Low income scheme index: a new deprivation scale based on prescribing in general practice

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Abstract

Objectives—To describe and validate a new deprivation index, based on the percentage of prescribed items exempt from the prescription charge under the low income scheme, at both family health services authority and practice level.

Design—Comparison of the index with three other deprivation indices and correlation of index values with the use of drugs given for conditions with known social class gradients.

Setting—All 90 family health services authorities and 7619/9289 practices in England.

Results—The ranking of family health services authorities on the new index correlated highly with rankings on the other indices. Values in relation to the use of drugs given for conditions with known social class gradients were in the predicted direction at both family health services authority level and practice level; correlation was highly significant at the authority level, but less significant at practice level.

Conclusions—The new index provides a good measure of deprivation at family health services authority level, and at practice level the results are sufficiently encouraging to warrant further research. It provides the best available instrument for relating deprivation to the use of drugs in any population that can be defined by prescribing data, but an attempt to use it in determining allocation of resources would at this stage be premature.

Introduction

Accurate, widely based morbidity data from general practice would be of great value in many kinds of epidemiological or health services research. In research on prescribing they would make it possible to study the relation between illness and drug use. Unfortunately such data do not exist.

Many studies have shown that proxies for morbidity, such as premature mortality and permanent sickness, are closely related to deprivation. Several deprivation indices have been widely accepted in health related research, but only one of them, the Jarman index, is available at practice level. This index has several drawbacks: it was designed to reflect factors perceived by general practitioners as increasing their workload rather than deprivation in the population; it has been heavily criticised on methodological grounds¹⁻³; and it depends on data collected only at 10 year intervals.

Our objectives in this study were to describe and validate a new deprivation index, based on existing data available at practice level and capable of being updated annually or even quarterly. The index is derived from prescribing data and may therefore be of particular value in research on prescribing.

THE LOW INCOME SCHEME AND A LOW INCOME SCHEME INDEX

More than 80% of items dispensed from prescriptions issued by general practitioners in England under the NHS are exempt from the prescription charge.⁴ Most exemption is based on age (54.6% of total items). A further 6.6% of items are accounted for by family health services authority exemption—many of them being related to pregnancy. The other large category, based on the low income scheme, accounts for 12.1%. The low income scheme covers recipients of family credit and their dependants, recipients of income support and their dependants, and others who qualify on grounds of low income. Nothing is known about the income of people exempt by reason of age or family health services authority criteria as they qualify regardless of financial status. People exempt under the low income scheme, on the other hand, are very poor, and their level of deprivation is formally recognised. According to statistics from the Department of Social Security⁵ 4.5 million adults were eligible for exemption under the low income scheme in November 1992, though an unknown number of them could have fallen into the family health services authority exemption category too.

The proportion of items in each exemption category dispensed by community pharmacists and appliance contractors (excluding those dispensed within a practice or administered personally) is estimated routinely from a 5% sample of all prescriptions and reported quarterly in prescription cost analysis tables.⁶ The data are routinely available only down to family health services authority level but can be derived at practice level.

The workings of the low income scheme have been heavily criticised on two main grounds: that the application forms are so difficult to complete that uptake is lower than it should be; and that some very poor people fail to qualify because their income is just above the threshold—sometimes by only a few pence a week—often because they are receiving some other social benefit.⁷ If, however, it is reasonable to assume that the relative numbers of very poor people covered and not covered by the low income scheme are fairly constant in all areas then an index based on percentage uptake in defined populations should be a good indicator of their relative levels of poverty.

In 1992 low income scheme exemption accounted for 46.7 million items (12.1% of the total) at a net ingredient cost of £239.5m (11.1% of the total). This was the first year in which the percentage of items exempt under the low income scheme exceeded that under the young persons' exemption. The average cost of an item exempt under the low income scheme was a little lower than that of all items (table I).

