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Does access to cardiac investigation and treatment contribute to social and ethnic differences in coronary heart disease? Whitehall II prospective cohort study

Annie Britton, Martin Shipley, Michael Marmot, Harry Hemingway

International Centre for Health and Society, Department of Epidemiology and Public Health, University College London Medical School, London WC1E 6BT
Annie Britton
lecturer in epidemiology
Martin Shipley
senior lecturer in medical statistics
Michael Marmot
professor of epidemiology and public health
Harry Hemingway
reader in clinical epidemiology

Correspondence to: H Hemingway
h.hemingway@ucl.ac.uk

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Abstract

Objective To determine whether access to cardiac procedures and drugs contributes to social and ethnic differences in coronary heart disease in a population setting.

Design Prospective study with follow up over 15 years. Civil service employment grade was used as a measure of individual socioeconomic position. Need for cardiac care was determined by the presence of angina, myocardial infarction, and coronary risk factors.

Setting 20 civil service departments originally located in London.

Participants 10 308 civil servants (3414 women; 560 South Asian) aged 35-55 years at baseline in 1985-8.

Main outcome measures Use of exercise electrocardiography, coronary angiography, and coronary revascularisation procedures and secondary prevention drugs.

Results Inverse social gradients existed in incident coronary morbidity and mortality. South Asian participants also had higher rates than white participants. After adjustment for clinical need, social position showed no association with the use of cardiac procedures or secondary prevention drugs. For example, men in the low versus high employment grade had an age adjusted odds ratio for angiography of 1.87 (95% confidence interval 1.32 to 2.64), which decreased to 1.27 (0.83 to 1.94) on adjustment for clinical need. South Asians tended to be more likely to have cardiac procedures and to be taking more secondary prevention drugs than white participants, even after adjustment for clinical need.

Conclusion This population based study, which shows the widely observed social and ethnic patterning of

coronary heart disease, found no evidence that low social position or South Asian ethnicity was associated with lower use of cardiac procedures or drugs, independently of clinical need. Differences in medical care are unlikely to contribute to social or ethnic differences in coronary heart disease in this cohort.

Introduction

Low social position and South Asian ethnicity are both associated with increased risk of dying from coronary heart disease.^{1,2} Most studies, but not all, find that low social position is associated with lower rates of coronary angiography and revascularisation. Several studies, mainly small and retrospective, report less aggressive treatment of South Asian people with coronary disease compared with white patients. Such potential disparities have stimulated calls for remedial action.^{3,4}

Three inter-related questions remain unanswered. Firstly, in a general population that exhibits social and ethnic differences in rates of coronary heart disease, do differences exist in access to care? Secondly, how does the social deprivation of an individual patient, as opposed to an area, influence access to cardiac investigation and treatment? Thirdly, among South Asians, is the use of cardiac investigation and treatment independent of or explained by their social position?⁵

The Whitehall II prospective cohort study of civil servants offers the opportunity to consider these questions. Our objective was to determine whether access to cardiac procedures and secondary prevention drugs



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Table 1 Use of exercise electrocardiography, coronary angiography, and coronary revascularisation by employment grade

