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Commentary

Measuring Structural Racism: A Guide for Epidemiologists and Other Health Researchers

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There have been over 100 years of literature discussing the deleterious influence of racism on health. Much of the literature describes racism as a driver of social determinants of health, such as housing, employment, income, and education. More recently, increased attention has been given to measuring the structural nature of a system that advantages one racialized group over others rather than solely relying on individual acknowledgement of racism. Despite these advances, there is still a need for methodological and analytical approaches to complement the aforementioned. This commentary calls on epidemiologists and other health researchers at large to engage the discourse on measuring structural racism. First, we address the conflation between race and racism in epidemiologic research. Next, we offer methodological recommendations (linking of interdisciplinary variables and data sets and leveraging mixed-method and life-course approaches) and analytical recommendations (integration of mixed data, use of multidimensional models) that epidemiologists and other health researchers may consider in health equity research. The goal of this commentary is to inspire the use of up-to-date and theoretically driven approaches to increase discourse among public health researchers on capturing racism as well as to improve evidence of its role as the fundamental cause of racial health inequities.

health disparities; health inequities; interdisciplinary methods; measurement; structural racism

Editor's note: *The opinions expressed in this article are those of the authors and do not necessarily reflect the views of the American Journal of Epidemiology. An invited commentary on this article appears on page 548.*

Racism is more than interpersonal discrimination or implicit bias toward people of color; it encompasses racist practices and systems that are embedded into institutions in the United States (1, 2). This form of racism is best described by the term structural racism. According to Bailey et al. (3), structural racism is the “totality of ways in which societies foster racial discrimination through mutually reinforcing systems of housing, education, employment, earnings, benefits, credit, media, health care, and criminal justice” (3, p. 1). Structural racism has produced and reinforced segregation, differential quality and access to health care, unequal distributions of social determinants of health, and physical and psychological injury to racialized and ethnic minoritized communities (henceforth referred to as marginalized communities) that together have culminated

in the health inequities observable in the United States (4–9). Although the United States is the focus of this article, similar consequences of racism can be observed in other countries with a history of colonization and marred by white supremacy (10).

More than a century of research supports structural racism as a fundamental cause of health inequities for marginalized communities, with some studies explicating the implications for Whites (4, 11–21). Much of the work on the impact of structural racism has been carried out by researchers from marginalized communities and is often framed as less scientific, which has limited its influence (22). Structural racism within academic institutions and publishing practices has discounted the importance of investigating the role of structural racism as a cause of health inequities (23, 24). Hence, contemporary researchers of structural racism, still mostly from marginalized communities, now call for models that delineate causal mechanisms connecting structural processes to individual health outcomes—a process that has been neglected in the field of epidemiology (25). A recent review of literature by Castle et al. (1) reveals that

little public health literature described structural racism as a determinant of health. Without widespread commitment to engage structural racism within epidemiologic and public health research, researchers from marginalized communities are forced to explain structural racism. Instead, we all should participate in generating causal evidence of the direct impacts of structural racism on health.

This article highlights scholarly work on the health impact of structural racism to provide key recommendations for how epidemiologists and other health researchers can measure structural racism, including approaches taken by other fields (26). This provides an introduction for epidemiologists and other health researchers who are not familiar with this work. Our goal is to spark conversation about operationalizing and measuring structural racism, applying these methods in research, and amassing the body of evidence on the role of structural racism as a determinant of health and health inequities (27).

OPERATIONALIZATION AND MEASUREMENT OF STRUCTURAL RACISM

Valid measurement of structural racism requires a complex process. First, structural racism operates at a systemic level (28); thus, approaches to measuring structural racism cannot focus entirely on self-reported measures as they primarily capture interpersonal experiences of racism (e.g., the Perceived Discrimination Scale (29–31)). This is vital to be mindful of as structural racism can operate without an individual's awareness of it.

