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Effect of socioeconomic deprivation on waiting time for cardiac surgery: retrospective cohort study

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Abstract

Objective To determine whether the priority given to patients referred for cardiac surgery is associated with socioeconomic status.

Design Retrospective study with multivariate logistic regression analysis of the association between deprivation and classification of urgency with allowance for age, sex, and type of operation. Multivariate linear regression analysis was used to determine association between deprivation and waiting time within each category of urgency, with allowance for age, sex, and type of operation.

Setting NHS waiting lists in Scotland.

Participants 26 642 patients waiting for cardiac surgery, 1 January 1986 to 31 December 1997.

Main outcome measures Deprivation as measured by Carstairs deprivation category. Time spent on NHS waiting list.

Results Patients who were most deprived tended to be younger and were more likely to be female. Patients in deprivation categories 6 and 7 (most deprived) waited about three weeks longer for surgery than those in category 1 (mean difference 24 days, 95% confidence interval 15 to 32). Deprived patients had an odds ratio of 0.5 (0.46 to 0.61) for having their operations classified as urgent compared with the least deprived, after allowance for age, sex, and type of operation. When urgent and routine cases were considered separately, there was no significant difference in waiting times between the most and least deprived categories.

Conclusions Socioeconomically deprived patients are thought to be more likely to develop coronary heart disease but are less likely to be investigated and offered surgery once it has developed. Such patients may be further disadvantaged by having to wait longer for surgery because of being given lower priority.

Introduction

Socioeconomic deprivation is associated with both prevalence of and mortality from coronary heart disease.[1–3] Social class differences in mortality from coronary heart disease have widened over the past three decades.[4] Despite being at greater risk of developing coronary heart disease and dying from it, patients in lower socioeconomic groups are less likely to be investigated once the disease develops[5–10] and are less likely to be referred for cardiac surgery thereafter.[5–12]

We studied whether socioeconomic inequalities also exist in the priority given to patients on the waiting list for cardiac surgery.

Methods

In Scotland information is routinely collected on every patient who is added to the waiting list for cardiac surgery by using the Scottish Morbidity Record 20 (SMR20) system. The Information and Statistics Division of the Common Services Agency in Edinburgh collates these data. The division provided SMR20 data on all patients on the cardiac surgery waiting list from 1 January 1986 to 31 December 1997. The information included age, sex, urgency, type of operation, dates of entry on to and exit from the waiting list, date of surgery, and postcode. The postcodes were used to derive Carstairs socioeconomic deprivation categories.[13] These range from 1 to 7 and are based on 1991 census data on car ownership, unemployment, overcrowding, and social class within postcodes. Category 1 denotes the least deprived areas and 7 the most deprived.

Multivariate logistic regression analysis was used to determine whether the deprivation category was associated with surgery being classified as urgent, after allowance for age, sex, and type of operation. Multivariate linear regression analysis was used to determine

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Table 1 Case mix of patients on waiting list for cardiac surgery by socioeconomic deprivation category (1=least deprived to 7=most deprived). Figures are percentages of patients*

Detail	No of patients	1 (n=1541)	2 (n=3409)	3 (n=5451)	4 (n=6515)	5 (n=4191)	6 (n=3355)	7 (n=2180)
Age (years):								
<55	7 386	22.5	23.9	26.4	27.3	30.1	28.5	36.2
55-64	10 885	38.7	40.0	39.6	41.7	41.7	41.8	41.4
>64	8 371	38.7	36.1	34.0	31.0	28.3	29.7	22.4
Sex:								
Male	18 706	73.0	73.1	73.1	69.1	69.8	66.3	66.9
Female	7 936	27.0	26.9	26.9	30.9	30.2	33.7	33.1
Type of operation:								
CABG only	20 213	77.9	75.7	76.9	75.0	75.6	74.2	77.6
CABG+valve(s)	742	2.5	2.8	2.0	2.6	2.7	4.5	3.0
Single valve	5 141	18.4	19.7	19.6	20.1	19.4	18.7	17.1
Multiple valves	546	1.2	1.8	1.5	2.2	2.3	2.6	2.3
Urgency:								
Routine	17 790	63.7	62.2	61.0	64.7	67.5	78.3	77.7
Urgent	8 852	36.3	37.8	39.0	35.3	32.5	21.7	22.3

CABG=coronary artery bypass graft
*Percentages relate to breakdown of each deprivation category by age, sex, type of operation, and urgency.

whether the deprivation category was associated with waiting time within each category of urgency, after allowance for age, sex, and type of operation.