Procedure	Employment grade (men)			Employment grade (women)		
	High	Medium	Low	High	Medium	Low
Exercise electrocardiography						
No of participants	2785	2329	316	444	1071	860
No of exercise electrocardiograms	410	301	56	34	95	98
Age adjusted percentage	14.7	13.5	17.5	8.6	8.9	10.6
Odds ratio (95% CI) adjusted for:						
Age	1	0.89 (0.76 to 1.05)	1.23 (0.90 to 1.67)	1	1.07 (0.71 to 1.62)	1.28 (0.84 to 1.96)
Age + CHD	1	0.76 (0.63 to 0.90)	1.06 (0.75 to 1.50)	1	0.95 (0.62 to 1.46)	1.12 (0.72 to 1.74)
Age + CHD + risk factors*	1	0.76 (0.62 to 0.93)	0.93 (0.60 to 1.43)	1	0.83 (0.51 to 1.38)	0.81 (0.47 to 1.39)
Coronary angiography†						
No of participants	2647	3607	641	381	1336	1696
No of angiograms	148	191	49	10	34	93
Age adjusted percentage	5.0	5.7	8.8	2.7	2.6	5.6
Odds ratio (95% CI) adjusted for:						
Age	1	1.16 (0.93 to 1.45)	1.87 (1.32 to 2.64)	1	0.95 (0.46 to 1.96)	2.04 (1.04 to 4.01)
Age + CHD	1	1.01 (0.79 to 1.29)	1.52 (1.04 to 2.23)	1	0.85 (0.41 to 1.79)	1.73 (0.86 to 3.45)
Age + CHD + risk factors*	1	0.92 (0.71 to 1.19)	1.27 (0.83 to 1.94)	1	0.75 (0.35 to 1.64)	1.25 (0.60 to 2.61)
Coronary revascularisation†						
No of participants	2647	3607	641	381	1336	1696
No of revascularisations	53	85	14	1	4	22
Age adjusted percentage	1.8	2.6	2.7	0.3	0.3	1.2
Odds ratio (95% CI) adjusted for:						
Age	1	1.50 (1.06 to 2.14)	1.41 (0.77 to 2.58)	1‡	3.62 (1.35 to 9.71)	
Age + CHD	1	1.31 (0.90 to 1.90)	1.02 (0.54 to 1.92)	1	3.26 (1.21 to 8.78)	
Age + CHD + risk factors*	1	1.24 (0.83 to 1.85)	1.14 (0.57 to 2.30)	1	2.62 (0.94 to 7.33)	

CHD=coronary heart disease.

Some analyses are based on smaller numbers (owing to missing variables). The social gradient was similar in this restricted group to that in the full cohort.

*Smoking, systolic and diastolic blood pressure, total cholesterol, body mass index, diabetes, ethnicity, and family history.

†Based on whole cohort and adjusted for baseline risk factors and phase 5 response indicator.

‡High and medium grade combined owing to small numbers.

contributes to social and ethnic differences in coronary heart disease in a population setting.

Methods

All non-industrial civil servants aged 35-55 years from 20 departments were invited to participate in the Whitehall II study. Recruitment took place during 1985-8, and the final cohort consisted of 10 308 participants (3414 women). Between 1985 and 1999 self completed questionnaires were obtained at five phases of data collection and physical examination was conducted at three phases. Full details are published elsewhere.⁶

Socioeconomic position and ethnicity

We used civil service employment grade as a measure of socioeconomic position, which we analysed in three levels: unified grades 1-7 (high), executive officers (medium), and clerical and support staff (low). We defined ethnicity according to the Office for National Statistics 1991 census categories. Of participants with known ethnicity, 9162 (89.7%) described themselves as white; 560 participants were grouped as South Asian, of whom 74% were Indian, 13% Sri Lankan, 10% Pakistani, and 3% Bangladeshi.

Clinical need

We obtained evidence of incident angina and non-fatal myocardial infarction from questionnaire items, resting electrocardiograms (at screening phases 1, 3 and 5), and clinical records. Full details of ascertainment and classification are published elsewhere.⁷

A total of 10 300 (99.9%) participants were flagged at the NHS Central Registry. The registry notified us of the date and cause of death up to the end of 2001.

Risk factors

At baseline, standardised assessments were made of smoking, blood pressure, total cholesterol, body mass index, self reported diagnosis of diabetes, and family history of onset of coronary heart disease before age 55 years. In addition, the presence of the metabolic syndrome was assessed at phases 3 and 5 on the basis of oral glucose tolerance tests, plasma triglycerides and high density lipoprotein, waist:hip ratio, and systolic blood pressure.⁸

Outcomes

Exercise electrocardiography, angiography, and revascularisation—A total of 7830 participants completed a phase 5 questionnaire (76% response rate from phase 1). Of these, 994 participants reported that they had had an exercise electrocardiogram, 403 reported having a coronary angiogram, and 124 reported having had coronary angioplasty or a coronary artery bypass graft operation (revascularisation procedure). Results obtained by using discharge data from the NHS-wide clearing service did not differ by grade or ethnicity from those obtained by using self reported data, so we combined both sources. The final numbers used in the analysis were 525 angiograms (122 identified from discharge data alone) and 179 revascularisations (55 identified from discharge data alone).