The potential advantages of a deprivation index based on low income scheme weightings are that the

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TABLE 1—Average net ingredient cost per item dispensed from prescriptions issued and percentage of total number of items, by category^a

Category	Average net ingredient cost per item (£)	% Of total No of items*
All items	6.72	100
Chargeable items:		
At point of dispensing	8.32	14.2
By prepayment	9.15	4.8
All	8.53	19.0
Contraceptives dispensed at no charge	5.70	1.6
Items exempt on grounds of:		
Age:		
Elderly	6.70	43.4
Young persons	4.42	11.2
Family health service authority exemption	8.30	6.6
War or service pensions	7.48	0.2
Low income	6.28	12.1

*Percentages do not total 100 because "no declaration" and "declaration not specific" categories are omitted.

data are (a) already produced quarterly and (b) obtainable at practice level.

Method

We extracted data on items and costs at practice level from the database held by the Prescription Pricing Authority for total prescribing, practice dispensed prescribing, and prescribing for which a claim had been made under the low income scheme. For the analyses at family health services authority level we aggregated the practice data (for the years ending 31 March 1992 and 31 March 1993). For analysis at practice level we excluded practices meeting any of the following criteria: (a) a list size of fewer than 1000 patients; (b) a mean number of items per patient below three over the year; (c) more than one third of drug costs accounted for by patients whose drugs were dispensed in the practice; and (d) a list size declared to the Prescription Pricing Authority that differed by more than 5% from that declared to the Department of Health.

We adopted the first criterion for two reasons. Very small practices often have special and atypical populations, such as students or nurses. In addition, as data on the low income scheme are estimated from a 5% sample of prescriptions, in practices with fewer than 1000 patients these data may relate to an extremely small number of patients, and a few claimants taking expensive drugs could distort the results grossly. Similarly, we excluded practices whose prescribing rates were unusually low because they too might have been atypical. Prescriptions dispensed direct by the practice are not endorsed by the patient and no exemption information is available for them: if the proportion of prescriptions dispensed by a practice is large the proportion attributable to an exemption category is of dubious value.

Of 9289 practices, we excluded 1670 practices that fell into the four exclusion categories. The analyses are therefore based on 7619 practices, covering 87.4% of the population.

We calculated two types of low income scheme index, one based on net ingredient costs and the other based on numbers of items:

Low income scheme index (cost) = $100 \times (\text{net ingredient cost attributable to low income scheme exemption}) / (\text{total net ingredient cost minus net ingredient cost due to dispensing})$

Low income scheme index (items) = $100 \times (\text{items attributable to low income scheme exemption}) / (\text{total items minus dispensed items})$

To validate the use of the low income scheme index we undertook two kinds of study. Firstly, we compared the index with three other deprivation indices—namely, the Jarman index,⁹ the Townsend

material deprivation index,⁹ and the Carstairs index.¹⁰ We based the Jarman index on data from the 1981 census and the other two on data from the 1991 census.

Secondly, we correlated the values in the low income scheme index with the use of drugs for conditions that have well recognised social class gradients. We included only conditions that are treated specifically with drugs that are not used for other purposes, not available over the counter, and not likely to show major variation in frequency of prescription among doctors. We were looking for both negative and positive correlations, and choices for appropriate conditions were very limited.

EXPECTED NEGATIVE CORRELATIONS

Breast cancer is known to be most common in women of social class I. It is often treated with tamoxifen, a drug used rarely for any other condition. No other preparation satisfied our criteria as completely as tamoxifen, but the case for using hormone replacement therapy was persuasive. We could find no British data proving a relation between uptake of this therapy and social class, but there appears to be a general agreement that uptake is highest in the upper social classes.¹¹ As a check, albeit an imperfect one, on the effect of social class on the level of use of the drugs used in hormone replacement therapy we used data from the 1991 census to estimate the proportions of each social class in the population of each family health services authority and correlated these with the use of the drugs in the same populations. We recognised that we had a less than satisfactory basis for using hormone replacement therapy in the validation of our index, but we accepted it provisionally in the absence of any better alternative.

