How much does self-reported health status, measured by the SF-36, vary between electoral wards with different Jarman and Townsend scores?

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SUMMARY

Background. *The best way for practices to determine the health status of patients living in areas with different socioeconomic characteristics is unclear.*

Aims. *To see how much SF-36 health status varies between electoral wards, how much of this variation can be explained by census-derived Jarman and Townsend scores, and compare the performance of census scores with direct socioeconomic information.*

Method. *A postal questionnaire survey of 3000 randomly selected 18 to 75-year-olds residing in 15 electoral wards and registered with two urban practices.*

Results. *The response rate was 73%. Only two of the eight SF-36 domains were significantly associated with Jarman scores, whereas seven domains were associated with the Townsend score. Of the four socioeconomic variables derived directly from the survey, unemployment showed the weakest association, housing tenure was associated with seven domains, and car ownership and low income were associated with all eight. Income explained between 47% to 71% of the variation across the eight domains.*

Conclusion. *The most accurate predictions about health status were made from direct socioeconomic information. Nonetheless, the association between Townsend score and health status was strong enough to be of practical importance. This study cautions against assuming the Jarman score of a population has a clear relationship with its health status.*

Keywords: equity; resource allocation; deprivation indicators; health status.

Introduction

TO provide an equitable service practices need to know how much health status differs between areas with different socioeconomic characteristics. Practices wishing to quantify the socioeconomic characteristics of their populations have three options. First, they can use postcodes to assign patients to electoral wards or enumeration districts and then use national census data.[1] Secondly, they can survey a sample of their population and estimate the characteristics of the remainder. Thirdly, they can attempt to record complete information for all patients.[2] The potential disadvantages of the first option are well documented: practice populations may differ from the overall census population;[1] the census is only updated every 10 years;[3] and the data will, at best, be only an estimate when attributed to individuals.[4] The problems with the second and third options are principally feasibility, cost, and deciding which variables to record. If socioeconomic data are to be compared between practices, for example for resource allocation, they need to be collected by a standard methodology and at the same time.

Scores derived from the national census are commonly used as proxies for social deprivation. The Jarman score[5] (calculated from eight weighted transformed census variables) is used for general practice deprivation payments but has been heavily criticised.[6] The Townsend score[7] (derived from four variables) is more directly related to material deprivation.[8]

The relationships between socioeconomic factors and both health status[9] and primary care activity at the individual patient level[10] are well established. Reductions in SF-36 associated with adverse social factors can be as large as those associated with specific clinical conditions.[9,11,12]

Whether health status varies between areas with different deprivation scores is less clear. Jarman score was associated with Nottingham Health Profile in a postal survey in London[13] but a similar study in a non-metropolitan area[14] showed no association. A study of general practice attenders showed an association with only one of six Nottingham Health Profile subscores.[15] The Nottingham Health Profile itself, however, has been criticised for not being sensitive to low levels of disability and the SF-36 questionnaire is now more commonly used as a valid and reliable method of assessing health status.[16]

We carried out a postal questionnaire survey in two practices where previous studies have shown that consultation rates are higher in more deprived electoral wards.[17] Our aims were:

- to see how much SF-36 health status varies between electoral wards,
- to see how much of this variation can be explained by Jarman and Townsend scores, and
- to compare the performance of census scores with direct socioeconomic information.

Method

Setting

The survey took place in October 1998 in two urban practices in Mansfield, Nottinghamshire that share the same practice area. The study was restricted to patients aged 18 to 74 years, living in 15 central electoral wards. The mean Jarman score of the wards studied was close to the national average of zero, reaching two standard deviations either side. The unemployment rate was 6% (national average = 5.3%[18]) and the ethnic population was 1.2% (national average = 5.9%[18]).

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Questionnaire design

The questionnaire consisted of three sections:

1. the SF-36 questionnaire,
2. six questions asking whether patients had experienced specific illnesses (not reported further here), and
3. questions about home and car ownership, employment status, and family income in a format used in a previous large population survey.[19]

Social class was not included because it is difficult to ascertain from a questionnaire and because we wanted to use simple questions that have the potential to be incorporated into routine practice.

Patients aged 18 to 64 years were sent the versions of the SF-36 used by Brazier (1992).[20] Patients aged 65 to 74 years were sent the version adapted by Munro (1997).[21] After ethical approval the questionnaire was piloted on 374 patients residing in outlying wards to refine the order and content of the second and third sections and to test delivery methods.

