North, South: Changing Directions in Cardiovascular Epidemiology

Despite impressive declines in cardiovascular disease (CVD) over the last half-century, stroke and coronary heart disease (CHD) still constitute the greatest disease burden in the developed world. Moreover, there is accumulating evidence that developing countries will be faced with stroke and CHD epidemics in the relatively near future. Much of our understanding of the etiology of CVD has been gained from prospective cohort studies such as the British Regional Heart Study (BRHS), and in this issue of *Stroke*, Morris and colleagues supplement a previous report from this study of geographical patterns of CHD incidence by extending the length of follow-up and examining geographical variations in stroke. The BRHS is an ideal study for investigating the geographical inequalities in CVD. Indeed, the study was established with this aim in mind, specifically to test the hypothesis that water quality was a determinant of CVD risk, which proved not to be the case. However, despite the fact that the study generated >250 articles, mostly on the causes and consequences of CVD, it was not until 2001 (>20 years after the initiation of the study) that the “definitive paper about the causes of regional variation in coronary heart disease appeared.” This most recent contribution is therefore welcome. The authors found that among men the risks of both CHD and stroke were greater in the rest of Britain compared with the south of England and that this difference was substantially, although not completely, explained by adjustment for a number of adult CVD risk factors: systolic blood pressure, smoking status, physical activity, social class, and height. Had they adjusted for other established risk factors, in particular diabetes status and dyslipidemia, which are associated with both CHD and occlusive stroke, the residual variation may have been completely removed. These findings are in line with those of a similar previous study of British men. What then does this work add to our epidemiological and public health knowledge? In part, the answer to this question requires a greater understanding of the factors responsible for geographical variations in CVD risk factors and thus CVD.

The results essentially confirm the association between several established adult risk factors and CVD, and the authors acknowledge in their concluding paragraphs that their findings have little to contribute to public health practice: “Clearly, any public health actions on diet . . . must be directed to the whole population throughout Britain and not targeted to specific geographically located groups.” The article refers to the north-south gradient, but in fact the comparisons are dichotomized between the south of England and the rest of Britain. From Table 1, it can be seen that in this particular study there is not a clear north-south gradient: Merthyr Tydfil, Gloucester, and Shrewsbury, all of which have southern latitudes, have high incidences of both CHD and stroke, whereas Darlington in the north has a relatively low risk of CHD, and Harrogate, also in the north, has a relatively low risk of stroke. This reflects in part the selection of towns in the BRHS, and although a north-south gradient was not observed, there is substantial geographical variation, with incidences of CHD varying between 6.16 and 12.21/1000 person-years and of stroke between 2.00 and 5.45/1000 person-years across the 24 towns. The between-town variation in both CVD and risk factor occurrence is likely to be explained by area- and/or individual-level deprivation; the authors might therefore have explored this geographic diversity within the BRHS and sought explanations beyond established adult risk factors.

Many studies have demonstrated geographical inequalities of the sort presented here. Importantly, many investigators have now moved beyond these simple ecological designs and examined individual- and area-level measures to determine whether the physical and social aspects of where people live influence health independently of the characteristics of the people themselves. The relevance of this issue is that if variations in health between areas can be entirely explained by the personal characteristics of the inhabitants of these areas, then policy makers need act only on improving the circumstances of individuals. Conversely, the demonstration of independent area-level effects would be key in emphasizing the need to focus attention on features of the areas where people live and not just the individuals living there. This is important because the widening gap between the rich and poor appears to be mirrored by a growing divergence of their residential environments, so that affluent people are increasingly living and interacting with other affluent people while the poor increasingly live and interact with other poor people. Such studies could go even further; rather than simply use census-derived contextual effects, the environments in which study participants live could and should be examined. Both the BRHS and the newly formed British Women’s Heart and Health Study could in the future incorporate an examination of the neighborhoods in which their participants live by assessing, for example, the following: the local availability of affordable fruits and vegetables, green areas, and physical activity facilities; area levels of criminal activity; and other indicators of environmental adversity.

That the baseline measurements in this study were taken 20 years before the final period of follow-up reaffirms the need to combat adverse risk factor profiles at least as early as middle age. However, the findings also prompt a wider consideration of cardiovascular risk. Blood pressure in middle age may be a strong risk factor but is itself set in train in early life, as evidenced by the declines seen in several regions over the last 50 years in young people who were not taking antihypertensive medication. Height is also a measure of early life exposures, and its association with CVD (demonstrated in the BRHS and other studies) may represent the role of genes, early nutrition or infection, or other socioeconomic exposures that become embodied over the years.
hypertension, inactivity) for CVD are known and that emphasis should now be placed on tackling these rather than searching for other risk factors. However, these risk factors do not explain socioeconomic variations in CVD and are themselves determined by social, environmental, and biological exposures acting throughout the course of life.

Finally, it is opportune to consider the growing burden of CVD in developed countries and the potential for it to greatly widen the global north-south gradient in health. With respect to exposures over the life course, the greatest risks to public health are likely to be seen in developing countries where the effects of extreme poverty in early life and in childhood are most vividly demonstrated.26,27 Cardiovascular research is increasingly carried out in developing countries, and continued support for this body of work is required. Similarly, it is imperative that interventions aimed at preserving the cardiovascular health of young individuals in developed countries are also implemented in more deprived parts of the globe. Geography provides a valuable tool for a more comprehensive investigation of disease etiology; it is essential that it is not used merely as an indicator of health inequality.

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