Ethnicity and cardiovascular risk: variations in people of African ancestry and South Asian origin

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Mortality from coronary heart disease (CHD), stroke and end-stage renal failure are high in South Asian migrants in the UK. This is associated with high prevalence of diabetes and hypertension. These seem to be manifestations of a metabolic syndrome with insulin resistance (hyperinsulinaemia) and central obesity (based on high waist-to-hip ratio rather than on conventional measures of body mass index). This is associated with sedentary lifestyle, high serum triglycerides and low HDL-cholesterol.

Mortality from stroke and end-stage renal failure are high in black migrants to the UK (both Caribbeans and West Africans). However, CHD mortality is low in this group. This pattern of mortality is associated with high prevalence of hypertension and diabetes. This group tends to be obese (particularly women) according to conventional measures of body mass index and to have hyperinsulinaemia, low serum triglycerides and high HDL-cholesterol.

Conventional risk factors such as cigarette smoking and hypercholesterolaemia are less prevalent in ethnic minority populations in the United Kingdom and unlikely to explain the differences seen *between* groups, although each risk factor is likely to contribute to the variation in vascular disease *within* each group.

There is difficulty in reconciling the results of migration studies (eg, from rural to urban environments) pointing to major environmental influences on the changes in cardiovascular risk factors with the consistent pattern of disease of ethnic groups across the world and in subsequent generations, suggesting a certain degree of genetic susceptibility. Important environment-gene interplays might be underlying some of these processes.

The detection and management of hypertension and diabetes are still unsatisfactory in inner city areas and show variations by ethnic origin. Strategies for the control of CHD and stroke adopted in European countries directed mostly to white populations may be inappropriate for ethnic minority populations.

Keywords: Africa; South Asia; cardiovascular risk

Introduction

Cardiovascular disease is the most common and yet one of the most preventable causes of death in the western world. Furthermore, the unprecedented economic development in Asia and the rapid urbanisation of Africa are accompanied by rapid changes in lifestyle and environmental exposures so that the burden of chronic vascular diseases are rising rapidly in developing countries.[1] The risk of premature disease varies by ethnic group. It is, therefore, necessary to understand the underlying disease processes and lines of causation which may vary between different ethnic groups, and to look at effective strategies to help limit this rapid increase in the burden of chronic vascular disease.

Mortality variations in person, time and place

Relative to subjects of Caucasian origin, African–Caribbeans and people of African descent have high incidence of stroke[2] and end-stage renal failure[3,4]

whereas coronary heart disease (CHD) is less common. On the other hand, South Asians (from the Indian sub-continent and from East Africa) have a much higher incidence of CHD.[2] Figure 1 summarises the mortality experience in England and Wales for ischaemic heart disease and cerebrovascular disease of men and women, aged 20–69 years, by place of birth. Ischaemic heart disease is highest in immi-
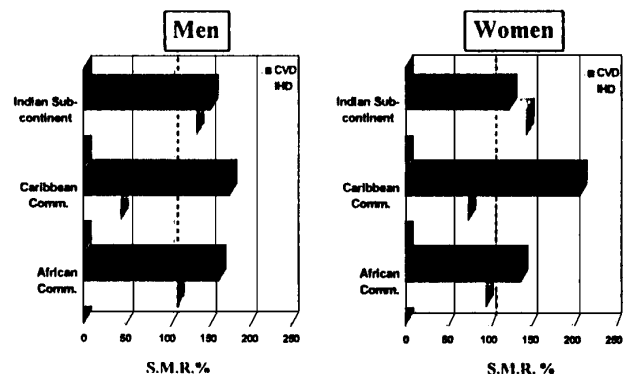

Figure 1 Mortality from ischaemic heart disease (IHD) and cerebrovascular disease (CVD) by place of birth in England and Wales (1983) in people aged 20 to 69 years. SMR = standardised mortality ratio. The dotted line indicates the expected mortality in the sex-specific white reference population (drawn from reference 2).