Sampling procedure and questionnaire delivery

The differences in mean score of the SF-36 domains between social classes reported by Jenkinson[9] were used to estimate the sample size. A sample of 3000 patients aged between 18 and 75 years and stratified by ward and practice was selected using random numbers (100 patients per practice per ward). Nine patients known to be terminally ill were excluded.

Non-responders were sent a post card reminder four weeks after the first mailing and a second questionnaire four weeks after the reminder. Data from the questionnaire were double entered onto an Access database. For questionnaires with some SF-36 items unanswered the missing values were substituted with the average value of the completed items.[23]

Statistical method

For ward level analysis we used mean SF-36 domain scores as dependant variables in linear regression using SPSS for Windows. We used six explanatory variables: Jarman and Townsend scores (derived from the census), car and home ownership, and unemployment and income (derived from the questionnaire). Each explanatory variable was entered together with the median age of the ward to adjust for the association between age and SF-36. The B-value in the results indicates the change in SF-36 predicted by a given change in deprivation score or socioeconomic variable. The r^2 value represents the amount of variation in SF-36 explained by each explanatory variable independently.

To test the relationship between the responses to the socioeconomic questions and the SF-36 scores we used the Mann–Whitney U-test on dichotomised data: car owners against non-car owners, unemployed against employed (full-time and part-time), home owners against non-home owners, and income less than £10 000 against greater than £10 000. To adjust for age we then used linear regression incorporating age plus each variable in turn.

Results

Practice characteristics

The practices had a total of 20 725 patients (9799 and 10 926 respectively) and 19 259 lived in the 15 wards studied. The number of patients eligible for the study in each ward ranged from 366 to 1798 (5%–26% of the total ward population). Jarman scores of the wards ranged from -22.98 to +25.54; Townsend scores ranged from -4.89 to +6.39.

Characteristics of responders

Of the 3000 patients sent questionnaires, 31 had moved and were deducted from the denominator. The response was 73% (2190/2969), ranging from 68% to 78% between wards. The mean age of responders was 48 years and 78% of females and 67% of males responded.

The social characteristics of the responders were compared with 1991 census and 1999 unemployment data for the relevant wards.[18] The percentage of responders with no car (31%) was similar to the census (34%), however more responders were homeowners (79% compared with 66%) and fewer were unemployed (4% compared with 6%). There were no significant differences in the responses to the socioeconomic questions between the two practices.

Non-responders

Non-responders were younger (mean age = 39 years compared with 48 years) and were more likely to come from more deprived wards (Spearman's rank correlation coefficient of ward response rate against Townsend score = -0.536, $P = 0.04$). The number of surgery consultations in the previous six months for 100 randomly selected non-responders did not differ significantly from 100 responders (Mann–Whitney $P = 0.851$, median number of consultations = 1).

Socioeconomic influences on SF-36 scores aggregated at ward level

There were substantial differences in mean SF-36 scores between wards: ward mean mental health scores differed by 11 points and general health perception scores by 12 points. Table 1 shows the results of using linear regression to explain variations in mean SF-36 scores between wards. The Townsend score was significantly associated with seven SF-36 domains and was able to explain more than half of the variation between wards for all domains, with the exceptions of 'role — physical' ($r^2 = 26\%$, $P = 0.07$) and 'pain' ($r^2 = 46\%$, $P = 0.009$). In contrast, the Jarman score was only significantly associated with variations in two domains: 'energy' and 'general health perception'.

Of the four variables derived directly from the survey, unemployment was not significantly associated with ward level variations for any SF-36 domain. Housing tenure was significantly associated with seven domains while car ownership and income were associated with variations in all eight domains. Income was able to explain the greatest amount of variation, ranging from 47% of variation in 'physical functioning' to 71% for 'social functioning'.

Socioeconomic influences on SF-36 scores at the individual patient level

Table 2 shows mean SF-36 scores categorised by patients' responses to the socioeconomic questions. Patients without cars, non-homeowners, and those on low incomes had significantly lower SF-36 scores for all domains. Unemployment was associated with significantly lower SF-36 scores for all domains except 'energy' and 'social functioning'. When age was accounted for in the analysis the significant associations remained unchanged.

Differences in income were associated with the biggest differences in mean SF-36 scores, ranging from 8 points for the 'energy' domain to 24 points for 'role — physical'. Car ownership had similar associations ranging from 7 points ('energy') to 18 ('role — physical'). Home ownership was associated with differences of between 7 points ('mental health') and 13 points

Table 1. Linear regression of mean ward SF-36 domain scores with explanatory variable adjusted for age.