If the level of use correlated negatively with the index then this would indicate that the index was highly sensitive to deprivation as women who take hormone replacement therapy constitute only a very small percentage of the population. We predicted that combined therapy would show a greater negative correlation than unopposed therapy because the former is more often optional. The drug formulations for which we expected negative correlations were therefore (a) tamoxifen (all strengths; generic and branded items); (b) conjugated oestrogens 0.625 mg (generic and branded items); and (c) conjugated oestrogens 0.625 mg with levonorgestrel 0.15 mg (generic and branded items).

EXPECTED POSITIVE CORRELATIONS

We found no single drugs that satisfied our criteria and therefore used two groups of drugs instead. Infections in children occur most commonly in poor socioeconomic conditions, and the drugs used to treat them should serve as a marker for their incidence at different levels of deprivation. We therefore obtained combined data for a group of drugs, given at paediatric dosage, that collectively cover almost all antibiotic prescribing for children.

Similarly, a cluster of cardiovascular conditions—hypertension, angina, and cardiac failure—occur most commonly in patients in low socioeconomic groups, and these conditions are treated with a definable group of drugs. The level of use of these drugs in a population should also show a positive correlation with low income scheme index values.

The drug formulations for which we expected positive correlations were therefore (a) amoxycillin, ampicillin, penicillin V, erythromycin, cefaclor, cephalixin, co-trimoxazole, and trimethoprim at paediatric dosage (liquid and solid preparations; generic and branded items) and (b) diuretics, α and β blockers, nitrates, calcium channel blockers, and angiotensin converting enzyme inhibitors (all solid

formulations; all strengths; generic and branded items).

Results and discussion

Four low income scheme indices were derived: two based on figures for 1 April 1991 to 31 March 1992 (LISI(I)91 and LISI(C)91) and two based on figures for 1 April 1992 to 31 March 1993 (LISI(I)92 and LISI(C)92). Table II shows the variability of these indices.

COMPARISONS OF LOW INCOME SCHEME INDEX WITH OTHER DEPRIVATION INDICES

Of the deprivation indices with which we compared the low income scheme indices, only the Jarman index could be related to practices; our comparisons were therefore made at family health services authority level.

Table III shows the correlations. In every case they were highly significant ($P < 0.01$). The four measures based on the low income scheme were of course closely correlated with each other, but they also had high correlations with the indices of Carstairs, Townsend, and Jarman.

One complaint commonly levelled at the Jarman index is that it puts four London family health services authorities among the six most deprived nationally. So too does the Townsend index, while the Carstairs index includes three. In the 1992-3 cost based low income scheme index, which must be the most appropriate of our four indices to use in a financial context, only two London family health services authorities are among the six most deprived. A full listing of the deprivation rankings of the family health services authorities according to the four indices is shown in the appendix. The 1992-3 cost based low income scheme index is clearly more sensitive to deprivation in the Mersey and Northern regions than the Jarman index but less so in the North Western region and in London.

Low income scheme exemption goes unrecorded in dispensing practices, but this does not seem to be a problem: in the three family health services authorities that have the highest percentages of patients whose drugs are dispensed in a practice (Lincolnshire, North Yorkshire, and Norfolk) the rankings in our index do not differ greatly from those in the other indices. Of course some patients may claim low income scheme exemption falsely, and though this could affect the

TABLE II—Variability of low income scheme indices and three other deprivation indices at family health services authority level

Index	Mean (SD)	Minimum	Maximum
Jarman	0.27 (16.57)	-31.06	53.34
Townsend	0 (3.53)	-5.41	11.82
Carstairs	0 (3.29)	-5.71	12.38
LISI(C)91	10.69 (3.78)	4.67	22.57
LISI(I)91	11.49 (4.11)	4.83	24.17
LISI(C)92	11.73 (3.82)	5.39	23.80
LISI(I)92	12.46 (4.02)	5.63	24.24

LISI(C)91=1991-2 cost based low income scheme index; LISI(I)91=1991-2 item based low income scheme index; LISI(C)92=1992-3 cost based low income scheme index; LISI(I)92=1992-3 item based low income scheme index.