Structural racism's role in driving health inequities has not been comprehensively operationalized empirically. In 2018, Groos et al. (32) published a review of methods used to quantify structural racism and found that only 4 publications utilized indicators across different sectors to better approximate, in the words of sociologist Barbara Reskin, the “race discrimination system” (33). The authors go on to use the terms “institutional racism” and “structural racism” interchangeably, reflecting how these constructs have been empirically conflated. Early attempts to name a system of racism utilized the names institutional or institutionalized racism to refer to a system of procedures, practices, and ideologies within and among organizations that disadvantage and abuse non-White groups (2, 34). Today, structural racism is the term used to best describe the multilevel nature of racism—interacting at the interpersonal and internalized levels as well as among institutions to have impacts on a range of health outcomes (3). However, such impacts are evident despite a lack of consensus of terms and measurement (35–38).

The challenge with well-established existing measures of structural racism is that they examine single dimensions of structural racism (e.g., housing, education, employment, incarceration, etc.) (39). The most used are measures of the index of concentration at the extremes and the index of disproportionality (38, 40). Measures of neighborhood segregation, such as the index of concentration at the extremes (38) and the Getis-Ord Local G_i^* statistic (36), have been brought into health equity research to capture the contextual dynam-

ics around clustering and isolation in neighborhood environments. These single-dimensional measures can be useful for those working within local health departments tracking the influence of specific policies on residential composition. Over time, single measures do not capture the multidimensional nature of structural racism and the extent to which numerous institutions and sectors reinforce health inequities. Epidemiologists must consider whether their approaches appropriately capture both multilevel (e.g., structural operations and individual outcomes) and multidimensional (e.g., segregation, credit/wealth) structural racism.

A true operationalization of structural racism encompasses “mutually reinforcing systems” (3). For example, residential segregation is not just the “physical separation of races in distinctive residential areas” (41, p. 107). This separation requires local governments and banks to implement zoning laws and mortgage policies that disenfranchise marginalized communities, ultimately restricting their housing to deleterious environments (41). This cross-sector cooperation also influences access to quality public education, healthy food, and additional factors important to health (42). Given this cross-sector influence and reinforcement, there is a need to measure the independent and overlapping roles of multiple systems (e.g., segregation, education, etc.) on the health of marginalized communities (43). However, measuring reinforcing systems may risk muted effects arising from multicollinearity. We recommend the approaches in Table 1; however, there are others in alignment with well-delineated theoretical frameworks for structural racism that merit consideration (3, 44–46).

“Race” as a proxy of structural racism

Race is not equivalent to structural racism (47). Race is a social construct that reflects neither biological nor cultural differences between groups (47). Much of our research enterprise relies on an idea of racial essentialism, by which we assume that differences between racialized groups are immutable, fixed, uniform, and often conflated erroneously with biology and ancestry. The measurement of “race/ethnicity” in the United States for federal data is defined by the Office of Management and Budget as categories that are sociopolitical constructs and should not be interpreted as being scientific or anthropological in nature (48). Therefore, when significant comparisons are acquired between racialized groups, it is instead the present or generational effect of social exclusion that is captured. However, few epidemiologists use race in this way. Few include a proper discussion of what “race” represents in their analyses, reinforcing erroneous assumptions about the biological differences between racialized groups (47, 49). More appropriate variables should be used to measure structural racism. Depending on study intent, models that measure the role of structural racism can be stratified or include terms for interaction by race/ethnicity or can focus on one racialized/ethnic group to illuminate the societal tax that marginalized groups must bear (50).

There are situations when race data must be collected to ensure health equity and monitor disparities over time

Table 1. List of Recommendations for Measuring Structural Racism by Suggestion and Required Action