Explanatory variables	SF-36 domain							
	Physical functioning	Role — physical	Role — emotional	Social functioning	Mental health	Energy/ vitality	Pain score	General health perception
Ward–Townsend (census)	B = -0.67 r^2 = 56% P = 0.002	B = -0.778 r^2 = 26% P = 0.07	B = -0.767 r^2 = 50% P = 0.02	B = -0.489 r^2 = 50% P = 0.03	B = -0.50 r^2 = 57% P = 0.03	B = -0.77 r^2 = 68% P = 0.002	B = -0.83 r^2 = 46% P = 0.009	B = -0.92 r^2 = 67% P = 0.001
Ward–Jarman (census)	B = -0.11 r^2 = 30% P = 0.05	B = -9.0 r^2 = 7% P = 0.3	B = -0.136 r^2 = 4% P = 0.09	B = -7.48 r^2 = 4% P = 0.2	B = -9.32 r^2 = 49% P = 0.09	B = -0.138 r^2 = 51% P = 0.03	B = -0.126 r^2 = 21% P = 0.1	B = -0.172 r^2 = 46% P = 0.01
Unemployed in each ward (survey)	B = -0.249 r^2 = 2% P = 0.6	B = -0.26 r^2 = 1% P = 0.7	B = -0.412 r^2 = 24% P = 0.6	B = -0.195 r^2 = 28% P = 0.7	B = -0.368 r^2 = 37% P = 0.5	B = -0.375 r^2 = 28% P = 0.5	B = -0.348 r^2 = 4% P = 0.6	B = -0.92 r^2 = 24% P = 0.2
Non-home owners in each ward (survey)	B = -0.162 r^2 = 41% P = 0.01	B = -0.23 r^2 = 28% P = 0.05	B = -0.19 r^2 = 45% P = 0.04	B = -0.13 r^2 = 49% P = 0.03	B = -0.16 r^2 = 63% P = 0.009	B = -0.19 r^2 = 60% P = 0.007	B = -0.20 r^2 = 35% P = 0.03	B = -0.25 r^2 = 62% P = 0.001
No car in each ward (survey)	B = -0.296 r^2 = 38% P = 0.02	B = -0.49 r^2 = 37% P = 0.02	B = -0.41 r^2 = 50% P = 0.02	B = -0.249 r^2 = 48% P = 0.04	B = -0.29 r^2 = 60% P = 0.02	B = -0.35 r^2 = 56% P = 0.01	B = -0.40 r^2 = 38% P = 0.02	B = -0.38 r^2 = 45% P = 0.02
£10 000 in each ward (survey)	B = -0.292 r^2 = 47% P = 0.007	B = -0.50 r^2 = 48% P = 0.007	B = -0.35 r^2 = 50% P = 0.03	B = -0.314 r^2 = 71% P = 0.001	B = -0.273 r^2 = 64% P = 0.009	B = -0.365 r^2 = 68% P = 0.002	B = -0.42 r^2 = 52% P = 0.004	B = -0.42 r^2 = 63% P = 0.001

Table 2. The relationship between dichotomous socioeconomic variables and mean SF-36 domain scores (not age adjusted).

Explanatory variables	SF-36 domain							
	Physical functioning (mean)	Role — physical (mean)	Role — emotional (mean)	Social functioning (mean)	Mental health (mean)	Energy/ vitality (mean)	Pain score (mean)	General health perception (mean)
Car owners (n = 1859)	80.27	74.81	80.16	83.26	73.55	58.03	71.76	66.64
Non-car owners (n = 283)	65.80	56.27	64.43	72.41	66.11	51.02	61.13	55.33
P-value[a]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Employed (n = 1187)	88.77	85.24	85.32	87.87	74.81	60.70	77.73	71.75
Unemployed (n = 67)	82.61	75.75	72.63	81.13	67.46	57.99	69.70	64.75
P-value[a]	<0.001	0.02	<0.001	0.06	<0.001	0.40	0.01	<0.001
Homeowners (n = 1750)	80.49	74.13	80.06	83.90	73.82	58.30	72.11	66.96
Non-homeowners (n = 405)	68.80	64.14	68.72	72.38	66.60	51.44	62.45	57.0
P-value[a]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Income >£10 000 (n = 579)	84.37	79.44	82.73	85.68	74.75	59.85	74.58	68.95
Income <£10 000 (n = 1200)	66.10	55.61	65.92	72.79	67.34	50.96	60.79	57.56
P-value[a]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]P-value for Mann–Whitney U-Test.