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Table 1 CHD mortality in South Asian populations overseas

Country	Years	Groups	Age	CHD mortality ratio
Singapore	1980–1986	S Asian *vs* Chinese	30–69	3.8
Fiji	1980	S Asian *vs* Melanesian	40–59	3.0
Trinidad	1977–1986	S Asian *vs* African	35–69	2.4
South Africa	1985	S Asian *vs* European	35–74	1.4
England	1979–1983	S Asian *vs* European	20–69	1.4

grants born in the Indian sub-continent whereas it is remarkably low in those born in the Caribbean Commonwealth. In contrast, stroke mortality is high in those born both in the Indian sub-continent and in the Caribbean, with the highest mortality amongst Caribbean women. Immigrants born in the African Commonwealth include both black West and South Africans as well as South Africans of European descent, and East African South Asian Indians. When these groups could be differentiated (ie, in the 1991 census), then a high stroke mortality rate and a reduced mortality from ishaemic heart disease were described in black African-born immigrants.[5] These figures clearly suggest a substantially different pattern of vascular disease as a function of ethnic origin.

The examination of the mortality from coronary heart disease of South Asian populations overseas indicate that the high risk appears to be a feature of these populations across the world, whether with a recent or longer history of migration[6] (Table 1). This is also true when the reference host population is at different risk (high in England, low in Chinese in Singapore). Similarly, the mortality from stroke of populations of black-African ancestry is high.[2,7] Although cause-specific mortality data are lacking in African countries, stroke rates are high in black African–Americans, whether born in the US or in the Caribbean[8] (Figure 2).

Mortality from renal disease also varies by ethnic origin worldwide. Mortality data for England and Wales for the period 1988–1992 show a three-fold higher mortality rate from renal disease among people born in the Indian subcontinent than the national average.[9] Likewise, African–Caribbeans experienced a four- to five-fold greater mortality from renal disease.[9]

Past comparisons of international variations in mortality rates from vascular diseases suggested that diet and environmental influences explain those differences rather than genetic variation. The studies of migrants of African and South Asian descent, however, suggest a rather more complex picture than that originally suggested, with an interplay between environmental factors and genetic susceptibility.

Morbidity

Non-fatal coronary ischaemic events are more common in populations of South Asian origin following the patterns of mortality. This is true in the country of origin and in the host countries, including the UK.[6,10] Similarly, non-fatal stroke events occur more often in people of black African ancestry.

The prevalence of end-stage renal failure can be inferred from the number of patients receiving renal replacement treatment, eg, haemodyalisis and renal transplantation. Studies in England and Wales have indicated a three- to four-fold higher rate of uptake of renal replacement therapy amongst South Asians and African-Caribbeans than amongst white subjects, the relative risk rising steeply with age[3,4] (Figure 3). This excess seems to suggest greater needs rather than differences in referral rates. High incidence rate of end-stage renal disease is also seen in African-Americans[11] with a four-fold greater risk than white Americans.

Risk factors

Studies of risk factors for vascular disease in different populations of different ethnic background have been carried out worldwide. A large body of evidence in the UK suggests that some traditional risk factors such as smoking rates and high cholesterol levels are less prevalent in ethnic minority populations when compared to the European white reference population.[12–14] This suggests that, although
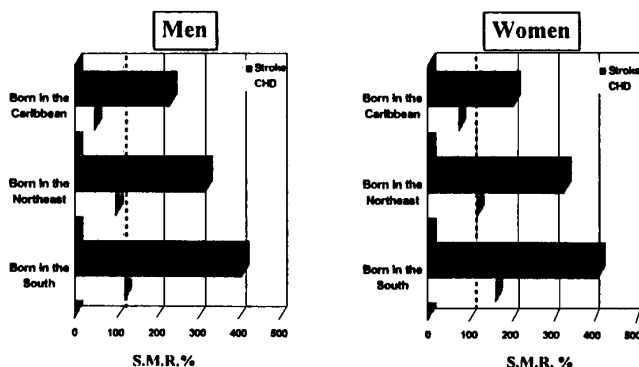

