Allocating resources to health authorities: results and policy implications of small area analysis of use of inpatient services

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A study designed to identify the principal determinants of use of inpatient facilities in NHS hospitals in England used the data and methods outlined in the previous paper. The model for the psychiatric sector contains mortality, self reported morbidity, and social variables indicating deprivation and the level of care at home. The non-acute model contains mortality and several socioeconomic variables. The models lay less weight on age than the current formula, and a national formula based on these models would, in the acute sector, redistribute resources to poorer areas compared with the current formula.

This paper gives a brief summary of the results of a study undertaken at the University of York to identify the principal determinants of inpatient use of NHS hospitals.[1] The sources of data and methods used are described in the accompanying paper.[2] The results of this study form the basis of recommendations by a Department of Health steering group to the secretary of state for health for a new weighted capitation formula that will be used to allocate about £18 billion of hospital and community health service funds each year to health authorities in England. We present first estimates of the use of hospital and community health service resources by age and sex and then analyse additional health and socioeconomic determinants of use in the acute and mental illness specialties. We then describe the methods used to develop a formula for distributing hospital and community health service funds to health authorities and give some illustrative consequences for resource allocation.

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Effects on resource allocation

In order to show the effects of our study on resource allocation we apply our results in this paper to the 14 former health regions in England. The results are, however, purely illustrative and do not necessarily represent the strategy the Department of Health might adopt if it implements the findings. Many policy judgments which lie outside our remit have to be made before the results of a study such as this can be made operational.

Age-cost relation

Estimates of the resource consequences of inpatient use by coarse age bands for all acute specialties combined (excluding maternity) and non-acute specialties (geriatrics, mental illness, and mental handicap) are shown in table I. Tables showing greater detail are published elsewhere.[1] The units of measurement are multiplied by an arbitrary constant but are scaled so that acute specialties account for 66·9% and non-acute stay specialties 33·1% of total inpatient expenditure, an estimate of relative spending in 1991-2. These age-sex cost curves can form the basis for weighting district populations for age and sex, although they have to be combined with the equivalent curves for non-inpatient activity.

Table I also compares these weightings with the current Department of Health curves. The York cost curves are shallower than the current curves. They assign higher costs to young people and reduced costs to the elderly, to the extent that the weight on the over 85 group for all inpatient specialties is reduced by 36%. The principal reasons for these changes are that, firstly, in contrast with the Department of Health data, the York data include day cases; and, secondly, the York analysis takes account of the cost structures of different specialties. Younger people tend to make more use of day case facilities and use the more expensive specialties.

TABLE I—*Inpatient cost curves 1991-2 according to current Departmen of Health (DoH) formula and revised York formula*

	Acute		Non-acute		Combined	
Age*	DoH	York	DoH	York	DoH	York
0-4	1·14	1·24	0·00	0·27	1·14	1·51
5-14	0·38	0·51	0·01	0·61	0·38	1·11
15-44	0·65	0·74	0·18	0·55	0·83	1·29
45-64	1·49	1·52	0·56	0·35	2·05	1·88
65-74	3·22	3·06	1·53	0·76	4·75	3·82
75-84	4·95	4·35	3·76	2·47	8·71	6·82
≥85+	7·03	5·52	9·39	4·96	16·43	10·48

*There is a slight discrepancy between the two series, as we used 5-14 and 15-44 rather than 5-15 and 16-44. This is unlikely to affect the analysis significantly.

The cost curves can be used to produce age weighted populations. For each of the former regions the population in each age group is multiplied by the relevant weight. The sum of these "weighted populations" is then constrained to equal the national population by multiplying the weighted populations by a suitable factor. Table II gives the implications of the York cost curves for regional age weighted populations. For each region the age weighted population is given as a percentage of the raw population. In general the York figures result in smaller adjustments for age than the current Department of Health curves, reflecting the reduced differentials between the weights for different ages. The biggest gainers from a switch to the York inpatient curves would be Oxford and the northern Thames regions, the biggest losers South Western, Wessex, and the southern Thames regions.

