

# The relationship between census-derived socio-economic variables and general practice consultation rates in three town centre practices

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## SUMMARY

**Background.** *The relationship between socio-economic factors and consultation rates is important in determining resource allocation to general practices.*

**Aim.** *To determine the relationship between general practice surgery consultation rates and census-derived socio-economic variables for patients receiving the same primary and secondary care.*

**Method.** *A retrospective analysis was taken of computerized records in three general practices in Mansfield, North Nottinghamshire, with 29 142 patients spread over 15 electoral wards (Jarman score range from -23 to +25.5). Linear regression analysis of surgery consultation rates at ward and enumeration district levels was performed against Jarman and Townsend deprivation scores and census socio-economic variables.*

**Results.** *Both the Townsend score ( $r^2 = 59\%$ ) and the Jarman score ( $r^2 = 39\%$ ) were associated with surgery consultation rates at ward level. The Townsend score had a stronger association than the Jarman score because all four of its component variables were individually associated with increased consultations compared with four out of eight Jarman components.*

**Conclusions.** *Even in practices not eligible for deprivation payments there were appreciable differences in consultation rates between areas with different socio-economic characteristics. The results suggest that the variables used to determine deprivation payments should be reconsidered, and they support suggestions that payments should be introduced at a lower level of deprivation and administered on an enumeration district basis.*

**Keywords:** *consultation rates; deprivation scores; census; socio-economic; town centres.*

## Introduction

THE relationship between deprivation and general practice consultation rates is complex. Deprivation and morbidity are closely related,<sup>1,2,3</sup> but consultation rates also depend on patient expectations and on service provision. Socio-economic factors are known to be powerful determinants of consultation rates at the individual patient level.<sup>4-7</sup> However, most practices do not have full socio-economic information on their patients, so the extent to which the more easily available census variables influence general practice workload is important.

Currently, practices receive deprivation payments for patients

living in electoral wards with Jarman scores more than two standard deviations above average (+30). The Jarman score is derived from census variables chosen following a survey of general practitioners' (GPs') opinions of factors affecting workload.<sup>8,9</sup> It has, however, been subject to little direct validation.<sup>10-14</sup> The effect of socio-economic characteristics on the likelihood of individuals to consult has been reported in several studies,<sup>6,7</sup> but it is not necessarily the case that these factors are good discriminators for area rates.<sup>6</sup> It has also been difficult to predict the effect of a given change in deprivation score on consultation rates.<sup>14</sup>

Deprivation payments have been criticized for their abrupt cut-off point, which can cause large changes in practice income when scores are recalculated following the decennial national census.<sup>15</sup> It has been suggested that it would be better to introduce payments more gradually starting at a Jarman score of 10 or 16,<sup>16</sup> and to base payments on the smaller population unit of enumeration districts.<sup>15-17</sup>

We describe surgery consultation rates for three town centre practices in Mansfield, Nottinghamshire. In Mansfield, the majority of people are registered with town centre practices, so each practice has patients from a relatively wide range of wards, none of which are sufficiently deprived to qualify for deprivation payments under the current system. By studying consultation rate variations within practices, we hoped to avoid variations produced by differences in the primary or secondary care available and to look directly at the influence of patient factors on consultation rates. We used two deprivation scores: the Jarman score, because it is currently used for deprivation payments, and the Townsend score, which is more closely related to material deprivation.<sup>2</sup> We also looked at the individual census variables used to calculate the deprivation scores, and performed the analysis at both ward and enumeration district levels.

## Method

Computerized surgery consultation data were obtained from three town centre practices with surgeries within 200 metres of each other. For two practices, the data were collected from the practices' clinical computer systems between April 1994 and March 1995; for the third practice, the data were collected from the practice's appointment system and relate to the subsequent year (April 1995 to March 1996). It was not possible to collect data from the practices for the same year because one practice changed computer system in 1996 and the appointment system of the other practice was not fully operational in 1994.

The study was restricted to surgery consultations with doctors because methods of recording visits, nurse, and clinic contacts varied between the practices. Patient registration data, including age, sex, and postcode, were extracted at the end of the respective study periods.

The recording accuracy and the data extraction procedure were validated by comparison of the study data with manual notes. Using randomly selected notes, 100 entries for each practice were checked against the computer record using a maximum of two entries per patient.