Secondary prevention drugs—At the phase 5 follow up participants reported their use of prescribed drugs over the previous 14 days.

Statistical analysis

We calculated the age adjusted rates of event outcomes and prevalence of having had a procedure by using direct standardisation. We used Cox's proportional hazards model to calculate adjusted rates for coronary

Table 2 Use of exercise electrocardiography, coronary angiography, and revascularisation by ethnicity

	Men		Women	
	White	South Asian	White	South Asian
Exercise electrocardiography				
No of participants	5065	222	2045	134
No of exercise electrocardiograms	670	66	162	30
Age adjusted percentage	13.5	26.6	7.7	20.6
Odds ratio (95% CI) adjusted for:				
Age	1	2.43 (1.79 to 3.29)	1	3.51 (2.26 to 5.45)
Age + CHD	1	2.04 (1.44 to 2.89)	1	2.63 (1.63 to 4.22)
Age + CHD + risk factors*	1	1.98 (1.30 to 3.01)	1	2.32 (1.27 to 4.27)
Angiography†				
No of participants	6294	348	2868	212
No of angiograms	327	46	98	21
Age adjusted percentage	5.1	12.7	3.3	10.4
Odds ratio (95% CI) adjusted for:				
Age	1	2.78 (1.97 to 3.90)	1	4.04 (2.42 to 6.76)
Age + CHD	1	2.15 (1.46 to 3.17)	1	2.90 (1.68 to 5.01)
Age + CHD + risk factors*	1	2.13 (1.39 to 3.27)	1	3.94 (2.05 to 7.57)
Revascularisation†				
No of participants	6294	348	2868	212
No of revascularisations	130	17	20	2
Age adjusted percentage	2.1	4.6	0.6	0.8
Odds ratio (95% CI) adjusted for:				
Age	1	2.25 (1.33 to 3.82)	1	1.79 (0.41 to 7.83)
Age + CHD	1	1.45 (0.83 to 2.56)	1	1.16 (0.26 to 5.17)
Age + CHD + risk factors*	1	1.45 (0.76 to 2.75)	1	2.34 (0.43 to 12.7)

CHD=coronary heart disease.

Some analyses are based on smaller numbers (owing to missing values). The age adjusted effect of ethnicity in these restricted groups was similar to that in the full cohort.

*Smoking, systolic and diastolic blood pressure, total cholesterol, body mass index, diabetes, employment grade, and family history.

†Adjusted for baseline risk factors and phase 5 response indicator.

event outcomes. We used logistic regression to calculate adjusted odds ratios of having had a procedure by employment grade (with high grades as the reference group) and by ethnicity (with "white" as the reference group). To assess the quality of medical care we calculated the age adjusted prevalence of use of secondary prevention drugs among participants who attended phase 5 and had a history of myocardial infarction or angina. See bmj.com for details.

Results

Analysis of baseline coronary risk factors and subsequent coronary events shows that incident coronary morbidity and mortality were higher among lower employment grades than among higher grades and higher among South Asians than among white participants (see bmj.com). For example, in men, the age adjusted rate ratio for incident angina and myocardial infarction was 1.66 (95% confidence interval 1.32 to 2.10) for low versus high employment grades and 1.95 (1.28 to 2.96) for South Asians compared with white participants. Risk factors tended to be adverse in low employment grades and among South Asians. South Asians were less likely to be in a high employment grade than were white participants.

Social position

Men and women in the low employment grades reported higher use of exercise electrocardiography (age adjusted proportion 17.5% in men and 10.6% in women) than did those in the high employment grades (14.7% in men and 8.6% in women) (table 1). When we adjusted for history of coronary heart disease during

follow up and baseline risk factors, we found no evidence of an overall grade gradient in either men or women. Men and women in the low employment grades had the highest use of angiography with adjustment for age alone, but no grade differences existed when we added clinical need and other risk factors to the models. Similarly, participants in the low grades had the highest use of revascularisation when we adjusted for age alone, but among men these differences were removed by further adjustment. Employment grade was not associated with taking secondary prevention drugs among the subgroup of participants with a history of angina or myocardial infarction (see bmj.com).