Figure 2 Mortality from coronary heart disease (CHD) and stroke in New York City (1988–1992) by place of birth in black people aged 25 to 64 years. The dotted line indicates the expected mortality in the sex-specific white reference population (drawn from reference 8).
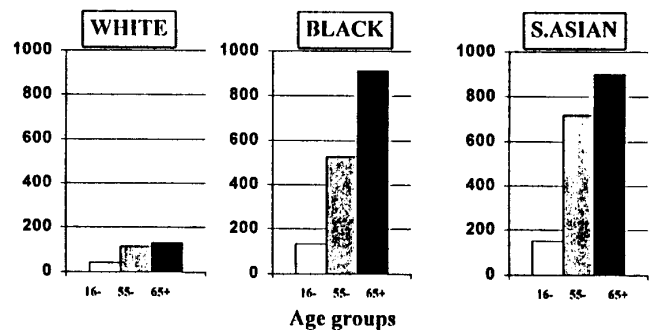

Figure 3 Acceptance rates (per million population) for renal replacement therapy in England (1991–1992) by different age groups. (Redrawn from reference 4).
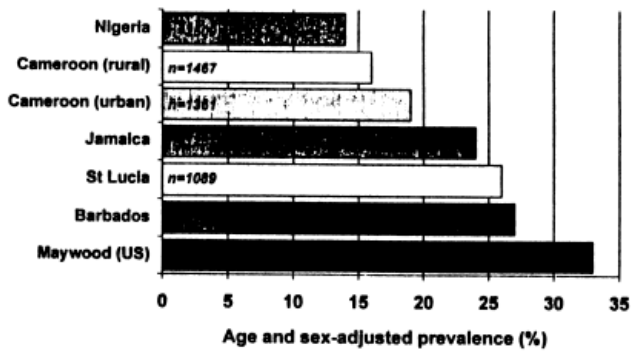
Figure 4 The prevalence of hypertension in several populations of black African origin participating in the International Collaborative Study of Hypertension in Blacks (ICSHIB). (Redrawn from reference 17).

these factors may still undoubtedly play an important role in determining the vascular risk within each population, they are unlikely to be responsible for the excess vascular risk of such groups when compared to the white population of England and Wales. At the same time there is consensus that amongst people of African ancestry hypertension is three- to four- fold more prevalent than in the white population.[12,13,15,16] This is true for men and women and is present at any age, at least in adulthood. This observation fits with the excess risk of stroke in these populations. African-Americans also show an increase in the prevalence and severity of hypertension.[17] Likewise, hypertension is very common in the Caribbean[7,17] as well as in urban black African populations[17] (Figure 4). Hypertension has also been more recently associated with all-cause mortality in rural Africa.[18]

The prevalence of hypertension is also significantly higher (about two-fold) in South Asian immigrants in the UK than in Europeans.[12,16] This observation is in agreement with recent evidence of a substantial increase in hypertension prevalence in both rural and urban populations living in India[19–20] but in contrast with some reports both in the UK[13] and in South Asian groups living in Tanzania.[21] A higher prevalence of hypertension in South Asians, particularly in view of their low smoking rates, is likely to contribute to their higher mortality from stroke experienced in the UK.[2,22]

The prevalence of non-insulin-dependent diabetes (NIDDM) is far higher in urban South Asians than Europeans.[10,12–14,23] This excess is remarkably constant in surveys of other South Asian populations overseas (Table 2) even when migration from India occurred many generations earlier. This sug-

gests that genetic factors may be important in determining susceptibility to the disease.