TABLE II—*Age weighted populations as a percentage of raw populations*

Region	York curve 1991-2	Current DoH curve	% Change from DoH to York
Northern	98·9	99·3	0·33
Yorkshire	99·6	99·8	0·15
Trent	99·6	99·7	0·13
East Anglia	103·6	102·3	−1·21
North West Thames	93·8	96·0	2·32
North East Thames	96·1	97·6	1·52
South East Thames	104·3	102·8	−1·42
South West Thames	104·3	102·7	−1·53
Wessex	106·6	104·2	−2·21
Oxford	91·1	94·2	3·48
South Western	109·7	106·2	−3·20
West Midlands	97·2	98·2	1·01
Mersey	98·5	99·0	0·53
North Western	99·2	99·6	0·37

Modelling costs of use in the acute sector

Detailed age-sex curves were used to derive estimates of expected resource use in each small area, and the main part of the study was concerned with modelling the ratio of various estimates of actual use to expected use. We want to emphasise that many of the needs variables used to explain variations in this index of resource use were highly collinear. It is the combination of selected variables that gives a model its predictive power, and not any one variable in isolation. Too much importance should therefore not be ascribed to the specific variables which were found to be statistically significant.

In this section we describe the development of a model for the acute sector, based on 1990-1 data. The four supply variables were found to be endogenous to the model, which was therefore estimated using two stage least squares. Needs variables were then added to the model, in accordance with the procedure noted in the previous paper.[2]

A set of binary (dummy) variables which allow for different intercept values for the various regional health authorities was found to be necessary at each stage of the modelling procedure. This resulted in an unrestricted model of use containing 30 needs variables. The model was then restricted by omitting needs variables (not significant at the 0·1% level) until the model shown in table III was found. Neither the constant nor the regional dummy variables are shown since they are not considered to be legitimate indicators of need, reflecting supply or policy differences between regions which should not be incorporated systematically into a formula. The model exhibits some evidence of misspecification ($\chi^2(33)=69{\cdot}7$; critical value $=63{\cdot}8$). However, with almost 5000 observations some misspecification is to be expected. Moreover, any additional variables included exhibit low β values (standardised coefficients), suggesting that their inclusion would not have a great effect from a policy perspective. Variables reflecting proportions of persons in each age-sex category were added to this model but were not found to be significant, suggesting that age-sex standardisation was satisfactory.

The results suggest that access to general practitioners and private inpatient services are positively related to use, while the provision of nursing home places serves to depress NHS inpatient use. NHS inpatient provision was not found to affect use significantly. However, the need to include the density variable suggests that there are aspects of supply that are not being captured in the existing supply measures. Six variables clearly related to health care needs are included in the equation. Two of them, the standardised mortality ratio and standardised illness ratio for ages 0-74, are direct measures of disease, and the others are intuitively and theoretically sensible proxies for the sorts of factors that influence the distribution of health care needs. The inclusion of standardised mortality ratio for ages 0 to 74 is in line with current resource allocation practice.

Although the results in table III represent a satisfactory statistical model for acute sector use, they are not directly useful for developing a resource allocation formula because they contain supply terms which may or may not reflect "legitimate" health care needs. For the purposes of developing a formula, the requirement was to develop a measure which we term "normative utilisation."[2] Firstly, we have to identify legitimate measures of health care needs and then estimate the link between those measures and use.

The results in table III indicate this study's assessment of the most important health and socioeconomic determinants of use of acute inpatient facilities over and above supply considerations. Therefore, in the absence of any other unambiguous indicators of health care needs, these were assumed to be the legitimate "drivers" of normative utilisation. The next stage in the analysis was therefore to carry out an ordinary least squares regression to assess the relation between variations in the cost of use and these needs indicators. This was carried out using data from 1990-1 and 1991-2 aggregated. The results for the acute sector are shown in table IV. It proved possible to drop the "manual" variable because its coefficient became insignificantly different from zero.

The coefficients on the needs variables in table IV are in general higher than those reported for the model in table III. This suggests that some of the costs of use attributable to legitimate health care needs were indeed captured in the supply variables in the original model shown in table III. The one exception is the proportion of dependants in single carer households for which the coefficient has reduced from 0·0577 to 0·0432. Examination of the β coefficients suggests that self reported illness is the most important determinant of the costs of use, followed by mortality, unemployment, and the elderly living alone. The single carer variable has the least effect in the equation.

The R^2 statistic indicates that the chosen acute sector needs variables account for 54% of the variance in the cost of use. But we are not necessarily searching for a model with high explanatory power. Rather we are searching for a model that captures only the impact of legitimate health care needs on the cost of use.

The final stage in the analysis was to undertake a multilevel analysis which provides unbiased estimates of the coefficients in the presence of significant district clustering. This part of the work showed that there is indeed significant variation attributable to the district level. Across all districts about 44% of the variance in the rate of use is attributable to interdistrict variation. It is therefore important to re-estimate the ordinary least squares equation of table IV using multilevel estimation methods (table V).