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Registration and consultation data were assigned to geographical areas using the postcode conversion software P91.<sup>18</sup> Annual consultation rates were calculated for each practice by ward and enumeration district. Ward Jarman and Townsend scores and 10 socio-economic variables from the 1991 census were obtained from North Nottinghamshire Health Authority. Jarman scores for enumeration districts were obtained from Professor Jarman: they were calculated from seven variables at enumeration district level and one variable at ward level. This was because the 'percentage unskilled' variable is derived from a 10% sample of the national census and is unreliable at enumeration district level.<sup>16</sup>

Linear regression analysis, using the weighted least squares option, was performed between consultation rates and socio-economic variables using SPSS for Windows version 6.0. The assumptions were checked by normal probability plots and by analysis of residuals. To try to ensure that the practice populations were representative of the census population, the analysis was confined to 15 town centre wards. Outlying wards, where the practices had only small numbers of patients, were omitted.

Three potential confounding factors were considered: the percentage of the population registered with the practices, the linear distance from the centres of wards to the surgery, and the age structure of the patients registered in the ward. The percentage of the population of each ward registered with the practices and the distance were analysed as independent variables against consultation rates. To check that differences in consultation rates were not simply the result of differences in age structure, standardized consultation rates were calculated by direct standardization. The age structure of the practices in the Fourth National Morbidity Study,<sup>5</sup> were used as the reference population. The results describe associations with crude consultation rates because it is confusing to compare age standardized rates with Jarman scores, which include age specific variables (percentage under-fives, elderly alone).

## Results

### *Practice characteristics*

The practices had a total of 30 850 patients, and 98% were successfully allocated to a ward. The 15 town centre wards included in the analysis had 29 142 patients from the three practices, this was 94% of the practices' populations. The percentage of ward population registered with the practices ranged from 11% to 50% (mean 34%). The 15 wards contained 176 enumeration districts with between 10 and 448 study patients per enumeration district (mean 165). The total populations of the enumeration districts ranged from 113 to 720. Jarman scores ranged between -23 to +25.5 for wards, and from -30.6 to +45 for enumeration districts (national average = 0, SD = 16).

### *Practice consultation rates*

Out of a total of 88 962 consultations, 83 578 (93.9%) were allocated to the 15 wards analysed. Comparison with 100 manual notes showed that 97%, 94%, and 92% of consultations were recorded on computer for the three practices respectively. The mean annual surgery consultation rate was 2.9 per patient per year; both this and age-specific consultation rates compared closely with those reported by the Fourth National Morbidity Study.<sup>5</sup>

### *Association between consultation rates and deprivation scores*

Ward consultation rates for the practices combined ranged from 2532 to 3161 per thousand patients per year. Linear regression

showed significant associations with both Jarman score ( $r^2 = 39\%$ ;  $\beta$  coefficient 9.83), and Townsend score ( $r^2 = 59\%$ ;  $\beta$  coefficient 49.98) (Figures 1 and 2). Age standardized rates had very similar associations (Jarman  $r^2 = 38\%$ ;  $\beta$  coefficient 10.5, Townsend  $r^2 = 61\%$ ;  $\beta$  coefficient 54.45).

Consultation rates for enumeration districts varied from 1563 to 5500 per thousand patients per year. The Jarman score explained a smaller percentage of the variation in consultation rates between enumeration districts ( $r^2 = 17\%$ ) than between wards ( $r^2 = 39\%$ ). However, the regression coefficient was higher and had narrower confidence intervals (Table 1).

Enumeration districts were divided into quartiles by Jarman score with around 7000 patients per quartile. Patients living in the most affluent enumeration districts (Jarman scores between -30.6 to -13.3) averaged 2.6 consultations per year; the next two quartiles averaged 2.7 and 3.0 consultations per year, while patients from the most deprived districts (Jarman scores >8.5), averaged 3.1 consultations per year.

### *Association between consultation rates and census variables*

All four components of the Townsend score (no car, unemployment, housing tenure, and overcrowding) were individually associated with increased consultation rates at ward level (Table 1). Of the eight variables used in the Jarman score, four were associated with higher consultation rates (unemployment, overcrowding, single parents, and under-fives), the other four variables (mobility, elderly alone, ethnicity, and unskilled) had no significant association.

### *Possible confounding factors*

Neither linear distances from ward centres to the surgery or the percentage of patients in a ward registered with the study practices were independently associated with ward consultation rates ( $P = 0.72$  and  $P = 0.78$  respectively). Both age standardized and crude consultation rates had very similar associations with the deprivation scores and census variables, indicating that the associations shown in Table 1 were not simply because of different age structures.

### *Predicted impact on consultation rates*

The data predict that a GP in Mansfield, with 1800 patients, should expect 5040 consultations per year. If all the patients lived in wards with Jarman scores of +20, there would be 706 (14%) more consultations than if the patients all lived in wards with Jarman scores of -20 (95% CI = 166–1238). If all the patients lived in enumeration districts with Jarman scores of +20 compared to -20 there would be 871 (17%) more consultations per year (95% CI = 578–1166).