People of African ancestry also display a higher prevalence of NIDDM when compared to Europeans.[12,13,23–25] This excess, as in the South Asian group, is relatively constant in surveys of other black communities in the UK, in the Caribbean, in South Africa as well as in African–Americans in the US (Table 3).

Etiology

To summarise the evidence shown so far, it is clear that both South Asian communities around the world and populations of African descent in urban environments do have a greater prevalence of hypertension and diabetes which is associated with a higher incidence of stroke and CHD in the South Asian group. What are the mechanisms by which this excess risk is expressed? It is a paradox that people of African descent, despite having a high prevalence of diabetes and hypertension, have low mortality rates from CHD. This suggests that the mechanism underlying, particularly diabetes in black communities, may differ from the one that expresses itself in South Asian populations. Detailed metabolic studies along with population-based investigations have consistently identified a pattern of inter-correlated metabolic disturbances to be associated with diabetes in South Asian populations. These are hyperinsulinaemia, raised triglyceride and low HDL cholesterol levels, central distribution of adiposity with a high waist to hip ratio, altogether indicating a condition of insulin resistance.[12,13,26–27] In contrast to this pattern, in people of African descent, diabetes is associated with a metabolic pattern that despite the presence of raised glucose intolerance does show low triglyceride and high HDL cholesterol levels, a different distribution of adiposity with body mass index being a better measure of obesity, particularly in black women.[15–17,23,25,28,29] Furthermore, recent evidence of a lower plasma fibrinogen level in populations of African descent[30] supports the view that a cluster of protective factors might, in part, explain the reduced risk of coronary heart disease in African populations. At the same time it appears that the excess mortality from stroke in black populations is, in part, related to the amount of salt intake in their diet and their reduced level of potassium intake.[17] This fits very well with the evidence from migration studies in Kenya where changes from a rural to an urban environment were associated with a rise in BP

Table 2 Prevalence figures for non-insulin dependent diabetes in South Asian populations in different parts of the world. European groups are for comparison

UK		Overseas		India		Europeans	
Coventry	10%	Trinidad	21%	urban Karnataka	29%	NW London	4%
Southall	19%	Fiji	25%	urban Madras	18%	SW London	6%
NW London	30%	South Africa	22%	rural Tamil Nadu	3%		
Wandsworth	23%	Singapore	25%				
		Mauritius	20%				

Table 3 Prevalence of non-insulin dependent diabetes in population groups of black African descent across the world

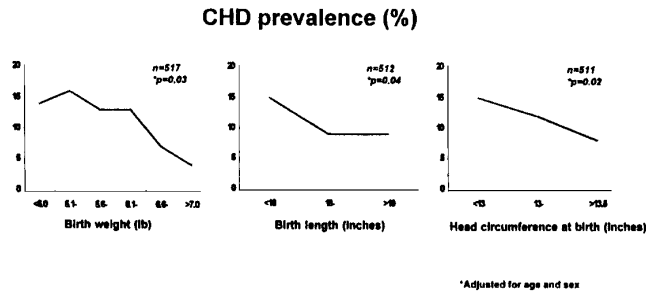| UK		Caribbean		Overseas		Africa		Europeans	
Southall	14%	Trinidad	12%	USA (NHANES II)	12%	Tanzania (Bantu)	0.9%	NW London	4%
Brent	15%			USA	18%	S.Africa	21%	SW London	6%
Harrow	29%								
Wandsworth	15%								

CHD prevalence (%)

Figure 5 Relationship between birth weight, birth length and head circumference at birth with the prevalence of coronary heart disease in a retrospective study in men and women born between 1934 and 1954 in South India. (Drawn from reference 32).

which was explained almost exclusively by the increase in sodium intake the parallel reduction in potassium intake and the weight gain.[31]