Ethnicity

South Asian men and women were more likely to have an exercise electrocardiogram or coronary angiography than white participants, even after adjustment for clinical need and employment grade (table 2). We found less evidence for ethnic differences in revascularisation procedures. Further adjustment for presence of the metabolic syndrome or diabetes or abnormality on resting electrocardiogram did not attenuate any of these effects. South Asians also tended to be more likely to take secondary prevention drugs than white participants—for example, among men with a history of angina or myocardial infarction, 34% of South Asians were taking β blockers compared with 14% of white men (see table on bmj.com).

Sex

Women were less likely to have coronary investigations and treatments than men within each grade (see bmj.com) and ethnic group. When adjusted for age, coronary heart disease, employment grade, and ethnicity, the odds ratios of women having an exercise electrocardiogram, angiogram, and revascularisation compared with men were 0.51 (95% confidence intervals 0.42 to 0.62), 0.48 (0.38 to 0.62), and 0.25 (0.15 to 0.40).

Discussion

Social position

In this population based cohort, which exhibits the ubiquitous inverse social gradient in coronary morbidity and mortality, we found no evidence of a social gradient in use of cardiac procedures and drugs after adjustment for clinical need. Differential access to medical care has previously been proposed as an explanation⁹; we found no evidence to support this.

Ethnicity

South Asian civil servants had a twofold increased risk of coronary morbidity and mortality compared with white civil servants. We found some evidence of higher rates of use of procedures in South Asians than in white participants, even after adjustment for coronary morbidity, risk factors, and the metabolic syndrome. This may be interpreted as South Asian patients and their doctors responding to the widely perceived increased risk of heart disease with lower thresholds for action.^{10 11}

The South Asians working in the civil service represent a relatively homogeneous group in socioeconomic terms. This offers the opportunity to separate the potential confounding link between social position and ethnicity.⁵

Limitations of the study

Civil servants do not represent the extremes of social position, nor the diversity of South Asian communities. However, the Whitehall II study shows marked social and ethnic differences in coronary heart disease, similar in magnitude to those reported in many other general population studies. Although largely based in southeastern England, many Whitehall participants live in areas that are among the most socially deprived in the country. In common with other population based studies, we were not able to detail the appropriateness of clinical management of individuals,¹² nor were we able to explore waiting times.

Strengths of the study

Access to use of a car is a measure of social position available in wider settings than civil service employment grade. We found higher rates of coronary heart disease and greater use of procedures in those participants without access to a car. This mirrors our findings with employment grade. The Whitehall II study offers unique data with which to explore the impact of access to cardiac care. We carried out detailed, repeated assessments of clinical need extending these to include the metabolic syndrome. The Whitehall II study is also alone in being able to report earlier stages of non-invasive and invasive investigation.

Quality of care and secondary prevention

Although the quantity of medical care in terms of procedure rates is not lower by social position or South Asian ethnicity, this does not exclude the possibility that the quality of care differs.¹³⁻¹⁴ This was not the case when ethnic differences in revascularisation were examined in another study.¹⁰ We found that use of secondary prevention, a direct marker of the quality of care, showed no differences by social position and tended to be higher among South Asians.

Sex

The findings on social position and ethnicity were consistent in men and women; however, women had substantially lower rates of use of cardiac procedures and secondary prevention than men, consistent with other studies.¹⁵⁻¹⁶ Reasons may include less severe disease among women, less willingness to undergo procedures, differences in language used to describe symptoms,¹⁷ or bias by physicians.

Conclusion

In this population based study we found no evidence that low social position or South Asian ethnicity was associated with lower use of cardiological investigation or treatment independent of clinical need. Differences in access to medical care are unlikely to explain the social and ethnic differences in coronary heart disease.

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What is already known on this topic

Low social position and South Asian ethnicity are associated with higher risk of developing coronary heart disease

Previous studies which suggested social and ethnic differences in access to care were limited by ecological measures of social position, poor ability to distinguish ethnic from social effects, and lack of population base

What this study adds

Social position was not associated with use of cardiac procedures or secondary prevention, once account was taken of clinical need

South Asians tended to be more likely to undergo cardiac procedures and be on secondary prevention drugs than were white participants

Access to medical care is unlikely to explain the social or ethnic differences in coronary morbidity

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