Editorial

Tracking Social and Biological Experiences
The Social Etiology of Cardiovascular Disease

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The social gradient in cardiovascular disease (CVD) is well known. There are literally scores of studies showing that men and women who are socially disadvantaged are at increased risk of developing CVD and have a worse prognosis once they develop the disease. During the last 40 years, in most industrialized countries, a clear pattern has emerged showing that each increase in socioeconomic position confers a decreased risk in cardiovascular morbidity and mortality. Men between the ages of 25 and 64 who are the most disadvantaged have an ≈2.5-fold risk of dying of CVD. For women, the risks are even greater (3.4-fold risk). Similar trends are seen for risk-related disorders, including hypertension and diabetes. The causes and mediating pathways by which this occurs are not nearly as well characterized, however. Identifying the biological and behavioral mechanisms that link economic and social disadvantage to cardiovascular morbidity and mortality provides valuable insights into the causes of CVD and information about where along the spectrum of disease development we may effectively intervene to improve outcomes in disadvantaged populations.

Much of the social gradient was attributed originally to the uneven distribution of a number of health behaviors related to diet, tobacco consumption, physical inactivity, compliance with therapeutic regimens, and differential access to high-quality medical care. As the story goes, as better educated, economically advantaged men and women learned about the risks that are related to tobacco, obesity, and inactivity, they changed their behaviors and subsequently reduced their cardiovascular risks, often giving rise to even greater disparities in coronary heart disease (CHD). We now know that differences in health behaviors account for a part of the disparities in CHD but leave much unexplained. It is also becoming increasingly clear that only a small part of the association results from the impact of CVD on economic and social mobility. The story is more complex, remains mysterious, and from a public health standpoint is even more important because we have been unable to reduce disparities even though we know so much about the causes of heart disease.

Although CHD mortality rates have fallen steadily during the last several decades, we have hardly made a dent in reducing the incidence of disease nor have we reduced the social disparities related to socioeconomic position or race/ethnicity in either morbidity or mortality. Reducing both disparities and morbidity in the population remains a major challenge to public health and to medicine. Until we have a better understanding of the causal links and pathways by which social disadvantage translates into disease, we may have a hard time reducing the burden of disease in the population. Furthermore, according to the World Health Organization’s Global Burden of Disease estimates, CHD will be the major cause of death throughout the world by 2010, and most of the prevention programs that the West has exported have not been effective.

There are two general areas in which we need more information to build our understanding of the ways in which social position influences CHD. The first relates to the identification of biological pathways that mediate the social experience of disadvantage and lead to increased risk. The second relates to understanding the nature of the social environment to identify precisely what it is about socioeconomic position that is so important to health. Often, scientists working in biomedicine understand the importance of the first of these areas (identifying the biological mechanisms) but underestimate the importance of understanding the nature of the social experience. To understand why this second issue is so important, think of a crude indicator of some social experience—say current occupation—and contemplate why it might be related to cardiovascular risk. For instance, we would like to know if the risk is related to the nature of the job experience itself, whether it is stressful or demanding, or to hazardous physical exposures on the job, or to the income it provides, or to the neighborhoods in which people with certain occupations live, or to the level of education needed to attain a specific job. We may also wonder about the extent to which current circumstances build on previous experiences or exposures that provide protection throughout the life course.

In deepening our understanding of social context and social experiences, one of the major advances in epidemiology has been the incorporation of life-course perspectives into our thinking. So, not only is it important to look at outcomes longitudinally but also increasingly we have come to appreciate the need to test the development of social and biological risks longitudinally.

Epidemiological approaches to evaluating the association between socioeconomic position and CVD are strongest...
methodologically when we can (1) obtain data on biological pathways likely to mediate social exposures and disease outcomes, (2) incorporate multilevel analytic approaches in which data are collected both at the “area” level as well as the individual level, and (3) obtain data that are longitudinal with regard to both risks and outcomes. The studies reported by Hemingway and associates9 and others in this issue address these 3 major issues involved in understanding the causes and biological pathways by which CVD is shaped by social disadvantage. They provide new insights but also have some serious limitations that further stress the need to incorporate both longitudinal and contextual frameworks into work in this area.

Probing Biological Mechanisms

Recent work on biological mechanisms related to CVD has identified new biomarkers related to inflammatory, sympathetic, and parasympathetic pathways and metabolic processes.10 Markers related to C-reactive protein, heart rate variability, and glucose metabolism and insulin resistance—themselves causing physiological cascades that impact other known risks—have emerged as central factors in the development of CVD.11 One of the most fascinating findings related to these biomarkers is their association with physical and psychosocial stressors.12 Thus, these biological processes hold the potential to link a range of stressful exposures, whether physical, social or psychological, to the onset and course of CVD.