## Discussion

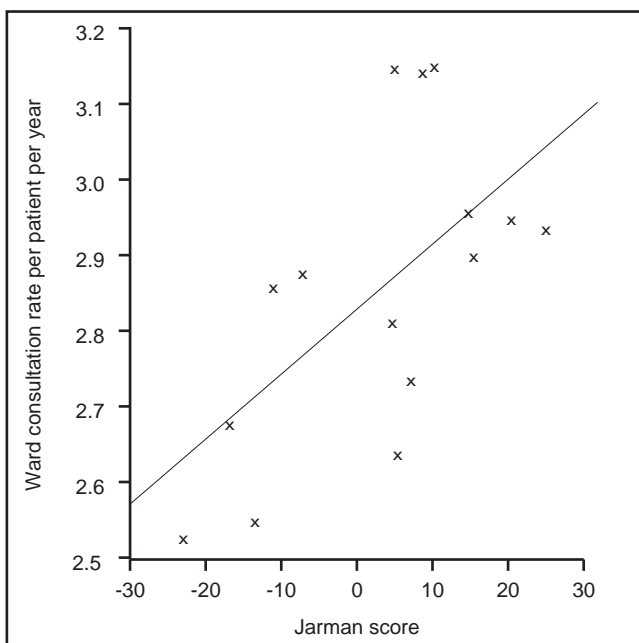
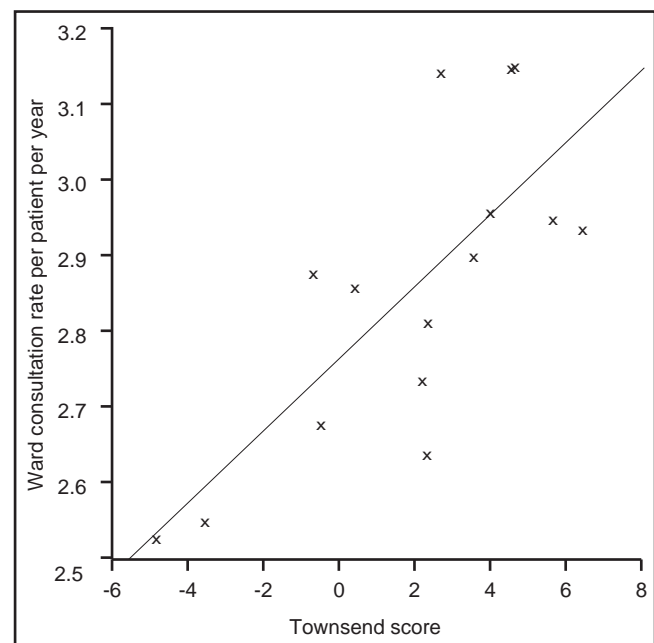
### *Assumptions and limitations*

The analysis was based on routinely recorded data that we believe adequately represented surgery consultation rates for the three practices. The validation showed a close relationship between computer and manual records for the practices, and both the total and age specific consultation rates compared closely with those from the Fourth National Morbidity Study.<sup>5</sup> The data were collected for a different year for one practice compared to the other two, but very few patients move between the practices, so we do not think this alters the conclusions. The study relies on census data from five years previously; this is one of the criticisms of the current system of deprivation payments. In

**Table 1.** Linear regression analysis of surgery consultation rates against socio-economic variables.

Independent variables <sup>a</sup> (J = included in Jarman, T = included in Townsend <sup>b</sup> )	r <sup>2</sup> (%)	β coefficient	95% confidence intervals for β	P-value
Jarman score (ward)	39	9.83	2.38 to 17.27	0.01
Jarman score (enumeration district)	16.9	12.28	8.04 to 16.02	<0.0001
Townsend (ward)	59	49.98	24.99 to 74.95	0.0008
No car (T)	56	15.47	7.26 to 23.6	0.001
Unemployment (J/T)	55	44.77	20.34 to 69.20	0.001
Housing tenure (T)	43	9.83	3.14 to 16.66	0.008
Overcrowding (J/T)	42	81.09	24.16 to 138.02	0.009
Single parent (J)	32	72.92	8.77 to 137.06	0.03
Children under 5 (J)	31	103.14	10.84 to 195.44	0.03
Moved within year (J)	18	50.23	-14.35 to 114.8	0.11
Ethnicity (J)	6	-78.85	267.69 to 109.98	0.38
Unskilled (J)	0.2	6.15	-75.19 to 87.49	0.87
Elderly living alone (J)	0.008	4.53	-979.7 to 101.0	0.97
Distance from surgery	10	-1.94	-13.66 to 9.77	0.72
Percentage of ward population	6	1.66	-11.16 to 14.49	0.78