Recommendation	Suggestions	Required Actions
Do not use race as a proxy for racism	Use variables that capture multiple dimensions of structural racism	Reconsider your model; include in the discussion that significant differences between racialized groups do not account biological or cultural differences
Race and social determinants	If necessary to use race, intersect race with another variable to capture intersectionality (e.g., race × socioeconomic status, race × redlining)	Become aware of the potential variables race can be confounded with
Interdisciplinary variables and data sets	Review interdisciplinary literature on racialized group(s); consult with colleagues outside of discipline; partner with marginalized communities	Become aware of biases embedded in funding and publishing that may influence access to scholarship on racism
Mixed methods	Collect qualitative and quantitative data	Become aware of your biases toward other methodologies
Life course, time, and history	Incorporate life-course pathways into models; explore impact of time on exposure and health outcomes; engage interdisciplinary colleagues and literature to build in the role of history	Become aware of your lack of knowledge on history; acknowledge historic abuses of your discipline and others; counter embedded biases that would create or reproduce harm
Mixed data	Engage with disciplines and practices that are advancing the field of mixed data integration; engage with discourse from the humanities and social sciences; practice researcher reflexivity	Disentangle your biases toward other methodologies; become aware of how your biases are embedded in the study
Multilevel and multidimensional models	Utilize an index of variables or a latent construct; take care when selecting variables	Use culturally responsive assessments that are valid for the population of interest; acknowledge limitations of model

(51). It is important to monitor the allocation of resources or trends in disease outcomes by race. Ethnicity is vital to capture when disaggregating categories of racialized groups to monitor health outcomes (e.g., disaggregating Native Hawaiian and Pacific Islander and Southeast Asian groups with worse health outcomes from the aggregate Asian or Asian American category with better health outcomes). If race is a variable within a preexisting data set, engage intersectional approaches (e.g., race × socioeconomic status; race × gender, race × redlining) that add dimensionality to groups (52).

Research using race as a variable should state that any significance between race and another variable is due largely to societal differences as race does not represent biological or cultural differences between groups (51). Distinctions between races and the importance we place on phenotypic or genetic characteristics are driven by cultural, historical, ideological, geographical, and legal influences rooted in structural racism and white supremacy (53). Often propped up by scientific racism, the social processes of racialization produce racial categories that derive meaning through the differentiation of groups, not from characteristics associated with the groups (54, 55). Racism is the father of race and becomes salient because of society-specific and time-specific racialization (56). Epidemiologists must explain why 2 racialized groups, groups that do not have between-group differences in genetic structure and that have meaningful within-group

variation in cultural practices, would have significant differences in health experiences and outcomes. Such an explanation is likely rooted in structural racism.

Race and social determinants of health

Race is correlated imperfectly with socioeconomic variables in measuring differential health outcomes or access to health-promoting resources. For example, area-level socioeconomic variables can depict geographic differences in groups based on a built sociological environment where communities are formed from shared social exclusion from resources. These variables indicate both outcomes (i.e., segregated neighborhoods) and processes (i.e., redlining) that capture the “hazards of place” (50, 57, 58). This implores an epidemiologist to stratify by race/ethnicity or use race in models as the focal relationship, where socioeconomic status penalties and stratification by place reflect the outcome of racist policies such as historical redlining. However, marginalized communities may experience heightened stress even in “healthier” neighborhoods that lack the protective effects of social and faith-based networks and culturally valent neighborhood amenities (59). Subsequently, consider employing the recommendation of intersectional approaches to capture the dynamics between race and social determinants of health.

METHODOLOGICAL RECOMMENDATIONS

Linking interdisciplinary variables and data sets

Current epidemiologic research relies heavily upon within-disciplinary knowledge and methods. Yet, this can limit the validity of research on structural racism by conflating race with ancestry and ignoring the role of intersectionality, the relationship between seemingly independent dimensions (e.g., racism, sexism) that interact to produce unique health experiences and inequities (60). Often the study of the role of structural racism on health entails the use of novel variables. For example, recent studies have linked mass incarceration and police exposure to risk of preterm birth among Black women (57, 58). Having the knowledge to link risk of preterm birth with mass incarceration and police exposure can be gained through lived experience, collaboration with marginalized communities and interdisciplinary scholars, and in-depth interdisciplinary literature review. To understand structural racism, epidemiologists should engage with scholars from interdisciplinary fields such as ethnic/cultural studies and sociology who can describe the relationship between individual outcomes (e.g., depression, alcohol addiction) and structural factors (e.g., frequency of jobs available on/near reservation, lack of land rights) (61, 62).