TABLE III—Correlations between low income scheme indices and other deprivation indices at family health services authority level

	Jarman	Townsend	Carstairs	LISI(C)91	LISI(I)91	LISI(C)92
Jarman						
Townsend	0.89					
Carstairs	0.88	0.94				
LISI(C)91	0.78	0.86	0.92			
LISI(I)91	0.83	0.89	0.92	0.98		
LISI(C)92	0.80	0.87	0.92	0.99	0.98	
LISI(I)92	0.85	0.91	0.93	0.99	0.99	0.99

LISI(C)91=1991-2 cost based low income scheme index; LISI(I)91=1991-2 item based low income scheme index; LISI(C)92=1992-3 cost based low income scheme index; LISI(I)92=1992-3 item based low income scheme index.

TABLE IV—Base populations for selected groups of drugs, based on data from Office of Population Censuses and Surveys for family health services authorities and data on registered patients at practice level

Drug	Base population
Tamoxifen	Women ≥ 25 years
Hormone replacement therapy	Women ≥ 45 years
Paediatric antibiotics	Boys and girls ≤ 15 years
Cardiovascular drugs	Men and women ≥ 45 years

TABLE V—Correlations between low income scheme index and cost and quantity of the selected groups of drugs at family health services authority level

Drug	Cost	Volume (defined daily doses)
Tamoxifen	-0.26	-0.24
Hormone replacement therapy:		
Oestrogen only	-0.46	-0.58
Oestrogen and levonorgestrel combined	-0.43	-0.44
Paediatric antibiotics*	0.63	
Cardiovascular drugs	0.55	0.49†

All values significant at $P < 0.0005$ level except for those for tamoxifen ($P < 0.05$).

*Volume not calculable.

†Measured in items.

TABLE VI—Correlation of cost of selected groups of drugs with percentage of population in different social classes across all 90 family health services authorities in England

Drug	Social classes I and II	Social class V
Tamoxifen	0.01	-0.6
Hormone replacement therapy:		
Oestrogen only	0.35**	-0.30**
Oestrogen and levonorgestrel combined	0.36***	-0.29*
Paediatric antibiotics	-0.32**	0.14
Cardiovascular drugs	-0.71***	0.62***

* $P < 0.05$; ** $P < 0.005$; *** $P < 0.0005$.

percentage of exemption claims in each family health services authority, the percentages for the authorities relative to each other would not necessarily be affected.

RELATION OF LOW INCOME SCHEME INDEX VALUES TO USE OF DRUGS IN CONDITIONS WITH KNOWN SOCIAL CLASS GRADIENTS

The values in the 1992-3 cost based low income scheme index would be expected to show a negative correlation with the drugs most commonly given to patients in the higher social classes, who would be least likely to qualify for low income scheme exemption, and a positive correlation with the drugs most commonly given to patients in the lower social classes. The prescribing data used were those for the year 1992-3.

Results at family health services authority level

Analyses at family health services authority level were made with the base populations shown in table IV. Table V shows the correlations between the drugs used in conditions with known social class gradients and the low income scheme index. The findings were as predicted and strongly support the validity of the low income scheme index at family health services authority level. As the cost of prescribing overall correlates positively with low income scheme exemption the ability of the index to pick up a negative correlation with the use of low volume drugs such as tamoxifen and the two hormone replacement preparations shows it to be a sensitive instrument.

Table VI shows the correlations of proportions of the different social classes in each family health services authority with the use of the groups of drugs. They support the other findings.

Results at practice level

One of the most important features of low income scheme exemption as an index of deprivation is that it

Key messages

- The low income scheme index can be used to quantify deprivation in all populations that can be defined by prescribing data (except those of practices in which most patients receive their prescription drugs within the practice)
- The scheme can be updated annually or even quarterly
- At family health services authority level the index is valid and easy to use
- At practice level a deprivation score is calculable but it is affected by the individual habits of prescribers
- It would be premature at the moment to use the index to allocate resources at practice level

TABLE VII—Correlations between low income scheme index and cost and quantity of selected groups of drugs at practice level

Drug	Cost	Volume (defined daily doses)
Tamoxifen	-0.30	-0.32
Hormone replacement therapy:		
Oestrogen only	-0.23	-0.23
Oestrogen and levonorgestrel combined	-0.22	-0.22
Paediatric antibiotics*	0.29	
Cardiovascular drugs	0.16	0.11†

All values significant at $P \geq 0.0005$ level.