Early influences

Associations have been described between small size at birth and CHD and its risk factors such as hypertension, diabetes and abnormalities in lipid metabolism. These observations have led to the hypothesis that the disease is programmed *in utero* as an adaptation made by the fetus in response to undernutrition. Low rates of fetal growth and small size at birth as well as social deprivation and poor maternal nutrition are still common both in India and in some Caribbean communities where both hypertension and diabetes are very common. The 'fetal origin' hypothesis was recently tested in two different settings. In a retrospective study of adult men and women living in South India, the prevalence of CHD was related to their size at birth.[32] Low birthweight, short birth length and small head circumference at birth were all associated with a raised prevalence of CHD later in life (Figure 5). In another retrospective study of Jamaican schoolchildren (6–16 years old), indices of small size at birth were associated with higher systolic BP, glycated haemoglobin and serum cholesterol levels[33] (Figure 6).
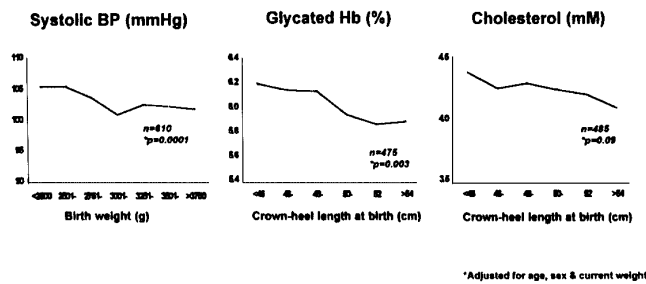
Figure 6 Association between indices of fetal growth and cardiovascular risk factors in Jamaican children aged 6 to 10 years. (Redrawn from reference 33).

Prevention, detection and management

Hypertension appears to be the main predictor of the excess of stroke mortality in both South Asians and people of African descent being two- three-fold higher than in any other white population. This raises the issue of how to reduce this burden. There is evidence to suggest that the rule of halves by which only a small proportion of people with hypertension receive appropriate management and adequate control has improved over the years.[16,34] People of black African origin in the UK are more likely to have their hypertension detected in the community when compared to other ethnic groups.[16] This may indicate a greater awareness amongst patients and doctors of the importance of controlling hypertension in black populations. However, when looking at the level of adequacy of management, then the black populations tend not to achieve a good BP control. This may indicate either a greater severity of their hypertension, inadequacy of drug therapy due to individual sensitivity to different drugs or to lack of compliance with therapy. Given that it is now established that the quality of hypertension control predicts the stroke mortality,[35] the need for improvement of community-based care for hypertension is of paramount importance in programmes for the prevention of stroke in black populations. It is also very important that dietary aspects like a reduction in sodium intake be implemented to the population level with particular emphasis to the populations of African descent who are believed to be particularly sensitive to the detrimental effect of high salt and low potassium intakes. A reduction in sodium intake and an adequate potassium intake by increasing the amount of fruit and vegetables, for instance, should be considered for the prevention of hypertension and stroke in communities of black African ancestry. As far as the control of diabetes, communities of South Asian origin tend to have the highest burden associated with metabolic disturbances and sedentary lifestyle and might benefit from increases in the level of exercise and physical activity associated with weight loss and improvement of insulin sensitivity. It is of interest that the outcome of patients with diabetes of African–Caribbean origin appeared not to be worse than those of white diabetics.[36] In particular, people with NIDDM of African–Caribbean origin tend to retain the low CHD mortality as compared to their white counterparts suggesting that protective factors such as low triglycerides, high HDL and low fibrinogen levels may play an important role. Finally, the importance of differences in diet and dietary components is still unclear. There are some preliminary studies suggesting that dietary differences do not explain the differ-

ences in insulin resistance and diabetes in South Asians as compared to European men.[37] More recent studies using nutritional biomarkers indicate that, for instance, substantially lower levels of Vitamin C are detected in people of South Asian origin as compared to any other ethnic group which would fit with the high coronary risk of these groups.[38] Further studies are obviously needed to investigate the potentially important role of diet as a contributor to differences in mortality between ethnic groups.

Acknowledgement

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