The results are broadly similar to those obtained

TABLE III—*Model of utilisation, acute services (1990-1)*

Variable	Coefficient	Standard error	β Value
Access to NHS acute beds	0·0234	0·0497	0·0326
Access to general practitioners	0·3769**	0·0809	0·0199
Proportion of population aged ≥75 *not* in nursing or residential homes	0·1290	0·0671	0·0384
Access to private hospital beds	0·1214**	0·0362	0·3048
Persons per hectare	−0·0370**	0·0051	−0·2340
Standardised mortality ratio (SMR) for ages 0-74	0·1179**	0·0210	0·1134
Standardised illness ratio for ages 0-74*	0·1090**	0·0291	0·1368
Proportion of pensionable age living alone	0·0915**	0·0240	0·0638
Proportion of economically active unemployed	0·0475**	0·0134	0·1018
Proportion of dependants in single carer households	0·0577**	0·0178	0·0719
Proportion in households with head in manual classes	0·0733**	0·0138	0·1147

*People in households only, based on the limiting longstanding illness variable.
**Significant at 0·5% level.

TABLE IV—*Regression of utilisation on needs, acute specialties (1990-2)*

Variable	Coefficient	Standard error	β Value
Standardised mortality ratio (SMR) for ages 0-74	0·1387**	0·0166	0·1482
Standardised illness ratio for ages 0-74	0·2023**	0·0203	0·2820
Proportion of pensionable age living alone	0·1323**	0·0160	0·1026
Proportion of economically active unemployed	0·0504**	0·0102	0·1202
Proportion of dependants in single carer households	0·0432**	0·0143	0·0598

**Significant at 0·5% level.

TABLE V—*Acute multilevel model: estimates of fixed coefficients (1990-2) and comparison with ordinary least squares coefficients*

Variable	Multilevel coefficient	Multilevel standard error	Ordinary least squares coefficients
Standardised mortality ratio (SMR) for ages 0-74	0·1619	0·0131	0·1387
Standardised illness ratio for ages 0-74	0·2528	0·0183	0·2023
Proportion of pensionable age living alone	0·0765	0·0130	0·1323
Proportion of economically active unemployed	0·0287	0·0092	0·0504
Proportion of dependants in single carer households	0·0436	0·0122	0·0432

from the ordinary least squares analysis shown in table IV, which are reproduced as the last column. We think that the multilevel results represent the best estimates of the national average relation between the chosen needs variables and acute sector utilisation, and we have recommended that they are used as the basis for a revenue allocation formula.

Modelling costs of use in psychiatry

Admissions in the specialties of geriatrics, psychiatry, and learning disability were modelled separately from those in the acute sector because of the higher proportion of admissions with long lengths of stay. They were modelled individually and in combination and are legitimately aggregated because they have in common the need for continuing long term care. It proved impossible to derive a satisfactory model for learning disability. The model presented here is for psychiatry and was derived from analysis of 1991-2 data. The parsimonious two stage least squares model is shown in table VI. To develop a model with reasonable statistical specification we found it necessary to use standard costs as the dependent variable owing to the problem of very long lengths of stay of some episodes. The supply variables are confirmed as endogenous. There is some evidence of misspecification ($\chi^2(32)=67\cdot5$; critical value=61·1), but this must be expected with so many observations. Again, age-sex standardisation appears to have been satisfactory.

In interpreting this model it is important to remember that the hospital episode statistics (HES) database recorded discharges in 1991-2, many of which related to very long episodes. At that time health authorities were seeking to close many long term beds and so discharged many long stay patients into the community. The apparent pattern of need this suggests may therefore be misleading, particularly if discharge destinations—the basis for ward of residence in the hospital episode statistics—are clustered into certain wards. However, similar results were obtained from the analysis applied to the 1990-1 data.

Again the variables included are intuitively plausible. High accessibility to beds appears to decrease inpatient use, perhaps because day care facilities can be used. Accessibility to general practitioners and provision of nursing homes is positively associated with use. The areas with high mortality have higher use (after adjusting for supply), as do areas with higher proportions of ethnic minorities; elderly people living alone; people in lone parent families; dependants with no carers; permanently sick adults; and people in manual socioeconomic groups. The level of 17 year olds in full time education and the proportion of the population living in urban areas are negatively associated with use in the non-acute specialties.