<sup>a</sup>Single parent = people in households of 1 person over 16 and one or more children under 16 as a percentage of all residents in private households. Overcrowding = people in households living at more than 1 person/room as a percentage of all residents in private households. No car = percentage of households without access to a car. Housing tenure = percentage of homes not owner occupied. Unemployment = people aged 16 or more seeking work as a percentage of all residents in private households. Ethnicity = people in households headed by a person born in the new commonwealth as a percentage of all residents in private households. Moved within year = people aged 1 year or over with a usual address one year before the census different from the present usual address as a percentage of total residents. Children under 5 = children under 5 as a percentage of all residents in private households. Unskilled = people in households headed by a person in socio-economic group 11 as a percentage of residents in private households. Elderly living alone = pensioners living alone as a percentage of all residents in private households. <sup>b</sup>Some variables common to the Jarman and Townsend scores are calculated slightly differently. The univariate analyses are based on the Jarman definition.

**Figure 1.** Ward consultation rates against Jarman score.**Figure 2.** Ward consultation rates against Townsend score.

Mansfield however, while the absolute levels of variables, such as unemployment, have changed since 1991, there has been little change in the position of wards and enumeration districts relative to each other.

The study assumed that census data aggregated from the whole population could be applied to practice populations at ward and enumeration district levels. For this reason, the study was confined to wards where at least 10% of the population were regis-

tered with the practices, and, in the regression analysis, the weighted least squares method was used to give increased weight to wards and enumeration districts with more patients. There has been debate about the accuracy of assigning census information to individuals and whether analysis by enumeration district carries any advantage over ward level analysis.<sup>19,20</sup> Several authors have pointed out the relatively low agreement between characteristics assigned to individuals from the census and their 'true'



characteristics.<sup>21,22</sup> This is mainly because the census data are the average for an area.<sup>23</sup> It is less of a problem in this study because the consultation rates themselves were area averages.

Care needs to be taken when drawing conclusions from studies using census variables. If a variable is associated with consultation rates at an area level, it does not necessarily follow that individuals with that characteristic consult more often (or vice versa): the 'ecological fallacy'.<sup>19,24</sup>

The study was restricted to one town centre without extremes of deprivation or affluence. The influence of some socio-economic variables is known to differ between regions,<sup>7</sup> and variables such as ethnicity, which is low throughout Mansfield, will be more important in other settings. The study only looked at one workload parameter. Variables such as the elderly living alone may be associated with visits rather than consultations, although a previous study in one of the three practices showed a strong association between night visit rates and Townsend scores.<sup>25</sup>

### Conclusions

Although the practices were not eligible for deprivation payments, the predicted difference, of 700 consultations for an average list size, is of practical importance. The association with consultation rates applied across the whole range of deprivation studied, so that, for example, more affluent areas had less consultations than average areas. This supports suggestions that payments should start at lower levels of deprivation and demonstrates that the influence of socio-economic factors on consultation rates is not solely confined to isolated pockets of deprivation.

The results are consistent with analyses based on the Third and Fourth National Morbidity studies, which concentrated mainly on the influence of socio-economic factors on the likelihood of individuals consulting.<sup>4,7</sup> The only previous study looking at the effect of deprivation on practice consultation rates predicted an increase of 1600 consultations per 2000 patients between wards, with much more extreme differences in deprivation.<sup>14</sup>

The  $r^2$  value, which represents the percentage of variation explained, was lower for enumeration districts than for wards. This was because some enumeration districts had small numbers of patients, thereby introducing more random variation in rate calculations. At enumeration district level, the Jarman score explained 17% of a 250% variation, at ward level it explained 37% of a 25% variation. The calculated effect on consultation rates for a given change in Jarman score was greater at enumeration district level; this supports proposals that payments should be based on enumeration districts.<sup>16,17</sup>

The Townsend score had a stronger association with consultation rates than the Jarman score; this was because all four of its component variables were associated with increased consultation rates compared with only four of the eight Jarman variables. This supports suggestions that the choice of variables used to determine deprivation payments should be reconsidered.<sup>11,12</sup> Payments could be based on the four Townsend variables, with under-fives separately reimbursed on a capitation basis.<sup>6</sup>

Now computerized consultation data are routinely recorded by many practices, it should be possible to have a deprivation payment system based on factors that have been shown objectively to affect consultation rates and by an amount proportional to that effect. This would be an important step forward in matching general practice service provision to health need.

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