Results

In total 26 642 patients were placed on the waiting list for cardiac surgery over the period studied. Socioeconomic deprivation was associated with a greater likelihood that the patient was female ($P<0.0001$) and under 65 years of age ($P<0.0001$) (table 1). The mean waiting time for surgery increased across the deprivation categories, with patients in categories 6 and 7 (most deprived) waiting, on average, three weeks longer than those in category 1 ($P<0.0001$) (table 2). There was a significant association between socioeconomic deprivation and classification of urgency. Only 22% of patients in categories 6 and 7 were classified as urgent compared with 36% of those in category 1 ($P<0.0001$; table 1). When account was taken of age, sex, and type of operation patients in categories 6 and 7 had an odds ratio of 0.5 for being classified as urgent (table 3). The mean waiting times for routine and urgent cases were 196 days and 67 days, respectively.

When routine and urgent cases were considered separately the association between waiting time and deprivation category was an inverted U shape rather than linear (table 4). Waiting times were lowest in the most and least deprived categories of patients and highest in the middle groups, with no significant difference between categories 7 and 1.

Table 2 Multivariate linear regression analysis of factors associated with waiting times in days for cardiac surgery for all patients

Detail	No of patients	Mean (SD) waiting time (days)	Difference in mean waiting time* (95% CI)
Age:			
<55†	6 906	143.7 (126.0)	0.0
55-64	10 060	158.2 (135.0)	14.6 (10.7 to 18.8)
>64	7 597	150.8 (135.6)	10.8 (6.4 to 15.1)
Sex:			
Male†	17 251	152.6 (133.4)	0.0
Female	7 312	150.0 (131.4)	2.8 (–1.0 to 6.7)
Operation type:			
CABG†	18 613	157.4 (133.8)	0.0
CABG+valve(s)	660	135.5 (133.2)	–25.1 (–14.8 to –35.4)
Single valve	4 790	134.8 (131.1)	–23.6 (–19.2 to –28.0)
Multiple valves	500	130.7 (120.8)	–28.4 (–16.6 to –40.3)
Carstairs deprivation category:			
1†	1 418	139.7 (130.9)	0.0
2	3 133	144.9 (133.2)	5.9 (–2.4 to 14.2)
3	5 040	149.4 (135.1)	10.5 (2.7 to 18.3)
4	6 028	152.8 (133.3)	14.2 (6.59 to 21.9)
5	3 852	150.4 (134.7)	12.0 (4.0 to 20.1)
6	3 100	161.8 (129.0)	23.5 (15.1 to 31.8)
7	1 992	161.9 (127.1)	23.5 (14.5 to 32.5)

*Compared with reference categories adjusted for the other factors in the model.
†Reference categories.

Discussion

Mortality and morbidity from coronary heart disease show a social class gradient, with more deprived groups experiencing a greater burden of disease.[1–3] In men the mortality from coronary heart disease is 40% higher in manual than non-manual workers.[1] Wives of manual and non-manual workers experience a twofold difference.[1] In contrast with population mortality,[1–3] case fatality does not vary significantly by socioeconomic group.[3]

Although social inequalities in coronary heart disease have been found in most countries, they vary in magnitude. The United Kingdom has a much higher social class gradient than some other countries, such as Sweden.[14] The overall mortality from coronary heart disease has declined over the past three decades. The decline, however, has been greater in the most affluent groups.[4] As a result, the social class gradient in such mortality has increased.