Public health researchers engaged with structural racism are often informed by law professor John A. Powell's framework of structural racism, which explains that "[s]tructural racism shifts our attention from the single, intra-institutional setting to inter-institutional arrangements and interactions. Efforts to identify causation at a particular moment of decision within a specific domain understate the cumulative impact of discrimination" (63, p. 796). According to Powell (63), our desire to measure a point in time (e.g., law implemented) may deflect from studying the impact of accumulated points leading to poor health outcomes. Concepts relevant to structural racism as delineated by Powell, other legal scholars such as Kimberlé Crenshaw and Dayna Bowen Matthew, and economists such as Darrick Hamilton can assist epidemiologists with explicating relationships between structural racism and health outcomes (64–66).

Unfortunately, there are few data sets with multilevel and multidimensional variables that capture structural racism. It is possible to build a new data set with the critical structural and individual levels variables necessary (67), but when otherwise, epidemiologists need to link existing data sets together (68). Linking can be achieved by using an anchor variable (e.g., Census tract, county, etc.) to connect data sets. In the study with mass incarceration, Sealy-Jefferson et al. (57) linked data from Detroit's Justice Atlas of Sentencing and Corrections to the Life-Course Influences on Fetal Environments study using zip codes. Through linking variables from different data sets, epidemiologists can explore the multilevel and multidimensional impact of structural racism on health outcomes.

It is important to be mindful of structural biases embedded in public health research and publication processes that privilege certain studies and variables by not recruiting, welcoming, promoting, or funding diverse investigators

that would explore differing scientific questions (69–72). Consequently, journal of publication, date of publication, epistemological underpinnings of the disciplines of authors, and other hang-ups should not deter engagement with interdisciplinary content or scholars.

Using mixed methods

Mixed methods data provide rich information that can assist with measuring the role of structural racism on health (73, 74). Due to the bias embedded in epidemiologic research and publication processes, preference has been given to studies with quantitative explanations of determinants of health (22). Supplementing quantitative data with qualitative data can provide a complete picture of the social determinant of health by describing the mechanisms by which health experiences are conditioned. Traditional qualitative methods, including focus groups, key informant interviews, and public deliberation can be labor intensive when gathering data from a large sample. However, conducting this research is feasible with new data-collection strategies such as video chatting, online diaries, photovoice, online communities, and social media posts. Both qualitative and quantitative data can corroborate, dispute, or delineate the practices and policies that create, sustain, and reinforce health inequities (75). With mixed-method analyses, epidemiologists can connect structural factors (e.g., policies) to individual outcomes (e.g., recorded via survey or interview).

Incorporating life course, time, and history

There is a need for approaches that illuminate the pathways between time-dependent exposure to structural racism and morbidity and mortality across the life course (76, 77). Life-course approaches to structural racism are similar to standard life-course approaches, including assessing exposure during sensitive and critical periods, cumulative exposures, other exposures, and combinations of them. However, the identification of exposures may require innovative incorporation of time and history to identify specific policy, social, and economic exposures that help us operationalize structural racism. For example, Krieger et al. (78) examined the association between Jim Crow laws established in the late 1800s that mandated the physical separation of Black and White people and the mortality rates of Black and White people living under Jim Crow laws in the 1960s. This approach explores how exposure to a set of racist laws has enduring impacts, resulting in differences in mortality between groups later in life. Structural racism persists over the life course, creating a "net effect of racism" (76, 79). Exposure, latency, and the negative moderation of stress over time need to be explored through innovative studies (46, 80). The Jim Crow cohort study illustrates the potential impacts of policy experiments where substantive changes made to determinants of health can have an impact on the health of marginalized communities in the long run (3, 81).

Structural racism may transform over time. For example, Jim Crow laws that explicitly created separate racialized

neighborhoods morphed into redlining policies that maintained residential segregation, which converted into racist mortgage algorithms that determined home loan viability (41). This transformative feature of structural racism highlights the utility of a multilevel and multidimensional measure that captures interconnections between forms of racial inequity. Epidemiologists should focus on measures that are derivable with data collected on an ongoing basis (e.g., American Community Survey, Survey of Income and Program Participation) that allow for tracking change over time.

