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Locations! Location! Location? Elucidating the Social Determinants of Cardiometabolic Health Among United States Adolescents

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It is becoming increasingly clear that the risk for cardiovascular disease begins in childhood [1,2]. Unfortunately, exposure to social determinants that contribute to health disparities in cardiovascular outcomes also begins in childhood [3,4]. These disparities have been attributed to multiple determinants, including cultural and language barriers, differences in income and education levels, lack of access to adequate healthcare coverage and providers, and the social and built environment. To reduce many of these barriers, broad changes in public policy will be needed (e.g., improvements in educational opportunities, reduction in income inequality). But for the community provider to be an effective advocate for her adolescent patients, more granular data are needed about environmental factors that contribute to cardiovascular health before personalized, meaningful interventions can be developed at the local level.

Until recently, obtaining objective data to account for the influence of environmental factors on cardiometabolic health was prohibitively expensive. However, in the era of "big data", it is becoming much easier to access data from federal, state, and local agencies to characterize the socioeconomic or built environment factors that contribute to health disparities. Yet, limited data on contributors to health disparities at the neighborhood level for racial/ethnic minorities continues to be a major barrier in understanding health risks in our most vulnerable adolescent populations. As Baicker et al. demonstrate, neglecting the influence of geographic differences in the health of racial/ethnic minorities can lead to inaccurate generalizations [5].

In this issue of the *Journal*, Williams et al. improves upon the existing literature by analyzing data at the neighborhood level [6]. The authors combine data from the National Health and Nutrition Examination Survey, Atlanta, GA, from 1999 to 2012 and United States census

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data from 2000 to 2010 to analyze the relationship between census-tract level poverty and a composite measure of cardiometabolic health by race/ethnicity. For the analysis, the cardiometabolic dysfunction score was divided into quintiles, with the first quintile considered the healthiest population and the reference group. The score was a composite measure of glycosylated hemoglobin, average systolic and diastolic blood pressure, total cholesterol, high density lipoprotein cholesterol, and waist circumference. Hierarchical ordinal regression models estimated overall and race/ethnicity specific associations between census-tract level poverty and cardiometabolic dysfunction. Post-hoc analyses explored the relationship between area-level poverty and family poverty-to-income ratio by racial/ethnic group.

Williams et al. not only found that there are differences in cardiometabolic dysfunction score by area-level poverty, but also that these differences are dependent on race/ethnicity. The authors find that adolescents in the fourth quartile (i.e., those with the highest level of poverty) had a 27% odds of a higher cardiometabolic dysfunction score compared to those in the first quartile. However, this association only holds for non-Hispanic whites and Mexican Americans and not for non-Hispanic blacks. Further, in post-hoc analyses, the authors find that family-level socioeconomic status remains higher for non-Hispanic white adolescents as compared to non-Hispanic black and Mexican-American adolescents across census-tract poverty levels, despite reductions in the family-level socioeconomic differences between racial/ethnic groups with increasing poverty. Finally, an important finding is the tendency of non-Hispanic whites to live in areas of similar incomes (i.e., non-Hispanic whites with higher incomes have neighbors with higher incomes and those with lower incomes live near others with lower incomes), whereas this is less true for Hispanics and non-Hispanic blacks.

The authors effectively demonstrate race/ethnic-specific associations of neighborhood-level poverty with cardiometabolic risk in adolescents, independent of individual-level socioeconomic factors. Thus, Williams et al. extend the work of prior studies that demonstrate living in a neighborhood with higher socioeconomic deprivation and lower socioeconomic status is associated with worsening cardiometabolic health [7,8]. Additionally, their findings highlight the key role of structural racism in limiting the association between area-level poverty and cardiometabolic dysfunction among non-Hispanic black adolescents, given the segregation of black families to higher poverty, lower-resourced communities even within seemingly homogeneous census tracts. This role for structural racism is also consistent with recent evidence that the racial/ethnic disparities in asthma prevalence may be better explained by differences in neighborhood quality, rather than race/ethnicity [9].

Despite the importance of these findings, the use of the cardiometabolic dysfunction score may leave the community provider concerned that these results do not accurately reflect the population’s risk for cardiovascular disease or the extent of the racial/ethnic disparities. In order to have an adequately powered study, the authors created a new cardiometabolic risk score using non-fasting lipid profiles. Since the risk score has not previously been validated, the community provider is left to wonder if an association with this group of risk factors is clinically important. However, the lack of longitudinal data from adolescence to adulthood means that the authors did not have another risk score available. Similarly, while fasting

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samples would have limited the power of the study, non-fasting samples can assess risk with similar, possibly superior, and accuracy [10]. Nevertheless, choosing the most predictive parameters is paramount. While recent pediatric guidelines use total cholesterol as a screening tool in adolescents [11] total cholesterol is not used in risk stratification or treatment decisions as other nonfasting parameters such as non−high-density lipoprotein cholesterol levels have a much stronger association with future cardiovascular events [10].

The community provider is also left wondering whether we can gather more detailed, contextual data about the neighborhood environment features which may differentially influence cardiometabolic health for adolescents across racial/ethnic groups. With the advent of mobile health technology, increasingly powerful mobile communication devices, and wide distribution of high-speed wireless communication networks, gathering data has become much simpler for researchers and less burdensome on study participants [12]. The convenience and ubiquity of mobile health technology would facilitate longitudinal studies with more objective environmental data over the life-course for diverse populations. In fact, mobile technology may be particularly useful in research focusing on the health of diverse populations given data showing mobile devices as the primary method of connectivity among younger racial/ethnic minority groups [13].

For the community-based health care provider, understanding the role of the local environment on the cardiometabolic health of our adolescent patients is critical to the development of effective interventions. Although changes at the healthcare system level and patient level are critical to reducing health disparities, the local, neighborhood environment appears to play an equally important role in the persistence of racial/ethnic disparities. With the use of novel measurements obtained by mobile technology, the effects of neighborhood-specific characteristics can be better understood and multilevel interventions can be developed that account for the adverse impact of neighborhood environment and lead to improvements in overall population health.

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