Despite being more likely to develop coronary heart disease and die from it, patients in lower socioeconomic groups are less likely to be investigated with coronary angiography once the disease develops[5–10] and are also less likely to be referred for coronary artery bypass grafting.[5–12]

Our results suggest that after referral for cardiac surgery, more deprived patients may be disadvantaged further in that they are required to wait significantly longer for their operations. This results primarily from the fact that the most affluent patients were significantly more likely to have their operations classi-

fied as urgent compared with the least affluent patients. Overall, the most deprived patients were required to wait three weeks longer for surgery. An additional waiting time of this magnitude may not be clinically important for routine cases. Deprived patients, however, had only half the odds of being classified as urgent cases. Urgent cases were, on average, operated on 129 days earlier than routine cases. An excess delay of this magnitude due to differences in classification of urgency may be associated with more frequent adverse events on the waiting list.

Table 3 Univariate and multivariate logistic regression analyses of factors associated with urgent rather than routine priority on cardiac surgery waiting list. Figures are odds ratios (95% confidence intervals)

Detail	No of patients	Univariate analysis	Multivariate analysis
Age:			
<55*	7 386	1.00	1.00
55-64	10 885	1.00 (0.94 to 1.06)	0.99 (0.93 to 1.05)
>64	8 371	1.44 (1.35 to 1.54)	1.35 (1.26 to 1.45)
Sex:			
Male*	18 706	1.0	1.0
Female	7 936	1.05 (1.00 to 1.11)	0.93 (0.87 to 0.98)
Operation type:			
CABG*	20 213	1.0	1.0
CABG+valve(s)	772	1.60 (1.50 to 1.70)	1.57 (1.47 to 1.68)
Single valve	5 141	1.13 (0.94 to 1.35)	1.22 (1.02 to 1.47)
Multiple valves	546	0.68 (0.58 to 0.81)	0.69 (0.58 to 0.83)
Carstairs deprivation category:			
1*	1 541	1.00	1.0
2	3 409	1.07 (0.94 to 1.21)	1.07 (0.94 to 1.21)
3	5 451	1.12 (1.00 to 1.26)	1.13 (1.01 to 1.27)
4	6 515	0.96 (0.85 to 1.07)	0.97 (0.87 to 1.09)
5	4 191	0.84 (0.74 to 0.95)	0.86 (0.76 to 0.98)
6	3 355	0.49 (0.43 to 0.55)	0.50 (0.44 to 0.57)
7	2 180	0.50 (0.43 to 0.58)	0.53 (0.46 to 0.61)

CABG = coronary artery bypass graft.
*Reference categories.

Study limitations

The SMR20 dataset does not collect information on the severity of cardiac disease and the presence of comorbidity. Obviously both of these need to be considered in determining whether waiting times accurately reflect clinical need and risk. Lack of these data constitute a limitation of this study, and therefore care should be taken in drawing conclusions. As deprived patients with coronary heart disease are less likely to be investigated and referred for surgery at the outset,[5–12] however, it is likely that those deprived patients who are added to the waiting list have more severe cardiac disease than their more affluent counterparts. As a result, intuition would suggest that prioritisation by clinical need should favour socioeconomically deprived patients. Therefore, it is likely that this study underestimates the extent to which more affluent patients are favoured. In addition to severity of cardiac disease and comorbidity, decisions on priority may take account of non-clinical factors such as employment status and dependants. Data on these factors were unavailable for analysis, and the extent to which they do and should contribute to priority setting is subject to debate.

Once classified into urgent and routine cases the differences in waiting time between the most and least deprived categories were no longer significant. Both groups, however, waited significantly less time than those in the middle categories. This may reflect a combination of factors. Possibly, compared with the most and least deprived groups, those in the middle may be less clinically needy and less vocal, respectively. Data to substantiate or refute this hypothesis, however, were not available from this study.

These results add to the growing evidence of socioeconomic inequalities in health care. Previous studies suggest that, despite being more likely to develop coronary heart disease, socioeconomically deprived

Table 4 Multivariate linear regression analyses of factors associated with mean* (SD) waiting time in days for cardiac surgery for routine and urgent cases