The needs variables in table VI were taken as the legitimate drivers of normative utilisation of psychiatric beds. The next stage in the analysis was therefore to carry out an ordinary least squares regression on these variables, resulting in the model shown in table VII. This model explains 47% of the variance in utilisation.

The final stage is the multilevel analysis. There is once again a substantial district effect, with the proportion of overall variance attributable to the district level being roughly 46%. It is therefore important to reestimate the ordinary least squares equation of table VII using multilevel estimation methods. The results are presented in table VIII. The first column presents the model estimated for table VII but allowing for interdistrict variation. The results indicate that in general there is a higher response to needs than indicated in table VII (reproduced as the last column of table VIII), suggesting that the response to need across wards *within* districts is steeper than the average response across all wards. This phenomenon is likely to arise when districts operate at different absolute levels of provision, and the multilevel procedure is designed to correct for such disparities between districts. This is the reason for recommending these results as the basis for a national formula.

We have presented here two of the models developed in the course of this study. Many alternative specifications were tested under a variety of assumptions. In particular, the acute model was tested by region, by specialty, and by mode of admission (elective *v* emergency); the full report gives a description of the various sensitivity analyses undertaken.[1]

TABLE VI—*Model of use, psychiatric specialty (1991-2)*

Variable	Coefficient	Standard error	β Value
Access to NHS non-acute beds	−0·3329*	0·1280	−0·1747
Access to general practitioners	0·3230**	0·0806	0·1360
Proportion of population aged 75+ not in nursing or residential homes	−0·7674**	0·1675	−0·0911
Access to private hospital beds	0·1582	0·1016	0·1581
Proportion in households headed by a lone parent	0·1454**	0·0256	0·1363
Proportion of dependants with no carer	0·1189**	0·0329	0·0702
Proportion in persons born in New Commonwealth	0·0583**	0·0120	0·1131
Proportion of pensionable age living alone	0·2045*	0·0474	0·0568
Standardised mortality ratio (SMR) for ages 0-74	0·2537**	0·0608	0·0972
Proportion of adult population permanently sick	0·2123**	0·0318	0·1790
Percentage of population living in "urban" enumeration districts	−0·1092*	0·0407	−0·0421
Proportion of 17 year olds who are students	−0·0695*	0·0329	−0·0390

**Significant at 0·5% level, *5% level

TABLE VII—*Regression of use on needs, psychiatric specialty (1990-2)*

Variable	Coefficient	Standard error	β Value
Proportion in households headed by a lone parent	0·1582**	0·0167	0·1700
Proportion of dependants with no carer	0·1131**	0·2395	0·0794
Proportion in persons born in New Commonwealth	0·0486**	0·0065	0·1122
Proportion of pensionable age living alone	0·3753**	0·0542	0·1241
Standardised mortality ratio (SMR) for ages 0-74	0·2267**	0·0447	0·1033
Proportion of adult population permanently sick	0·2671**	0·0233	0·2673

**Significant at 0·5% level.

TABLE VIII—*Psychiatric multilevel model: estimates of fixed coefficients (1990-2)*

Variable	Coefficient	Standard error	Ordinary least squares coefficients
Proportion in households headed by a lone parent	0·1846	0·0149	0·1582
Proportion of dependants with no carer	0·1431	0·0213	0·1131
Proportion in persons born in New Commonwealth	0·1073	0·0070	0·0486
Proportion of pensionable age living alone	0·3609	0·0468	0·3753
Standardised mortality ratio (SMR) for ages 0-74	0·2426	0·0382	0·2267
Proportion of adult population permanently sick	0·2616	0·0215	0·2671

Policy implications

Our results could form the basis of a formula for distributing hospital and community health service funds to geographical areas. Clearly, other components of the formula need to be designed. For example, the acute model must be combined with the psychiatric model in proportions which reflect the existing or desired split of expenditure between the two sectors. Moreover, decisions must be made about the extent to which these results are used to distribute revenue relating to non-inpatient services—specifically, outpatient and community services which are not recorded in the hospital episode statistics. And it is also necessary to decide how to distribute funds relating to geriatrics and learning disability. Finally, variations between areas in the costs of delivering services (market forces factors) must be considered. All of these considerations lay outside the scope of this study.

