available than individual or household data, but the use of only aggregated data confounds individual and contextual effects,\textsuperscript{35,36} as in the study by Groeneveld and colleagues, in which race was known for individuals but socioeconomic indicators were available only for areas.\textsuperscript{7}

When multilevel phenomena are modeled without explicitly taking into account the multilevel structure, both systematic effects and unexplained variation could easily be attributed to the wrong level or variable, as illustrated by the potential confounding of hospital- and area-level effects in the analyses by Barnato and colleagues.\textsuperscript{6} While it is not always practical to build the most comprehensive models with any given dataset, such limitations should be considered when interpreting results of more simplified models. Of course, regression models (however complex) do not establish causality, but they can establish associations (such as treatments by race/ethnicity) that are often of primary interest when studying disparities.

The Institute of Medicine (IOM) Unequal Treatment report presents a useful framework for interpreting regression models of health care disparities that conceptually separates observed differences in treatment among racial/ethnic groups into 3 parts.\textsuperscript{3} One part of such differences may be due to clinically relevant variables such as comorbid conditions, which might reflect pervasive disparities in health\textsuperscript{16,37} but not in health care during the episode under consideration. Disparities in health may represent cumulative effects of poor health care as well as other social, economic and environmental stresses disproportionately affecting underprivileged people over the lifecycle. Thus educating patients about healthy lifestyles, as suggested by Cromwell and colleagues, is only 1 component of the concerted national effort required to eliminate health disparities.\textsuperscript{37,38}

A second part of the observed racial and ethnic differences in health care may be due to group differences in preferences for care. The interpretation of preferences is complex and potentially controversial because they are difficult to measure, and even when elicited may reflect in part patients’ expectations based on current or historical experiences with care, including poor communication and discrimination.\textsuperscript{39,40} Thus, for example, the aversion to surgery speculatively hypothesized by Cromwell and colleagues to explain lower rates of cardiac surgery among blacks could arise from having received worse care in the past or inadequate information about current treatment options.

The remaining part of the racial/ethnic difference, constituting the “disparity” under the IOM definition, includes the effects mediated by nonclinical differences among groups such as income and insurance coverage, as well as residual differences by race and ethnicity that cannot be attributed to measured mediators. As we add more socioeconomic mediators to models, the residual effect directly attributable to race (typically characterized by the coefficient of an indicator of individual race) will be reduced in most cases. Nonetheless, in the IOM framework, these mediated effects are still part of the disparity; estimation of the disparity requires combining the direct and mediated effects. A number of mechanisms may contribute to the racial/ethnic disparity, including those mediated by socioeconomic characteristics. For example, access barriers may arise from residential segregation, inadequate insurance, or inability to pay out-of-pocket costs of care. Communication and trust between providers and patients may be impaired by social and cultural differences or...
historical and contemporary discrimination. Systems of care may be unresponsive to the distinct needs of diverse populations of patients.

In the IOM framework, the role of geography in disparities is an interesting special case. Concentration of a group in areas that are persistently medically underserved will systematically affect the care experienced. From this standpoint, location is like a socioeconomic variable that contributes to a disparity, especially when both geographical concentration and geographical differences are consequences of historical (and perhaps current) patterns of oppression and discrimination. On the other hand, the component of disparities due to geographical variation is less relevant to actions that might be taken to reduce disparities within each area.

A comprehensive analytic strategy will identify a number of mechanisms contributing to racial differences, reflecting disparities in health care as well as other societal and individual differences. The policy and ethical implications differ for the various components of intergroup differences in health care—those mediated by individual health characteristics, preferences, and socioeconomic status and by systematic geographical and institutional variations in quality. As the focus of research advances from identifying disparities to discerning their mechanisms and ultimately their cures, methodological advances will help researchers to obtain more valid and insightful inferences to promote policy solutions.

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