

LETTERS TO THE EDITOR

Geographical variation in coronary revascularisation rates

Sir - I found the paper by Black *et al*¹ on the geographical variation in coronary revascularisation rates extremely interesting. This is a vital area if the NHS is to try to achieve a more equitable service. I am impressed by the tremendous size of the study embarked upon to investigate these variations and the wealth of information available for analysis.

The authors report a negative correlation between SMRs for coronary heart disease and revascularisation indicating inequities in service provision. However, this conflicts with the positive correlation between social deprivation indices and revascularisation. This implies that higher intervention rates are associated with districts with lower SMRs and with more deprived districts. The authors argue that this could be confounded by the close proximity of specialist centres to more socially deprived districts.

I believe there are important possible explanations for this relationship that have not been discussed. The first is related to the statistical analyses. Pearson correlation coefficients are quoted for relationships between rates for coronary artery bypass grafting (CABG) and percutaneous transluminal coronary angioplasty (PTCA) and both the Jarman social deprivation index and the Department of the Environment social index (DoE). These show CABG to have a significant correlation with both the Jarman and DoE indices, and when all revascularisations are considered together there is a significant correlation with the DoE index. The revascularisation rates and DoE index are illustrated in figure 2 of the paper. On closer inspection, however, it is evident that these relationships could be due to one outlying district. I have entered the data for CABG rates obtained from figure 2 and reanalysed the data removing this district. This shows no significant correlation between CABG and the DoE index. It would also lead to non-significant correlation between rates of all revascularisations and the DoE index. Evidently this unusual district requires further investigation. A more appropriate analysis would be a binomial or Poisson regression model.² This could adjust for differences in district population size which is not allowed for in the correlation analysis.

A further issue relates to the indices used as indicators of coronary heart disease morbidity. The Jarman and DoE indices combine both direct measures of material deprivation, for example, unemployment and overcrowding, and indirect measures of material deprivation, for example, lone pensioners, single parents, and ethnicity. Studies^{3,4} have shown that these two indices correlate less well with measures of morbidity than indices comprising solely of direct measures of material deprivation such as the Townsend

index,⁵ and single indicators such as unemployment rates. It would be extremely interesting to see the results of an analysis comparing revascularisation and a material deprivation index to understand more fully this relationship.

I feel the message of this paper could be significantly enhanced by the suggested re-analyses since it will give more convincing results and may well result in conclusions consistent with previous studies. The rate of CHD is known to be higher in more deprived areas and yet here on removal of the outlying district the rate of provision does not appear to vary with deprivation implying that there is still a great deal of inequity in intervention rates.

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- 1 Black N, Langham S, Petticrew M. Coronary revascularisation: why do rates vary geographically in the UK? *J Epidemiol Community Health* 1996;49:408-12.
- 2 Aitkin M, Anderson D, Francis B, Hinde J. *Statistical modelling in GLIM*. Oxford, Oxford University Press.
- 3 Campbell DA, Radford JMC, Burton P. Unemployment rates: an alternative to the Jarman index? *BMJ* 1991;303:750-5.
- 4 Morris R, Carstairs V. Which deprivation? A comparison of selected deprivation indexes. *J Public Health Med* 1991;13:318-26.
- 5 Townsend P, Phillimore P, Beattie A. *Health and deprivation: inequality and the north*. London: Croom Helm, 1988.

Reply

Lucy Smith points out that the analysis of our paper on geographical variation in coronary revascularisation rates would be enhanced by re-analysing the data without one outlying district. Apart from the dubious scientific basis of selectively excluding inconvenient data, there are three points we would like to make in response to this comment.

Firstly, figure 2 shows the relationship between the revascularisation rates and the Department of Environment index for NHS plus private cases, which excludes South East Thames region for which private data were not available. In table 2, the correlation coefficients for the relationships are based on NHS rates only, which allowed us to include South East Thames, so the re-analysis of our data done by Lucy Smith from figure 2 does not relate to the analysis we conducted.

Secondly, there are several districts with

exceptionally high rates in our data, which could have potentially influenced the results. Four districts had NHS rates for coronary artery bypass grafting or percutaneous transluminal coronary angioplasty above 1000 per million population (aged >24 years). However, when these districts were excluded from the analysis the significance of the relationships between the rates and social deprivation indices remained the same, although the confidence intervals became wider.

Thirdly, further investigation into the districts with exceptionally high rates shows that they are all in close proximity to a specialist centre. This observation strengthens our conclusion that the results may have been confounded by distance as the more deprived districts tend to be in inner city areas where many of the specialist centres are located.

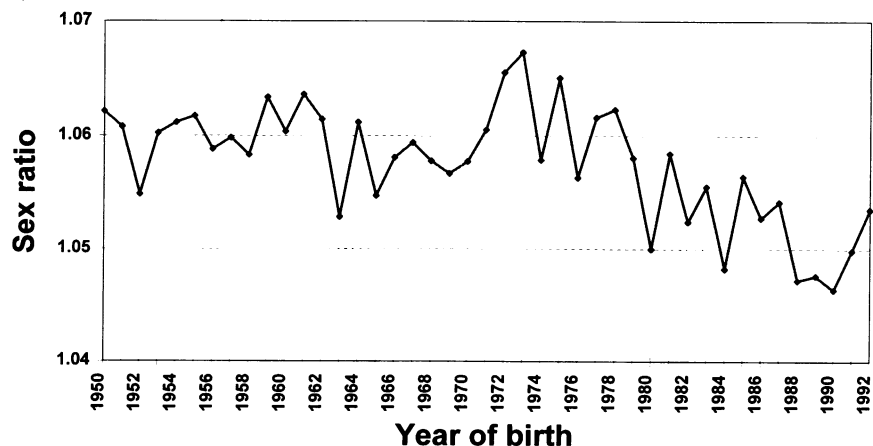
The use of a binomial or Poisson regression model to analyse the data may have been more appropriate given the different sizes in district populations. Finally, we agree that comparison of revascularisation rates with an index that measures deprivation entirely directly may produce different results but in practice does not.

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Why is the sex ratio falling in England and Wales?

Sir - There is concern about the declining sperm count and whether this might be due to the effects of chemicals in the environment affecting the levels of male sex hormones.¹ There is also speculation that the sex ratio (the ratio of the number of boys born to the number of girls) is affected by parental hormone levels.²

The sex ratio in England and Wales, as estimated from government statistics, has declined from 1950 to 1992 (figure). There is a lower sex ratio, 1.052, from 1980 onwards compared with 1.060 for the preceding period. Analysis by logistic regression shows a significant linear trend OR=0.9998, (95%CI: 0.9997, 0.9998). It is known that older mothers, in particular those over 35 years, are more likely to have girls.³ The proportion of these older mothers fell until the



Sex ratio in England and Wales, 1950-92.