*Volume not calculable.

†Measured in items.

can be obtained at practice level; our next step therefore was to see how well its values correlated at that level with the use of the same groups of drugs. At practice level we could not use data from the Office of Population Censuses and Surveys for the base populations and had to rely on list data declared to the Department of Health, though these are known to be affected by list inflation. Table VII shows the correlations between the same groups of drugs and the low income scheme index. They are all in the predicted direction and all highly significant. This level of significance is, however, due to the large numbers involved, and the degree of correlation is not a good guide to the importance of the relation. The figure illustrates this point, showing that the highly significant correlation is not associated with consistent behaviour among the practices.

To estimate the practical importance of the corre-

lations we compared them with those found in other prescribing studies based on practice data. When age, sex, and temporary resident originated prescribing units (ASTRO-PU) were derived,¹² a correlation of about 0.5 was found between the number of ASTRO-PU per patient and the net ingredient cost per patient. In a recent study of prescribing practices in Lincolnshire (M Pringle *et al*, unpublished data), correlations between the number of items per patient and the percentages of practices' patients in the age ranges 0-64, 65-74, and ≥ 75 were 0.35, 0.33, and 0.34 respectively. Bearing in mind that the demographic structure of a practice population is a more powerful determinant of variation in prescribing than deprivation, these values give some idea of the scale of residual variation between practices and show the correlations reported here in a favourable light.

CONCLUSIONS

At family health services authority level no doubt seems to exist about the validity of the low income scheme index as a deprivation index. It correlates strongly with other established indices, each based on different social variables, and also with the level of use of drugs given for conditions that have a recognised social class gradient—even in cases of drugs that are not given in high volume.

The unique features of the low income scheme index that we wished to exploit were that it could give a value for most practices in England and could do so as frequently as required—even quarterly. We did not expect its correlations with the use of the drugs that we studied to be as high at practice level as they were at family health services authority level, but they did compare well with those reported between prescribing and population variables in other studies, and this is encouraging.

We see an immediate application of the index in studying the relation of deprivation to the use of drugs in any population in England that can be defined by prescribing data. Any attempt to use it in determining resource allocation would, however, at this stage be premature.

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Appendix

Rankings of the family health services authorities* by three existing and four proposed deprivation indices