	Routine cases			Urgent cases		
Detail	No of patients	Mean (SD)	Difference in mean waiting time† (95% CI)	No of patients	Mean (SD)	Difference in mean waiting time† (95% CI)
Age (years):						
<55‡	4 725	180.7 (127.0)	0.0	2181	63.6 (76.9)	0.0
55-64	6 896	198.9 (130.1)	18.2 (13.4 to 23.0)	3164	69.6 (97.9)	6.0 (1.1 to 10.9)
>64	4 538	206.6 (133.0)	28.5 (23.1 to 33.9)	3059	67.9 (89.2)	4.0 (–1.0 to 9.0)
Sex:						
Male‡	11 386	196.5 (130.9)	0.0	5865	67.3 (89.8)	0.0
Female	4 773	193.8 (129.2)	2.1 (–2.6 to 6.8)	2539	67.7 (89.3)	–0.9 (–5.3 to 3.5)
Operation type:						
CABG‡	12 596	201.0 (130.1)	0.0	6017	66.1 (87.1)	0.0
CABG+valve(s)	496	158.9 (115.3)	–46.9 (–58.6 to –35.2)	164	64.7 (68.6)	–1.2 (–15.2 to 12.8)
Single valve	2 741	181.7 (132.3)	–21.8 (–27.4 to –16.2)	2049	72.0 (99.4)	5.6 (1.1 to 10.5)
Multiple valves	326	167.3 (126.2)	–33.7 (–48.1 to –19.3)	174	62.1 (70.3)	–3.8 (–17.4 to 10.2)
Carstairs deprivation category:						
1‡	886	192.7 (132.7)	0.0	532	51.6 (62.4)	0.0
2	1 902	197.5 (129.3)	6.0 (–4.3 to 16.3)	1231	63.7 (91.9)	12.0 (2.9 to 21.1)
3	3 029	201.2 (136.2)	10.0 (0.3 to 19.7)	2011	71.4 (87.6)	19.6 (11.0 to 28.2)
4	3 837	199.5 (133.3)	9.6 (0.1 to 19.1)	2191	70.9 (85.1)	19.3 (10.8 to 27.8)
5	2 559	191.2 (126.9)	2.0 (–7.9 to 11.9)	1293	69.6 (111.2)	18.0 (8.9 to 27.1)
6	2 419	189.0 (126.2)	–0.3 (–9.7 to 10.3)	681	64.8 (84.4)	14.0 (3.8 to 24.1)
7	1 527	193.0 (122.9)	4.4 (–6.4 to 15.2)	465	59.6 (77.1)	8.6 (–2.6 to 19.8)

*Unadjusted for other factors in model.
†Compared with reference categories adjusted for other factors in model.
‡Reference categories.

What is already known on this topic

Socioeconomic deprivation is associated with a greater likelihood of developing coronary heart disease

Although deaths from the disease have declined over the past three decades, this decline has been greatest in the most affluent groups, and as a result the social class gradient in mortality has increased

Lower socioeconomic groups are less likely to be investigated once coronary heart disease develops and are less likely to be referred for cardiac surgery

What this paper adds

On average, the most deprived patients waited about three weeks longer for surgery than the most affluent

Deprived patients had an odds ratio of 0.5 for having their operations classified as urgent, after allowance for age, sex, and type of operation

When urgent and routine cases were considered separately there was no significant difference in waiting times between the most and least deprived categories

In addition to their greater burden of disease, worse prognosis, and poorer access to investigation and surgery, socioeconomically deprived patients may be further disadvantaged by having to wait longer for surgery because of being given lower priority

patients are less likely to be investigated and treated. Even after treatment is offered, deprived patients may be further disadvantaged by being required to wait longer for surgery.

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Commentary: Three decades of the inverse care law

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I developed the inverse care law nearly 30 years ago.[1] It seemed to be something everyone knew but nobody said because there was no succinct way to say it. We all at least half remembered the inverse square law, so inverse care might be memorable. And so it was. You name it, there's now some inverse law for it, or soon will be. The world never runs out of injustice.

The inverse care law was devised as a weapon and has so remained. If now established as a classic reference this reflects a global shift of British medical and allied professionalism towards alliance with the mass of the people the profession serves, throughout an era in which the tide still flows the other way, toward social polarisiation.