('physical functioning'). Unemployment had less association with SF-36 and differences did not reach statistical significance for two domains ('social functioning' and 'energy').

Discussion

The study was restricted to one setting, although the distribution of socioeconomic characteristics was close to the national distribution. Factors such as ethnicity and unemployment are likely to be more important in more deprived settings. When extrapolating the data to other settings it is known that the influence of specific factors, such as housing tenure and car ownership, differs between regions.[10]

The socioeconomic profile from the survey appeared to be

somewhat better than that predicted from census data, with more homeowners and fewer unemployed. There are three possible reasons. First, time has elapsed since the 1991 census. Secondly, the practice populations may truly differ from the overall ward populations (although the data for both practices were closely comparable with each other). Finally, non-responders could have more adverse socioeconomic characteristics than responders. The response rate was acceptable for a postal survey of this type but there were more non-responders in deprived wards. This suggests the survey may have underestimated the full variation in health status, although the fact that non-responders did not have increased consultation rates indicates they did not have increased expressed need.

We found appreciable differences in mean SF-36 domain scores between electoral wards, ranging from 7 points to 14 points. These compare with reported differences between social classes and clinical conditions reported in previous studies.[9,11] Using Townsend scores we were able to explain half of the variation for all domains except 'role — physical'. This is despite the fact that the study took place eight years after the national census and presumably reflects the fact that, although individual variables can change markedly according to economic fluctuations, the relative position of wards ranked by their Townsend scores is comparatively stable over ten-year periods.[25]

Our study is the first to report the relationship between SF-36 and Jarman score, which was only associated with two out of eight domains. This is probably owing to the fact that car ownership and housing tenure, two important determinants of deprivation, are not included in the Jarman score.[8] Because the Jarman score is used for deprivation payments it is widely available, making it tempting to use it as a deprivation score. We caution against assuming the Jarman score of a population has a clear relationship with its health status

When the survey's socioeconomic data were used to explain variations in SF-36 scores aggregated at ward level, income had the strongest association for the majority of domains. Overall, however, there was only a modest improvement from using direct survey data at ward level compared with the Townsend score. This suggests that when making comparisons between practices, attributing data on the basis of postcode and using the Townsend score may be sufficient, unless there are specific reasons to believe practice populations differ markedly from census populations.

As expected, when socioeconomic variables were compared with SF-36 scores at the level of individual patients they were associated with larger differences in health status than those between electoral wards. Income was associated with differences between domains ranging from 8 points ('energy') to 17 points ('role — physical') and there were comparable, but slightly smaller, differences with car ownership and housing tenure.

It has been suggested that practices should routinely record socioeconomic information.[2] Practices wishing to do so could use car ownership and housing tenure as simple dichotomous variables. Income has been widely used as a measure of social status in the United States.[26,27] Our study would suggest it has the potential to be more widely used in British general practice, although the non-response rate (18% of responders did not complete this question) suggests its acceptability needs to be examined.

The weak association between unemployment and health status at the individual level and its lack of association as a ward level explanatory variable should be interpreted with caution, as this was in an area with average, rather than high, unemployment. However, there were 67 unemployed responders and ward unemployment rates varied from 1.3% to 6.1%, so it was surprising it did not serve as a marker of wards with other adverse socioeconomic factors.

Practices and primary care groups will always be able to make stronger predictions about health status if they use direct socioeconomic information rather than attribute data on the basis of postcode.[28] Nevertheless, the association between Townsend scores and health status in this setting was strong enough to be of practical importance. Census scores, such as the Townsend, are easier to compare between practices because they are recorded consistently and simultaneously. It should be borne in mind that the distribution of problems that are amenable to medical intervention may not be identical to variations in health status[29] and primary care has to respond to demand as well as to need. Nevertheless, there is a clear need for more strategic targeting to make primary care resources and efforts responsive to the marked variations in health status between areas.[2]