Interdisciplinary literature from art, history, and anthropology can support research on exposure to structural racism by providing an understanding of how events were interpreted through cultural depictions (82). Disciplines such as genetics and evolutionary medicine present cautious promise for exploring variables that can illuminate how chronic exposure to structural racism influences disease progression (83). Still, extreme attention must be paid to the ways genetic and evolutionary research reinforce eugenic notions of inherent differences between racialized groups and other socially categorized groups (e.g., nonbinary and cisgender). When engaging genetics, evolutionary medicine, and related disciplines, avoid variables and equations that lead to the assumption that sociodemographic factors are related to genetic variation (47, 49) since sociodemographic factors, too, are outcomes of structural racism. Interdisciplinary approaches utilizing the aforementioned disciplines, methods, and analytical tools must acknowledge and remedy the legacies of racial bias and structural racism embedded in their corresponding practices (84).

ANALYTICAL RECOMMENDATIONS

Integrating mixed data

Connecting structural factors to individual outcomes sometimes involves analytical models that account for multiple levels and draw the path from structural factors (e.g., number of foreclosures per zip code) to individual outcomes (e.g., combination of diurnal cortisol and level of vitamin D) with the use of mixed data (e.g., biometric, survey, administrative, and string data). Integrating mixed data also encompasses the mixing of qualitative and quantitative data through a process of triangulation (85). Mindfully engage advancements in information sciences, health information technology, data science, system science, engineering, medical decision making, and economics that can integrate diverse data. There are analytical methods and technologies, such as geographic information systems, machine learning, and mathematical modeling, that can integrate mixed data. Mathematical models create a simplified version of complex social and biological processes such as neighborhood selections, hiring of workers, and disease development (86–88). Mathematical models such as system dynamic models, network models, and agent-based models can be useful for the evaluation of the potential health impact of structural racism and antiracist initiatives.

Epidemiologists should engage with discourse from the humanities and social sciences (e.g., critical race studies)

to integrate mixed data. Engagement with interdisciplinary colleagues encourages conversations around the misuse of algorithmic technologies like machine learning and mathematical modeling to harm racialized groups (84). Conversations with scholars from the humanities and social sciences encourage reflection on the epistemological underpinnings of our disciplines and the methods we use (54, 89). For example, some researchers in diverse fields acknowledge constructivist framings that assume participants co-construct reality based on their experiences (90). Whereas many researchers in fields like epidemiology and statistics may hold the postpositivist assumption that there is one knowable reality that we can extract through our methods.

As well as interdisciplinary engagement, researcher reflexivity is required by the full research team (22, 54). Reflexivity is a process whereby individuals examine and discuss their beliefs (91). Epidemiologists may assume that our individual biases can be separated from the research process, and therefore, we never evaluate them (92). Subsequently, research teams should embed practices of reflexivity throughout their studies for all personnel. Study personnel must educate themselves on the violence that has occurred due to the use of research and analytical tools (e.g., role of genetic data in racism, aggregating data making subpopulations invisible, etc.), and hold conversations among all personnel to discuss how individual beliefs may influence the current study. Epidemiologists must engage and reflect on the tough questions about our disciplinary and individual biases to achieve a more antiracist practice of public health research.

Using multilevel and multidimensional models

Racism is a multidimensional determinant of health that may produce collinearity. Societal variables used commonly by epidemiologists are categorical, and limit statistical explorations of collinearity to correlations. For multilevel models such as hierarchical linear models and generalized estimating equations (93–95), variables with shared variance (e.g., race and income) will result in one or both variables being pushed out of the model with consequences for significance and R^2 values (93–95). To address the issue of collinearity among multiple variables in regression models, we recommend that epidemiologists compile multiple dimensions of structural racism into an index of variables or a latent construct (26, 96). The difference between an index and a latent construct is conceptually meaningful; however, the statistical approaches are similar. Both involve conducting a factor analysis that proportionately combines the dimensions as a predictor variable for a health outcome. However, a latent measure assumes that the shared variance between dimensions represents the construct of structural racism. This is an assumption all users of scales must reckon with, and we can do so only with a conceptual framework for structural racism.