The inverse care law was summarised as follows: "The availability of good medical care tends to vary inversely with the need for it in the population served. This … operates more completely where medical care is most exposed to market forces, and less so where such exposure is reduced. The market distribution of medical care is a primitive and historically outdated social form, and any return to it would further exaggerate the maldistribution of medical resources." Papers referring to the law have with few exceptions ignored all but the first sentence. This is surprising, considering the extent to which government policies after 1979 took precisely the opposite path, exposing the NHS to external and internal markets, deliberately introducing and trying to legitimise market culture. These policies had some success ideologically, though virtually none in terms of effectiveness or efficiency in production of health gain. The law has therefore had considerable explanatory and predictive power

The excellent paper by Pell et al is representative of the best "inverse care law literature," which, starting with Noyce, Snaith, and Trickey in 1974,[2] has created a

mountain of supportive empirical evidence, which my original paper largely lacked. This is awkward for those still trying to impose their worldwide, neoliberal economic "reform" programme while anxious to preserve at least some appearance of social justice. All they have left is therapeutic nihilism, sold to our professions by Tom McKeown.[3] If medical care makes no measurable difference to public health, access to good care becomes a matter of appearance not substance. This view remains fashionable. Even such stalwarts for social justice as Richard Wilkinson[4] and the editor of this journal[5] have tied their hands by minimising the actual and potential contribution of clinical medicine to public health. McKeown's argument has been demolished in print by John Bunker[6] and many others. It is even more convincingly refuted by the behaviour of us all, nihilists included, when we suspect any serious threat to our own health. We seek the best medical advice available.

The inverse care law identified an important enemy. New ways to measure how this battle is going are useful; but a more important task is to win it, by eliminating this anomaly. Given sufficient political will and a great deal of hard work, this is certainly possible.[7] The inverse care law is not a law of nature but of dehumanised market economics. It could be unmade by a rehumanised society.

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Assessment of impact on health of residents living near the Nant-y-Gwyddon landfill site: retrospective analysis

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Abstract

Objectives To compare indices of health in a population living near a landfill site with a population matched for socioeconomic status and to review environmental monitoring data.
Design Ecological study with small area statistics and environmental reports.
Setting Electoral wards in valleys of South Wales.
Subjects Populations in the five wards near the landfill site who had formally complained of odours (exposed population), and comparison populations in 22 wards in the same unitary authority within the same fifth of Townsend score.
Outcome measures Mortality, rates of hospital admission, measures of reproductive health (proportion of all births and stillbirths of infants weighing <2500 g; rates of admissions for spontaneous abortion; rates of all reported congenital malformations). Environmental data on site emissions.
Results There were no consistent differences in mortality, rates of hospital admissions, or proportion of low birthweight infants between the two populations. There was an increased maternal risk of having a baby with a congenital abnormality in residents near the site, both before its opening (relative risk 1.9; 95% confidence interval 1.3 to 2.85; $P<0.001$) and after (1.9; 1.23 to 2.95; $P=0.003$). Environmental monitoring showed that hydrogen sulphide from the site was probably responsible for odours.
Conclusions The area surrounding the landfill site has an increased rate of reported congenital malformations, which predated the opening of the landfill, although the cluster of cases of gastroschisis postdated its opening. Several chemicals emitted from the site, including hydrogen sulphide and benzene, were found in air samples in the nearby community. Further studies of the reproductive risk in such communities are needed to examine the safety of waste disposal sites.

Introduction

Recent work has suggested that women living near landfill sites that receive hazardous waste have an increased risk of having a baby with congenital malformations,[1] but the potential risk from sites that receive only domestic, commercial, and industrial waste has not been examined adequately.

In 1996 residents living in the wards near the Nant-y-Gwyddon landfill site voiced increasing concerns that odours from the landfill site were causing illnesses. Symptoms and diseases they associated with exposure included stress, fatigue, headaches, eye infections or irritation, coughs, stuffy nose, dry throat and nausea, sarcoidosis, asthma, gastroschisis, and spontaneous abortions.

The Nant-y-Gwyddon landfill site, covering 24 hectares, was opened in January 1988 within 3 km of a population of 20 000 (fig 1). The local authority licence allowed the disposal of household, commercial, and industrial waste, and by 1996 about 850 000 m^3 of waste, including calcium sulphate filter cake, had been deposited on the site.

We assessed the health of the population living near the site using existing available epidemiological and environmental data. At the same time further monitoring of site emissions was carried out. We assessed, firstly, whether there was a difference in age

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