In this section, by way of illustration, we describe the implications of the models described above for the old regional health authorities. Each of the relevant needs variables for a regional health authority was

TABLE IX—*Needs weighted populations as a percentage of raw populations*

Region	Square root of SMR (a)	York acute model (b)	Change from (a) to (b) % (c)	York psychiatric model (d)	% Change from (a) to (d) (e)
Northern	109·1	112·2	2·80	112·7	3·28
Yorkshire	103·4	102·9	−0·42	105·2	1·79
Trent	101·8	103·5	1·69	101·6	−0·16
East Anglia	92·6	92·0	−0·64	76·1	−17·81
North West Thames	96·3	94·4	−1·91	101·9	5·82
North East Thames	99·2	101·0	1·80	114·5	15·38
South East Thames	97·9	98·5	0·57	104·7	6·93
South West Thames	92·7	89·7	−3·29	86·5	−6·75
Wessex	93·9	92·0	−1·99	77·5	−17·47
Oxford	93·6	89·2	−4·76	75·4	−19·45
South Western	94·8	94·7	−0·07	81·3	−14·23
West Midlands	102·9	102·1	−0·71	104·2	1·31
Mersey	106·6	109·3	2·46	106·4	−0·23
North Western	108·2	110·0	1·62	124·9	15·39

inserted into the multilevel variant of the models (tables V and VIII). This resulted in a relative needs index, which was multiplied by the region's population to yield a weighted population. All populations were then scaled so that the national raw population total was the same as the weighted population total. This process yielded a population weighted purely for needs—that is, not for demography—as shown in table IX. A figure of 100 indicates a population unaltered by the needs formula. It should be noted that the regional needs profiles shown in table IX disguise considerable variability at district level.

In the acute sector the regions with the highest needs are therefore Northern, North Western, and Mersey, which would gain about 10% more revenue under these methods than under an equation based purely on population. Oxford has the lowest needs. The acute sector model shown in column (*b*) is more redistributive than the current formula (the square root of standardised mortality ratio, shown in column (*a*)). Column (*c*) indicates the difference between allocating funds purely on the current formula and the results of the York work, suggesting that Northern and Mersey would gain most from the York acute sector formula and that South West Thames and Oxford would lose most. More detailed analysis (not shown) indicates that, within regions, the new formula would redistribute funds towards inner city areas.

In the psychiatric sector there is more variability between regions. The highest needs occur in North East Thames and North Western regions, the lowest in the southern regions of East Anglia, Wessex, and Oxford. In comparing these figures with the current formula (the square root of standardised mortality ratio), it should be borne in mind that mental illness was not included in the small area analysis that informed review of the Resource Allocation Working Party (RAWP). Social determinants of use seem to be particularly important in the psychiatric specialty, giving rise to the greater response to needs than in the acute sector. Again, a redistribution towards inner city areas is implied by the formula.

The targets for health authorities will be based on populations weighted for age, needs, and other factors. The needs weighting should be determined by some weighted average of the acute and non-acute allocations, reflecting Department of Health policies. As a rough guide, in the inpatient sector, the non-acute specialties currently account for about half the costs of the acute specialties, so that the acute weights shown in table IX are considerably more important than the psychiatric weights. However, as noted above, the chosen ratio will depend on judgments about how to treat maternity, geriatrics, learning disability, outpatient, and community services. Although the analysis has been disaggregated into two groups of specialties, there is no suggestion that authorities would be expected to spend in line with their allocations in each group of specialties. The disaggregation is purely to yield a formula which is responsive to needs. Furthermore, in line with current practice, the allocations implied by the new formulas would probably be used as targets, to which authorities would be expected to converge over several years.

Table IX is based entirely on a particular choice of model and set of assumptions. If the results of this study are implemented the final formula used for allocation will be determined by the Department of Health, informed by this analysis, but incorporating a number of policy judgments which are outside the scope of this study. This example is therefore purely for illustration and may not be an accurate indication of the actual target allocations announced by the Department of Health.

Discussion

The purpose of this study was to provide a sound empirical basis for a formula to distribute hospital and community health services resources between regions in England, taking into account many of the criticisms that have been levelled at previous work by ourselves[3,4] and others.[5] Our remit was to carry out a small area analysis of hospital admissions using the most appropriate statistical analyses.

We tried to address many of the criticisms of previous work. In particular:

- we tested the impact of a wide range of health needs variables on use;
- we used estimates of the resource costs of use specific to each episode;
- we explicitly modelled four aspects of the supply of health care;
- using multilevel modelling techniques, we attempted to explore differences in policies and practices between geographical areas;
- we modelled a wide range of social circumstances as possible additional determinants of need for health care;
- we sought to use technically appropriate statistical methods.