The findings from the Whitehall study published in this issue of Circulation show the way in which heart rate variability (HRV) varies by grade of employment and the extent to which it clusters with other risks related to the metabolic syndrome.6 This study of British civil servants has been of central importance in identifying the ways in which social hierarchies produce increases in risk of a number of diseases and disorders, of which CVDs have been of prime importance. The authors report that increasingly high occupational grade is related to decreasing heart rate and increasing HRV risks that we know from other studies are protective against cardiovascular events. Heart rate and HRV are also associated with most indicators of the metabolic syndrome, even when excluding subjects with the frank clinical syndrome. The authors argue that HRV mediates the influence of social position on subsequent cardiovascular risk, in this case risk related to the metabolic syndrome. Because the data from this study are cross-sectional, this is an intriguing but controversial argument. Although the correlation between chronically impaired autonomic function and social position is solid as is the correlation between HRV and the metabolic syndrome, equally plausible is that components of the metabolic syndrome such as weight/hip circumference, impaired glucose function, or blood pressure–influence patterns of HRV. Longitudinal data on the course of the development of risk would be invaluable here. For instance, if some of these risks are laid down in early life or result from long-term exposures in adulthood, we might identify whether patterns of autonomic function are precursors of the metabolic function or the result of disturbances in them.

Data from studies that are strong on the clinical side but weaker in assessing social experience may add to our knowledge of physiological cascades. We might then extrapolate from these patterns to studies such as the Whitehall study. For instance, data from the Framingham study show that autonomic dysregulation is present in the early stages of hypertension and that altered HRV predicts the new onset of hypertension in men. Patterns are not so clear among women in the Framingham study.13 HRV is also associated with diabetes and impaired levels of fasting blood glucose, although the Framingham data are cross-sectional and it is as reasonable to suspect that fasting blood glucose is involved in the pathogenesis of autonomic dysregulation as the reverse.14 Reaven and colleagues15 have also argued that metabolic abnormalities, particularly insulin resistance, are primary influences on sympathetic activity and the development of hypertension. In fact, the authors of the Whitehall study note in their discussion that consistent with this hypothesis, components of the metabolic syndrome explained 27% of the social gradient in low-frequency power. Similar arguments could be made for measures of obesity such as waist-to-hip ratio. Thus, one could have as easily set up the Whitehall analyses to examine the effects of components of the metabolic syndrome on heart rate and HRV and inferred causal processes leading from glucose metabolism to other outcomes.

Need for Population-Based Longitudinal Studies

As we search for the ways in which social conditions affect cardiovascular health, it is critical to enroll random samples of populations that are truly representative of the wide range of men and women in particular nations or communities. The diversity of social experiences related to economic and occupational conditions cannot be captured any longer by looking at white men in the workforce and excluding women, minorities, and people who flow into and out of the workforce because of market fluctuations and job insecurities. The authors of the Whitehall study note that they are looking at a “general population.” These analyses do not include women and racial/ethnic minorities are excluded to avoid “confounding.” Because the Whitehall study is already a truncated cohort in terms of range of occupational experiences, the exclusion of such large segments of the UK population makes generalizability precarious. Do the authors really mean to suggest that job strain, HRV, and health behaviors “explain” the gradient in heart disease? What about the gradients we see for men and women who are not in the workforce? The contribution of the Whitehall study to our understanding of social gradients in heart disease has been immense,16 and in terms of understanding biological mediation it has been at the forefront of studies in this area. In light of the rising importance of area-level effects, however, we may do well to broaden our understanding of the range of social and economic exposures that travel with occupational grade of employment. If, as other study findings suggest, the effects of living in an impoverished and disadvantaged area remain strong in future studies in which individual level indicators are available, then entirely new areas of investigation are open.
Finally, much of epidemiology is longitudinal in the sense of assessing risk and then following people prospectively into the future, but this is not enough. Studies would be able to draw stronger inferences if they were longitudinal in assessing exposures and identifying social and physiological cascades leading to disease onset and survival. No one study can do everything, and this study gives us a peek at a long-term process. We need an epidemiology that will help us sort out the time course of the development of risks, with attention paid to both the social and biological exposures and the mediating pathways.

References


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