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EDITORIAL COMMENT

New Dimensions Assessing Poverty and Cardiovascular Disease

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Social determinants of health, including socioeconomic factors, are major risk factors for cardiovascular disease.[1] The contemporary conception of ideal cardiovascular health acknowledges that social determinants of health are key arbiters of cardiovascular disease.[2] A robust and growing body of evidence links poverty to increased cardiovascular disease risk. For example, family income, classified using the family income to poverty ratio, was associated with dose-related increases in the risk of cardiovascular mortality and total mortality, as well as heart failure, coronary disease, stroke, diabetes, and hypertension.[3] Moreover, although there are improvements in cardiovascular disease incidence and outcomes at the population level,[4] such improvements are not evenly distributed across the population. For example, those with the highest income did demonstrate declining trends in cardiovascular disease and improved outcomes at the population level, while those in the lowest income grouping demonstrated no reduction or even increases in cardiovascular disease prevalence.[5] The relationship between financial stressors and cardiovascular health is cumulative, with additional financial stressors leading to worse outcomes.[6] Thus, improving poverty is a requisite for improving population cardiovascular health, and poverty contributes to growing disparities in cardiovascular outcomes that, left unchecked, will worsen cardiovascular health across the poverty spectrum.

There are several mechanisms by which poverty contributes to adverse cardiovascular outcomes. Poverty causes psychological stress, depression, and anxiety, which themselves increase cardiovascular disease.[7] Poverty is invariably linked to other environmental cardiovascular risk factors such as air and noise pollution,[8] lack of access to healthy foods, and residing in a 'food desert'.[9] Lack of access to parks and safe spaces to exercise increases risk.[10] Finally, lack of financial resources certainly reduces access to care through transportation difficulties,[11] medication cost-related nonadherence,[12] and other mechanisms. This list is not exhaustive; rather, it highlights that multiple mechanisms exist whereby poverty increases cardiovascular disease risk. It also highlights the urgent need to address poverty in order to improve cardiovascular outcomes.

A multidimensional definition of poverty is needed; focusing solely on income misses an opportunity to account for the multiple mechanisms by which poverty impacts an individual. Accurate, meaningful, and reproducible classification of the poverty exposure variable is an important step to moving the field forward. To address this need, in this issue of *JACC: Advances* the authors present a much-needed analysis investigating a multidimensional poverty index.[13] They incorporate multiple variables—including income, education, self-reported health, and health insurance status—into a single multidimensional poverty index.[13] Using National Health and Nutrition Examination Survey data, the authors demonstrate that the multidimensional poverty index is indeed associated with atherosclerotic cardiovascular disease, as one would expect.[13] The multidimensional index also outperformed a unidimensional income-based definition of poverty, with a greater area under the receiver-operator curve (0.62 vs 0.58).[13]

The authors' work constitutes an important advancement in several ways. First, their work demonstrates the feasibility of applying a multidimensional index to a nuanced and multifaceted problem,

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and this paradigm should be used in considering other social determinates of cardiovascular health. Second, they do show that models can be made more accurate by considering the multidimensional nature of poverty specifically and perhaps social determinants of health in general.

There are opportunities for further study and important next steps in advancing the authors' work. Poverty and the multidimensional index are assuredly associated with noncardiovascular adverse health outcomes as well. When modeling and predicting outcomes, future analyses should consider competing risks of these different outcomes or consider the aggregate outcomes of health in tandem, such as all-cause mortality. Second, it is fair to consider that the model improvements observed when comparing the multidimensional index to income alone are very modest. The tradeoffs between modestly improved model discrimination and increased complexity to define the exposure should be considered and a balance struck between complexity and parsimony and pragmatism. Exciting future areas for study could include incorporating patient-reported outcomes and other novel patient-generated data into multidimensional indices. Extending multidimensional indices into surgical and procedural outcomes, quality reporting, and quality benchmarking could also contribute to alleviating disparities.

Overall, the authors' work adds to the robust body of literature that poverty is associated with adverse cardiovascular outcomes and moves the field forward by enabling a multidimensional classification of poverty as an exposure. Future work will extend these important concepts and contribute to reversing growing disparities in cardiovascular disease outcomes.

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