No study using methods based on use can capture variations in health care needs that are not reflected, at least partially, in use. Despite adjusting for supply considerations and using the appropriate statistical procedures, our method is vulnerable to the possibility that, for a whole range of reasons, health care needs may not be captured in the use of hospitals by inpatients. Nevertheless, we have sought to extract as much as possible from existing data and statistical resources and believe that the study marks a considerable advance on previous work.

The analysis has yielded a model of national average response to needs. The sensitivity analysis suggests that the national model is not always sustained at lower levels of aggregation. Yet, although the model changes between care groups, geographical areas, and other levels of aggregation, this does not necessarily invalidate its use as the basis for a national allocation mechanism. The purpose of a formula is to develop a set of allocation rules which smooths out the effects of local variation in policy and practice. In other words, it should be based only on systematic differences in needs. When using a formula derived from national data the implicit judgment is that the national average relations between needs and use should form the basis for national allocation of funds.

There will always be variations between geographical areas caused by policy and practice which cannot be captured in a statistical model. If the new national formula were applied more or less directly to derive targets for districts, significant divergences from

Policy implications

- Statistical methods were used to devise a new equity based formula for allocating NHS resources to the health authorities
- The models show that in the acute sector standardised mortality rates, self reported morbidity, and a variety of social factors are legitimate indicators of need
- Taking into account the cost of hospital use, including day cases, the effect of age is less important than is currently assumed
- A formula based on this work would redistribute some resources towards poorer areas

current district allocations are likely to be observed. These divergences can be attributed to a number of factors—for example, local policies, clinical practice, efficiency levels, historical supply, local needs factors not captured by the national model, and random variation.

No national formula can possibly capture all the legitimate variations in needs existing in a large number of districts. As a result, although the figures derived from the formulas described here can serve as useful targets, there is always likely to be a need for local discretion. If the regional tier no longer has a role in resource allocation then serious thought must be given to methods by which such local discretion can operate to take into account legitimate local considerations.

Finally, the study has generated an invaluable dataset, which should be of interest to policymakers and researchers. The ward level dataset we have constructed will be released by the Department of Health for general use.

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Relation between socioeconomic deprivation and pathological prognostic factors in women with breast cancer

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Abstract

Objective—**To investigate the relation between socioeconomic deprivation and pathological prognostic factors in women with breast cancer as a possible explanation for socioeconomic differences in survival.**

Design—**Retrospective analysis of data from cancer registry and from pathology and biochemistry records.**

Setting—**Catchment areas of two large teaching hospitals in Glasgow.**

Subjects—**1361 women aged under 75 who had breast cancer diagnosed between 1980 and 1987.**

Main outcome measures—**Tumour size, axillary lymph node status, histological grade, and oestrogen receptor concentration in relation to deprivation category of area of residence.**

Results—**There was no significant relation between socioeconomic deprivation and four pathological prognostic factors: 93 (32%) women in the most affluent group presented with tumours less than 20 mm in size compared with 91 (31%) women in the most deprived group; 152 (48%) of the most affluent group presented with negative nodes compared with 129 (46%) of the most deprived group; 23 (22%) of the most affluent group presented with grade I tumours compared with 12 (17%) of the most deprived group; and 142 (51%) of the most affluent group had a low oestrogen receptor concentration at presentation compared with 148 (52%) of the most deprived group. None of these differences was statistically significant.**

Conclusions—**Differences in survival from breast cancer by socioeconomic deprivation category could not be accounted for by differences in tumour stage or biology. Other possible explanations, such as differences in treatment or in host response, should be investigated.**

Introduction

Affluent women have a higher incidence of breast cancer than women who are socioeconomically deprived.[1] However, the relation between deprivation and survival from breast cancer is less clear. Six studies published since 1985 have produced conflicting findings: three found that deprived women had poorer survival,[2-4] one that deprived women had better survival,[5] one found no relation between deprivation and survival,[6] and one was equivocal.[7]

Data from the West of Scotland Cancer Registry on 7537 women with breast cancer showed that women from affluent areas (defined with Carstairs' residence based measure of deprivation[8]) had consistently higher five year survival rates than women from more deprived areas. This applied equally to women aged under 45 (mainly premenopausal) and to those aged 55-74 (mainly postmenopausal). For all women aged under 75, five year survival was 66% in the most affluent group compared with 55% in the most deprived group (figure).

Since significant differences in survival were observed across all age groups, they were unlikely to be due to excess deaths from other causes among deprived women. There appeared to be four possible explanations for the differences between socioeconomic groups: differences in tumour stage, tumour biology, treatment factors, or host response. Differences in