Family health services authority	Jarman	Townsend	Carstairs	LISI(C)91	LISI(I)91	LISI(C)92	LISI(I)92
Northern Regional Health Authority:							
Cleveland	71	67	70	85	84	85	84
Cumbria	34	27	38	18	18	17	17
Durham	57	56	62	70	61	71	66
Northumberland	40	42	44	38	32	25	28
Gateshead	65	75	76	81	77	76	77
Newcastle	80	84	81.5	78	80	81	81
N Tyneside	61	60	63	60	60	61	60
S Tyneside	70	82	81.5	76	76	78	76
Sunderland	73	79	77	83	83	84	82
Yorkshire Regional Health Authority:							
Humberside	58	49	57	61	64	64	64
N Yorkshire	16	3	12	7	6	7	5
Bradford	86	68	79	59	68	59	68
Calderdale	77	50	54	42	41	44	42
Kirklees	78	53	59	54	56	56	58
Leeds	66	59	53	55	55	55	54
Wakefield	35	54	58	53	50	51	49
Trent Regional Health Authority:							
Derbyshire	28	37	41	28	26	28	29
Leicestershire	49	38	37	36	36	34	36
Lincolnshire	26	23	35	34	35	24	26
Nottinghamshire	38	47	50	49	48	47	48
Barnsley	20	64	73	66	66	63	62
Doncaster	47	58	68	69	65	67	65
Rotherham	44	62	64	68	59	62	56
Sheffield	55	71	69	74	67	69	63
East Anglian Regional Health Authority:							
Cambridgeshire	43	20	13.5	29	31	29	34
Norfolk	27	21	33	25	25	23	27
Suffolk	36	11	17.5	11	10	14	11
North West Thames Regional Health Authority:							
Bedfordshire	45	36	31	50	51	54	51
Hertfordshire	4	15	5	4	5	5	6
Barnet	30	51	21	8	9	8	12
Brent and Harrow	60	73	51	39	42	48	46
Ealing, Hammersmith, and Hounslow	79	80	67	63	62	65	67
Hillingdon	19	39	25	9	13	13	13
Kensington, Chelsea, and Westminster	85	87	75	64	72	60	75
Essex	10	18	15	15	17	11	19
Barking and Havering	18	52	48	26	28	26	32
Camden and Islington	89	89	86	84	85	83	85
City and East London	90	90	90	87	87	88	88
Enfield and Haringey	62	76	66	62	69	75	74
Redbridge and Waltham Forest	53	66	55	51	52	53	55
South East Thames:							
East Sussex	56	41	39	23	22	30	24
Kent	39	32	26	20	24	22	23
Greenwich and Bexley	52	61	47	48	47	49	50
Bromley	3	5	3	5	4	3	3
Lambeth, Southwark, and Lewisham	88	88	87	86	90	86	87
South West Thames Regional Health Authority:							
Surrey	1	1	1	1	1	1	1
West Sussex	25	2	9	2	2	2	2
Croydon	33	48	28	32	40	45	47
Kingston and Richmond	11	25	2	3	3	4	4
Merton, Sutton, and Wandsworth	64	63	43	45	46	42	44
Wessex Regional Health Authority:							
Dorset	23	14	27	12	7	12	7
Hampshire	31	19	13.5	19	19	19	20
Wiltshire	24	7	11	6	8	9	8
Isle of Wight	46	35	56	24	23	31	25
Berkshire	12	17	6	17	16	16	18
Oxford Regional Health Authority:							
Buckinghamshire	7	4	4	16	14	18	15
Northamptonshire	54	22	23	31	33	35	31
Oxfordshire	17	16	8	10	15	6	14
South Western Regional Health Authority:							
Avon	22	28	22	27	30	32	35
Cornwall and Isles of Scilly	42	34	40	35	34	38	33
Devon	37	30	36	33	29	36	30
Gloucestershire	9	8	20	13	12	15	9
Somerset	8	6	16	14	11	10	10
West Midlands Regional Health Authority:							
Hereford and Worcester	14	13	19	21	20	20	21
Shropshire	32	26	30	41	39	39	39
Staffordshire	13	29	34	43	37	37	38
Warwickshire	5.5	10	17.5	22	21	21	16
Birmingham	83	83	85	79	82	82	83
Coventry	72	65	74	73	74	73	72
Dudley	5.5	43	42	47	45	40	41
Sandwell	69	81	84	72	70	72	71
Solihull	2	12	7	40	43	33	40
Walsall	48	70	65	75	73	74	70
Wolverhampton	74	78	78	77	78	77	79
Mersey Regional Health Authority:							
Cheshire	21	24	29	44	44	46	43
Liverpool	82	85	88	90	89	90	90
St Helens and Knowsley	68	74	80	88	86	87	86
Sefton	41	45	45.5	65	58	68	57
Wirral	59	44	52	82	79	80	78
North Western Regional Health Authority:							
Lancashire	63	40	45.5	52	54	50	53
Bolton	76	55	61	57	57	58	59
Bury	51	31	32	37	38	41	37
Manchester	87	86	89	89	88	89	89
Oldham	81	69	72	67	71	66	69
Rochdale	84	72	71	71	75	70	73
Salford	75	77	83	80	81	79	80
Stockport	15	9	10	30	27	27	22
Tameside	67	57	60	58	63	57	61
Trafford	29	33	24	46	49	43	45
Wigan	50	46	49	56	53	52	52

*Grouped according to regional health authorities in existence at time of study.
 LISI(C)91 = 1991-2 cost based income scheme index;
 LISI(I)91 = 1991-2 item based low income scheme index;
 LISI(C)92 = 1992-3 cost based low income scheme index;
 LISI(I)92 = 1992-3 item based low income scheme index.