Some multilevel and multidimensional models, such as structural equation models, can capture the intricacies of practices and policies that comprise structural racism. The most recent example is Dougherty et al.'s (96) 5-factor model of county structural racism that accounted for

housing, education, employment, health care, and criminal justice using variables such as Housing Dissimilarity Index, School Dissimilarity Index, White–Black High School Graduation Ratio, Black–White Incarceration Ratio, Black–White Poverty Ratio, White–Black Primary Care Ratio, and Black–White Ambulatory Care Ratio. Dougherty et al. (96) used this measure of structural racism to explain obesity inequities between Black and White people at the county level.

Structural equation models can also be used to measure aspects of structural racism such as institutional racism. Griffith et al. (97) proposed a framework for examining institutional racism within health centers that incorporates 3 levels of institutional racism—individual, intra-organizational, and extra-organizational. In this multidimensional measure expanded upon by Adkins-Jackson et al. (34), individual racism is measured using an index of variables accounting for patient and clinician interactions such as time spent with the clinician, conversation pace and tone, clinician body language, amount of information provided, procedures prescribed, and degree of shared decision-making. The intra-organizational level captures the internal practices of a health center that contributes to health inequities, which is represented by a health center–wide average score on the Implicit Association Test. The extra-organizational level has a range of variables that capture the availability of services, distribution of resources, and the use of racist curricula and demographically homogeneous research data sets. Through structural equation modeling, these dimensions provide a connection from structural racism to individual health outcomes.

When constructs are used at the neighborhood/area versus individual level, multilevel models can detect the within and between differences of structural racism within a neighborhood context. These insights are particularly useful in formulating both place-based and population-based policies to eliminate health inequities. However, care should be taken with the variables selected. For any constructed measure, use culturally responsive assessments that are valid with the populations of interest (98). Additionally, any number of variables utilized will not represent an exhaustive list of the factors and pathways by which structural racism operates, especially as life-course exposures complicate these pathways. Therefore, a discussion of these limitations must be included.

CONCLUSION

Epidemiologists must do better in delineating the root cause of a “significant association” between race and health outcomes. Interdisciplinary training is needed to capture structural racism’s multidimensionality and pathways from exposure to outcome. The goal in measuring structural racism is to connect health outcomes to the racist practices and policies preventing health equity (46, 54, 99, 100). Epidemiologists must integrate in their training programs the theoretical and methodological frameworks from disciplines that articulate the drivers of social stratification and marginalization, such as sociology, history, political science,

law, and psychology. Epidemiologists must also undo the processes and procedures that perpetuate structural racism, such as the privileging of publications from certain journals, research methods, and topics that exclude meaningful scholarship that could benefit epidemiologic research, end health inequities, and lead to improvements in public health. This scholarship is not possible when we accept the legacies of inequities, undermine scholarship by using race as a proxy, and leave this work to only a few colleagues.

An interdisciplinary approach centered on population health equity is vital to responding to public health challenges and epidemics (101, 102). We can draw on social work, the performing arts, international studies, and others to construct measures of structural racism. We must acknowledge the ways our unidisciplinary thinking has undermined our ability to solve key public health problems (103). As well, we must acknowledge how our fields have participated in current health inequities. We can increase the study of structural racism by applying widespread use of the methodological and analytical approaches described above. We must think beyond our training, statistical tests, and practices that dismiss methodologies that we may be unfamiliar with. There is scholarship being overlooked that proposes new approaches we could explore (7, 32, 39, 52, 58, 104), but we cannot move forward with capturing variables like structural racism if we do not explore our creativity. May this commentary serve as a guide for the work that must be done by everyone, soon, to increase public health for all.

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