References

1. Hutchinson A, Foy C, Smyth J. Providing census data for general practice. *J R Coll Gen Pract* 1987; **37:** 448-450.
2. Smeeth L, Heath I. Tackling inequalities in primary care. *BMJ* 1999; **318:** 1020-1021.
3. Majeed FA, Cook DG, Poloniecki J, *et al*. Sociodemographic variables for general practices: use of census data. *BMJ* 1995; **310:** 1373-1374.
4. Carr-Hill R, Rice N. Is enumeration district level an improvement on ward level analysis on studies of deprivation and health? *J Epidemiol Community Health* 1995; **49(Suppl 2):** S28-S29.
5. Jarman B. Identification of underprivileged areas. *BMJ* 1983; **286:** 1705-1709.
6. Carr-Hill RA, Sheldon T. Designing a deprivation payment for general practitioners: the UPA(8) wonderland. *BMJ* 1991; **302:** 393-396.
7. Townsend P, Phillimore P, Beattie A. *Health and Deprivation.* London: Croom Helm, 1988.
8. Ben-Shlomo Y, White I, McKeigue PM. Prediction of general practice workload from census based social deprivation scores. *J Epidemiol Community Health* 1992; **46:** 532-536.
9. Jenkinson C, Layte R, Coulter A, Wright L. Evidence for the sensitivity of the SF-36 health status measure to inequalities in health: results from the Oxford healthy lifestyles survey. *J Epidemiol Community Health* 1996; **50:** 377-380.
10. Carr-Hill RA, Rice N, Roland M. Socioeconomic determinants of rates of consultation in general practice based on fourth national morbidity survey of general practices. *BMJ* 1996; **312:** 1008-1012.
11. Brown N, Melville M, Gray D, *et al*. Quality of life four years after acute myocardial infarction: short form 36 scores compared with a normal population. *Heart* 1999; **81:** 352-358.
12. Garratt AM, Ruta D, Abdalla MI. The SF-36 Health Survey questionnaire: an outcome measure suitable for routine use within the NHS? *BMJ* 1993; **306:** 1440-1444.
13. Curtis SE. Use of survey data and small area statistics to assess the link between individual morbidity and neighbourhood deprivation. *J Epidemiol Community Health* 1990; **44:** 62-68.
14. Jessop EG. Individual morbidity and neighbourhood deprivation in a non-metropolitan area. *J Epidemiol Community Health* 1992; **46:** 543-546.
15. Hopton JL, Howie JG, Porter AM. Social indicators of health needs for general practice: a simpler approach. *Br J Gen Pract* 1992; **42:** 236-240.
16. McHorney CA, Ware JE, Raczek AE. The MOD 36-item short form health survey: II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care* 1993; **31:** 247-263.
17. Carlisle R, Johnstone S. The relationship between census-derived socioeconomic variables and general practice consultation rates in three town centre practices. *Br J Gen Pract* 1998; **48:** 1675-1678.
18. Nottingham County Council. Policy and Resources Unit. *NCC Policy and Resources Unit Employment and Ethnicity Bulletins.* Nottingham: NCC Policy and Resources Department, 1999.
19. Roberts H, Dengler R, Magowan R. *Trent Health Adult Lifestyle Survey.* Sheffield: Trent NHS Executive, 1995.
20. Brazier JE, Harper R, Jones NMB. Validating the SF-36 Health Survey questionnaire: new outcome measure for primary care. *BMJ* 1992; **306:** 1437-1440.
21. Munro J, Brazier J, Davey R, Nicholl J. Physical activity for the over-65s: could it be a cost effective exercise for the NHS? *J Public Health Med* 1997; **19:** 397-402.

22. The Counselling Versus Antidepressants in Primary Care Study Group. How disabling is depression? Evidence from a primary care sample. *Br J Gen Pract* 1999; **49:** 95-98.
23. Jenkinson C, Layte R, Wright L. *The UK SF-36: an analysis and interpretation manual.* Oxford: Health Services Research Unit, 1996.
24. Lyons R, Fielder H, Littlepage N. Measuring health status with the SF-36: the need for regional norms. *J Public Health Med* 1995; **17:** 46-50.
25. Phillimore P, Beattie A, Townsend P. Widening inequality of health in northern England, 1981-91. *BMJ* 1994; **308:** 1125-1128.
26. Kaplan GA, Pamuk ER, Lynch JW, *et al.* Inequality in income and mortality in the United States: analysis of mortality and potential pathways. *BMJ* 1996; **312:** 999-1003.
27. Kennedy B, Kawachi I, Prothrow-Stith D. Income distribution and mortality: cross sectional ecological study of the Robin Hood index in the United States. *BMJ* 1996; **312:** 1004-1007.
28. Ben-Shlomo Y, Davey-Smith G. Socioeconomic position should be measured accurately. *BMJ* 1999; **318:** 844-845.
29. Fankel S. The epidemiology of indications. *J Epidemiol Community Health* 1991; **45:** 257-259.

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